Successful
SERVICING
REG. U.S. PAT. OFF.

Dedicated to the financial and technical advancement of electronic maintenance personnel

VOLUME 14 NUMBER 1 JANUARY, 1953

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MEMBER

Curtain Time

The Itinerant TV Service Technician

It has been common practice to do light TV servicing — mainly tube changing — in the home. Judging by the comments of some large service facilities of all sorts, customers' home service will be expanded in the future to where virtually all troubles will be remedied in the home. Only in extreme cases will chassis be pulled.

This approach to TV servicing will, more than likely, result in other changes too. It is going to mean a greater investment in test equipment — portable equipment which can be taken into the home. This means that test equipment manufacturers will have to design equipment specifically for this purpose.

It is going to give the small independent operator the opportunity to survive. It has been the general opinion that TV servicing set a limit on the minimum number of personnel required by a service facility because of the to-and-fro movement of a TV receiver. Doing most of the service in the home enables a TV service facility to operate with whatever number of technicians the facility wishes to place in the field — as few as one man.

Another practice associated with this kind of service is the use of the rolling parts stock, that is, the replacement parts stock will be in the truck which is driven to the job. This is being done to a limited extent today and is proving successful. In fact, the roving service truck idea was talked about years ago — at the advent of television, but it did not gather too much momentum, except as applied to receiver and antenna installations. Now it looks like it will become an everyday occurrence.

The idea will be accepted by the public. Even though the average housewife is not too happy at the prospect of having one of her rooms cluttered with servicing equipment, it still is the lesser of the two evils relative to all the possibilities of what can occur when the chassis is removed from the home. In the mind of the public anything can happen after a chassis is pulled — even to having to pay a ransom to get it back. Having it serviced in the home will reduce the period during which the receiver is inactive. It will cut the travel time cost, to say the least.

Once the practice blooms, it will be necessary for all service facilities to follow suit. This is becoming evident today in the form of the responses received by those shops that advertise service in the home. They outpull the ads which do not make the same offer.

Doing extensive TV servicing in the home will place a greater than ever premium on technically qualified men. In fact, successful operation cannot be carried on in any other way. Properly handled, it should minimize repeat calls because it is possible to demonstrate the performance of the receiver before the technician leaves; also it means freedom from the complications of operating a receiver in one location and servicing it in another, where completely different receiving conditions prevail.

All in all, major service in the customer's home offers interesting possibilities. Let's see what happens.

The OPS Price Order for TV Service

The price order covering TV service has yet to be issued by the OPS. According to reports it will be done, providing the regulatory body will remain after the new administration becomes active. We have not changed our ideas as expressed in the November, 1952 issue of SUCCESSFUL SERVICING. We feel that the problem of diagnosis of TV receiver troubles, the "bugs" which frequently develop in TV receivers — in general the behavior of electronic equipment makes it necessary to treat the repair of these devices differently than ordinary electrical and mechanical equipment.

It is reported that the contents of the proposed regulation has the approval of TV service facilities. We hope that diagnosis time was given its full due apart from the time required for the repair.

John F. Rider

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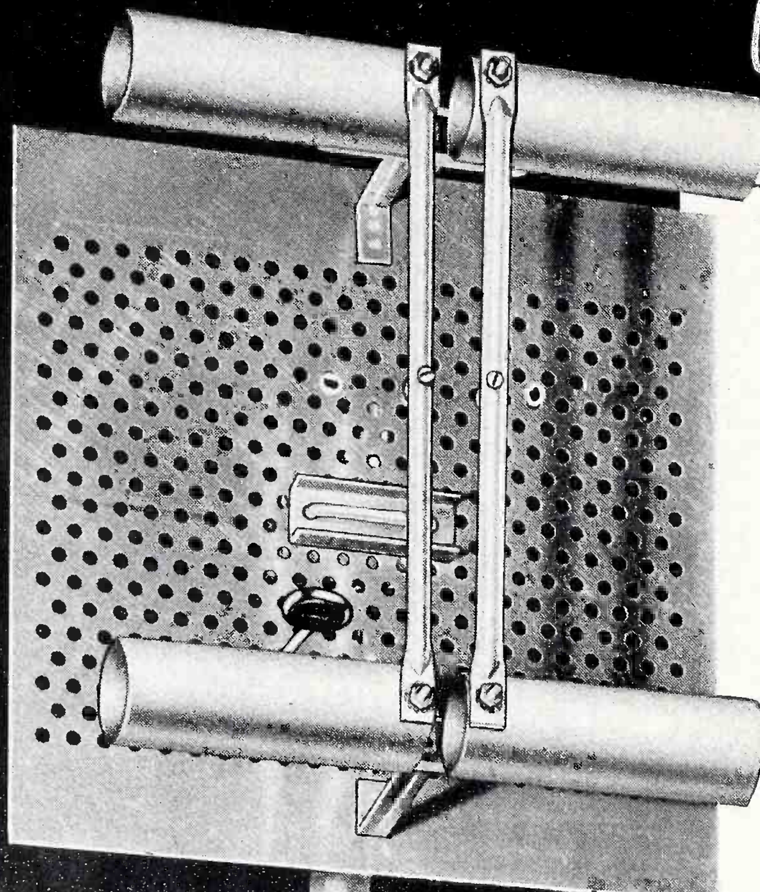
why guess?



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Replacement Parts in TV Receivers

Part I - Capacitors (cont'd)

This is the third in a series of articles on "Replacement Parts in TV Receivers." "Capacitors" will be continued next month.

by John F. Rider

DIFFERENCE BETWEEN CAPACITORS

The various names which appear in the capacitor family tree designate both physical and electrical differences in the components and in the behavior and suitability of the component for different classes of service. As to the physical differences in dimensions, these require no special comments other than to say that, in the final analysis, the suitability of a capacitor on this basis, is determined by its location in the receiver.

Mica Capacitors. The differences between foil mica and silver mica capacitors are manifold. The foil type, or ordinary "molded" mica is made up of alternate slabs of active surface (usually metal foil) and mica dielectric. The assembly is compressed under high pressure and housed in a molded case, usually of brown bakelite, although yellow bakelite also is used for this purpose. The uniformity of closeness of the foil to the dielectric slab determines in a great measure the electrical behavior of the device. This behavior is a function of the materials used, the pressure applied when the unit is encased, and the expansion or contraction of the casing under the influence of varying temperature. This in turn gives rise to changed spacing between the active surfaces and the dielectric, and a change in capacitance.

The variation in capacitance under varying temperature conditions is minimized by the use of yellow bakelite, but since the foil type represents a category of component, certain conditions of behavior are acceptable. Thus the usual brown bakelite mica capacitor is acknowledged to possess certain operating characteristics and is used on that basis.

The tendency toward change in capacitance with variation of temperature has given rise to a sub-classification. This is the deliberately engineered temperature coefficient mica capacitor, wherein the capacitance changes by a prescribed amount per degree C. change in operating temperature. This type was popular years ago for correcting circuit behavior with changing temperature, but, as is discussed in detail later, it has been supplanted by the ceramic dielectric unit.

The silver mica variety, whether of the "postage stamp" or "button" shape, uses a deposit of silver on the two sides of the mica dielectric. This produces a firm bond between active surface and dielectric. Moreover, the assembly is housed in either red or yellow bakelite; that is, in material which maintains its dimensional stability with changing temperature. The result is a capacitor which is very efficient electrically; is much more stable in capacitance than the ordinary mica; can be produced to a much greater degree of accuracy relative to capacitance rating; in general is much more suitable for use in all critical circuits under varying conditions of frequency (including UHF), temperature and humidity. It too is available in a variety of temperature coefficient characteristics, although in the main it is a positive temperature coefficient capacitor.

Manufacturing know-how enables producers of mica capacitors to deliver an end product which displays prescribed characteristics relative to an increase or decrease in capacitance within prescribed limits for unit changes in operating temperature. This establishes the "class" or "characteristic" of the capacitor. Since the set designer weds the characteristic of the capacitor to the circuit requirements, it is a relatively important consideration in the matter of replacement. In essence, the characteristic is a designation of the temperature coefficient of the capacitor. More about this later.

The comparative superiority of the silver mica capacitor over the ordinary foil mica type does not make the latter a bad unit. It is an excellent capacitor and enjoys a great variety of uses; it is simply that where frequency stability is a very important item, and the frequency is controlled by capacitance (as for example in oscillators and other critical tuned circuits) the silver mica unit is preferred.

The use of mica as a dielectric provides high insulation resistance. This is true for both kinds of active surface construction; hence the mica capacitor is frequently used for d-c isolation (and coupling) where d-c leakage must be kept very low. To minimize the absorption of moisture in humid atmosphere, and also to keep surface leakage between the connecting wires low, the complete capacitor often is coated with a layer of wax.

Ceramic Capacitors. Ceramic capacitors are available in a number of types. Neglecting physical differences, the ceramic unit is highly efficient electrically. Constructionwise, regardless of the shape, it consists of a metallic deposit on the opposite surfaces of a ceramic dielectric with connecting leads soldered to the active surfaces. The result is a very stable capacitor, and one in which, by selection of the ceramic dielectric material, a variety of electrical characteristics can be achieved. One of its paramount virtues is a relatively high value of capacitance in a small, compact-sized unit. In this respect it is superior to all other types of capacitors.

Another feature stemming from the easy control of the specific composition of the ceramic dielectric, is the ability to manufacture a capacitor which will *change* in capacitance in a definite direction and decrease or increase by a predetermined amount with changes in operating temperature. While this is possible with the foil type of mica capacitor, it is much more easily controlled in the ceramic, with the result that the latter variety of temperature compensating capacitor has displaced the

(Continued on page 26)

Using An A-M Signal Generator etc.

(Continued from page 3)

The height and vertical linearity controls should then be adjusted until the height of the blanking bar is uniform regardless of its position on the screen.

Although the vertical height and linearity controls can be adjusted for reasonably good linearity without a test pattern or test equipment, the adjustment of the horizontal linearity control does require some type of a pattern on the screen. An incorrect adjustment of the height and vertical linearity controls is more noticeable on the ordinary program than is an incorrect adjustment of the horizontal controls. This does not mean that the horizontal adjustments can be overlooked, however, since the owner will see a number of programs on which a circle will be used, and if this is not a reasonably true circle, a return service call will probably be required.

The signal generator can also be used to make this adjustment without removing the chassis from the cabinet. The only additional items required are a .01-μf capacitor and a piece of thin spaghetti. The location of the first video amplifier tube must also be known. This tube can, of course, be identified if a circuit diagram is available. If a diagram is not on hand, the tube layout will ordinarily indicate the video amplifier tube or this tube may be recognized by its location on the chassis.

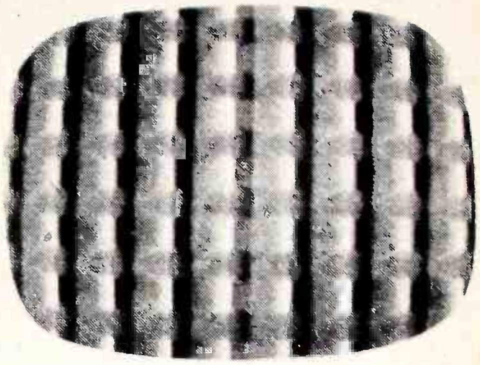


Fig. 7. Pattern produced by signal generator with 157.5 kc modulated by 400-cycle audio.

A number of manufacturers are also including test jacks located at various points in the circuit which can be used for trouble-shooting or signal insertion. One of these test jacks is usually located at the output of the video detector or the input to the first video amplifier. If a test jack is available the output of the signal generator can be connected to this point through a .01-μf capacitor by inserting one end of the capacitor, bent to make proper contact, into the test jack.

If a test jack is not available at this point in the circuit, contact can be made by connecting the .01-μf capacitor to the grid pin on the first video amplifier tube. A piece of thin spaghetti should cover both of the capacitor terminal wires so that only about one-quarter inch of wire is exposed at the end of each wire. One end can then be bent so that it will fit snugly over a miniature pin, and the other end can be bent to fit over an octal pin. Either end can then be used depending on the tube used in the receiver. The spaghetti will prevent a short either to the chassis or to some other tube pin.

The channel selector should be sent on a blank channel and the r-f output cable of the signal generator connected to the unused end of the .01-mf capacitor. The output of the signal generator should be unmodulated and the frequency adjusted for some harmonic of the horizontal sweep frequency of 15,750 cycles, such as the tenth harmonic which is 157,500 cycles or 157.5 kc. This will produce about ten vertical dark and light bars across the screen as shown in Fig. 6. The spacing of these bars can then be used to adjust the horizontal-linearity control. If more bars are preferred the frequency of the signal generator can be increased; if fewer bars are desired the frequency can be decreased. The vertical bars will sync in at harmonics of the horizontal-sweep frequency. If the audio modulation is not turned off the bars will be wavy as shown in Fig. 7.

If either a cross-hatch generator or an a-m signal generator must be used, it should be remembered that these instruments are only substitutes for the test pattern. If a pattern can be used it should be preferred although reasonably close linearity adjustments can be made with instruments.

Addition to TV 10 and TEK-FILE Pack 67

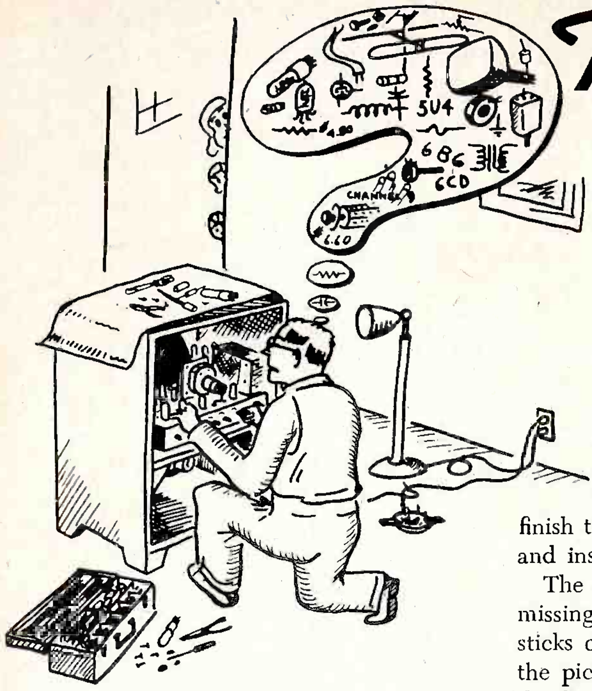
National TV Model 1701

VOLTAGE CHART

Tube No.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1	-.5	0	6.3 AC	0	80	80	0	
V2	96	96	6.3 AC	0	-3.5	-2.5	0	
V3	-.45	0	0	6.3 AC	90	90	.4	
V4	-.45	0	6.3 AC	0	90	90	.5	
V5	-.45	0	0	6.3 AC	90	90	.6	
V6	0	0	0	6.3 AC	90	90	.7	
V7	-2.5	-.2	0	6.3 AC	.5	0	-3	
V8	0	6.3 AC	-.4 to -2.5	-2.5	.4	160	0	115
V9	90	-9	4.5	0	0	0	0	0
V10	20	0	0	6.3 AC	20	-.6	0	
V11	0	0	6.3VAC	0	13	NC	-9	
V12	NC	NC	6.3VAC	0	320	-90	0	
V13	NC	0	350	350	27	0	6.3VAC	0
V14	25	220	13	-7	120	13	6.3VAC	0
V15	NC	6.3VAC	1.7	TP*	-18	NC	0	320
V16	HV RECTIFIER							
V17	NC	280	540	NC	360	NC	6.3VAC	6.3VAC
V18	PICTURE TUBE							
V19	0	0	0	6.3AC	88	90	.6	
V20	96	140	340	90	94	96	90	
V21	88	92	42	92	280	150	92	
V22	0	90	320	250	90	90	90	105
V23	NC	390	0	0	360	0	NC	390
V24	88	88	92	92	92	NC	80	

*Tie point

John Gigl



The Quick Diagnosis

or

Working Under Pressure

by John D. Burke

What goes on in the head of a TV repairman when he goes into a house or apartment to "take a look" at a TV set?

Within the space of a very few minutes a *torrent* of thought surges through his head. Yet, to the observer, it would seem that the repairman has little on his mind.

From years of personal experience I shall try to set down a record of such thinking. Perhaps it will be interesting to psychologists. At any rate, my fellow repairmen should be interested, amused, even compensated for their somewhat tonguetied characteristic — unable to convey to an outsider that which we of the trade undergo.

Since we are dealing with a torrent of thoughts — the only organization possible is movement. It will start at one point, and finish at another.

* * * *

"What could it be? It must be just a tube! We had all the tubes overhauled just last month! Must be just an adjustment! Maybe the aerial has blown down! Do you think it is the picture tube? What do you think of these..................sets? What kind of a set do you have? Which set would you recommend? Let the man alone! What's that? An ash tray? (Gladly they rush to bring an ash tray. Gives them something to do. Like a doctor asking for hot water.)"

". . . Hmm. They *never* think to clear the junk off the top! Where's the light? Living rooms are certainly dark nowadays since television . . . ah, at least this floor lamp still has a bright bulb. What is it? A console. Drag it out. Careful, watch out for that rug . . . remember, put something on the top . . . this paper will do. Never forget the time I accidentally burned a tiny spot on a top. So small it rubbed out easy . . . looked like they'd kill me . . . refused to take pay for the job . . . told 'em to apply it to refinish the cabinet . . . man came to my shop and insisted on paying for my work.

The back . . . oh no . . . screws mostly missing. Watch out for that tube neck . . . sticks out! If the back drops . . . bang goes the picture tube. Hey! Better take a look at the front *before* pulling off the back. What's the complaint? Plays a while — then goes crazy. Hmmm — at least this one's got the hold controls on the front . . . Ah, not enough width . . . 5U4 or more? Gee, I hope it doesn't use a 6CD . . . haven't got one with me Lousy intermittent. Picture's solid now. Try to speed up the craziness . . . rotate band switch. Turn set on and off . . . rotate hold controls. The people will think I'm ruining their set — swinging these knobs so fast. Those fix-it books — TUUUUUURN SLOOOOWLY — got everybody nuts. 'Fraid to turn a knob. Never forget the old pair that thought the set should be turned *off* before changing stations!

O.K. — there she goes. Sync. Is it both vert and hor? Vertical very unstable . . . horizontal, no sync at all. Oh, oh — breaks into multiple images sideways. Nice. Hope its just the oscillator. Nice, clean, simple — through in a wink. Maybe the horizontal amplifier, too. Hope not. Rough to explain *that* tube's price. Off with the back . . . where's my junk? Ah, ah, somebody's broken the cheater off the back. No need to use my cord . . . always forgetting them . . . such a hurry to get out after the job is done I forget the cord.

How about the controls? Marked on the chassis . . . ? Those engineers should have to work on some of their own monstrosities. What is this . . . intercarrier or conventional? Looks intercarrier. How many tubes in the sync . . . Mmmm. Horizontal oscillator — where the devil is it? The places they put tubes! Ah, at least this one has a spring mount base. That's the baby . . . oh, oh . . . wait . . . don't pull it or you'll blow a fuse!

Off with the cord . . . change tubes . . . hope this *new* one is good! Now . . . let's see . . . before turning it on . . . Where's the fuse? In the box. Good. Lucky. Better open her up before turning it on again. May see something. Some case, that last one! Somebody just laid a new fuse on top of the old one! That set sure acted crazy. How about finger smears on the tubes? Yeh, they've been in here. Just feeling to see if they are hot. Hey! How about the trap . . . have they been at it, too? Yeh! Mm . . . doesn't look like they moved it. It looked O.K. when the set did play before . . .

Would the horizontal oscillator tube being bad explain lack of vertical sync? Might. If vertical draws voltage from the damper — damper works off horizontal . . . O.K. Let's see how she works . . . look at the people watching me! Every move I make. Probably figure I'm trying to cheat them . . . they should know. If I get out of this without a shop job, or an argument, I'll be happy.

Set's two years old . . . plenty trouble due any minute now. Original picture tube . . . funny, it looked bright in spite of its age . . . O.K. . . . she holds. How's that hold control? Whoops! Got to readjust the back to permit centering of front control. Where's that mirror . . . *That's alright . . . I'll just hold my own. Thanks!* Wonder if it was just the tube? How long should I let it play to be sure? Oh-oh-look at that width jumping! In and out an inch on each side! . . . Damper? Sound seems steady . . . vertical, too. Must be the 6BG — variation in screen current, maybe . . . lucky it's not a 6CD . . . lucky if it is just the tube. Hate to put one in . . . Nobody believes a tube can be four-eighty. When they hear six-sixty for a 6CD . . . Man! . . . Ouch! That tube's hot! Pry it out with a screw driver . . . burn your fingers! . . . Alright. Try again. When they saw that second tube come up their eyebrows went up too! Width . . . good . . . steady.

Focus? Where is it? Um, um. Linearity? Just a touch—O.K. That does it. How about the glass? Not too bad. Does the front come off? No! Too bad. I'm not going to pull out the chassis for that little dirt on the face. If I did, I'd surely be blamed for every future trouble. "It was working fine till *you* pulled out the chassis!" Glad this thing wasn't a series filament job . . . hate em.

Oh! Look at that ghost on Channel 9! . . . Sneak a look at the people . . . are they

(Continued on page 29)

Here are more data that will keep your RIDER'S DEPENDABLE REPLACEMENT PARTS LISTING published in TV Volume 10 up to date. This is also to be included in TEK-FILE Packs 58, 59, 60, 61, 63, 64, 67, 68, 70, 71, 75, and 76.

ADDITIONS:

Set Mfg.	Set Mfg.'s Original Part No.	Replacement Part Mfg. Name	Dependable Replacement Part No.	Remarks
Belmont	8C-17845	C. D.	C031	
"	8C-18487	C. D.	D078*	*Omit 125mf section
"	8C-19546	C. D.	BR2015A	
"	8C-19564	C. D.	BR1015	
Hallicrafters	45B173	C. D.	C036*	*Parallel sections
Motorola	25B710925	Stancor	A-3877	
Philco	30-2417-7	C. D.	BBR2-50T	
		Mallory	TC 302	
"	30-2570-57	C. D.	D 111	
		Mallory	FP 476	
"	30-2570-66	C. D.	XA 004	
		Mallory	FP 117	
"	30-2584-9	C. D.	D 111	Parallel sections
		Mallory	FP 344.5	
"	30-2584-10	Mallory	FP 225	
"	30-2584-15	C. D.	UPT 435	
		Mallory	FP 255-TC 72	
"	32-8242-11	Stancor	A-3823	
"	32-8522	Stancor	A-3825	
		Triad	F-21A	
Starrett	CO 1050-2	Aerovox	AFH-3-44	
"	CO 1050-3	Aerovox	AFH-4-14	
Stromberg-Carlson	161030	Stancor	C-2326	
Western-Auto	12C-18743	Stancor	A-3878	
		Triad	S-8X	
"	12M-18241-1	Stancor	A-8125	
		Triad	A-97X	

CORRECTION:

Western-Auto	12M-18241	Change A-99X to A-97X in Triad Sweep Transformers column.

CORRECTIONS FOR VARIABLE RESISTANCE CONTROLS LISTINGS:

Crosley	153348	Change P 128 to P1-128 in IRC Outer Shaft column.
Emerson	390156	Transpose DS-36 from Mallory Switch No. column to Inner Shaft column.
"	390181	Transpose DS-36 from Mallory Switch No. column to Inner Shaft column.
"	390183	Transpose DS-36 from Mallory Switch No. column to Inner Shaft column.
Firestone	78X12	Change QJ-375 to QJ-418 in IRC Stock No. column.

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ATTENTION AUTHORS:

We are soliciting articles concerning radio, television, and allied electronic maintenance. All aspects are of interest. Articles of 1,000 to 2,000 words are desired. Preference is given to subject matter which reflects practical work rather than theory. The presentation should be *direct,* to the *point,* and amply illustrated. Finished art work will be prepared by us from the roughs submitted. Photographs are welcome. The rate of payment is on a word basis — and, needless to say, good writing rates good pay!

Submit all articles and inquiries to Editor, *Successful Servicing.*

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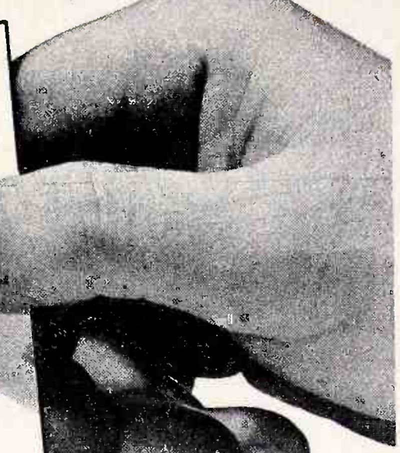
Let's forget the *"glittering generalities"* about quality.

Let's Check 4 specific ways CBS-HYTRON cuts your call-backs



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Longest experience with production . . . with applications . . . with improvements . . . all count. *CBS-Hytron-built* 1AX2, 1X2A, 6GQ6GT, 12A4, 12B4, 12BH7, 12BY7, 12BZ7, 25BQ6GT, 16RP4, etc. *are* more trouble-free. Prove it to yourself.

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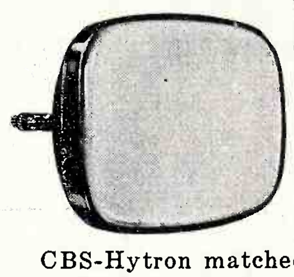
CBS-Hytron 6AL5 is typical. Experience with the military 6AL5 family (JAN 6AL5, 6097/CT, 5726) is passed on to you. You profit by a commercial CBS-Hytron 6AL5 made truly reliable.



4. BY MATCHING EACH TUBE TO THE SET.

Daily, CBS-Hytron analyzes leading TV chassis. Dynamic socket-by-socket checks, plus continuous field experience, pay off. Give you CBS-Hytron matched-to-the-set performance . . . with the accent on trustworthy replacements.

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by SERVICEMEN CBS-HYTRON TOOL for SERVICEMEN

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NOW...TEST THE *EASY* TOPSIDE WAY!

Wish you could test a chassis topside? Without first pulling and wrestling with the heavy chassis? Without disturbing wiring and parts by digging underneath for buried sockets? How much faster, easier, safer you could work! New CBS-Hytron Test Adapter does the trick. Just replace a 7-pin miniature tube with the Test Adapter. Plug tube into Test Adapter. Presto, all socket connections are topside . . . within instant reach of your test prod or clip. Just one job pays for this new CBS-Hytron Test Adapter. Get yours today!

HERE'S HOW! With the CBS-Hytron Test Adapter, you quickly measure voltage, resistance, gain. You inject and trace signals . . . monitor intermittents. You check oscillating stages. Or the effect of adding a bypass condenser or shunt resistor.

With several CBS-Hytron Test Adapters you make stage-by-stage circuit checks . . . fast. You do all this dynamic testing the e-a-s-y way . . . topside. With no ill effects at a-f frequencies. And only slight capacitance and inductance effects at much higher frequencies.

You will like: The positive contact of the low-resistance, silver-plated base pins and test points. The plainly marked pin connections. The easy insertion and tight grip. CBS-Hytron Test Adapter is another designed-by-and-for-you "must" you must have. See your CBS-Hytron jobber today.

CBS HYTRON RADIO TUBES

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TV Set Functions With Transitors*

T. R. Kennedy Jr.

A complete portable television receiver functioned perfectly here today without radio vacuum tubes. Instead, it utilized thirty-seven bits of laboratory magic known as "transistors," which even now are said to perform nearly all the functions of the ordinary radio tube, and do some of them even better.

The video receiver, which was battery operated and about one-quarter the weight and size of an ordinary home table model set, was only one of a number of familiar electronic devices such as home and automotive radios, record players and public address systems — using only transistors — demonstrated for the first time as a "transistor application progress report" in this new field by the David Sarnoff Research Center of the Radio Corporation of America.

The only conventional type of vacuum tube in the video set was its own self-contained picture tube, on which the image was created.

And even that last conventional radio tube in the home video may in time give way to a newer device patterned after the transistor. Dr. E. W. Engstrom, vice president of the R.C.A. Laboratories Division, expressed such views as the new transistor-operated devices were demonstrated for newspaper men and technical writers, who saw them for the first time.

"Even now we are thinking along such lines," he said. "Tomorrow's video screen may be something entirely different than we have in today's sets. We have seen more progress in four years of transistor development in the laboratory than in twenty for the radio tube."

Great Cost Production Seen

Dr. Engstrom explained that the small size of the viewing screen of the receiver demonstrated — five inches wide — had nothing to do, however, with the transistors inside the unit, which provided only the amplification of the signal and converted it to something the viewing screen could turn into a moving image. The laboratories had only tried to eliminate the thirty-seven ordinary tubes.

With transistors in use, however, the largest element of cost in the ordinary home video set except the viewing screen — the power needed to light twenty-four to thirty ordinary tube filaments — might be reduced almost to nil. It was Dr. Engstrom's estimate that tomorrow's video receivers with full complement of transistors and the usual cathode-ray viewing screen might be, when production is stepped up, "something about half of today's costs."

For those not familiar with transistor history, Dr. Engstrom explained that the original device was a product of the work of Dr. William Shockley and associates of the Bell Telephone Laboratories in 1948, and since then under intensive development in many electronic laboratories, including the R. C. A.'s.

In the various branches of the laboratories the visitors saw transistors being made from refined bars of metal called "germanium," which must be first purified, then contaminated with other elements to achieve the required end of being good amplifiers and generators of electric currents — "better than most radio tubes and far more versatile than many."

When the germanium bars are finished they are sliced up into minute particles, the bits, mounted in plastic holders, "cat whiskers" of fine wires applied through which small voltages are applied from batteries. The result is amplification of a radio signal, without the heated filaments in ordinary vacuum tubes.

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RIDER · TEK-FILE INDEX

PACKS 1–77

HOW TO USE THIS INDEX

To locate service data instantly, all you need to know is the manufacturer's name and the model or chassis number of the set.

The index is compiled alphabetically, according to manufacturer. Note the column headings at the top of each page: MODEL, PACK-FILE, PAGES.

Model numbers run in numerical sequence, starting with the smallest number under a manufacturer's name. This applies also to model numbers using letters. (i. e. model AR precedes model CG). Model numbers starting with letters precede model numbers starting with numbers.

Under the column PACK-FILE, the first number is the TEK-FILE Pack number, and the second number is the File number.

Under the column headed PAGES, the first and second numbers indicate the page where the information starts; the last number shows where the data is concluded.

As an example, let's look up ADMIRAL model 36X36AS. It shows that the information is in (1-1) Pack No. 1, ADMIRAL, File No. 1. The data (8=23-46) starts on page 8-23 and runs through page 8-46. There is also data on the ADMIRAL record changer model RC 550. It's in (1-RC2) TEK-FILE Pack No. 1, in ADMIRAL Record Changer File No. 2. The data begins on page 21-9 and ends on page 21-16.

If you remove the pages from the TEK-FILE Files and insert them in the TEK-FILE binder, you can disregard the PACK-FILE column and refer to the PAGES only.

ADMIRAL
ANDREA

ANDREA RADIO CORP. (Cont'd)

MODEL	PACK-FILE	PAGES
Mayfield	43-1	6=1-10
Saybrook	43-1	6=1-10
Stratford	58-2	10=1-8
Sutton	43-1	6=1-10
Warwick	43-1	9=1-4
C-VL16, Ch. VL16, Sutton	43-1	6=1-10
C-VL17, Ch. VL17, Brewster	43-1	9=1-4
CO-VL16, Ch. VL16, Fleetwood	43-1	6=1-10
CO-VL19, Ch. VL19, Caronia	43-1	6=1-10
T-VL12, Ch. VL12, Saybrook	43-1	6=1-10
T-VL16, Ch. VL16, Mayfield	43-1	6=1-10
T-VL17, Ch. VL17, Gotham	43-1	9=1-4
VL12, VL16, Ch.	43-1	6=1-10
VL17, Ch.	43-1	9=1-4
VL19, Ch.	43-1	6=1-10
VL-20, Ch.	58-2	10=1-8
2C-VL17, Ch. VL17, Warwick	43-1	9=1-4
2C-VL20, Ch. VL-20, Stratford	58-2	10=1-8

ARTONE
See AFFILIATED RETAILERS, INC.
Also See MACY'S

ARVIN INDUSTRIES, INC.

MODEL	PACK-FILE	PAGES
TE272-1, TE272-2, Ch.	43-2	6=1-9
TE276, Ch.	43-2	6=1-9
TE282, Ch.	43-2	6=13-18
TE 286, Ch.	1-1	8=4-6
TE289, Ch.	43-2	6=10-12
TE-289-2, Ch.	1-1	8=1-3
TE289-3, Ch.	43-2	7=1-4
TE290, Ch.	43-2	7=5-8
TE300, Ch.	43-2	9=1-8
TE-302, Ch.	1-1	8=6-8
TE-302-1, Ch.	1-1	8=6 8=9-10
TE315, TE315-1, TE315-2, Ch.	43-2	9=1-8
TE 331, Ch.	58-3	10=1-4
2120, 2121, Ch. TE289-3	43-2	7=1-4
2120CM, 2121TM, Ch. TE-289-2	1-1	8=1-3
2122TM, Ch. TE289	43-2	6=10-12
2123, Ch. TE289-3	43-2	7=1-4
2123TM, Ch. TE-289-2	1-1	8=1-3
2124, Ch. TE289-3	43-2	7=1-4
2124CCM, Ch. TE-289-2	1-1	8=1-3
2126, Ch. TE289-3	43-2	7=1-4
2126CM, Ch. TE-289-2	1-1	8=1-3
2160, 2161, 2162, 2164, Ch. TE290	43-2	7=5-8
3100TB, 3100TM, Ch. TE272-1	43-2	6=1-9
3101CM, Ch. TE272-1	43-2	6=1-9
3120CB, 3120CM, Ch. TE272-2	43-2	6=1-9
3121TM, Ch. TE272-2	43-2	6=1-9
3160CM, Ch. TE276	43-2	6=1-9
4080T, Ch. TE282	43-2	6=13-18
4162, Ch. TE 286	1-1	8=4-6
5170, Ch. TE-302	1-1	8=6-8
5170, Ch. TE-302-1	1-1	8=6 8=9-10
5171, Ch. TE-302	1-1	8=6-8
5171, Ch. TE-302-1	1-1	8=6 8=9-10
5172, Ch. TE-302	1-1	8=6-8
5172, 5173, Ch. TE-302-1	1-1	8=6 8=9-10
5204, 5206, Ch. TE300	43-2	9=1-8
5210, 5211, 5212, Ch. TE315, TE315-1, TE315-2	43-2	9=1-8
6175TM, 6179TM, Ch. TE 331	58-3	10=1-4

ASTORIA
See MACY'S

AUTOMATIC RADIO MFG. CO., INC.

MODEL	PACK-FILE	PAGES
TV-5217, TV-5217T	58-1	10=1-6

BELMONT
See RAYTHEON TELEV. & RADIO CORP.

BENDIX RADIO DIV.

MODEL	PACK-FILE	PAGES
Belair, Guilford	48-2	7=1-9
C172, Belair	48-2	7=1-9
OAK3	58-3	10=1-12
*C182	48-2	7=1-9
C200, Guilford	48-2	7=1-9
T170	27-1	5=1-11
*T171	48-2	7=1-9
21K3, 21KD, 21T3, 21X3	58-3	10=1-12
2051	27-1	5=1-11
2060, 2070	27-1	5=1-11
3051	27-1	5=1-11
6001, 6003	27-1	5=1-11
6100	27-1	5=1-14
7001	27-1	5=1-11

BENRAY ELECTRONICS CORP. (SURREY)

MODEL	PACK-FILE	PAGES
17T31, 20T31, 24T31, See VIDEO PRODUCTS 630 Series	69-1	10=1-12
621-20, 621-16, See TRAD T-20E Series	54-1	9=1-16

CADILLAC ELECTRONICS CORP.

MODEL	PACK-FILE	PAGES
F-16	2-1	8=1-8

CBS-COLUMBIA INC.
Also See AIR KING PRODUCTS CO., INC.

MODEL	PACK-FILE	PAGES
17C18, 17M18, 17T18, Ch. 817	59-1	10=1-5
20M18, 20M28, 20T18, Ch. 820	59-1	10=1-5
817, 820, Ch.	59-1	10=1-5

CAPEHART-FARNSWORTH CORP.

MODEL	PACK-FILE	PAGES
C-278, C-279, Ch.	27-1	7=1-13
C-281, Ch.	27-1	5=1-12
CT-27, Ch. CX-33DX	27-1	9=1-4
CT-37, CT-38, CT-39, Ch. CX-33DX	27-1	9=1-4
CT-45, Ch. CX-33DX	27-1	9=1-4
CT52, CT57, CTR68, Ch., Prelim.	59-2	10=1-10
CX-32, Ch.	27-1	7=1-13
CX-33, Ch.	27-1	5=1-12
CX-33DX, Ch.	27-1	9=1-4
CX-36, Ch., Prelim.	59-2	10=1-10
1T172M, 2C172M, Ch. CT52, CX-36, Prelim.	59-2	10=1-10
3C212B, 3C212M, Ch. CT57, CX-36, Prelim.	59-2	10=1-10
4H212B, 4H212M, Ch. CT57, CX-36, Prelim.	59-2	10=1-10
5F212M, 6F212B, 7F212M, 8F212B, 9F212M, Ch. CT57, CX-36, Prelim.	59-2	10=1-10
10W212M, Ch. CTR68, CX-36, Prelim.	59-2	10=1-10
3005-M, Ch. C-279, CX-32	27-1	7=1-13
3008-M, Ch. C-278, CX-32	27-1	7=1-13
3011-B, 3011-M, Ch. C-281, CX-33	27-1	5=1-12
3012-B, 3012-M, Ch. C-281, CX-33	27-1	5=1-12

CONRAC, INC.

MODEL	PACK-FILE	PAGES
27-M-40, 27-W-40, Ch. 40, 44	2-1	8=1-3
28-B-40, 29-P-40, Ch. 40, 44	2-1	8=1-3
30-M-40, 30-W-40, Ch. 40, 44	2-1	8=1-3
31-P-40, Ch. 40, 44	2-1	8=1-3
40, 44, Ch.	2-1	8=1-3

* See HANDY.

CORONADO
See GAMBLE-SKOGMO, INC

COVIDEO, INC.

MODEL	PACK-FILE	PAGES
T-1400	2 1	8=1-4

CROSLEY DIV. AVCO MFG. CORP.

MODEL	PACK-FILE	PAGES
DU-17CDB, Ch. 356-1	2-1	8=13-17
DU-17CDB, Ch. 356-3, 356-4	59-5	10=1-4
DU-17CDM, Ch. 356-1	2-1	8=13-17
DU-17CDM, Ch. 356-3, 356-4	59-5	10=1-4
DU-17CHB, Ch. 356-3, 356-4	59-5	10=1-4
DU-17CHM, Ch. 356-1	2-1	8=13-17
DU-17CHM, Ch. 356-3, 356-4	59-5	10=1-4
DU-17CHN, Ch. 356-1	2-1	8=13-17
DU-17CHN, DU-17CHN1, Ch. 356-3, 356-4	59-5	10=1-4
DU-17COB, Ch. 356-1	2-1	8=13-17
DU-17COB, DU-17COL, DU-17COLa, Ch. 356-3, 356-4	59-5	10=1-4
DU-17COM, Ch. 356-1	2-1	8=13-17
DU-17COM, Ch. 356-3, 356-4	59-5	10=1-4
DU-17PDB, DU-17PDM, Ch. 359	17-3	9=5-10
Record Changer CROSLEY V-950	17-RC1	RCH 9=1-16
DU-17PHB, DU-17PHM, DU-17PHN, DU-17PHN1, Ch. 359	17-3	9=11-16
Record Changer CROSLEY V-950	17-RC1	RCH 9=1-16
DU-17TOB, Ch. 356-1	2-1	8=13-17
DU-17TOB, Ch. 356-3, 356-4	59-5	10=1-4
DU-17TOL, Ch. 356-1	2-1	8=13-17
DU-17TOL, DU-17TOL1, DU-17TOL2, Ch. 356-3, 356-4	59-5	10=1-4
DU-17TOM, Ch. 356-1	2-1	8=13-17
DU-17TOM, Ch. 356-3, 356-4	59-5	10=1-4
DU-20CDM, DU-20CHB, DU-20CHM, DU-20COB, DU-20COM, Ch. 357	17-3	9=1-4
DU-20PDM, Ch. 363	17-3	9=17-22
Record Changer CROSLEY V-950	17-RC1	RCH 9=1-16
DU-21CDM1, DU-21CDN, DU-21CHM1, Ch. 357-1	59-5	10=5-8
DU-21COB1, DU-21COL, DU-21COLB, DU-21COM1, Ch. 357-1	59-5	10=5-8
EU-17COL, EU-17COLB, Ch. 385	59-5	10=9-16
EU-17COM, Ch. 380	59-5	10=17-24
EU-17TOB, Ch. 380	59-5	10=17-24
EU-17TOLa, EU-17TOLB, Ch. 385	59-5	10=9-16
EU-17TOM, Ch. 380	59-5	10=17-24
EU-21CDB, EU-21CDM, EU-21CDN, Ch. 381	59-5	10=17-24
EU-21COBa, Ch. 381	59-5	10=17-24
EU-21COLd, Ch. 386	59-5	10=9-16
EU-21COLe, Ch. 387	59-5	10=9-16
EU-21COLBd, Ch. 386	59-5	10=9-16
EU-21COLBe, Ch. 387	59-5	10=9-16
EU-21COMa, Ch. 381	59-5	10=17-24
EU-21TOL, EU-21TOLB, Ch. 386	59-5	10=9-16
S11-442M1U, Ch. 331-4	2-1	8=18-23
S11-444MU, Ch. 331-4	2-1	8=18-23
Record Changer CROSLEY V-950	2-RC1	RCH 9=1-16
S11-447MU, Ch. 321-4	2-1	8=24-29
S11-453MU, Ch. 331-4	2-1	8=18-23
S11-459MU, Ch. 321-4	2-1	8=24-29
S11-472BU, Ch. 331-4	2-1	8=18-23
S11-474BU, Ch. 331-4	2-1	8=18-23
Record Changer CROSLEY V-950	2-RC1	RCH 9=1-16

CROSLEY DIV. (Cont'd)

MODEL	PACK-FILE	PAGES
S17-CDC1, S17-CDC3, S17-CDC4, Ch. 331-4	2-1	8=18-23
S17COC1, S17COC2, S17COC3, Ch. 331-4	2-1	8=18-23
S20-CDC1, S20-CDC2, S20-CDC3, Ch. 323-6	2-1	8=30-35
9-422M-LD	17-2	5=1-13
9-423M-LD	17-2	5=14-24
Record Changer CROSLEY 700F-33/45	17-RC2	RCH 9=17-24
10-401	17-2	5=25-36
10-404MU, 10-404M1U	18-4	6=1-4
10-412MU	18-4	6=1-4
10-414MU	17-2	5=37-41
10-416MU, 10-416M1U	17-2	5=37-41
10-418MU	18-4	6=1-4
10-419MU	17-2	5=42-46
10-421MU	18-4	6=5-9
10-428MU	18-4	6=10-14
10-429MU	17-2	5=37-41
11-441MU, Ch. 320	18-4	6=15-26
11-442M1U, Ch. 331	18-4	6=27-34
11-443MU, Ch. 323	18-4	6=35-40
11-444MU, Ch. 331	18-4	6=27-34
Record Changer CROSLEY V-950	18-RC1	RCH 9=1-16
11-453, Ch. 331	18-4	6=27-34
11-454MU, Ch. 323	18-4	6=35-40
11-458MU, Ch. 323	18-4	6=35-40
11-460MU, Ch. 331	18-4	6=27-34
11-461WU, Ch. 320	18-4	6=15-26
11-470BU, Ch. 331	18-4	6=27-34
11-471BU, Ch. 320	18-4	6=15-26
11-472B1U, Ch. 331	18-4	6=27-34
11-473BU, Ch. 323	18-4	6=35-40
11-474BU, Ch. 331	18-4	6=27-34
Record Changer CROSLEY V-950	18-RC1	RCH 9=1-16
11-476BU, Ch. 325, 325-1, 325-2	18-4	6=21-27
11-483BU, Ch. 331	18-4	6=27-34
11-484MU, Ch. 323	18-4	6=35-40
17CDC1, 17CDC2, 17CDC3, 17CDC4, Ch. 331, 331-1, 331-2	2-1	8=1-6
17COC1, 17COC2, 17COC3, Ch. 331, 331-1, 331-2	2-1	8=1-6
20CDC1, 20CDC2, 20CDC3, Ch. 323-3, 323-4	2-1	8=7-12
320, Ch.	18-4	6=15-26
321-4, Ch.	2-1	8=24-29
323, Ch.	18-4	6=35-40
323-3, 323-4, Ch.	2-1	8=7-12
323-6, Ch.	2-1	8=30-35
325, 325-1, 325-2, Ch.	18-4	6=21-27
331, Ch.	18-4	6=27-34
331, 331-1, 331-2, Ch.	2-1	8=1-6
331-4, Ch.	2-1	8=18-23
356-1, Ch.	2-1	8=13-17
356-3, 356-4, Ch.	59-5	10=1-4
357, Ch.	17-3	9=1-4
357-1, Ch.	59-5	10=5-8
359, Ch., DU-17PDB	17-3	9=5-10
359, Ch., DU-17PHB	17-3	9=11-16
363, Ch.	17-3	9=17-22
380, 381, Ch.	59-5	10=17-24
386, 387, Ch.	59-5	10=9-16

DE WALD RADIO MFG. CORP.

MODEL	PACK-FILE	PAGES
FT-200	59-1	10=1-6

ALLEN B. DUMONT LABORATORIES, INC.

MODEL	PACK-FILE	PAGES
Andover	18-1	7=1-9
Ardmore	33-3	6=1-26
Banbury	60-5	10=1-34
Beverly	60-5	10=35-42
Bradford	39-4	4=5-14
Brookville	33-3	6=1-26

ALLEN B. DUMONT LABORATORIES, INC. (Cont'd)

MODEL	PACK-FILE	PAGES
Burlingame	33-3	6=1-26
Canterbury	39-4	1=31-42
		3=1-4
		4=1-4
Carlton	18-1	7=1-9
Chatham	39-4	1=31-42
Clinton	60-5	10=35-42
Devon	60-5	10=1-34
Dynasty	60-5	10=1-34
Fairfield	39-4	1=31-42
		3=1-4
		4=1-4
Flanders	60-5	10=1-34
Guilford, Hanover	33-2	5=1-25
Hastings	39-4	1=31-42
		3=1-4
		4=1-4
Mansfield	39-4	4=5-14
Milford	60-5	10=35-42
Mt. Vernon	33-3	6=1-26
Newbury	60-5	10=1-34
Park Lane	18-1	7=1-9
Putnam	33-2	5=26-43
Revere	33-3	6=1-26
Ridgewood	60-5	10=35-42
Royal Sovereign	33-2	5=1-25
		8=1-12
Rumson	39-4	1=31-42
		3=1-4
		4=1-4
Savoy	39-4	1=31-42
Sheffield	39-4	1=31-42
		3=1-4
		4=1-4
Shelburne	60-5	10=35-42
Sherbrooke	33-2	5=1-25
Somerset	60-5	10=1-34
Strathmore, Sumter	18-1	7=1-9
Sussex	39-4	4=5-14
Tarrytown	33-3	6=1-26
Wakefield	60-5	10=35-42
Wellington	39-4	1=31-42
		3=1-4
		4=1-4
Westerly	33-3	6=1-26
The Westminster	39-4	9=1-24
Westwood	39-4	1=31-42
		3=1-4
		4=1-4
Whitehall II	60-5	10=1-34
Wickford	60-5	10=1-34
Wimbledon	60-5	10=1-34
Winslow	33-2	5=1-25
Winthrop	39-4	1=31-42
RA-103, Chatham, Savoy	39-4	1=31-42
RA-103C, Winthrop	39-4	1=31-42
RA-103-D, Canterbury, Rumson, Sheffield	39-4	1=31-42
		3=1-4
		4=1-4
RA-104-A, Hastings, Wellington	39-4	1=31-42
		3=1-4
		4=1-4
RA-105-B, Sussex	39-4	4=5-14
RA-108-A, Bradford, Mansfield	39-4	4=5-14
RA-110-A, Fairfield, Westwood	39-4	1=31-42
		3=1-4
		4=1-4
RA-109-A1, Winslow	33-2	5=1-25
RA-109-A2, Hanover	33-2	5=1-25
RA-109-A3, Sherbrooke	33-2	5=1-25
RA-109-A5, Winslow	33-2	5=1-25
RA-109-A6, Hanover	33-2	5=1-25
RA-109-A7, Sherbrooke	33-2	5=1-25
RA-111-A1, Putnam	33-2	5=26-43
RA-111-A2, Guilford	33-2	5=26-43
RA-111-A4, Putnam	33-2	5=26-43
RA-111-A5, Guilford	33-2	5=26-43

ALLEN B. DUMONT LABORATORIES, INC. (Cont'd)

MODEL	PACK-FILE	PAGES
RA-112-A1, Ardmore	33-3	6=1-26
RA-112-A2, Westerly	33-3	6=1-26
RA-112-A3, Mt. Vernon	33-3	6=1-26
RA-112-A4, Ardmore	33-3	6=1-26
RA-112-A5, Westerly	33-3	6=1-26
RA-112-A6, Mt. Vernon	33-3	6=1-6
RA-113-B1, RA-113-B2, Brookville	33-3	6=1-26
RA-113-B3, RA-113-B4, Revere	33-3	6=1-26
RA-113-B5, RA-113-B6, Burlingame	33-3	6=1-26
RA-113-B7, RA-113-B8, Tarrytown	33-3	6=1-26
RA-116A, The Westminster, Series II	39-4	9=1-24
Record Changer WEBSTER 100	39-RC1	RCH21=1-10
RA-117-A1, Sumter	18-1	7=1-9
RA-117-A3, Carlton	18-1	7=1-9
RA-117-A5, Strathmore	18-1	7=1-9
RA-117-A6, Andover	18-1	7=1-9
RA-117-A7, Park Lane	18-1	7=1-9
RA-119A, Royal Sovereign	33-2	5=1-25
		8=1-12
RA-160-A1, Devon	60-5	10=1-34
RA-162-B1, Wickford	60-5	10=1-34
RA-162-B4, Banbury	60-5	10=1-34
RA-162-B5, Flanders	60-5	10=1-34
RA-162-B6, Wimbledon	60-5	10=1-34
RA-162-B7, Whitehall II	60-5	10=1-34
RA-162-B10, Flanders	60-5	10=1-34
RA-162-B11, Newbury	60-5	10=1-34
RA-162-B12, Somerset	60-5	10=1-34
RA-162-B13, Banbury	60-5	10=1-34
RA-162-B14, Dynasty	60-5	10=1-34
RA-162-B21 -- RA-162-B26, Banbury	60-5	10=1-34
RA-164-A1, Clinton	60-5	10=35-42
RA-165-B1, Milford	60-5	10=35-42
RA-165-B2, Beverly	60-5	10=35-42
RA-165-B3, Wakefield	60-5	10=35-42
RA-165-B4, Ridgewood	60-5	10=35-42
RA-165-B5, Shelburne	60-5	10=35-42

ELECTRONIC APPLIANCES INC.

MODEL	PACK-FILE	PAGES
101, 102, 103, 104, 105, 107, 110, 111, Series, Lincoln, See VIDEO PRODUCTS 630-K3C	69-1	10=1-12

ELECTRO-TECHNICAL INDUSTRIES (TELEKIT)

MODEL	PACK-FILE	PAGES
19C	3-1	8=1-10

ELECTRO-VOICE INC.

MODEL	PACK-FILE	PAGES
3000, Booster	26-1	7=1-2

EMERSON RADIO & PHONO. CORP.

MODEL	PACK-FILE	PAGES
609, Ch. 120084-B	3-1	8=1-13
614D, Ch. 120095-B	26-2	6=1-4
637A, Ch. 120095-B	26-2	6=1-4
649A, Ch. 120094A	26-2	6=5-10
650B, Ch. 120118B	26-2	6=11-19
654B, Ch. 120118B	26-2	6=11-19
661B, Ch. 120134-B, 120134-G	26-3	7=1-10
662B, 663B, Ch. 120127-B, 120128-B	26-3	7=11-19
665B, Ch. 120131-B	26-3	7=20-27
666B, Ch. 120135-B	26-3	7=28-35
667B, 668B, Ch. 120134-B, 120134-G	26-3	7=1-10
669B, Ch. 120129-B	26-3	7=36-44
674B, Ch. 120134-G	26-3	7=1-10
675B, Ch. 120129-B	26-3	7=36-44

EMERSON RADIO & PHONO. CORP. (Cont'd)

MODEL	PACK-FILE	PAGES
676B, Ch. 120140-B, 120140-G, 120140-H	26-3	7=45-57
676D, Ch. 120144-B, 120144-G, 120144-H	3-1	8=16-30
*676F, Ch. 120143-B, 120143-H, similar to 681F, 686F, 687F, 696F	3-1	8=31-39
677B, 678B, Ch. 120134-B	26-3	7=1-10
680B, Ch. 120144-B, 120144-G, 120144-H	3-1	8=16-30
680D, 681B, Ch. 120140-B, 120140-G, 120140-H	26-3	7=45-57
681D, Ch. 120144-B, 120144-G, 120144-H	3-1	8=16-30
681F, Ch. 120143-B, 120143-H	3-1	8=31-39
683B, Ch. 120141-B	3-1	8=40-45
684B, 685B, Ch. 120134-B	26-3	7=1-10
686B, Ch. 120144-B, 120144-G, 120144-H	3-1	8=16-30
686D, Ch. 120140-B, 120140-G, 120140-H	26-3	7=45-57
686F, Ch. 120143-B, 120143-H	3-1	8=31-39
686L, Ch. 120142-B	3-1	8=46-55
687B, Ch. 120144-B, 120144-G, 120144-H	3-1	8=16-30
*687D, Ch. 120140B, similar to 680D, 686D	26-3	7=45-57
687F, Ch. 120143-B, 120143-H	3-1	8=31-39
687L, Ch. 120142-B	3-1	8=46-55
688B, 689B, 690B, Ch. 120129-B	26-3	7=36-44
*692B, 693B, 694B, Ch. 120129-D, similar to 688B, 689B, 690B, Ch. 120129-B	26-3	7=36-44
696F, Ch. 120143-B, 120143-H	3-1	8=31-39
696L, Ch. 120142-B	3-1	8=46-55
*697B, Ch. 120129-D, similar to 688B, 689B, 690B, Ch. 120129-B	26-3	7=36-44
699B, Ch. 120148-B	39-4	9=9-16
Record Changer VM-950	39-RC1	RCH22=1-16
699D, Ch. 120160-B	60-6	10=1-8
700B, Ch. 120153-B	39-4	9=1-8
Record Changer VM-950	39-RC1	RCH22=1-16
700D, Ch. 120158-B	50-5	9=17-24
700L, Ch. 120153-D	61-7	10=18-27
701B, Ch. 120153-B	39-4	9=1-8
Record Changer VM-950	39-RC1	RCH22=1-16
701D, Ch. 120158-B	50-5	9=17-24
709A, Ch. 120162-A	61-7	10=9-17
711B, 712B, Ch. 120164-B	61-7	10=28-39
714B, Ch. 120153-B	61-7	10=18-27
714D, 715D, Ch. 120153-D	61-7	10=18-27
720B, Ch. 120164-B	61-7	10=28-39
120084-B, Ch.	3-1	8=1-13
120094A, Ch.	26-2	6=5-10
120095-B, Ch.	26-2	6=1-4
120118B, Ch.	26-2	6=11-19
120127-B, 120128-B, Ch.	26-3	7=11-19
120129B, 120129D, Ch.	26-3	7=36-44
120131-B, Ch.	26-3	7=20-27
120134-B, 120134-G, Ch.	26-3	7=1-10
120135-B, Ch.	26-3	7=28-35
120140-B, 120140-G, 120140-H, Ch.	26-3	7=45-57
120141-B, Ch.	3-1	8=40-45
120142-B, Ch.	3-1	8=46-55
120143-B, 120143-H, Ch.	3-1	8=31-39
120144-B, 120144-G, 120144-H, Ch.	3-1	8=16-30
120148-B, Ch.	39-4	9=9-16
120153-B, Ch.	39-4	9=1-8
120153-B, Ch., Late	61-7	10=18-27
120153-D, Ch.	61-7	10=18-27
120158-B, Ch.	50-5	9=17-24
120160-B, Ch.	60-6	10=1-8
120162-A, Ch.	61-7	10=9-17

* See Emerson HANDY No. 16, Pack 26

EMERSON RADIO & PHONO. CORP. (Cont'd)

MODEL	PACK-FILE	PAGES
120164-B, Ch.	61-7	10=28-39
470651, Tuner	3-1	8=56-62
470662, Tuner	3-1	8=63-69

FADA RADIO & ELECTRIC CO., INC.

MODEL	PACK-FILE	PAGES
R7C15, R7C25	4-1	8=1-8
Tuner 42.51 for all 'R' Series	4-1	9=1-2
R-1025, R-1050	32-2	5=1-7
S6C55, S6C70, S6T65	32-2	7=1-12
S7C20, S7C30	32-2	7=1-14
S7C20, S7C30, Rev.	32-2	9=11-18
S7C70, S7T65	32-2	7=1-12
S-1015, S-1020, S-1030	32-2	5=8-12
S-1055	32-2	5=10-14
		7=1-12
S-1055X	32-2	7=1-12
S-1060, S-1065	32-2	5=10-14
		7=1-12
S20C10, S20T20	32-2	9=11-18
7C42, 7C52, 7T32	61-3	10=1-11
721, 775T	61-3	10=1-11
42.56, 42.64, Tuners used with 'S' Series	32-2	9=3-10

THE FIRESTONE TIRE & RUBBER CO.

MODEL	PACK-FILE	PAGES
13-G-44, 13-G-45	4-1	8=10-24
13-G-51, 13-G-52	4-1	8=25-39
13-G-53, 13-G-54, Ch. 700-90, 700-96	4-1	8=40-51
13-G-55, Ch. 700-93	4-1	8=40-51
13-G-56	4-1	8=52-59
13-G-57	4-1	8=1-9
Record Changer VM-950	4-RC1	RCH22=1-16
13-G-58, 13-G-59, 13-G-79, Ch. 700-96	4-1	8=60-70
13-G-110, Code 334-2-MS31C/A	61-2	10=1-10
13-G-115, 13-G-116, 13-G-119, 13-G-120, Code 334-2-MS31C/A	61-2	10=1-10
700-90, 700-93, Ch.	4-1	8=40-51
700-96, Ch., 13-G-53, 13-G-54	4-1	8=40-51
700-96, Ch., 13-G-58, -59, -79	4-1	8=60-70

FRANKLIN AIRLOOP CORP.

MODEL	PACK-FILE	PAGES
500-A-10, Tuner	4-1	8=1-2

FREED-EISEMANN

See FREED RADIO CORP.

FREED RADIO CORP. (FREED-EISEMANN)

MODEL	PACK-FILE	PAGES
54, 55, 56, 68, Ch. 1620C	32-1	5=1-7
101, 102, 103, 104, Ch. 1900	32-1	5=8-10
110, 111, 112, Ch. 700-120	50-2	9=1-8
121	50-2	9=9-14
700-120, Ch.	50-2	9=9-14
1620C, Ch.	32-1	5=1-7
1900, Ch.	32-1	5=8-10

GAMBLE-SKOGMO, INC. (CORONADO)

MODEL	PACK-FILE	PAGES
05RA4-43-8935A	31-2	6=1-6
05TV1-43-9014A, Ch. 16AY210	31-2	6=7-16
05TV2-43-8950A	31-2	6=17-26
05TV2-43-9010A	31-2	6=17-26
05TV6-43-8935A	31-2	6=1-6
15RA2-43-9105A, Ch. 16AY210	31-2	6=7-16
15TV1-43-8957A	5-1	8=1-8
15TV1-43-8958A	31-2	9=1-8
15TV1-43-9008A	5-1	8=9-18
15TV1-43-9015A, 15TV1-43-9016A	5-1	8=1-8
15TV1-43-9020A, 15TV1-43-9021A	31-2	9=1-8
15TV2-43-9101A, 15TV2-43-9102A	5-1	8=19-27
Record Changer VM-950	5-RC1	RCH22=1-16

INTERSTATE STORES BUYING CORP. (Cont'd)

MODEL	PACK-FILE	PAGES
AR-71, AR-71B	50-2	9=1-16
AR-73L	50-2	9=1-16
ARC-21, ARC-21B	50-2	9=1-16
ARC-71, ARC-71B	50-2	9=1-16
ARD-21M, ARD-22B	50-2	9=1-16
ARD-72, ARD-72B	50-2	9=1-16
250, 350	35-1	5=1-11
750	35-1	5=1-11
P1650T	35-1	7=1-8
P1652, P1653	35-1	7=1-8
P1751, P1752, P1753	35-1	7=1-8
P2052	35-1	7=1-8

JACKSON INDUSTRIES, INC.

MODEL	PACK-FILE	PAGES
114G, Ch.	6-1	8=1-8
114H, Ch.	65-2	10=10-17
116G, 117G, Ch.	6-1	8=1-8
117H, Ch.	65-2	10=10-17
120G, Ch.	6-1	8=1-8
120H, Ch.	65-2	10=10-17
217A, 217B, Ch.	65-2	10=1-9
220A, 220B, Ch.	65-2	10=1-9
221A, 221B, Ch.	65-2	10=1-9
1400T, Ch. 114G, 116G, 117G, 120G	6-1	8=1-8
1700C, 1700T, Ch. 114G, 116G, 117G, 120G	6-1	8=1-8
1700T, Ch. 117H	65-2	10=10-17
2000C, Ch. 114G, 116G, 117G, 120G	6-1	8=1-8
2000C, 2000CD, 2000CDB, Ch. 120H	65-2	10=10-17
3170C, Ch. 114G, 116G, 117G, 120G	6-1	8=1-8
Record Changer VM-950	6-RC1	RCH22=1-16
5120C, Ch. 114G, 116G, 117G, 120G	6-1	8=1-8
Record Changer VM-950	6-RC1	RCH22=1-16

KAYE-HALBERT CORP.

MODEL	PACK-FILE	PAGES
Cambridge, Hideaway	30-2	6=1-7
Normandy, Windsor	30-2	6=1-7
014, 024, Ch. 253	6-1	8=1-6
044, 045, 046, Ch. 253	6-1	8=1-6
074, 076, 077, Ch. 253	6-1	8=1-6
231, Ch.	30-2	6=1-7
231, 232, 233, Ch. 231, 242	30-2	6=1-7
234, Ch. 231, 242, Hideaway	30-2	6=1-7
235, Ch. 231, 242, Windsor	30-2	6=1-7
236, Ch. 231, 242, Normandy	30-2	6=1-7
237, Ch. 231, 242, Cambridge	30-2	6=1-7
238, Ch. 231, 242	30-2	6-1-7
239, Ch. 231, 242, Hideaway	30-2	6=1-7
240, Ch. 231, 242, Windsor	30-2	6=1-7
242, Ch.	30-2	6-1-7
252, Ch.	6-1	8=1-6
424, Ch. 253	6-1	8=1-6
714, 724, Ch. 253	6-1	8=1-6
731, 733, Ch. 231, 242	30-2	6=1-7
744, 745, Ch. 253	6-1	8-1-6
777, Ch. 253	6-1	8=1-6
914, Ch. 253	6-1	8=1-6

MACY ASSOCIATES

See MACY'S

MACY'S

MODEL	PACK-FILE	PAGES
AR14L, Ch. TVG, Artone, Hyde Park	7-1	9=21-30
AR-16 T-68, Artone	7-2	9=31-38
AR17L, Ch. TVG, Artone, Hyde Park	7-1	9=21-30
AP-23TV-1, Artone	7-2	9=31-38
HP-21B, HP-21M	47-3	9=57-72
HP-71B, HP-71M	47-3	9=57-72
HPC-21B, HPC-21M, HPC-22X	47-3	9=57-72
HPC-71B, HPC-71M	47-3	9=57-72

MACY'S (Cont'd)

MODEL	PACK-FILE	PAGES
HPD-21	47-3	9=57-72
MST12, Artone, Astoria, Hyde Park	7-2	9=45-52
Q-2617, Q-2617-1, Ch. 260-FM, 260-V, Macy Associates, Supremacy	7-2	9=53-56
Q-2619, Q-2619-1, Q-2620, Q-2620-1, Ch. 260-FM, 260-V, Macy Associates, Supremacy	7-2	9=53-56
S-20, Ch. 260-FM, 260-V, Macy Associates, Supremacy	7-2	9=53-56
S-210, S-211, S-212, S-213, Ch. 260-FM, 260-V, Macy Associates, Supremacy	7-2	9=53-56
TVG, Ch.	7-1	9=21-30
10C, 12X, Artone, Astoria, Hyde Park	7-2	9=45-52
16CD, Artone, Astoria, Hyde Park	7-1	9=1-8
16TR, Artone, Hyde Park	7-1	9=11-20
17CD, Ch. TVG, Artone, Hyde Park	7-1	9=21-30
17CR, Artone, Hyde Park	7-1	9=11-20
17CR, 17CRR, Ch. TVG, Artone, Hyde Park	7-1	9=21-30
17RDG, Ch. TVG, Artone, Hyde Park	7-1	9=21-30
17RO, Artone, Hyde Park	7-1	9=11-20
17ROR, Ch. TVG, Artone, Hyde Park	7-1	9=21-30
19CD, Artone, Hyde Park	7-1	9=1-9
19CX, Artone, Hyde Park	7-1	9=1-10
20CD, 20TR, Ch. TVG, Artone, Hyde Park	7-1	9=21-30
112, 112X, Artone, Astoria, Hyde Park	7-2	9=45-52
114, Artone, Hyde Park	7-1	9=11-20
203D, 204CAF, Ch. TVG, Artone, Hyde Park	7-1	9=21-30
260-FM, 260-V, Ch.	7-2	9=53-56
312, Artone, Astoria, Hyde Park	7-2	9=45-52
316, Astoria, Hyde Park	7-1	9=1-8
516, Artone, Hyde Park	7-1	9=11-20
816-3CR, Artone, Astoria, Hyde Park	7-1	9=1-8
819, Artone, Hyde Park	7-1	9=1-8 9=10
819, 819-3CM, 920, Ch. TVG, Artone, Hyde Park	7-1	9=21-30
1000, 1001, Ch. TVG, Artone, Hyde Park	7-1	9=21-30
1920, Ch. TVG, Artone, Hyde Park	7-1	9=21-30
2400, 4620, Ch. 260-FM, 260-V, Macy Associates, Supremacy	7-2	9=53-56

THE MAGNAVOX CO.

MODEL	PACK-FILE	PAGES
CT-232, CT-236, Ch.	30-1	6=1-14
CT-239, CT-240, Ch.	30-1	6=1-14
CT-244, CT-245, CT-246, Ch.	30-1	6=1-14
CT-247, CT-248, CT-249, Ch.	30-1	6=15-28
CT-250, CT-251, Ch.	30-1	6=1-14
CT-252, CT-253, CT-255, Ch.	30-1	6=15-28
CT-257, CT-258, CT-259, CT-260	30-1	7=1-13
CT-262, CT-263, CT-264, CT-265, CT-266, CT-267, CT-269, Series 103 Ch.	30-1	6=29-38
CT-270, CT-271, CT-272, CT-273, CT-274, CT-275, CT-276, CT-277, CT-278, CT-279, CT-280, CT-281, CT-282	30-1	7=14-28
CT-283, CT-284, CT-285, CT-286, CT-287, CT-288, CT-289, CT-290, CT-291, CT-293, CT-294, Series 103 Ch.	30-1	6=29-38

THE MAGNAVOX CO. (Cont'd)

MODEL	PACK-FILE	PAGES
CT-295, CT-296	30-1	7=1-13
CT-297, Series 103 Ch.	30-1	6=29-38
CT301, CT302, CT303, CT304, CT305, CT306, CT307, CT309, CT310, CT311, 104 Series	65-2	10=1-8
CT331, CT332, CT333, CT334, CT335, CT336, CT337, CT338, CT339, 105 Series	65-2	10=9-22
CT340, CT341, CT342, CT343, CT344, CT345, CT346, CT347, CT348, CT349, CT350, 105 Series	65-2	10=9-22

MAJESTIC RADIO & TELEVISION DIV. OF WILCOX-GAY CORP.

MODEL	PACK-FILE	PAGES
A-70, Ch. 106A	6-1	8=1-7
A-712, Ch. 106A	6-1	8=1-7
7P1, 7P2, 7P3, Ch. 101A	30-2	7=1-16
7P10, 7P11, Ch. 101A	30-2	7=1-16
7PR12, 7PR13, Ch. 101C	30-2	7=1-16
9P4, 9P5, Ch. 103	30-2	7=1-16

MAJESTIC RADIO & TELEVISION (Cont'd)

MODEL	PACK-FILE	PAGES
9PR8, 9PR9, Ch. 103A	30-2	7=1-16
17DA, Ch. 101D	30-2	7=1-16
17FA, Ch. 106A	6-1	8=1-7
17GA, 17HA, Ch. 101D	30-2	7=1-16
17JA, 17K, Ch. 106A	6-1	8=1-7
20FP88, 20FP89, 109 Series	66-3	10=1-10
20K, Ch. 108C	6-1	8=1-7
20KA, 20LA, Ch. 108A	6-1	8=1-7
20UAT, Ch. 108B	6-1	8=1-7
20UC, 20UT, Ch. 108D	6-1	8=1-7
20X, Ch. 108B	6-1	8=1-7
70, 72, 73, Ch. 106	6-1	8=1-7
99, 100, 101, 101A, 101B, 101C, 101D, 102, 103, 103A, Ch.	30-2	7=1-16
105, Ch.	30-2	7=1-16
106, 106A, Ch.	6-1	8=1-7
108, 108A, 108B, 108C, 108D, Ch.	6-1	8=1-7
120, 121, 121B, Ch. 99	30-2	7=1-16
141, 141B, Ch. 100	30-2	7=1-16
141C, Ch. 101B	30-2	7=1-16
142, 142B, Ch. 100	30-2	7=1-16
143	30-2	7=1-16
160, 160B, Ch. 101	30-2	7=1-16
162, 163, Ch. 101	30-2	7=1-16
170, Ch. 101A	30-2	7=1-16
173	30-2	7=1-16
700, 701, Ch. 106	6-1	8=1-7
712, 715, 717, 718, 719, Ch. 106	6-1	8=1-7
800, 801, 802, 803, 804, Ch. 108	6-1	8=1-7
902, 903, Ch. 103	30-2	7=1-16
910, 911, Ch. 103	30-2	7=1-16
1400, 1400B, Ch. 100	30-2	7=1-16
1401, Ch. 105	30-2	7=1-16
1600, 1600B, Ch. 101	30-2	7=1-16
1605, 1605B, Ch. 102	30-2	7=1-16
1610, 1610B, Ch. 102	30-2	7=1-16
1700C, 1701C	30-2	7=1-16
1710, Ch. 101A	30-2	7=1-16
1720, 1721	30-2	7=1-16

JOHN MECK INDUSTRIES, INC. DIV. OF SCOTT RADIO LABS., INC. (MIRRORTONE)

MODEL	PACK-FILE	PAGES
JM-717C, JM-717T, Ch. 9021	7-1	8=1-11
JM-720C, JM-720T, Ch. 9023	7-1	8=1-11
MM-510T, MM-512C, MM-512T	45-2	6=1-5
MM-516C, MM-516T	45-2	6=1-5
MM-614C, MM-614T, Ch. 9018	45-2	7=1-11
MM-614TL, Ch. 9022, 9024	7-1	8=1-11
MM-616C, MM-616T, Ch. 9018	45-2	7=1-11
MM-617C, MM-617T, Ch. 9018	45-2	7=1-11
MM-617C, MM-617TL, Ch. 9022, 9024	7-1	8=1-11

JOHN MECK INDUSTRIES, INC.

MODEL	PACK-FILE	PAGES
MM-619C, Ch. 9018	45-2	7=1-11
XOB, XQA, XQR	45-2	6=1-5
XRA, XRPS, XRPT, XSA	45-2	6=1-5
XSB, XSC, XSD, Ch. 9018	45-2	7=1-11
XSPS, XSPT, XTA, XTR	45-2	6=1-5
17PCSB, 17PCW, 17PTE, Ch. 9033, 9034	66-3	10=1-13
20PCSB, 20PCW, Ch. 9033, 9034	66-3	10=1-13
20PTE, 20PTSB, 20PTW, Ch. 9033, 9034		
20TPRSB, 21PCS, Ch. 9033, 9034	66-3	10=1-13
21QDCS, 24QDCS, Ch. 9033, 9034	66-3	10=1-13
9018, Ch.	45-2	7=1-11
9021, 9022, 9023, 9024, Ch.	7-1	8=1-11
9033, 9034, Ch.	66-3	10=1-13

MIDWEST RADIO & TELEV. CORP.

MODEL	PACK-FILE	PAGES
BT-20, Ch.	7-1	8=1-6
CV-20, Ch.	7-1	8=7-11
DJ-19, Ch.	45-2	6=1-6
DM-16, DMA-16	45-2	7=1-7
DR-16, Ch.	45-2	6=1-6
DX-19, DXA-19, Ch.	45-2	7=1-7
K-19, KR-19, Ch. DJ-19	45-2	6=1-6
KX-19, Ch. DX-19	45-2	7=1-7
KXA-19, Ch. DXA-19	45-2	7=1-7
N-20, NC-20, Ch. BT-20	7-1	8=1-6
Record Changer VM-950	7-RC1	RCH22=1-16
NV-20, Ch. CV-20	7-1	8=7-11
P-16, PR-16, Ch. DR-16	45-2	6=1-6
PX-16, Ch. DM-16	45-2	7=1-7
PXA-16, Ch. DMA-16	45-2	7=1-7

MIRRORTONE

See JOHN MECK INDUSTRIES, INC.

MITCHELL MFG. CO.

MODEL	PACK-FILE	PAGES
T16-2KB, T16-2KM	45-2	6=1-4
T16-B, T16-M	45-2	6=1-4
T17-B, T17-M	7-1	8=1-4

MONTGOMERY WARD (AIRLINE)

MODEL	PACK-FILE	PAGES
05BR-3034A, 05BR-3041A	8-1	8=1-10
05GCB-3019A	45-4	6=1-10
05WG-3038A	8-1	8=11-20
Record Changer VM-950	8-RC1	RCH22=1-16
05WG-3045A	8-1	8=21-30
Record Changer GENERAL INSTRUMENT 700F	8-RC1	RCH19=1-10
15BR-3035A	8-1	8=31-40
Record Changer VM-950	8-RC1	RCH22=1-16
15BR-3048A	51-5	9=1-8
15BR-3053A, 15BR-3053B	8-2	8=41-51
15BR-3054A	66-6	10=1-10
15GSE-3047A, 15GSE-3047B	8-2	8=52-62
15WG-3046A	8-3	8=63-70
15WG-3049A	51-5	9=9-16
15WG-3046B	8-3	8=63-73
15WG-3050A	8-3	8=74-83
Record Changer WEBSTER 100	8-RC1	RCH21=1-10
15WG-3050B	8-3	8=74-83
Record Changer VM-950	8-RC1	RCH22=1-16
15WG-3051A	8-3	8=63-70
15WG-3051B	8-3	8=63-73
16K1/63-3019	45-4	6=1-10
25BR-3048B	66-6	10=11-21
25GSE-3065A	66-6	10=22-29
94GCB-3023A, 94GCB-3023B, 94GCB-3023C	45-4	6=1-10
94WG-3008A	45-4	6=11-20
94WG-3106A, 94WG-3016B, 94WG-3016C	45-4	6=11-22
94WG-3028A	45-4	6=23-32

MOTOROLA INC.

MODEL	PACK-FILE	PAGES
TS-53, Ch.	36-3	6=1-15
TS-60, Ch.	47-4	7=1-16
TS-74, Ch.	36-3	6=51-64
TS-88, Ch.	36-3	6=29-41
TS-89, Ch.	47-4	7=17-34
TS-94, Ch.	47-4	7=17-34
TS-95, Ch.	47-4	7=17-34
TS-101, Ch.	47-5	7=57-65
TS-114, Ch.	36-3	6=42-50
TS-115, Ch.	36-3	6=16-28
TS-118, Ch.	47-5	7=35-45
		7=66-68
TS-118A, TS-118B, Ch.	51-6	9=25-32
TS-119, TS-119A, TS-119B, TS-119C, Ch.	9-1	8=25-38
TS-119D, Ch.	67-7	10=51-58
TS-172, Ch.	47-5	7=46-56
TS-174, TS-174A, TS-175B, Ch.	9-1	8=1-15
TS-214, Ch.	51-6	9=33-40
TS-216, Ch.	9-2	9=1-8
TS-221, Ch.	9-1	8=16-24
TS-228, Ch.	70-8	10=1-12
TS-236, Ch.	9-2	9=9-16
TS-307, Ch.	70-8	10=42-50
TS-314, Ch.	51-6	9=17-24
TS-314A, Ch.	51-6	9=41-44
TS-315, Ch.	51-6	9=17-24
TS-315A, Ch.	51-6	9=41-44
TS-325, TS-325B, Ch.	70-8	10=13-41
TS-326, TS-326A, TS-326B, Ch.	70-8	10=13-41
TS-351, Ch.	70-8	10=13-41
TS-401, Ch.	67-7	10=59-68
12K1, 12K1B, Ch. TS-53	36-3	6=1-15
12K2, 12K2B, Ch. TS-53	36-3	6=1-15
12K3, 12K3B, Ch. TS-53	36-3	6=1-15
12T1, 12T1B, Ch. TS-53	36-3	6=1-15
12T2, 12T3, Ch. TS-53	36-3	6=1-15
14K1, 14K1B, Ch. TS-88	36-3	6=29-41
14K1BH, 14K1H, Ch. TS-115	36-3	6=16-28
14T1, 14T1B, Ch. TS-68	36-3	6=29-41
14T3, Ch. TS-114	36-3	6=42-50
14T4, 14T4B, Ch. TS-216	9-2	9=1-8
16F1, 16F1B, Ch. TS-60	47-4	7=1-16
16F1BH, 16F1H, Ch. TS-89	47-4	7=17-34
16K2, 16K2B, Ch. TS-74	36-3	6=51-64
16K2BH, 16K2H, Ch. TS-94	47-4	7=17-34
16T1, 16T1B, Ch. TS-60	47-4	7=1-16
16T1BH, 16T1H, Ch. TS-89	47-4	7=17-34
17F1, Ch. TS-118A, TS-118B	51-6	9=25-32
17F1, 17F1B, Ch. TS-118	47-5	7=35-45
17F1A, 17F1BA, Ch. TS-89	47-4	7=17-34
17F2W, Ch. TS-118	47-5	7=35-45
17F2W, Ch. TS-118A, TS-118B	51-6	9=25-32
17F2WA, Ch. TS-89	47-4	7=17-34
17F3B, Ch. TS-118	47-5	7=35-45
17F3B, Ch. TS-118A, TS-118B	51-6	9=25-32
17F3BA, Ch. TS-89	47-4	7=17-34
17F4, Ch. TS-118	47-5	7=35-45
17F4, Ch. TS-118A, TS-118B	51-6	9=25-32
17F4A, Ch. TS-89	47-4	7=17-34
17F5, Ch. TS-118	47-5	7=35-45
17F5, Ch. TS-118A, TS-118B	51-6	9=25-32
17F5A, Ch. TS-89	47-4	7=17-34
17F5B, Ch. TS-118	47-5	7=35-45
17F5BA, Ch. TS-89	47-4	7=17-34
17F6, Ch. TS-118	47-5	7=35-45
17F6, Ch. TS-118A, TS-118B	51-6	9=25-32
17F6B, Ch. TS-118	47-5	7=35-45
		7=66-68
17F6BC, 17F6C, Ch. TS-174 TS-174A, TS-174B	9=1	8=1-15
Record Changer MOTOROLA RC-36A	9-RC1	RCH21=1-16
17F7, Ch. TS-118A, TS-118B	51-6	9=25-32
17F7B, Ch. TS-118	47-5	7=35-45
		7=66-68
17F7B, Ch. TS-118A, TS-118B	51-6	9=25-32

MOTOROLA INC. (Cont'd)

MODEL	PACK-FILE	PAGES
17F7BC, Ch. TS-174, TS-174A, TS-174B	9-1	8=1-15
Record Changer MOTOROLA RC-36A	9-RC1	RCH21=1-16
17F8, Ch. TS-118	47-5	7=35-45
17F8, Ch. TS-118A, TS-116B	51-6	9=25-32
17F8C, Ch. TS-174, TS-174A, TS-174B	9-1	8=1-15
Record Changer MOTOROLA RC-36A	9-RC1	RCH21=1-16
17F9, Ch. TS-118A, TS-116B	51-6	9=25-32
17F9, 17F9B, Ch. TS-118	47-5	7=35-45
		7=66-68
17F9BC, 17F9C, Ch. TS-174, TS-174A, TS-174B	9-1	8=1-15
Record Changer MOTOROLA RC-36A	9-RC1	RCH21=1-16
17F11, Ch. TS-228	70-8	10=1-12
17F12, Ch. TS-325	70-8	10=13-41
17F12A, Ch. TS-326	70-8	10=13-41
17F12B, Ch. TS-325	70-8	10=13-41
17F12BA, Ch. TS-326	70-8	10=13-41
17F12D, Ch. TS-401	67-7	10=59-68
17K1A, 17K1BA, Ch. TS-95	47-4	7=17-34
17K1BE, 17K1E, Ch. TS-172	47-5	7=46-56
17K2BE, 17K2E, Ch. TS-172	47-5	7=46-56
17K3, Ch. TS-118	47-5	7=35-45
17K3, Ch. TS-118A, TS-118B	51-6	9=25-32
17K3A, 17K3BA, Ch. TS-89	47-4	7=17-34
17K3B, Ch. TS-118	47-5	7=35-45
17K4A, Ch. TS-95	47-4	7=17-34
17K4E, Ch. TS-172	47-5	7=46-56
17K5, Ch. TS-118	47-5	7=35-45
		7=66-68
17K5, Ch. TS-118A, TS-118B	51-6	9=25-32
17K5C, Ch. TS-174, TS-174A, TS-174B	9-1	8=1-15
17K5E, Ch. TS-221	9-1	8=16-24
17K6, Ch. TS-118	47-5	7=35-45
		7=66-68
17K6, Ch. TS-118A, TS-118B	51-6	9=25-32
17K6C, Ch. TS-174, TS-174A, TS-174B	9=1	8=1-15
17K7, 17K7B, Ch. TS-118	47-5	7=35-45
		7=66-68
17K7, Ch. TS-118A, TS-118B	51-6	9=25-32
17K7BC, 17K7C, Ch. TS-174, TS-174A, TS-174B	9-1	8=1-15
17K8, Ch. TS-236	9-2	9=9-16
17K8A, Ch. TS-228	70-8	10=1-12
17K8B, Ch. TS-236	9-2	9=9-16
17K8BA, Ch. TS-228	70-8	10=1-12
17K9A, 17K9BA, 17K10, Ch. TS-228	70-8	10=1-12
17K10E, Ch. TS-314	51-6	9=17-24
17K10E, Ch. TS-314A	51-6	9=41-44
17K10M, Ch. TS-228	70-8	10=1-12
17K11, Ch. TS-236	9-2	9=9-16
17K11A, Ch. TS-228	70-8	10=1-12
17K11B, Ch. TS-236	9-2	9=9-16
17K11BA, Ch. TS-228	70-8	10=1-12
17K11C, Ch. TS-236	9-2	9=9-16
17K12, Ch. TS-325	70-8	10=13-41
17K12A, Ch. TS-326	70-8	10=13-41
17K12B, Ch. TS-325	70-8	10=13-41
17K12BA, Ch. TS-326	70-8	10=13-41
17K12W, Ch. TS-325	70-8	10=13-41
17K12WA, Ch. TS-326	70-8	10=13-41
17K13A, Ch. TS-326A, TS-326B	70-8	10=13-41
17K13D, Ch. TS-401	67-7	10=59-68
17T1, 17T1B, Ch. TS-118	47-5	7=35-45
17T1A, 17T1BA, Ch. TS-89	47-4	7=17-34
17T2, Ch. TS-118A, TS-118B	51-6	9=25-32
17T2, 17T2B, Ch. TS-118	47-5	7=35-45
17T2A, 17T2BA, Ch. TS-89	47-4	7=17-34
17T3, Ch. TS-118	47-5	7=35-45
17T3, Ch. TS-118A, TS-118B	51-6	9=25-32

MOTOROLA INC. (Cont'd)

MODEL	PACK-FILE	PAGES
17T3A, Ch. TS-89	47-4	7=17-34
17T3G, Ch. TS-221	9-1	8=16-24
17T3X1, Ch. TS-118A, TS-118B	51-6	9=25-32
17T4, Ch. TS-118	47-5	7=35-45
		7=66-68
17T4, Ch. TS-118A, TS-118B	51-8	9=25-32
17T4C, Ch. TS-174, TS-174A, TS-174B	9-1	8=1-15
17T4E, Ch. TS-221	9-1	8=16-24
17T5A, Ch. TS-214	51-6	9=33-40
17T5C, Ch. TS-228	70-8	10=1-12
17T5CA, Ch. TS-214	51-6	9=33-40
17T5D, Ch. TS-236	9-2	9=9-16
17T5E, Ch. TS-314	51-6	9=17-24
17T5E, Ch. TS-314A	51-6	9=41-44
17T5F, Ch. TS-315	51-6	9=17-24
17T5F, Ch. TS-315A	51-6	9=41-44
17T6BD, Ch. TS-236	9-2	9=9-16
17T6BF, Ch. TS-228	70-8	10=1-12
17T6C, 17T6D, Ch. TS-236	9-2	9=9-16
17T6F, Ch. TS-228	70-8	10=1-12
17T6G, Ch. TS-314A	51-6	9=41-44
17T7, Ch. TS-325	70-8	10=13-41
17T7A, Ch. TS-326	70-8	10=13-41
17T8, Ch. TS-325	70-8	10=13-41
17T8A, Ch. TS-326	70-8	10=13-41
17T8B, Ch. TS-325	70-8	10=13-41
17T8BA, Ch. TS-326	70-8	10=13-41
17T9, 17T9A, 17T9E, Ch. TS-326A, TS-326B	70-8	10=13-41
17T9EF, 17T9F, Ch. TS-401	67-7	10=59-68
17T10, Ch. TS-325B	70-8	10=13-41
17T10A, Ch. TS-326A, TS-326B	70-8	10=13-41
17T10D, Ch. TS-401	67-7	10=59-68
19K2, 19K2B, Ch. TS-101	47-5	7=57-65
19K2BE, 19K2E, Ch. TS-119, TS-119A	9-1	8=25-38
19K3, Ch. TS-101	47-5	7=57-65
19K4, 19K4B, Ch. TS-101	47-5	7=57-65
20F1, 20F1B, Ch. TS-119, TS-119A	9-1	8=25-38
Record Changer MOTOROLA RC-36A	9-RC1	RCH21=1-16
20F2, 20F2B, Ch. TS-119B, TS-119C	9-1	8=25-38
Record Changer MOTOROLA RC-36A	9-RC1	RCH21=1-16
20K1, 20K1B, 20K2, Ch. TS-119B, TS-119C	9-1	8=25-38
20K3, 20K3B, Ch. TS-119D	67-7	10=51-58
20K4, 20K4B, Ch. TS-119D	67-7	10=51-58
20K6, 20K6B, Ch. TS-307	70-8	10=42-50
20T1B, Ch. TS-119B, TS-119C	9-1	8=25-38
20T2, Ch. TS-119D	67-7	10=51-58
20T2A, Ch. TS-307	70-8	10=42-50
20T2B, Ch. TS-119D	67-7	10=51-58
20T2BA, Ch. TS-307	70-8	10=42-50
20T3, 20T3B, Ch. TS-307	70-8	10=42-50
21F1, 21F1B, Ch. TS-351	70-8	10=13-41
21K1, 21K1B, Ch. TS-351	70-8	10=13-41
21K2, 21K2B, Ch. TS-351	70-8	10=13-41
21K3, 21K3B, 21K3W, Ch. TS-351	70-8	10=13-41
21T1, 21T1B, Ch. TS-351	70-8	10=13-41
21T2, 21T2B, Ch. TS-351	70-8	10=13-41

M. P. TELEVISION

MODEL	PACK-FILE	PAGES
16T503, 17T504	9-1	8=1-4

MULTIPLE TELEV. MFG. CO.

MODEL	PACK-FILE	PAGES
EC20, Ch. 630K3B	9-1	8=1-2
HFD17, HFD20, Ch. 630K3B	9-1	8=1-2
LFD17, LFD20, Ch. 630K3B	9-1	8=1-2
OF17, OF20, OF20R, Ch. 630K3B	9-1	8=1-2
630K3B, Ch.	9-1	8=1-2

MUNTZ T-V, INC.

MODEL	PACK-FILE	PAGES
M31, Ch. TV17A2	36-1	6=1-12
M31R, Ch. TV17A3	36-1	6=1-12
M32, M32R, Ch. TV17A3	36-1	6=1-12
M33, M34, Ch. TV17A4	36-1	6=1-12
M41, M42, Ch. TV17A3A	36-1	6=1-12
M46, M49, Ch. TV17A7	36-1	6=1-12
TV17A2, Ch.	36-1	6=1-12
TV17A3, TV17A3A, Ch.	36-1	6=1-12
TV17A4, TV17A7, Ch.	36-1	6=1-12
WG2060	51-2	9=13-20
17B1, 17B2, 17B3, 17B4, Ch.	51-2	9=1-12
17B4, Carco, Ch.	67-3	10=1-10
17B5, 17B6, Ch.	51-2	9=1-12
17B6, Carco 17B6, Ch.	67-3	10=1-10
*1750, 1751, 1752, Ch. TV17A3A	38-1	6=1-12
*2053, 2054, 2055, 2056, Ch. TV17A7	36-1	6=1-12
2053-A, 2054-A, 2055-A, Ch. 17B1, 17B2	51-2	9=1-12
2055-B, Ch. 17B2	51-2	9=1-12
2056-A, Ch. 17B1, 17B2	51-2	9=1-12
2158-A, 2159-A, Ch. 17B5		
2158-A, 2159-A, Ch. 17B6, Carco 17B6, Late	67-3	10=1-10
2162-A, Ch. 17B5, 17B6	51-2	9=1-12
2162-A, Ch. 17B6, Carco 17B6, Late	67-3	10=1-10
2457-A, Ch. 17B3, 17B4	51-2	9=1-12
2457-A, 2461-A, Ch. Carco 17B4, Late	67-3	10=1-10

NATIONAL CO., INC.

MODEL	PACK-FILE	PAGES
TV1701	67-1	10=1-12

NORELCO

See NORTH AMERICAN PHILLIPS CO., INC.

NORTH AMERICAN PHILLIPS CO., INC. (NORELCO)

MODEL	PACK-FILE	PAGES
The Irvington	38-1	6=1-11
The Mt. Vernon	38-1	6=1-11
PT200, Ch.	38-1	6=1-11
PT200, Ch. PT200, The Irvington	38-1	6=1-11
PT300, Ch. PT200, The Mt. Vernon	38-1	6=1-11

OLYMPIC RADIO & TELEV. INC.

MODEL	PACK-FILE	PAGES
Broadmoor	44-1	6=1-12
Catalina	44-1	6=1-15
Challenger	44-1	6=1-12
Lancaster, Marlborough	44-1	7=1-8
Monte Carlo	44-1	6=1-12
Prince George	44-1	6=1-15
Riviera	44-1	6=1-12
Riviera Deluxe	44-1	7=1-8
Windsor	44-1	7=1-8
DX-214, DX-215, DX-216	44-1	4=1
		5=1-6
DX-619, DX-620	44-1	5=1-7
DX-621	44-1	5=1-7
		6=13-15
DX-622	44-1	5=1-7
DX-931, DX-932	44-1	5=1-7
DX-950	44-1	5=1-7
TG, Ch.	67-2	10=1-9
TH, Ch.	67-2	10=10-16
XL-210, XL-211	44-1	5=8-14
XL-612, XL-613	44-1	5=8-14
17C24, 17K31, 17K32, Ch. TG	67-2	10=1-9
17T20, 17T33, Ch. TG	67-2	10=1-9
21C28, 21D29, Ch. TH	67-2	10=10-16
21K26, 21T27, Ch. TH	67-2	10=10-16
752, Riviera	44-1	6=1-12

* See Muntz HANDY No. 8, Pack 36

MODEL	PACK-FILE	PAGES
OLYMPIC RADIO & TELEV. INC. (Cont'd)		
752U	44-1	6=1-12
753, Monte Carlo	44-1	6=1-12
753U	44-1	6=1-12
755, Challenger	44-1	6=1-12
755U	44-1	6=1-12
762, Riviera Deluxe	44-1	7=1-8
764, Broadmoor	44-1	6=1-12
764U	44-1	6=1-12
766, Catalina	44-1	6=1-15
766U, 767	44-1	6=1-12
769, Prince George	44-1	6=1-15
783	44-1	7=1-8
967, Windsor	44-1	7=1-8
968, Lancaster	44-1	7=1-8
970, Marlborough	44-1	7=1-8
PACKARD-BELL CO.		
2001-TV, 2002-TV	44-2	5=1-8
2091-TV, 2092-TV	44-2	5=3-8
2101, 2102, Ch. 2101-2	44-2	7=1-9
2101-2, Ch.	44-2	7=1-9
2105,2105A, Ch. 2101-2	44-2	7=1-9
2202-TV, 2204-TV	44-2	7=10-16
2111, Ch. 2111-2	52-3	9=15-20
2111-2, Ch.	52-3	9=15-20
2112, 2113, Ch. 2111-2	52-3	9=15-20
2114, Ch. 2114	52-3	9=15-20
2114, Ch.	52-3	9=15-20
2115, Ch. 2115-2	71-4	10=1-10
2115-2, Ch.	71-4	10=1-16
2116, DeLuxe, Standard, Ch. 2115-2	71-4	10=1-10
2117, DeLuxe, Standard, Ch. 2117	71-4	10=1-10
2117, Ch.	71-4	10=1-10
2118	71-4	10=17-26
2301, 2302	9-1	8=1-13
2311	52-3	9=1-14
2421, Ch. 2421-2	71-4	10=27-39
2421-2, Ch.	71-4	10=27-39
2422, DeLuxe, Standard, Ch. 2421-2	71-4	10=27-39
2423, DeLuxe, Standard, Ch. 2423-2	71-4	10=27-39
2423-2, Ch.	71-4	10=27-39
2601-TV	44-2	5=9-14
2602	44-2	7=1-9 8=14-19
2611	52-3	9=21-24
Record Changer VM-950	52-RC1	RCH22=1-16
2612, Ch. 2115-2	71-4	10=11-16
2692-TV	44-2	5=9-14
2801-TV, 2801A-TV	44-2	6=1-7
2803	9-1	8=1-13
Record Changer WEBSTER 100	9-RC1	RCH21=1-10
2811	52-3	9=1-14
Record Changer WEBSTER 100	52-RC1	RCH21=1-10
2811, Late	52-3	9=1-14
2822, Ch. 2822	71-4	10=27-39
2822, Ch.	71-4	10=27-39
PATHE TELEVISION CORP.		
TAP, Ch.	10-1	8=1-5
14-PT	10-1	8=6-11
17-N25, Ch. TAP	10-1	8=1-5
17-PC	10-1	8=6-11
17-RPC, 17-RPT, Ch. TAP	10-1	8=1-5
PHILCO CORP.		
RC-1 Remote Control Unit	10-1	8=1-4
C-2, CP-1, Ch.	22-3	9=1-16
D-1, D-4, Ch.	22-3	9=17-32
F-2, Ch.	22-3	9=1-16
G-1, Ch.	71-8	10=1-12

MODEL	PACK-FILE	PAGES
PHILCO CORP. (Cont'd)		
G-2, Ch.	68-7	10=13-21
G-4, Ch.	68-7	10=22-34
J-1, Ch.	68-7	10=35-44
33, 35, 37, 38, Ch.	22-3	9=1-16
41, Ch.	22-3	9=17-32
42, Ch.	68-7	10=13-21
44, Ch.	22-3	9=17-32
44, Ch.	68-7	10=22-34
50-T1104, Codes 121, 122	34-4	5=1-6 6=18-20
50-T1105, Codes 121, 122	34-4	5=1-6 6=19-20
50-T1106	34-4	5=1-6 6=19-20
50-T1403, Code 125	34-4	5=7-16 6=29-32
50-T1404, Codes 123, 124, 125	34-4	5=7-16 6=29-32
50-T1406, Codes 123, 124, 125	34-4	5=7-16 6=29-32
50-T1432, Code 124	34-4	5=7-16 6=29-32
50-T1443, Codes 122, 123	37-5	6=33-43
50-T1478, 50-T1479	37-5	6=44-54
50-T1476, 50-T1477	37-5	6=44-54
Record Changer PHILCO M-20	37-RC1	RCH20=1-16
50-T1481, 50-T1482	37-5	6=44-54
Record Changer PHILCO M-20	37-RC1	RCH20=1-16
50-T1483	22-2	7=1-10
50-T1484	37-5	6=44-54
50-T1600, Code 121	34-4	5=17-23
50-T1600, Code 122	22-2	7=11-17
50-T1630, Code 121	22-2	7=18-21 5=17-23
50-T1630, Code 122	22-2	7=18-32
50-T1632, 50-T1633, Code 121	34-4	5=17-23
50-T1632, 50-T1633, Code 122	22-2	7=11-17
50-702, Code 122	37-5	6=9-17 5=17-23
51-PT1207, 51-PT1208	10-1	8=5-12
51-PT1234	10-1	8=5-12
51-PT1282	10-1	8=5-12
Record Changer PHILCO M-22	10-RC2	RCH22=1-12
51-T1443B, 51-T1443L, 51-T1443M	22-2	7=33-40
51-T1443PL, 51-T1443PM, 51-T1443PW	22-2	7=41-50
51-T1443X, 51-T1443XL	22-2	7=33-40
51-T1601, 51-T1601T, 51-T1602, Codes 121, 122	22-2	7=51-58
51-T1634, Codes 123, 124	22-2	7=51-58
51-T1836, 51-T1836L, Code 123	10-1	8=14-31
51-T1838, Code 124	10-1	8=14-31
51-T1870, 51-T1872, Code 121	10-1	8=14-31
Record Changer PHILCO M-22	10-RC2	RCH22=1-12
51-T1874, 51-T1874L, Code 121	10-1	8=14-31
Record Changer PHILCO M-22	10-RC2	RCH22=1-12
51-T1875, Code 121	10-1	8=14-31
Record Changer PHILCO M-20	10-RC1	RCH20=1-16
51-T1876, Code 124	10-1	8=14-31
Record Changer PHILCO M-20	10-RC1	RCH20=1-16
51-T2134, 51-T2136, 51-T2138, Code 124	10-1	8=14-31
51-T2175, 51-T2176, Code 124	10-1	8=14-31
Record Changer PHILCO M-20	10-RC1	RCH20=1-16
52-T1802, Ch. 33, C-2, Code 122	22-3	9=1-16
52-T1802, Ch. 37, C-2, Code 123	22-3	9=1-16
52-T1802, Ch. 71, G-1, Code 124	71-8	10=1-12

MODEL	PACK-FILE	PAGES
PHILCO CORP. (Cont'd)		
52-T1804, Ch. 33, C-2, Code 122	22-3	9=1-16
52-T1804, Ch. 37, C-2, Code 123	22-3	9=1-16
52-T1804, Ch. 71, G-1, Code 124	71-8	10=1-12
52-T1808, Ch. 33, C-2, Code 122	22-3	9=1-16
52-T1808, Ch. 37, C-2, Code 123	22-3	9=1-16
52-T1808, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T1810, Ch. 33, C-2, Code 122	22-3	9=1-16
52-T1810, Ch. 37, C-2, Code 123	22-3	9=1-16
52-T1810, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T1810-L, Ch. 33, C-2, Code 122	22-3	9=1-16
52-T1812, Ch. 33, C-2, Code 122	22-3	9=1-16
52-T1812, Ch. 37, C-2, Code 123	22-3	9=1-16
52-T1812, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T1820, Ch. 37, C-2, Code 123	22-3	9=1-16
52-T1820, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T1820, Ch. 71, G-1, Code 124	71-8	10=1-12
52-T1821, Ch. 37, C-2, Code 123	22-3	9=1-16
52-T1821, Ch. 71, G-1, Code 124	71-8	10=1-12
52-T1822, Ch. 71, G-1, Code 124	71-8	10=1-12
52-T1831, Ch. 33, C-2, Code 122	22-3	9=1-16
52-T1831, Ch. 33, C-2, Code 124	22-3	9=1-16
52-T1839, Ch. 33, C-2, Code 122	22-3	9=1-16
52-T1839, Ch. 37, C-2, Code 123	22-3	9=1-16
52-T1839, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T1840, Ch. 33, C-2, Code 122	22-3	9=1-16
52-T1840, Ch. 37, C-2, Code 123	22-3	9=1-16
52-T1840, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T1841-L, Ch. 37, C-2, Code 123	22-3	9=1-16
52-T1841-L, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T1842, Ch. 33, C-2, Code 122	22-3	9=1-16
52-T1842, Ch. 37, C-2, Code 123	22-3	9=1-16
52-T1842, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T1842-L, Ch. 33, C-2, Code 124	22-3	9=1-16
52-T1842-L, Ch. 37, C-2, Code 123	22-3	9=1-16
52-T1844, Ch. 33, C-2, Code 122	22-3	9=1-16
52-T1844, Ch. 33, C-2, Code 124	22-3	9=1-16
52-T1844, Ch. 37, C-2, Code 123	22-3	9=1-16
52-T1844, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T1845, Ch. 71, G-1, Code 124	71-8	10=1-12

MODEL	PACK-FILE	PAGES
PHILCO CORP. (Cont'd)		
52-T1850, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T1882, Ch. 35, CP-1, Code 122	22-3	9=1-16
Record Changer PHILCO M-22	22-RC2	RCH22=1-12
52-T1882, Ch. 38, CP-1, Code 123	22-3	9=1-16
Record Changer PHILCO M-22	22-RC2	RCH22=1-12
52-T1883, Ch. 44, D-4, Code 121	22-3	9=17-32
52-T2106, Ch. 35, F-2, Code 122	22-3	9=1-16
52-T2106, Ch. 38, F-2, Code 123	22-3	9=1-16
52-T2106, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2108, Ch. 35, F-2, Code 122	22-3	9=1-16
52-T2108, Ch. 38, F-2, Code 123	22-3	9=1-16
52-T2108, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2110, Ch. 35, F-2, Code 122	22-3	9=1-16
52-T2110, Ch. 38, F-2, Code 123	22-3	9=1-16
52-T2110, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2120, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2120, Ch. 71, G-1, Code 124	71-8	10=1-12
52-T2122, 52-T2122-L, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2122, 52-T2122-L, Ch. 71, G-1, Code 124	71-8	10=1-12
52-T2140, Ch. 35, F-2, Code 122	22-3	9=1-16
52-T2140, Ch. 38, F-2, Code 123	22-3	9=1-16
52-T2140, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2142, Ch. 35, F-2, Code 122	22-3	9=1-16
52-T2142, Ch. 38, F-2, Code 123	22-3	9=1-16
52-T2142, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2144, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2145X, Ch. 44, D-4, Code 125	22-3	9=17-32
52-T2150, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2150, Ch. 71, G-1, Code 124	71-8	10=1-12
52-T2151, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2151, Ch. 71, G-1, Code 124	71-8	10=1-12
52-T2151L, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2151-L, Ch. 71, G-1, Code 124	71-8	10=1-12
52-T2152, Ch. 71, G-1, Code 124	71-8	10=1-12
52-T2175, 52-T2176, Ch. 35, F-2, Code 124	22-3	9=1-16
52-T2175, Ch. 42, G-2, Code 125	68-7	10=13-21
52-T2182, 52-T2182-L, Ch. 44, D-4, Code 121	22-3	9=17-32
Record Changer PHILCO M-22	52-RC2	RCH22=1-12
52-T2224, Ch. 41, D-1, Code 121	22-3	9=17-32

PHILCO CORP. (Cont'd)

MODEL	PACK-FILE	PAGES
52-T2244, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2245, Ch. 44, D-4, Code 121	22-3	9=17-32
52-T2252, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2252, Ch. 71, G-1, Code 124	71-8	10=1-12
52-T2253, Ch. 44, D-4, Code 121	22-3	9=17-32
52-T2254, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2256, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2258, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2259, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2275, Ch. 35, F-2, Code 122	22-3	9=1-16
52-T2283, Ch. 44, D-4, Code 121	22-3	9=17-32
53-T1824, 53-T1825, 53-T1826, 53-T1852, Ch. 71, G-1, Code 124	71-8	10=1-12
53-T1853, 53-T1853L, Ch. 91, J-1, Code 126	68-7	10=35-44
53-T1883, 53-T1884, Ch. 44, G-4, Code 125	68-7	10=22-34
53-T1886, 53-T1886L, Ch. 44, G-4, Code 125	68-7	10=22-34
53-T2126, Ch. 42, G-2, Code 125	68-7	10=13-21
53-T2127, Ch. 91, J-1, Code 126	68-7	10=35-44
53-T2193, Ch. 44, G-4, Code 125	68-7	10=22-34
53-T2260, 53-T2262, 53-T2264, Ch. 42, G-2, Code 125	68-7	10=13-21
53-T2266, 53-T2268, Ch. 91, J-1, Code 126	68-7	10=35-44
53-T2269, 53-T2270, 53-T2271, Ch. 91, J-1, Code 126	68-7	10=35-44
53-T2273C, 53-T2273M, Ch. 91, J-1, Code 126	68-7	10=35-44
71, Ch.	71-8	10=1-12
76-4402, 76-5411, 76-5433, Series; Tuners	37-5	6=1-8
91, Ch.	68-7	10=35-44

PHILHARMONIC RADIO & TELEV. CORP.

MODEL	PACK-FILE	PAGES
C-6161, T-616	22-1	7=1-5
1116, 5816	22-1	7=1-5

PILOT RADIO CORP.

MODEL	PACK-FILE	PAGES
TV-125	20-1	5=1-12
TV-127	37-2	6=1-10
TV-161	20-1	5=1-12
TV-163	20-1	5=1-14
TV-164	37-2	6=1-10
TV-165	20-1	5=1-14
TV-167A	37-2	6=1-10
*TV-167B, TV-168	37-2	6=1-10
TV-191	37-2	6=1-10
*TV-191	37-2	6=1-10
TV-271, TV-273, TV-274	53-3	9=1-14
TV-293, TV-294	53-3	9=1-14

PLYMOUTH

See INTERSTATE STORES BUYING CORP.

PRECISION

See THE HERTNER ELECTRIC CO.

* See Pilot HANDY No. 1, Pack 37.

RADIO CORP. OF AMERICA

MODEL	PACK-FILE	PAGES
Ainsworth	72-12	10=64-72
Albury	72-12	10=55-63
Ashton	72-12	10=55-63
Belgrove	74-13	10=73-82
Bently	16-3	9=1-16
Brandon	74-13	10=73-82
Brett	72-12	10=64-72
Bristol	16-5	9=73-80
Bristol, Late	72-12	10=17-34
Brookfield	74-13	10=73-82
Caldwell	72-12	10=17-34
Calhoun	72-12	10=17-34
Clarendon	16-4	9=45-52
Colby	68-11	10=1-16
Covington	72-12	10=17-34
Crafton	68-11	10=1-16
Donley	16-4	9=45-52
Fairfield, Final	16-5	9=53-72
Glenside	68-11	10=1-16
Hadley	72-12	10=55-63
Hampton	16-5	9=73-80
Hampton, Late	72-12	10=17-34
Haywood	16-3	9=17-30
Highland, Final	16-5	9=53-72
Hillsdale	11-2	8=62-76
Hillsdale, Late	72-12	10=35-54
Kentwood	72-12	10=55-63
Lambert	74-13	10=73-82
Lansford	74-13	10=73-82
Lindale	74-13	10=73-82
Kendall	16-5	9=73-80
Kent, Modern, Newport; Final	16-5	9=53-72
Preston	16-5	9=73-80
Preston, Late	72-12	10=17-34
Provincial	11-2	8=62-76
Provincial, Final	16-5	9=53-72
Provincial	72-12	10=35-54
Regency, Final	16-5	9=53-72
Rockingham	16-4	9=45-52
Rutland	10-1	8=31-48
Shelley	72-12	10=55-63
Somerville	10-1	8=1-16
Suffolk	16-4	9=45-52
Talbot	16-4	9=31-44
Whitfield, Late	72-12	10=17-34
Winston, Final	16-5	9=53-72
York	11-2	8=62-76
York, Late	72-12	10=35-54
KCS31-1, Ch., S1000	20-6	5=48-64
KCS31-1, Ch., 9TW390	20-6	5=32-47
KCS34C, Ch.	34-7	5=80-110
KCS38, Ch.	34-7	5=65-79
KCS38C, Ch.	20-6	5=1-15
KCS40, KCS40A, Ch.	37-8	6=1-15
KCS40B, Ch.	46-10	7=50-64
KCS41-1, Ch.	20-6	5=16-31
KCS45, KCS45A, Ch.	46-9	7=1-16
KCS46, Ch.	46-9	7=17-32
KCS47, KCS47A, KCS47AT, Ch.	46-10	7=33-49
KCS47B, KCS47C, KCS47D, Ch.; Final	16-5	9=53-72
KCS47E, Ch.	16-4	9=31-44
KCS47F, KCS47G, Ch.; Final	16-5	9=53-72
KCS47GF-2, Ch.	16-3	9=17-30
KCS47T, Ch.	46-10	7=33-49
KCS48A, Ch.	10-1	8=31-48
KCS49B, Ch.	11-2	8=62-76
KCS49B, Ch., Late	72-12	10=35-54
KCS49BF, KCS49BF-2, Ch.	72-12	10=35-54
KCS49C, Ch.	11-2	8=62-76
KCS49C, Ch., Late	72-12	10=35-54
KCS49CF, KCS49CF-2, Ch.	72-12	10=35-54
KCS60A, Ch.	11-2	8=77-94
KCS61, Ch.	16-3	9=1-16
KCS62, Ch.	10-1	8=1-16
KCS66, Ch.	16-5	9=73-80
KCS66, Ch., Late	72-12	10=17-34
KCS66A, Ch.	16-5	9=73-80
KCS66A, Ch., Late	72-12	10=17-34
KCS66C, Ch.	68-11	10=1-16

RADIO CORP. OF AMERICA (Cont'd)

MODEL	PACK-FILE	PAGES
KCS66D, Ch.	72-12	10=17-34
KCS68C, Ch.	16-4	9=45-52
KCS72, Ch.	72-12	10=55-63
KCS72A, Ch.	74-13	10=73-82
KCS74, Ch.	72-12	10=64-72
S1000, Ch. KCS31-1	20-6	5=48-64
T100, Ch. KCS38	34-7	5=65-79
T120, Ch. KCS34C	34-7	5=80-94
T121, Ch. KCS34C	34-7	5=95-110
T164, Ch. KCS40	37-8	6=1-15
TC165, TC166, TC167, TC168, Ch. KCS40A	37-8	6=1-15
2T51, Ch. KCS45	46-9	7=1-16
2T60, Ch. KCS45A	46-9	7=1-16
2T81, Ch. KCS46	46-9	7=17-32
4T101, Ch. KCS61, Bently	16-3	9=1-16
4T141, Ch. KCS62, Somerville	10-1	8=1-16
Record Changer RCA 960282-4, 960282-5	10-RC2	RCH21=19-34
RCA RP-190-2	10-RC1	RCH21=1-12
6T53, 6T54, Ch. KCS47, KCS47T	46-10	7=33-49
6T64, 6T65, Ch. KCS47A, KCS47AT	46-10	7=33-49
6T71, Ch. KCS47A, KCS47AT	46-10	7=33-49
6T72, Ch. KCS40B	46-10	7=50-64
6T74, 6T75, 6T76, Ch. KCS47A, KCS47AT	46-10	7=33-49
7T103, Ch. KCS47B, Newport, Final	16-5	9=53-72
7T104, Ch. KCS47B, Kent, Final	16-5	9=53-72
7T104B, Ch. KCS47F, Final	16-5	9=53-72
7T111B, Ch. KCS47GF-2, Haywood	16-3	9=17-30
7T112, Ch. KCS47C, Highland, Final	16-5	9=53-72
7T112B, Ch. KCS47G, Final	16-5	9=53-72
7T122, Ch. KCS47C, Fairfield, Final	16-5	9=53-72
7T122B, Ch. KCS47G, Final	16-5	9=53-72
7T123, Ch. KCS47C, Regency, Final	16-5	9=53-72
7T123B, Ch. KCS47G, Final	16-5	9=53-72
7T124, Ch. KCS47C, Modern, Final	16-5	9=53-72
7T125B, Ch. KCS47G, Provincial, Final	16-5	9=53-72
7T132, Ch. KCS47D, Winston, Final	16-5	9=53-72
7T143, Ch. KCS48A, Rutland	10-1	8=31-48
Record Changer RCA 960284	10-RC3	RCH21=35-50
RCA RP-190	10-RC1	RCH21=1-12
9T105, Ch. KCS49B, York	11-2	8=62-76
9T105, Ch. KCS49B, KCS49BF, KCS49BF-2, York, Late	72-12	10=35-54
9T126, Ch. KCS49C, Hillsdale	11-2	8=62-76
9T126, Ch. KCS49C, KCS49CF, KCS49CF-2, Hillsdale, Late	72-12	10=35-54
9T128, Ch. KCS49C, Provincial	11-2	8=62-76
9T128, Ch. KCS49C, KCS49CF, KCS49CF-2, Provincial, Late	72-12	10=35-54
9T147, Ch. KCS60A	11-2	8=77-94
Record Changer RCA 960284	11-RC3	RCH21=35-50
RCA RP-190	11-RC1	RCH21=1-12
9T256, Ch. KCS38C	20-6	5=1-15
9TW309, Ch. KCS41-1	20-6	5=16-31
9TW390, Ch. KCS31-1	20-6	5=32-47
16T152, Ch. KCS47E, Talbot	16-4	9=31-44
17T150, Ch. KCS66C, Colby	68-11	10=1-16
17T151, Ch. KCS66C, Glenside	68-11	10=1-16
17T153, Ch. KCS66, Bristol	16-5	9=73-80
17T153, Ch. KCS66, Bristol, Late	72-12	10=17-34
17T154, Ch. KCS66, Whitfield, Late	72-12	10=17-34
17T155, Ch. KCS66, Preston	16-5	9=73-80
17T155, Ch. KCS66, Preston, Late	72-12	10=17-34

RADIO CORP. OF AMERICA (Cont'd)

MODEL	PACK-FILE	PAGES
17T160, Ch. KCS66, Hampton	16-5	9=73-80
17T160, Ch. KCS66, Hampton, Late	72-12	10=17-34
17T162, Ch. KCS66A, Caldwell, Late	72-12	10=17-34
17T163, Ch. KCS66C, Crafton	68-11	10=1-16
17T172, Ch. KCS66A, Covington, Late	72-12	10=17-34
17T172K, Ch. KCS66D	72-12	10=17-34
17T173, Ch. KCS66A, Calhoun, Late	72-12	10=17-34
17T173K, Ch. KCS66D	72-12	10=17-34
17T174, Ch. KCS66A, Kendall	16-5	9=73-80
17T174K, Ch. KCS66D	72-12	10=17-34
17T200, Ch. KCS72, Shelley	72-12	10=55-63
17T201, Ch. KCS72, Hadley	72-12	10=55-63
17T202, Ch. KCS72, Kentwood	72-12	10=55-63
17T211, Ch. KCS72, Ashton	72-12	10=55-63
17T220, Ch. KCS72, Albury	72-12	10=55-63
17T250DE, Ch. KCS74, Brett	72-12	10=64-72
17T261DE, Ch. KCS74, Ainsworth	72-12	10=64-72
21T176, Ch. KCS68C, Suffolk	16-4	9=45-52
21T177, Ch. KCS68C, Donley	16-4	9=45-52
21T178, Ch. KCS68C, Rockingham	16-4	9=45-52
21T179, Ch. KCS68C, Clarendon	16-4	9=45-52
21T208, Ch. KCS72A, Lambert	74-13	10=73-82
21T217, Ch. KCS72A, Brookfield	74-13	10=73-82
21T218, Ch. KCS72A, Lansford	74-13	10=73-82
21T227, Ch. KCS72A, Lindale	74-13	10=73-82
21T228, Ch. KCS72A, Brandon	74-13	10=73-82
21T229, Ch. KCS72A, Belgrove	74-13	10=73-82

RADIO CRAFTSMEN

MODEL	PACK-FILE	PAGES
RC101	15-1	8=1-5
RC100A	38-2	5=1-6
RC201	15-1	8=6-9
RC202	74-3	10=1-6

RAYTHEON TELEV. & RADIO CORP.

MODEL	PACK-FILE	PAGES
Adams	2-1	8=1-13
The Belmont	27-2	5=1-8
Catalina, Clayton	2-1	8=1-13
Commander	58-4	10=1-10
The Console	27-2	5=1-8
Constellation	2-1	8=1-13
The Evanston	48-3	7=1-16
Highland	58-4	10=11-20
Linden	58-4	10=1-10
The Marquis	48-3	7=1-16
The Mayfair, The Mozart	48-3	7=1-16
Raleigh	58-4	10=11-20
The Rancho, The Revere	48-3	7=1-16
The Rocket	48-3	7=1-16
Roseland	58-4	10=1-10
The Rover	27-2	5=1-8
The Savoy, The Santung	48-3	7=1-16
Sensation	58-4	10=11-20
The Starlight	2-1	8=14-25
The Suburban	27-2	5=1-8
Vogue	58-4	10=11-20
C-1104B, Ch. 12AX27, The Console	27-2	5=1-8
C-1401, Ch. 14AX21	27-2	5=9-18
C-1602, Ch. 16AX23, 16AX25, 16AX26	27-2	5=21-29
C-1602, Series C, Ch. 16AX29	27-2	5=21-29
C-1614A, Ch. 16AY211, The Marquis	48-3	7=1-16
C-1614B, Ch. 16AY28, The Marquis	48-3	7=1-16
C-1615A, Ch. 16AY211, The Mayfair	48-3	7=1-16
C-1615B, Ch. 16AY28, The Mayfair	48-3	7=1-16

RAYTHEON SEARS — SEARS SPARTON

RAYTHEON TELEV. & RADIO CORP. (Cont'd)

MODEL	PACK-FILE	PAGES
C-1616A, Ch. 16AY211, The Mozart	48-3	7=1-16
C-1616B, Ch. 16AY28, The Mozart	48-3	7=1-16
C-1714A, Ch. 17AY24, The Marquis	48-3	7=1-16
C-1714B, Ch. 17AY21, The Marquis	48-3	7=1-16
C-1715A, Ch. 17AY24, The Mayfair	48-3	7=1-16
C-1715B, Ch. 17AY21, The Mayfair	48-3	7=1-16
C-1716A, Ch. 17AY24, The Mozart	48-3	7=1-16
C-1716B, Ch. 17AY21, The Mozart	48-3	7=1-16
C-1724A, Ch. 17AY21, The Evanston	48-3	7=1-16
C-1729A, Ch. 17AY21A, Roseland	58-4	10=1-10
C-1731A, Ch. 17AY21A, Linden	58-4	10=1-10
C-2001A, Ch. 20AY21, Clayton	2-1	8=1-13
C-2002A, Ch. 20AY21, Catalina	2-1	8=1-13
C-2006A, Constellation	2-1	8=1-13
C-2103A, Ch. 21AY21, Raleigh	58-4	10=11-20
C-2105A, Ch. 21AY21, Highland	58-4	10=11-20
M-1105B, Ch. 12AX27, The Suburban	27-2	5=1-8
M-1106, Ch. 12AX27, The Rover	27-2	5=1-8
M-1107, Ch. 12AX27, The Belmont	27-2	5=1-8
M-1402, M-1403, M-1404, Ch. 14AX21	27-2	5=9-18
M-1601, Ch. 16AX23, 16AX25, 16AX26	27-2	5=21-29
M-1611A, Ch. 16AY211, The Rocket	48-3	7=1-16
M-1611B, Ch. 16AY28, The Rocket	48-3	7=1-16
M-1612A, Ch. 16AY211, The Rancho	48-3	7=1-16
M-1612B, Ch. 16AY28, The Revere	48-3	7=1-16
M-1613A, Ch. 16AY211, The Revere	48-3	7=1-16
M-1613B, Ch. 16AY28, The Revere	48-3	7=1-16
M-1711A, Ch. 17AY24, The Rocket	48-3	7=1-16
M-1711B, Ch. 17AY21, The Rocket	48-3	7=1-16
M-1712A, Ch. 17AY24, The Rancho	48-3	7=1-16
M-1712B, Ch. 17AY21, The Rancho	48-3	7=1-16
M-1713A, Ch. 17AY24, The Revere	48-3	7=1-16
M-1713B, Ch. 17AY21, The Revere	48-3	7=1-16
*M-1725A, Ch. 17AY21	48-3	7=1-16
M-1726A, Ch. 17AY21A, Commander	58-4	10=1-10
M-1728A, Ch. 17AY21A, Vogue	58-4	10=1-10
M-2101A, Ch. 21AY21, Sensation	58-4	10=11-20
P-301, Series B, Ch. 7DX22P	27-2	5=31-34
RC-1405, Ch. 14AX21	27-2	5=9-20
RC-1618A, Ch. 16AY211, The Savoy	48-3	7=1-16
RC-1618B, Ch. 16AY28, The Savoy	48-3	7=1-16
RC-1619A, Ch. 16AY211, The Santung	48-3	7=1-16

RAYTHEON TELEV. & RADIO CORP. (Cont'd)

MODEL	PACK-FILE	PAGES
RC-1619B, Ch. 16AY28, The Santung	48-3	7=1-16
RC-1718A, Ch. 17AY24, The Savoy	48-3	7=1-16
RC-1718B, Ch. 17AY21, The Savoy	48-3	7=1-16
RC-1719A, Ch. 17AY24, The Santung	48-3	7=1-16
RC-1719B, Ch. 17AY21, The Santung	48-3	7=1-16
RC-1720A, Ch. 17AY27, The Starlight	2-1	8=14-25
Record Changer VM-950	2-RC1	RCH22=1-16
RC-2005A, Ch. 20AY21, Adams	2-1	8=1-13
Record Changer VM-950	2-RC1	RCH22=1-16
6J6, 12AT7, Tuners	2-1	8=26-31
7DX22P, Ch.	27-2	5=31-34
12AX27, Ch.	27-2	5=1-8
14AX21, Ch.	27-2	5=9-20
16AX23, 16AX25, 16AX26, Ch.	27-2	5=21-29
16AX29, Ch.	27-2	5=21-29
16AY28, Ch.	48-3	7=1-16
16AY211, Ch.	48-3	7=1-16
17AY21, Ch.	48-3	7=1-16
17AY21A, Ch.	58-4	10=1-10
17AY24, Ch.	48-3	7=1-16
17AY27, Ch.	2-1	8=14-25
20AY21, Ch.	2-1	8=1-13
21AY21, Ch.	58-4	10=11-20

SCOTT RADIO LABS., INC.

MODEL	PACK-FILE	PAGES
Ashly, Chippendale, Cressy, Croydon, Ravenswood, Waverly, Wellington	54-1	9=1-16
AC-17, AT-17, Ch. 720, Ravenswood	54-1	9=1-16
Record Changer WEBSTER 100	54-RC1	RCH21=1-10
310, Ch. 720, Croydon	54-1	9=1-16
Record Changer MILWAUKEE 11600	54-RC1	RCH 9=1-4
320, Ch. 920, Croydon	54-1	9=1-16
Record Changer MILWAUKEE 11600	54-RC1	RCH 9=1-4
510, Ch. 720, Cressy	54-1	9=1-16
Record Changer WEBSTER 100	54-RC1	RCH21=1-10
520-TA, Ch. 920, Ashly	54-1	9=1-16
Record Changer WEBSTER 100	54-RC1	RCH21=1-10
720, Ch.	54-1	9=1-16
910, Ch. 920, Waverly	54-1	9=1-16
Record Changer WEBSTER 100	54-RC1	RCH21=1-10
920, Ch.	54-1	9=1-16
924, Ch. 924, Wellington	54-1	9=1-16
Record Changer WEBSTER 100	54-RC1	RCH21=1-10
924, Ch.	54-1	9=1-16
1000-TC, Ch. 924, Chippendale	54-1	9=1-16
Record Changer WEBSTER 100	54-RC1	RCH21=1-10

SEARS, ROEBUCK & CO. (SILVERTONE)

MODEL	PACK-FILE	PAGES
100.112, Ch.	11-1	8=1-14
100.120, Ch.	55-4	9=57-72
102-A, Ch. 549.100-7	55-4	9=49
110.111, Ch.	11-1	8=15-31
110.700, Ch.	74-5	10=1-30
110.700-1, 110.700-2, Ch.	74-5	10=1-30
110.700-10, 110.700-20, Ch.	74-5	10=1-30
110.700-40, 110.700-50, Ch.	74-5	10=1-30
110.700-90, 110.700-91, Ch.	74-5	10=1-30
110.700-92, 110.700-93, Ch.	74-5	10=1-30
110.700-96, 110.700-97, Ch.	74-5	10=1-30
111, 113, Ch. 110.700	74-5	10=1-30

SEARS, ROEBUCK & CO. (Cont'd)

MODEL	PACK-FILE	PAGES
116, Ch. 110.700-1, 110.700-10	74-5	10=1-30
116A, Ch. 110.700-1, 110.700-10, 110.700-90	74-5	10=1-30
127-12, Ch. 110.700	74-5	10=1-30
128-16, Ch. 478.337	55-3	9=13-20
131, Ch. 110.700-1, 110.700-10	74-5	10=1-30
131A, Ch. 110.700-1, 110.700-10, 110.700-90	74-5	10=1-30
132.014, Ch.	55-4	9=53-56
132.890, 132.890-1, 132.890-2, Ch.	12-2	8=53-66
134, Ch. 110.700-2, 110.700-20	74-5	10=1-30
139, 140, Ch. 110.700	74-5	10=1-30
143, Ch. 100.111	11-1	8=15-31
Record Changer SEARS 100.211-20	11-RC1	RCH 9=1-16
143A, Ch. 100.111	11-1	8=15-31
Record Changer VM-950	11-RC1	RCH22=1-16
150-14, Ch. 478.338	11-1	8=32-39
153-16, Ch. 478.341	55-3	9=9-12
161-16, Ch. 100.112	11-1	8=1-14
162-16, Ch. 110.700-10, 110.700-90	74-5	10=1-30
163-16, Ch. 478.319	55-3	9=1-8
165-16, Ch. 100.120	55-4	9=57-72
166-16, Ch. 478.339	55-3	9=21-36
166-17, Ch. 478.339-A	55-3	9=21-36
167-16, Ch. 549.101	11-1	8=40-52
167-16A, Ch. 549.101-1	11-1	8=40-52
168-16, Ch. 549.100-7	55-4	9=49
172-16, Ch. 549.101-4	74-5	10=31-40
173-16, Ch. 110.700-10, 110.700-90	74-5	10=1-30
175-16, 175-16A, Ch. 549.100-5, 549.100-8, 549.100-9	55-4	9=37-48
176-19, Ch. 549.100-6	55-4	9=50-52
177-19, Ch. 110.700-40, 110.700-91	74-5	10=1-30
179-16, 180-16, Ch. 132.890, 132.890-1, 132.890-2	12-2	8=53-66
185-16, Ch. 549.101-2	11-1	8=40-52
186-19, Ch. 549.101-3	11-1	8=40-52
187-16, 188-16, Ch. 110.700-10	74-5	10=1-30
189-16, Ch. 110.700-1, 110.700-10	74-5	10=1-30
191-16, Ch. 110.700-50, 110.700-92	74-5	10=1-30
192-16, Ch. 110.700-50	74-5	10=1-30
194-16, Ch. 132.890, 132.890-1, 132.890-2	12-2	8=53-66
195-16, Ch. 132.890, 132.890-1, 132.890-2	12-2	8=53-66
Record Changer VM-950	12-RC1	RCH22=1-16
478.319, Ch.	55-3	9=1-8
478.337, Ch.	55-3	9=13-20
478.338, Ch.	11-1	8=32-39
478.339, 478.339-A, 478.339-B, Ch.	55-3	9=21-36
478.341, Ch.	55-3	9=9-12
478.361, 478.361-A, Ch.	55-3	9=21-36
478.375, 478.376, Ch.	55-3	9=13-20
549.100-5, Ch.	55-4	9=37-48
549.100-6, Ch.	55-4	9=50-52
549.100-7, Ch.	55-4	9=49
549.100-8, 549.100-9, Ch.	55-4	9=37-48
549.101, 549.101-1, 549.101-2, 549.101-3, Ch.	11-1	8=40-52
549.101-4, Ch.	74-5	10=31-40
1116-16, Ch. 110.700-90	74-5	10=1-30
1117-17, 1130-17, Ch. 110.700-96	74-5	10=1-30
1132-17, Ch. 478.376	55-3	9=13-20
1135-17, Ch. 110.700-96	74-5	10=1-30
1141-20, Ch. 110.700-93	74-5	10=1-30
1146-20, Ch. 132.014	55-4	9=53-56
1150-14, Ch. 478.361, 478.361-A	55-3	9=21-36
1162-16, Ch. 110.700-90	74-5	10=1-30
1162-17, Ch. 110.700-96	74-5	10=1-30
1163-17, Ch. 478.375	55-3	9=13-20

SEARS, ROEBUCK & CO. (Cont'd)

MODEL	PACK-FILE	PAGES
1166-17, Ch. 478.339-B	55-3	9=21-36
1191-17, Ch. 110.700-97	74-5	10=1-30

SENTINEL RADIO CORP.

MODEL	PACK-FILE	PAGES
YA, YB, YC, Ch.	38-1	7=1-13
		9=1-12
1U416	38-1	5=1-8
1U419, 1U420	38-1	5=9-16
		6=1-8
1U424	38-1	6=1-8
1U425, 1U428, Ch. YA, YB, YC	38-1	7=1-13
1U432, Ch. YA, YB, YC	38-1	7=1-13
1U435, Ch. YB, YC	38-1	7=1-13
1U438, 1U439, 1U440, Ch. YA, YB, YC	38-1	9=1-12
1U441, 1U443, 1U444, Ch. YA, YB, YC	38-1	9=1-12
1U446, Series XD	38-1	9=1-12
1U-447-A, 1U-448-A, 1U-449-A	75-2	10=1-7
1U-450-A, 1U-451-A	75-2	10=1-7
416	38-1	5=1-8
419, 420	38-1	5=9-16
420B	38-1	6=1-8
423, 424	38-1	6=1-8
425, 428, Ch. YA, YB, YC	38-1	7=1-13
432, Ch. YA, YB, YC	38-1	7=1-13
435, Ch. YB, YC	38-1	7=1-13
438, 439, 440, Ch. YA, YB, YC	38-1	9=1-8
441, 443, 444, Ch. YA, YB, YC	38-1	9=1-8

SHERATON TELEV. CORP.

MODEL	PACK-FILE	PAGES
260-DX, 260-FM	54-1	9=1-6
260-S, 260-V	54-1	9=1-6

SILVERTONE

See SEARS, ROEBUCK & CO.

SKYRIDER

MODEL	PACK-FILE	PAGES
519, 520	12-1	8=1-7

SONORA RADIO & TELEV. CORP.

MODEL	PACK-FILE	PAGES
323, 324	54-1	9=1-4

SPARTON RADIO-TELEVISION DIV. OF THE SPARKS-WITHINGTON CO.

MODEL	PACK-FILE	PAGES
Berkeley	56-2	9=1-10
Del Mar	56-2	9=22-24
Gramercy	56-2	9=17-21
Hanover	56-2	9=11-16
Harrison	75-3	10=1-7
Hastings	75-3	10=1-7
Radmoor	75-3	10=1-7
Rochelle	56-2	9=22-24
Roxbury	75-3	10=1-7
Sheffield	56-2	9=22-24
The Sparcraft	24-1	7=3-10
		8=1-6
The Westmont	24-1	7=3-10
		8=1-6
Whitney	56-2	9=1-10
		9=17-21
25RD190, Ch.	24-1	7=10
		8=7-13
25SD201, Ch.	24-1	7=10
		8=14-20
25SD201A, Ch.	56-2	9=11-16
26SD160, Ch.	24-1	7=3-12
26SD170, Ch.	24-1	7=3-10
		8=1-6
		8=21-25
26SD170, DeLuxe, Ch., 5078BB	24-1	7=3-10
		8=6
		8=31

WESTINGHOUSE ELECTRIC CORP. (Cont'd)

MODEL	PACK-FILE	PAGES
V-2150-136, Ch.	42-3	6=18-24
V-2150-146, Ch.	42-3	6=33-40
V-2150-176, Ch.	42-3	6=41-47
V-2150-176U, V-2150-177U, Ch.	42-3	6=41-48
V-2150-186, V-2150-186A, V-2150-186C, V-2150-186CA, Ch.	21-2	7=1-8
V-2150-197, Ch.	21-2	7=9-15
V-2152-16, Ch.	42-3	6=25-32
V-2171, Ch.	21-2	7=16-24
		7=34-35
V-2172, Ch.	21-2	7=16-24
V-2173, Ch.	15-1	8=4-13
V-2175, Ch.	21-2	7=16-25
		7=34-35
V-2175-1, V-2175-3, V-2175-4, V-2175-5, Ch.	15-1	8=14-31
V-2176, Ch.	21-2	7=16-24
V-2177, Ch.	21-2	7=16-26
V-2178, Ch.	21-2	7=27-35
V-2178-1, V-2178-3, Ch.	15-1	8=32-39
V-2179, V-2179-1, Ch.	21-2	7=36-42
V-2192, V-2192-1, V-2192-2, V-2192-3, Ch.	15-1	8=14-31
V-2194, V-2194-1, V-2194-2, V-2194-3, Ch.	15-1	8=32-44
V-2200-1, Ch.	15-1	8=45-54
V-2201-1, Ch.	21-2	9=9-16
V-2202-2, V-2202-3, Ch.	54-4	9=17-24
V-2203-1, Ch.	21-2	9=1-8
V-2204-1, Ch.	15-1	8=45-54
V-2207-1, Ch.	73-5	10=1-10
V-2210-1, Ch.	54-4	9=17-24
V-2214-1, V-2215-1, Ch.	77-6	10=11-29
V-2216-1, V-2216-2, Ch.	77-6	10=11-29
V-2217-1, V-2217-2, Ch.	77-6	10=11-29
V-2218-1, Ch.	77-6	10=30-40
V-2220-1, Ch.	73-5	10=1-10
V-2220-2, Ch.	73-5	10=1-10

ZENITH RADIO CORP.

MODEL	PACK-FILE	PAGES
Aldrich	42-3	6=1-20
Barrett, Barrie	21-2	9=1-16
Burton, Byron	42-3	6=1-20
Carlyle, Chesterton	21-2	9=1-16
Churchill	42-3	6=1-20
Coleridge, J2051E	21-2	9=1-16
Coleridge, H2439R	42-3	6=1-20
Conrad	21-2	9=1-16
Fielding, J2030R	21-2	9=1-16
Fielding, H2437E	42-3	6=1-20
Galsworthy	21-2	9=1-16
Garland	42-3	6=1-20
Hawthorne, J2026R	21-2	9=1-16
Hawthorne, H3267	42-3	6=1-20
Irving, Kilmer	42-3	6=1-20
Kipling	21-2	9=1-16
Lowell	42-3	6=1-20
Mansfield	42-3	6=1-20
Markham	21-2	9=1-16
Meredith, Morley	42-3	6=1-20
Shelley	42-3	6=1-20
Tennyson	42-3	6=1-20
Thackeray, J2054R	21-2	9=1-16
Thackeray, H3477R	42-3	6=1-20
Walpole	42-3	6=1-20
Walton, J2044R	21-2	9=1-16
Walton, H2328R	42-3	6=1-20
Warton	42-3	6=1-20
Wordsworth, J2043R	21-2	9=1-16
Wordsworth, H3469E	42-3	6=1-20
H-2029R, H-2030E, H-2030R, Ch. 20H20	15-1	8=1-8
H-2041R, Ch. 20H20	15-1	8=1-8
H-2052R, H-2053R, Ch. 20H20	15-1	8=1-8
H2226E, Ch. 22H20	42-3	6=1-20
H2226R, Ch. 22H20, Warton	42-3	6=1-20
H2226RQ, Ch. 22H20	42-3	6=1-20
H2227E, Ch. 22H20, Garland	42-3	6=1-20

ZENITH RADIO CORP. (Cont'd)

MODEL	PACK-FILE	PAGES
H2227EQ, Ch. 22H20	42-3	6=1-20
H2227R, Ch. 22H20, Walpole	42-3	6=1-20
H2227RQ, Ch. 22H20	42-3	6=1-20
H2250R, Ch. 22H20, Lowell	42-3	6=1-20
H2250RQ, Ch. 22H20	42-3	6=1-20
H2255E, Ch. 22H20, Morley	42-3	6=1-20
H2255EQ, Ch. 22H20	42-3	6=1-20
H2328E, Ch. 23H22	42-3	6=1-20
H2328EZ, Ch. 23H22Z	42-3	6=1-20
H2328R, Ch. 23H22, Walton	42-3	6=1-20
H2328RQ, Ch. 23H22	42-3	6=1-20
H2328RQZ, H2328RZ, Ch. 23H22Z	42-3	6=1-20
H2329R, Ch. 23H22, Burton	42-3	6=1-20
H2329RQ, Ch. 23H22	42-3	6=1-20
H2329RZ, Ch. 23H22Z	42-3	6=1-20
H2352R, Ch. 23H22, Mansfield	42-3	6=1-20
H2352RQ, Ch. 23H22	42-3	6=1-20
H2352RQZ, H2352RZ, Ch. 23H22Z	42-3	6=1-20
H2353E, Ch. 23H22, Meredith	42-3	6=1-20
H2353EQ, Ch. 23H22	42-3	6=1-20
H2353EQZ, H2353EZ, Ch. 23H22Z	42-3	6=1-20
H2437E, Ch. 24H20, Fielding	42-3	6=1-20
H2437EQ, Ch. 24H20	42-3	6=1-20
H2437R, Ch. 24H20, Irving	42-3	6=1-20
H2437RQ, Ch. 24H20	42-3	6=1-20
H2438R, Ch. 24H20, Aldrich	42-3	6=1-20
H2439R, Ch. 24H20, Coleridge	42-3	6=1-20
H2438RQ, Ch. 24H20	42-3	6=1-20
H2445R, Ch. 24H21, Tennyson	42-3	6=1-20
H2445RQ, Ch. 24H21	42-3	6=1-20
H2447R, Ch. 24H21, Byron	42-3	6=1-20
H2447RQ, Ch. 24H21	42-3	6=1-20
H2449E, Ch. 24H20, Churchill	42-3	6=1-20
H-2868R, Ch. 20H20	15-1	8=1-8
H-3074R, Ch. 20H20	15-1	8=1-8
H3267, Ch. 24H20, Hawthorne	42-3	6=1-20
H3267R, H3267RQ, Ch. 24H20	42-3	6=1-20
H3469E, Ch. 24H20, Wordsworth	42-3	6=1-20
H3469EQ, Ch. 24H20	42-3	6=1-20
H3475R, Ch. 24H20, Kilmer	42-3	6=1-20
H3475RQ, Ch.24H20	42-3	6=1-20
H3477R, Ch. 24H21, Thackeray	42-3	6=1-20
H3477RQ, Ch. 24H21	42-3	6=1-20
H3478E, Ch. 24H21, Shelley	42-3	6=1-20
H3478EQ, Ch. 24H21	42-3	6=1-20
J2026R, Ch. 20J22, Hawthorne	21-2	9=1-16
J2027E, Ch. 20J21, Barrett	21-2	9=1-16
J2027R, Ch. 20J21	21-2	9=1-16
J2029E, J2029R, Ch. 20J21, Markham	21-2	9=1-16
J2030E, Ch. 20J21	21-2	9=1-16
J2030R, Ch. 20J21, Fielding	21-2	9=1-16
J2040E, Ch. 20J21, Conrad	21-2	9=1-16
J2042R, Ch. 20J21, Galsworthy	21-2	9=1-16
J2043R, Ch. 20J21, Wordsworth	21-2	9=1-16
J2044E, Ch. 20J21	21-2	9=1-16
J2044R, Ch. 20J21, Walton	21-2	9=1-16
J2051E, Ch. 20J22, Coleridge	21-2	9=1-16
J2053R, Ch. 20J22, Chesterton	21-2	9=1-16
J2054R, Ch. 20J22, Thackeray	21-2	9=1-16
J2055R, Ch. 20J22, Carlyle	21-2	9=1-16
J2126R, Ch. 21J21	21-2	9=1-16
J2127E, J2127R, Ch. 21J20	21-2	9=1-16
J2129E, J2129R, Ch. 21J20	21-2	9=1-16
J2130E, J2130R, Ch. 21J20	21-2	9=1-16
J2140E, J2142R, J2143R, Ch. 21J20	21-2	9=1-16
J2144E, J2144R, Ch. 21J20	21-2	9=1-16
J2151E, J2153R, J2154R, J2155R, Ch. 21J21	21-2	9=1-16
J2868R, Ch. 20J21, Kipling	21-2	9=1-16
Record Changer ZENITH S14029	21-RC1	RCH21=9-24

ZENITH RADIO CORP. (Cont'd)

MODEL	PACK-FILE	PAGES
J2968R, Ch. 21J20	21-2	9=1-16
Record Changer ZENITH S14029	21-RC1	RCH21=9-24
J3069E, Ch. 20J21, Barrie	21-2	9=1-16
Record Changer ZENITH S14029	21-RC1	RCH21=9-24
J3169E, Ch. 21J20	21-2	9=1-16
Record Changer ZENITH S14029	21-RC1	RCH21=9-24
K1812E, K1812R, Ch. 19K22	77-4	10=1-19
K1815E, K1815R, Ch. 19K20	77-4	10=1-19
K1820E, K1820R, Ch. 19K20	77-4	10=1-19
K1846E, K1846R, Ch. 19K20	77-4	10=1-19
K1850E, K1850R, K1880R, Ch. 19K20	77-4	10=1-19

ZENITH RADIO CORP. (Cont'd)

MODEL	PACK-FILE	PAGES
K2229R, Ch. 19K23	77-4	10=1-19
K2230E, K2230R, Ch. 21K20	77-4	10=1-19
K2240E, K2240R, Ch. 21K20	77-4	10=1-19
K2258R, Ch. 19K23	77-4	10=1-19
K2260R, K2263E, Ch. 21K20	77-4	10=1-19
K2266, K2266R, Ch. 21K20	77-4	10=1-19
K2267E, K2268R, Ch. 21K20	77-4	10=1-19
K2270H, K2270R, Ch. 21K20	77-4	10=1-19
K2286R, K2288E, Ch. 19K23	77-4	10=1-19
K2290R, K2291E, Ch. 21K20	77-4	10=1-19
19K20, 19K22, 19K23, Ch.	77-4	10=1-19
20H20, Ch.	15-1	8=1-8
20J21, 20J22, 21J20, 21J21, Ch.	21-2	9=1-16
21K20, Ch.	77-4	10=1-19
22H20, 23H22, 23H22Z, Ch.	42-3	6=1-20
24H20, 24H21, Ch.	42-3	6=1-20

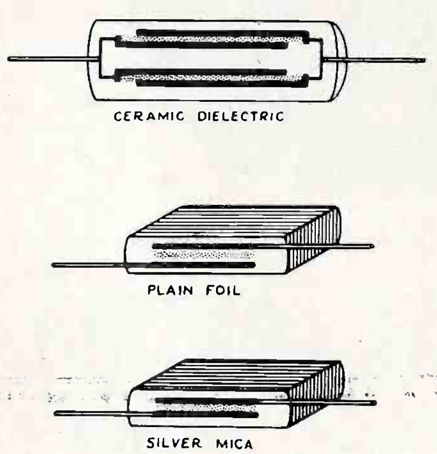
Replacement Parts in TV Receivers

(Continued from page 7)

mica type almost completely. It is interesting to note the rapid rise in the use of negative temperature coefficient ceramic capacitors in television receivers. In these, the capacity decreases with increase in temperature. They are very prominent in the front-ends and are used more and more in other parts of a tv receiver where it is desired to maintain constant circuit behavior under varying temperatures.

The ceramic dielectric capacitor offers high insulation resistance; therefore, it is used for d-c blocking, bypassing, and coupling, especially in those circuits that operate at frequencies above the audio range. Its behavior under varying conditions of frequency (including UHF), temperature, and humidity is excellent.

Another feature of the ceramic dielectric unit is the ease with which it can be produced in very low values of capacitance, with the result that the wide variety of low values of capacitance used in television receivers are prominently available in this kind of capacitor.



Construction of fixed mica and ceramic capacitors.

A high order of interchangeability between mica and ceramic capacitors exists, especially between certain ceramics and silver micas. Since the subject is somewhat elaborate, the discussion will be held in abeyance until the subject of substitution is treated.

Paper Dielectric Tubulars. Paper dielectric tubulars follow two patterns of construction. One utilizes alternate layers of foil (the active surface) and paper dielectric between. The foil and paper are wound concentrically; by making proper electrical connections to the active surfaces, non-inductive behavior is accomplished to a highly satisfactory degree. Also, any desired capacitance value and voltage rating within certain limits is achieved.

The usual limit on the minimum capacitance produced in this manner, and also on the maximum, is a low of about .001 μf and a high limit of about 50 μf. However, the upper capacitance limit of paper dielectric capacitors used in tv receivers is about .25 μf.

A second form of construction uses metallized paper, that is, metal is sprayed on the paper dielectric. The metallized strip then is rolled concentrically and the connections made to the active surfaces.

An important part of the construction of both varieties of capacitors is the impregnation. All air is drawn out of the assembly and all spaces within are filled with an impregnant that also penetrates the paper dielectric. It may be any one of a variety of substances such as mineral oil, castor oil, wax, or a synthetic substance. The impregnant ascribes certain electrical characteristics to the capacitor. Only some of the highlights can be treated here because the subject is extremely broad.

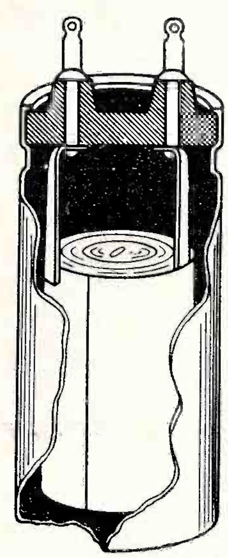
The impregnant influences the capacitance of the capacitor – whether it is going to increase or decrease relative to the nominal value with changing temperatures, and by what amount. It determines the variation in electrical losses within the capacitor with changes in operating temperature, thereby determining the suitability of the component for use at various operating temperatures. Insulation resistance on the other hand always decreases with increase in temperature.

These details are a matter of concern to the tv receiver designer, although his problem revolves more around what happens with increasing temperatures than for the opposite temperature variation. That is why design engineers specify the operating temperature of fixed capacitors used in the equipment they conceive. Fortunately, the service technician's problem is greatly simplified, in that the vast majority of paper dielectric capacitors used in television receivers bear one of two operating temperature ratings, 65° C or 85° C. Judging by specifications, the tendency is toward the higher rating. These needs are being satisfied by replacement components, but it still behooves the responsible tv service technician to make certain that he is procuring the proper part. This is one reason why the use of surplus capacitors for replacements is a very bad practice, and suggestions for replacement must be based on the original specifications.

The casing or housing used for the capacitor has a bearing on its operation with different conditions of temperature and humidity. There was a time when all these capacitors were contained in wax impregnated cardboard tubes and wax sealed. The tendency is away from these to molded plastic casings in order to improve operation under high humidity conditions. Hermetically sealed metal cases also are available, but these seldom are used as original equipment or for replacement in tv receivers.

Electrolytic Capacitors. Although the electrolytic capacitor is in a class by itself, it still conforms with the basic requirement of a capacitor; namely two conducting surfaces between which a dielectric exists. The essential difference between the electrolytic capacitor and the ordinary fixed capacitor is that the dielectric in the form is an exceedingly thin oxide film which is deposited on the metal surfaces of the capacitor. The film displays unilateral conductivity properties, that is, when the applied voltage is of one polarity, the film displays very high resistance, and relatively little current flows through the dielectric, and when the voltage is of the opposite polarity a high current would flow through the capacitor. In spite of this, the unit is still capable of storing electricity.

In view of this behavior relative to the polarity of the applied voltage, electrolytic capacitors are polarized. By this is meant the capacitor terminals bear polarity designations which must be adhered to when the d-c or pulsating voltage is applied to the capacitor. Otherwise, the unit may be damaged.



Cutaway view of an electrolytic capacitor.

The three types of electrolytics – etched foil, plain foil and fabricated – refer to the manner in which the basic metal surface is treated so as to afford maximum surface for contact with the oxide film. The plain foil presents a smooth surface and affords a unit surface area, hence a unit value of capacitance. When the metal is etched by a chemical process, the surface area is increased. This occurs because the etching process causes microscopic cavities in the surface, all of which tends to increase the surface area in contact with the film. Substantial increase in capacitance is obtained in this fashion, perhaps from 5 to 8 or more times the capacitance which is obtainable with the plain foil. In the fabricated plate type, the anode material is made by deposit-

(Continued on page 34)

Notice to All Purchasers of:

RIDER'S TV 10

We have always prided ourselves on the accurate information we have made available to the servicing industry. To live up to this tradition we wish to correct certain discrepancies that crept into the replacement parts listings published in TV 10. Because we are anxious to give you thoroughly accurate replacement parts listings, which include additions that arrived after the publication of TV 10, we ask you to do the following:

Please fill in the registration coupon on the first page of your Rider TV 10 Manual and send it to us. We will forward the replacements parts listing corrections direct to your address. Also, by returning this coupon to us, you will be assured of having your name on our mailing list for exclusive information that will be available to TV 10 owners. Do Not send us the replacement parts pages!

Look to future issues of SUCCESSFUL SERVICING for the newest additional replacement parts listings.

John F. Rider,
Publisher

The Quick Diagnosis

(Continued from page 9)

used to this poor reception? Or am *I* going to be blamed? Nothing on their faces . . lucky. The times I've been blamed for *all* the ghosts and everything else after just putting in one tube . . . !

Hey! What's that noise? Picture, too? Yeh. Streaks, and flashes, once in a while. Is it aerial? Bang the cabinet! Yeh, something's loose . . . here we go again! Tap. Where's that long handled fibre screw driver? No good for alignment anymore, but swell for tapping. Watch out for that picture tube! Don't put your hand near it! Oh. This one's glass. Got so I react against any picture tube . . . got banged so hard by the metal ones without a plastic shield. Imagine, expecting a man to work on a set without that protection . . .

Boy! Like a toothache . . . this one hurts all over. Uh. Tuner? Not more sensitive than most . . . just normal oscillator response to a bang. First i.f.? No. Second . . . um . . . gee . . . everything around that tube is sensitive. Can I work without a mirror? Yeh. The flashes when I hit show through the edge of the picture tube . . . hear and see at the same time. Is it *this* tube? Doubt it . . . but, *have* to try a new one . . . I wonder . . . try another . . . Wow! Hotter'n the devil! What is it? Mmm. Oh, here it is . . . 6CB6. Where's that tube kit? The load I carry! Can't keep 'em in order . . . swell . . . here it is. They are really watching me now! Sure that I'm putting in more than necessary. Alright . . . she's hot now . . . no use banging till they are hot . . . same thing! Alright! Pull out the new one . . . put back the old. Darn these tiny pin tubes!

Ugh, ugh . . . got to be a contortionist . . . geez it's hot in here . . . O.K., turn her on again. Tap some more . . . that's the spot alright. Just like an unsoldered connection. Wonder if they had been bothered by this . . . ? ;

What's that? Yeh, the trouble for which you called me is fixed . . . but what I just found is another trouble which may not bother you, if you are lucky. It is apparently a loose connection under the chassis, but if the set is not jarred too much, it may hang on and you can get it fixed when the set does have to have a major repair . . .

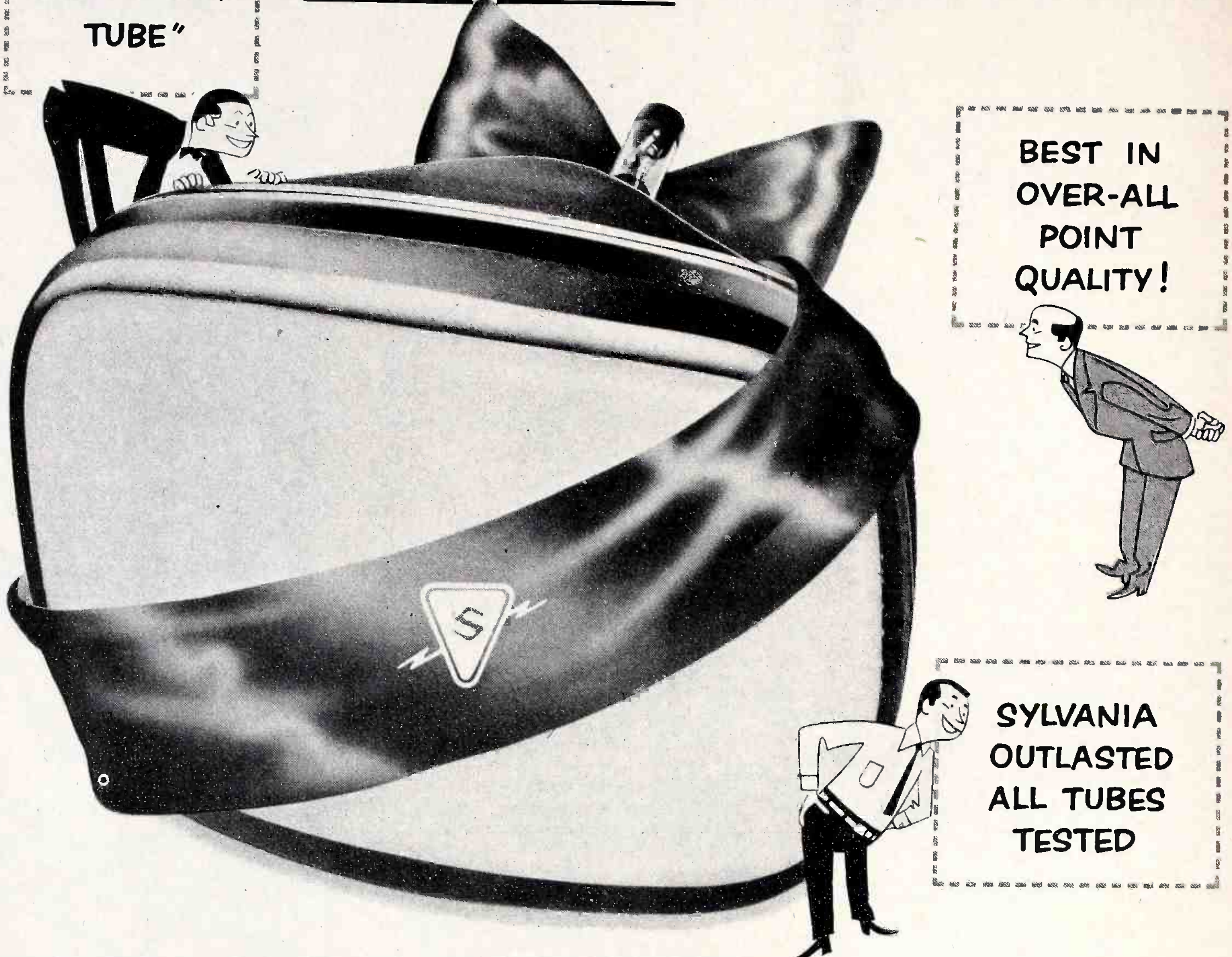
MERIT ADDED TO RIDER'S REPLACEMENT PARTS LISTING PROGRAM

Merit Coil and Transformer Corp. is now a participating manufacturer in the Rider Replacement Parts Program.

Merit replacement parts will make their appearance with TEK-FILE Pack No. 78 and Rider's TV Manual 11. However, it is intended that supplementary information on Merit replacement parts will be made available to the servicing industry for those TV receivers covered by Rider's TV 10 This data will appear in SUCCESSFUL SERVICING.

SYLVANIA PICTURE TUBES

Lasted Longer than others tested!



Only Sylvania tubes showed NO FAILURES after 1400 hours . . . *at accelerated voltages*

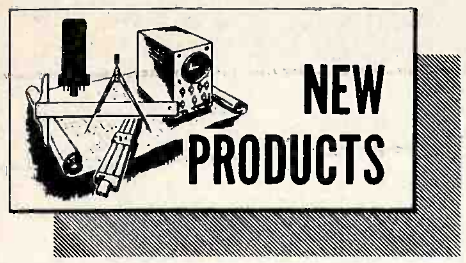
Exhaustive tests conducted under the supervision of an outside impartial laboratory, the United States Testing Company, showed Sylvania Picture Tubes lasted longer than any others tested.

These tests included the picture tubes of nine leading manufacturers. All tubes were placed in identical test racks and tested under identical accelerated voltages. At the end of 1400 hours, only the Sylvania Picture Tubes showed *no failures.*

These tests definitely establish the outstanding dependability of Sylvania Picture Tubes. They prove that these tubes will best uphold your reputation for fine performance in the sets you manufacture, sell or service. Send today for complete details about Sylvania Picture Tubes. Sylvania Electric Products Inc., Dept. 3R-1801, 1740 Broadway, New York 19, New York.

SYLVANIA

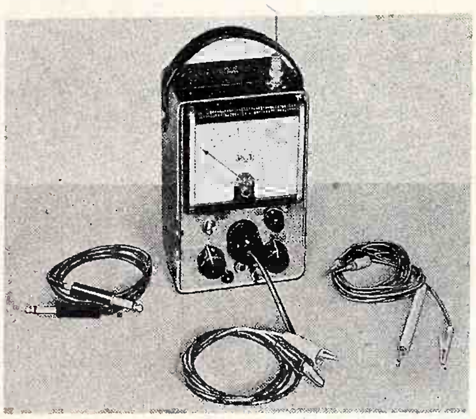
RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT TUBES, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS



Additional literature on each of the products described in these columns may be obtained from SUCCESSFUL SERVICING. See the coupon in column three.

New Tester for Mobile Radio Systems

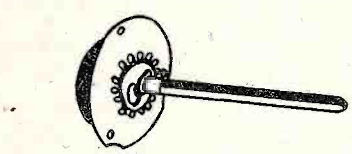
This new general purpose test meter, RCA Model 6X-7A, will measure current, voltage, and radiated power — all the electrical measurement necessary to install and service two-way radio communications systems. Tester is designed so that several related functions can be checked with a single arrangement of test leads.



Item 1

Sturdy-Tune Detents

Telematic Industries has broadened its line of Sturdy-Tune Detents so that it now includes eleven different detents to handle the replacement needs of nearly every brand TV receiver on the market.



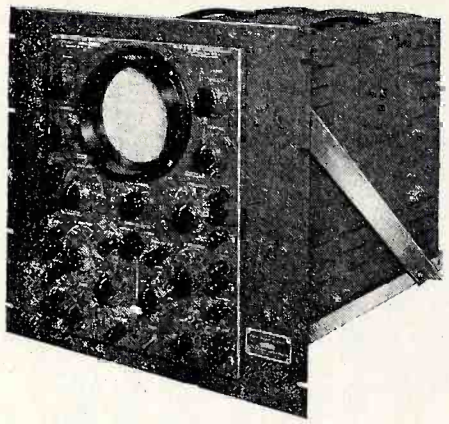
Item 2

The detents are available with or without a back plate. The availability of the Sturdy-Tune Detents without a back plate, if so desired by the serviceman, serves to cut the replacement cost.

Rack Mounting Adapter for Cathode-Ray Oscillographs

Allen B. DuMont Laboratories announces the availability of a new Rack Mounting Adapter, Type 2598, for use with DuMont Types 303, 303-A, 303-AH and 322 cathode-ray oscillographs.

Shipped dis-assembled, the Adapter provides a rigid mount for the instrument in standard 19 inch relay racks; the front opening is large enough to permit all but the front panel of the oscillograph to pass through. The Adapter has been designed so that the entire relay rack may be moved with the instrument in place.

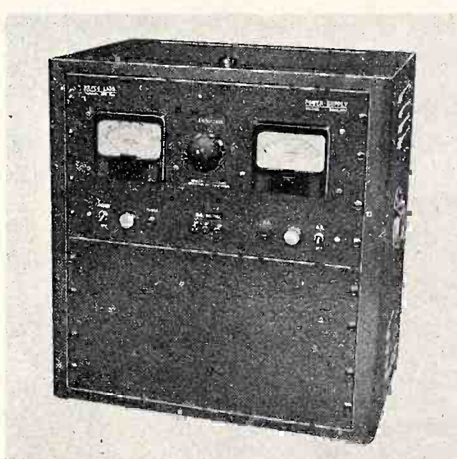


Item 3

Standard Voltage Rated Power Supplies

Kepco Laboratories has released a new group of voltage regulated power supplies, the Model 700 series. Model 700 feature one regulated d-c voltage supply, a high voltage supply continuously variable from 0 to 350 volts and a delivery of from 0 to 750 milliamperes; Model 710 delivers 1.5 amperes, 720 delivers 2.25 and Model 730 delivers 3 amperes. In the range of 30-350 volts, output voltage variation is less than ½% for line fluctuations from 105-125 volts and load variation from minimum to maximum current. Ripple voltage is less than 10 millivolts P-P.

The gray cabinet is 22¾ inches high, 21¾ inches wide and 15¼ inches deep.

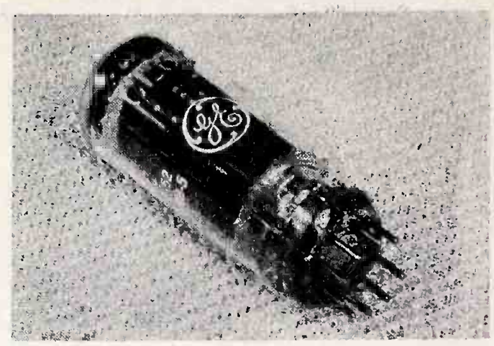


Item 4

Video Output Tube

General Electric has added a new power pentode, type 6CL6, for use in the video output stage of tv receivers.

The tube provides a high plate current at low plate voltage, giving a 40 to 45 voltage gain in wide band video circuits and being capable of supplying 132 volts peak-to-peak output across a load resistor of 3,900 ohms. This new nine-pin miniature may also be used as a wide-band amplifier in industrial and laboratory equipment.



Item 5

Low Resistance—High Accuracy Instrument Resistor

Type 245S, a new 1-watt precision wire-wound resistor for decades and other applications requiring low resistance values with close tolerances, low temperature rise, and low inductance, has been announced by the Shallcross Mfg. Co. The new resistor can be calibrated to a tolerance of ±0.1% or better and is available in values from 0.1 ohm to 1000 ohms. A single layer bifilar winding protected by a moisture resistant lacquer coating is used for all values. The Steatite bobbin and axial wire leads are at the same end for ease in mounting the resistor directly on decade switch decks or other similar equipment. Size is 1⅛ inches long by ⅜ inch diameter.

Item 6

To obtain additional literature on any of the items described in this section encircle the number of the product (number appears under picture) on the coupon below, cut the coupon out and mail it to SUCCESSFUL SERVICING, 480 Canal Street, New York 13, N. Y.

Cut Here

SUCCESSFUL SERVICING
480 Canal Street, New York 13, N. Y.

Please send me additional literature on the items circled below appearing in the NEW PRODUCTS column of the January, 1953 issue of SUCCESSFUL SERVICING:

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4 5 6

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Address ....
City .... Zone .... State ....
Company ....

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A monthly summary of product developments and price changes supplied by RADIO'S MASTER, the Industry's Official Buying Guide, available through local parts distributors.

COMMENT: With more manufacturers reporting changes for this period, a continued emphasis is being placed on the introduction of new products, especially by manufacturers of antennas, capacitors and controls. Also evident is the continued tendency toward increased prices by the leading TV tube manufacturers.

New Items

AEROVOX—Added 3 new values to their series CP 2, 2 watt carbofilm resistors.

ASSEMBLY PRODUCTS — Added No. 2056-1, thermocouple at $2.90 net and Model C, portable pyrometer case at $1.75 net.

BAKER MFG. — Added No. 2 FM at $2.37 net to their line of TV antenna towers.

BLILEY ELECTRIC — Added TV service crystal MC9, 13,627.5 kc. at $5.50 net.

BOGEN CO. — Introduced Model R701, high fidelity FM-AM receiver at $145.20 net . . . Model DO10, high fidelity power amplifier at $37.95 net and Model RCPR, remote controller-preamplifier at $78.85 net.

CLAROSTAT — Added TV replacement controls RTV 356 to 383 inclusive.

EITEL-McCULLOUGH — Added No. HR-10 at $1.60 net to their series of heat dissipating connectors.

ELECTRONIC MEASUREMENT—Added Model 600, oscilloscope at $99.50 net, to their test equipment line.

FEDERAL TEL. & RADIO — Added kit No. 3, all purpose selenium rectifier assembly at $19.95 net.

GENERAL ELECTRIC — Added No. RPX-052 at $38.95 list and No. RPX-053 at $57.90 list to their triple play variable reluctance cartridge series. Also added 20DP4A, rectangular all-glass picture tube for TV receiver applications at $39.35 net.

GON-SET — Introduced FM radarray No. 1517 at $28.50 net . . . No. 1529, rhombic UHF antenna with 8 foot mast at $7.77 net . . . No. 1531, parabolic with 9 foot mast at $5.18 net and 5 other UHF antennas.

GREAT EASTERN MFG. — Added Model CRT, luxor emission booster at $1.95 net.

HYTRON — Introduced No. SH27, test adapter at $1.45 net. Also added special purpose tubes OA2WA at $4.50 list and OB2WA at $4.90 list.

JENSEN INDUSTRIES — Introduced a number of diamond replacement needles for the following manufacturers: Astatic, Audak, Columbia, Crosley, Electro-Voice, General Electric, Magnavox, Philco, RCA, Seeburg, Shure, Sonotone, Webster Electric and Webster-Chicago.

MALLORY & CO. — Added No. PS54010, motor starting capacitor at $4.89 net . . . No. FF45052, photoflash capacitor at $13.50 net . . . No. U-67, 5 meg. carbon control at $.75 net and WF252-T23, 2500 ohm wire wound control at $1.50 net.

MERIT TRANSFORMER — Added No. A-3100, high fidelity output transformer at $10.80 net.

MINNESSOTA MINING & MFG.—Added sound recording tape No. 111AP, plastic prof. reel, ¼" x 1200 feet.

PACIFIC TRANSDUCER — Added Model 201D at $33.00 net This model is the same as Model 201, a wide range variable reluctance cartridge with a frequency response to above 12,000 cps. with an output of 60 millivolts, with a diamond stylus instead of a standard sapphire stylus.

PERMOFLUX — Added No DHS-31B at $50.00 net to their line of monaural dynamic headsets and No. PHA-6 at $8.00 net and No. PHA-8 at $13.00 net to their line of headbands.

PREMAX PRODUCTS—Added mobile mounting CA at $6.00 net.

PREMIER METAL PRODUCTS — Introduced new series ARP, aluminum rack panels.

R.C.A. — Added 12BF6 at $1.70 list, a multi-unit minature tube of the heater-cathode type containing two diodes and one medium-mu triode in one envelope, intended primarily for use as a detector or an amplifier in auto radio receivers operating from a 12-volt storage battery. Also added 12V6-GT at $2.00 list, a beam power tube of the

(Continued on page 35)

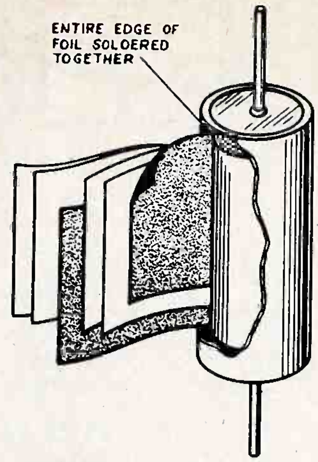
Replacement Parts, etc.

(Continued from page 26)

ing small particles of molten metal (aluminum) on a suitable carrier. This construction also provides increased surface area over that of plain foil, hence greater capacitance per unit size. This type is said to have as much as 10 times the capacitance as the plain foil type.

The varieties of foils also affect the operating capabilities of the electrolytic capacitor. Since a certain amount of current leakage is permitted in an electrolytic unit (although definite limits are set on it), and since each electrolytic capacitor is associated with a value of equivalent series resistance, power loss occurs inside the unit. This raises the operating temperature of the device, which in turn, is a limiting agency on the proper functioning of the unit and on its operating life. The plain foil type of electrolytic is capable of withstanding higher operating temperatures than the etched variety. Also, the plain foil electolytic is capable of withstanding much higher a-c ripple components than is the etched foil type.

As a general rule, electrolytic capacitors used in television receivers for a variety of



Construction of a paper tubular capacitor.

filtering and bypassing duties are of the etched foil kind. This derives from the fact that it affords the maximum capacity per unit size and per unit price, and also because the temperatures prevailing in a tv receiver are within its ratings. On occasion the tv receiver makes use of plain foil units.

The references to tubular and can electrolytics apply to the physical types. Both are contained in metal housings, except that the tubular variety has an insulating cardboard sleeve around the metal container. These are mounted in place by means of the connecting wires, or a mounting bracket. The can type is intended for above chassis mounting, to be screwed into a socket, or to be locked in place by means of twist lugs.

Like the paper dielectric capacitor, the electrolytic variety also is affected in its operation by temperature. This is especially true of the leakage current. This leakage increases with operating temperature inasmuch as heat tends to deteriorate the oxide film. Any action which tends to destroy the effectiveness of the film naturally displays an adverse effect on the capacitance of the unit. Also, high operating temperatures tend to dry out the electrolyte and so effect the capacitance and performance of the device.

Radio's Master Reports

(Continued from page 33)

heater-cathode type intended primarily for use in the output amplifier of auto radio receivers operating from a 12-volt storage battery.

RADIO MFG. ENGINEERS—Added mobile converters No. MC-55 at $69.50 net and MC-57 at $64.50 net.

REGENCY — Added UHF converter, Model RC-600 at $37.46 net.

RIDER, JOHN F. — Added No. 2010, Rider's Television Manual, Volume 10, at $24.00 net.

STANDARD TRANSFORMER — Added deflection yokes (with leads and networks added) No. DY-1A at $4.74 net . . . No. DY-7A at $5.37 net . . . No. DY-8A at $6.60 net . . . No. DY-9A at $6.60 net and No. DY-10A at $6.60 net.

SUPERIOR INSTR.—Added Model 660-A, signal tracer generator at $42.95 net.

SUPREME INC.—Added a number of "vest pocket" testing instruments; Model 402, voltmeter at $10.65 net . . . Model 403. voltmeter at $10.65 net . . . Model 404, voltmeter at $10.65 net . . . Model 410, milliammeter at $10.65 net . . . Model 411, milliammeter at $10.65 net . . . Model 420, ammeter at $10.65 net . . . Model 430, microammeter at $14.50 net and Model 440, ohmmeter at $11.50 net.

TABET—Added Model NT10, 10 foot antenna top section with guy rings at $15.38 net and Model NRB, rigid mounting base with hardware at $5.67 net.

TERADO CO.—Introduced Model 6-71160 at $37.50 list and Model 12-71160 at $42.95 list, both in the Trav-Electric super series, portable dc to ac converters designed for car use to operate other electrical devices.

UTAH RADIO PRODUCTS — Added Model SP15R at $41.70 net to their series of wide range and pa group loudspeakers.

VIDEO INDUSTRIES—Added 5 element Yagi antenna for channel three at $6.83 net.

WINCHARGER CORP.—Added Model 3095 at $11.75 net to their guyed tower series and Model 2406 at $2.97 net, screw anchor for guyed towers.

Discontinued Items

ASTATIC CORP.—Discontinued Model S-8, crystal pickup arm.

AUDIO DEVELOPMENT — Discontinued No. 111A, microphone cable.

BOGEN CO. — Discontinued Model DB10, high fidelity 10 watt amplifier . . . Model PH10, 10 watt multi-range photo-amplifier and Model PX15, 15 watt phono-amplifier.

CHICAGO INDUSTRIAL INSTR.—Discontinued Model 453, featherweight miniature volt-ohm-milliammeter.

HUBBELL, HARVEY—No. 408B32, straight plug and No. 412B42, connector are discontinued.

LENK MFG.—Discontinued Models 201 and 205, heavy duty industrial soldering irons.

RADIART CORP. — Discontinued TV booster, Model TVB-1.

R.C.A.—Discontinued No. 202S1 from their electronic components speaker (PM type) series.

RADIO MFG. ENGINEERS—Discontinued mobile converter MC-H4.

RADIO MERCHANDISE SALES—Discontinued No. STYL8-2H, 8 element Yagi antenna.

SARKES TARZIAN—Advises that their line of TV picture tubes is discontinued.

SUPERIOR INSTR. — Discontinued Model 660, ac signal generator and CA-12, signal tracer.

SYLVANIA — Discontinued subminiature tubes 6BF7 and 6BG7.

TALK-A-PHONE — Discontinued Models C-5912 and C-5920 in their "chief" universal series.

UNIVERSAL METAL PRODUCTS—Model EM-2 in their series of universal mounts is discontinued.

Price Increases

ARGOS PRODUCTS — Increased price on Model TC-2, tube caddy "junior", to $7.75 net.

BOGEN CO.—Increased price on Model CH18P-1 to $92.50 net and Model CH30P-1 to $108.80 net in their challenger sound equipment series.

BURLINGTON INSTR.—Increased price of No. A70x32 to $11.50 net in their current transformer series.

HAMMARLUND MFG. — Increased price on HQ129X, receiver without speaker to $239.50 net.

LITTELFUSE — Increased price on No. 342008, dust-proof, drip-proof in their 3 AG fuse extractor post series to $.75 list.

MERIT TRANSFORMER—Increased No. A-3080, vertical output transformer to $3.60 net and No. A-4003, vertical blocking oscillator transformer to $1.80 net.

PENN BOILER & BURNER—Increased price of the universal adaptor in their tenna-mast hardware series to $.50 net.

RADIO MERCHANDISE SALES — Increased price on the TYL8 series of 8 element Yagi antennas.

(Continued on next page)

Radio's Master Reports

(Continued from page 35)

SIMPSON ELECTRIC—Increased price on Model 476, mirroscope to $197.00 net. This oscilloscope employs a 5" cathode ray tube mounted in a vertical position, with the image reflected from a high grade mirror mounted in the adjustable cover at the top of the cabinet, bringing the viewing surface near eye level when used on work benches of normal height.

SYLVANIA—Increased price on 1N82, UHF detector crystal to $1.15 net.

VIDEO INDUSTRIES—Increased price on No. 103, fan antenna to $3.68 net and No. 106, in-line folded di-pole antenna to $4.75 net.

Price Decreases

BURLINGTON INSTR.—Decreased price on No. A70x8 to $7.80 net in their current transformer series.

CLAROSTAT—Decreased prices on their series of 160 watt adjustable wire-wound resistors, series K-160-WA.

GENERAL ELECTRIC — Decreased prices on a number of items in their Alnico 5 loudspeaker line.

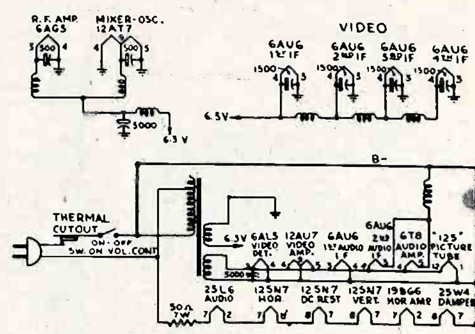
NATIONAL UNION RADIO—Decreased prices on videotron TV picture tubes NU-16DP4 to $30.00 net . . . NU-10BP4 to $21.00 net and NU-10BP4A to $21.00 net.

R.C.A.—Decreased price on portable "AB" pack VSO64 to $3.68 net.

TV Filament Circuits

(Continued from page 1)

These examples, which are representative, show the serviceman that, in troubleshooting a receiver, filament circuits cannot be taken for granted but must be checked with the wiring diagram. The fact that chokes are used in the r-f tuning and video i-f units must not be forgotten. Suppose, for instance, in Fig. 3, that the choke between the first and second i-f amplifiers should burn out, or there should be a bad connection. This means that the second, third, and fourth amplifiers would fail to function. Or, if a filament bypass capacitor should short, the heating current would no longer pass through the filament. More important than this is the fact that the transformer winding is shorted and will be damaged. An understanding, therefore, of why and how chokes and capacitors are used in the filament circuits is necessary for successful servicing.



After Capehart-Farnsworth

Fig. 3. The schematic diagram of Capehart-Farnsworth Model 300-1B filament circuits showing the use of r-f blocking chokes, bypass capacitors, series and parallel combinations, and several transformer windings.

contain many chokes and capacitors. The r-f amplifier and the mixer-oscillator have 500-μμf capacitors in parallel with their filaments. These bypass any high-frequency signals. There is also an r-f choke directly in series with each filament to block the r-f signals. In addition, there is a 5,000-μμf capacitor which is across the two-tube parallel network. This, of course, further and more completely bypasses the r-f voltage. And finally there is another r-f choke in series with the circuit across the supply which even further removes any r-f signal. Again, this is done to prevent these signals from reaching the video stages of the receiver and causing interference in the picture.

The video i-f amplifiers are also across this filament winding to ground. Each has a 1,500-μμf capacitor across it to bypass signals. These elements are three times the size of those across the r-f tuning unit tubes. This is so since the frequencies in the video i-f stages are reduced from the incoming carrier frequency which the r-f stages use. The r-f chokes are again used to block the r-f signals. Note also the use the filament choke used to isolate the audio amplifier and the 2nd audio i-f tube as well as the use of the 5,000-μμf capacitor for video and audio bypassing.

Arnold J. Unger

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FEBRUARY 1953

the cosine yoke

by harry e. thomas

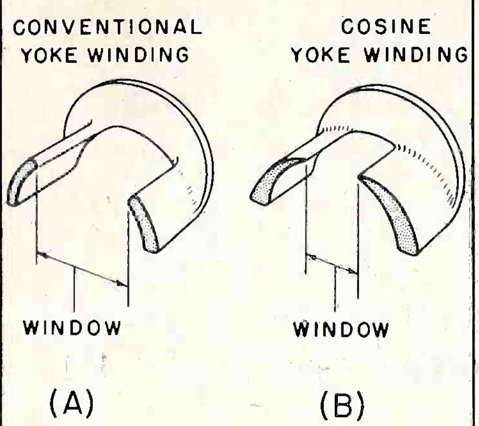

Fig. 1. Cross section of yoke winding.

In physical appearance deflection yokes for tv receivers have changed but little since the early models. However, electrically and magnetically the changes have been considerable.

In size, for instance, the first yokes were about three inches long and were designed to be used with small picture tubes having deflection angles of about 50 degrees. Present-day yokes run a maximum of two and one half inches long and are used for 66-degree and 70-degree tubes.

Electrically the old-style yokes used lower inductance horizontal coils (8 mh) while modern coils have inductances which run from 13 to 30 mh. At the same time, vertical windings have grown somewhat smaller, with inductances of about 30 to 40 mh, against the early 50 mh windings.

Magnetically, modern design employs ferrite cores in a yoke known as the *cosine yoke.* This yoke gives a notable improvement in focusing at the edges of the picture. This deficiency in performance of earlier yokes was generally ignored because of the use of smaller picture tubes. The design of these early yokes was primarily concerned with sensitivity of deflection and toward obtaining a perfectly rectangular raster with no sagging inward or bulging outward of the sides. The sagging inward is called "pincushioning" while the bulging outward is known as "barrelling."

The means employed to construct a cosine yoke involves the correct distribution of the winding. The cross section of the winding is not uniform as in the case of older yokes (see part A of Fig. 1). The turns near the inside of the winding are in a thin layer, and pile up to successively increasing thickness as the winding progresses away from the window (see part B of the figure). As a result of this type of winding arrangement, the distribution of magnetic flux threading through the neck of the tube is more uniform than with the old-style yokes. Because of this more uniform field, the focus of the spot toward the edges and the corners of the picture-tube raster is considerably improved.

As the electron beam, which has a definite thickness, passed through the nonuniform field produced by the conventional yoke, different portions of that beam experienced differing amounts of deflection force. As a result, an elongated spot was produced at the raster edges that resulted in an out-of-focus condition. By causing the beam to travel through the more uniform field produced by the cosine yoke, uniform deflection of all parts of the electron beam occur, and a 500 minimum amount of defocusing takes place.

The arrangement of the conventional windings around the picture-tube neck can be seen in part A of Fig. 2. The deflection coils are shown in cross section here. The horizontal windings produce a magnetic field with vertical lines of force. This magnetic field produces horizontal deflection. The vertical windings produce a magnetic field

(Continued on page 10)

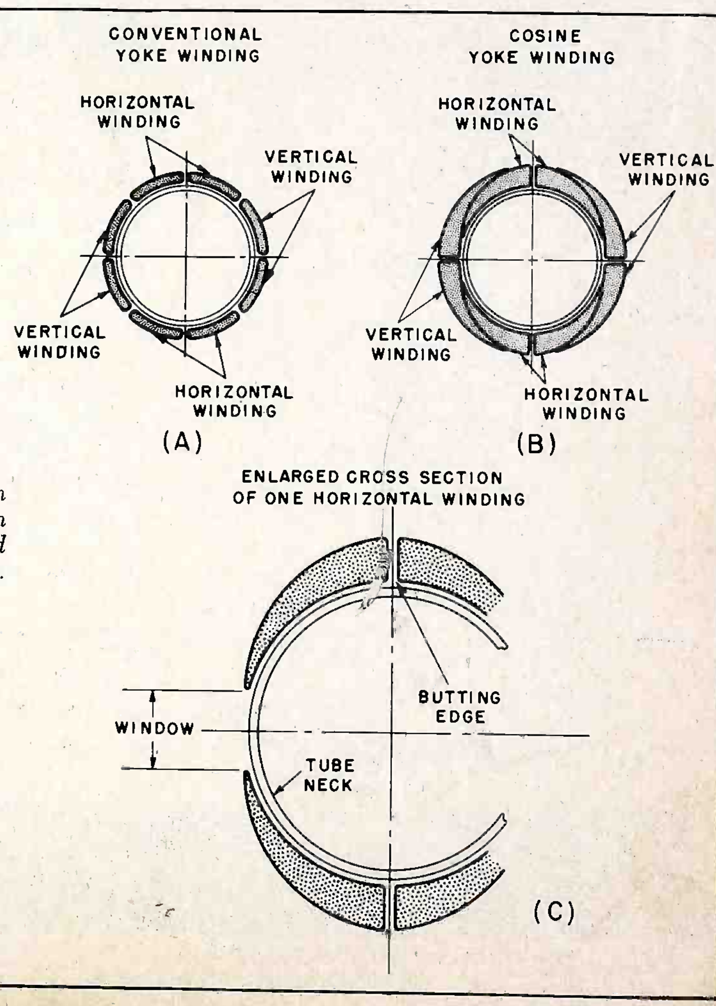

Fig. 2. Distribution of windings (shown in cross section) around neck of picture tube.

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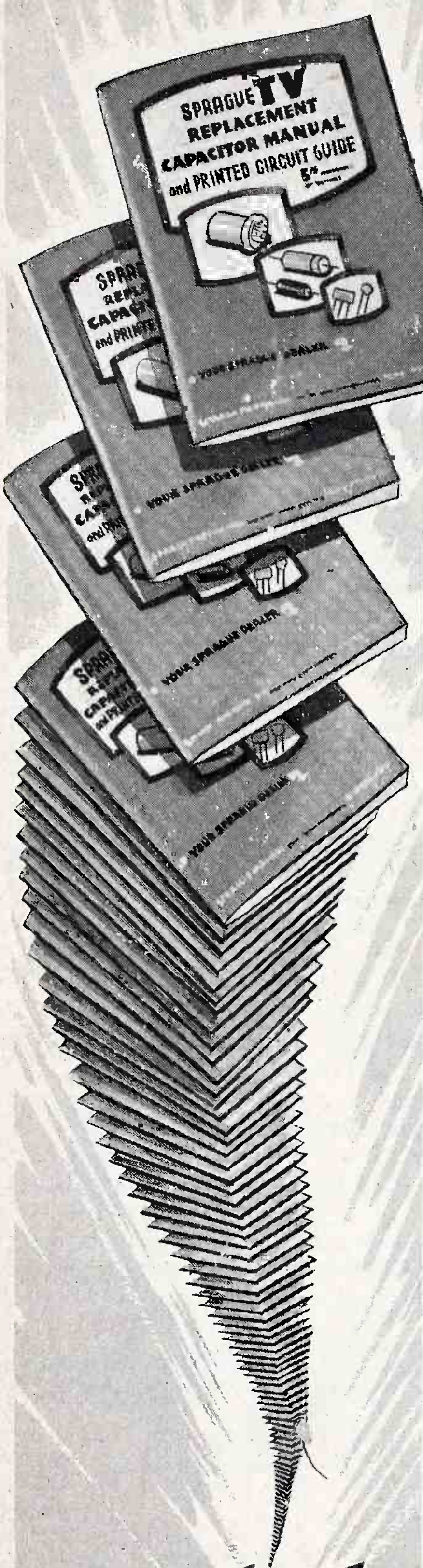

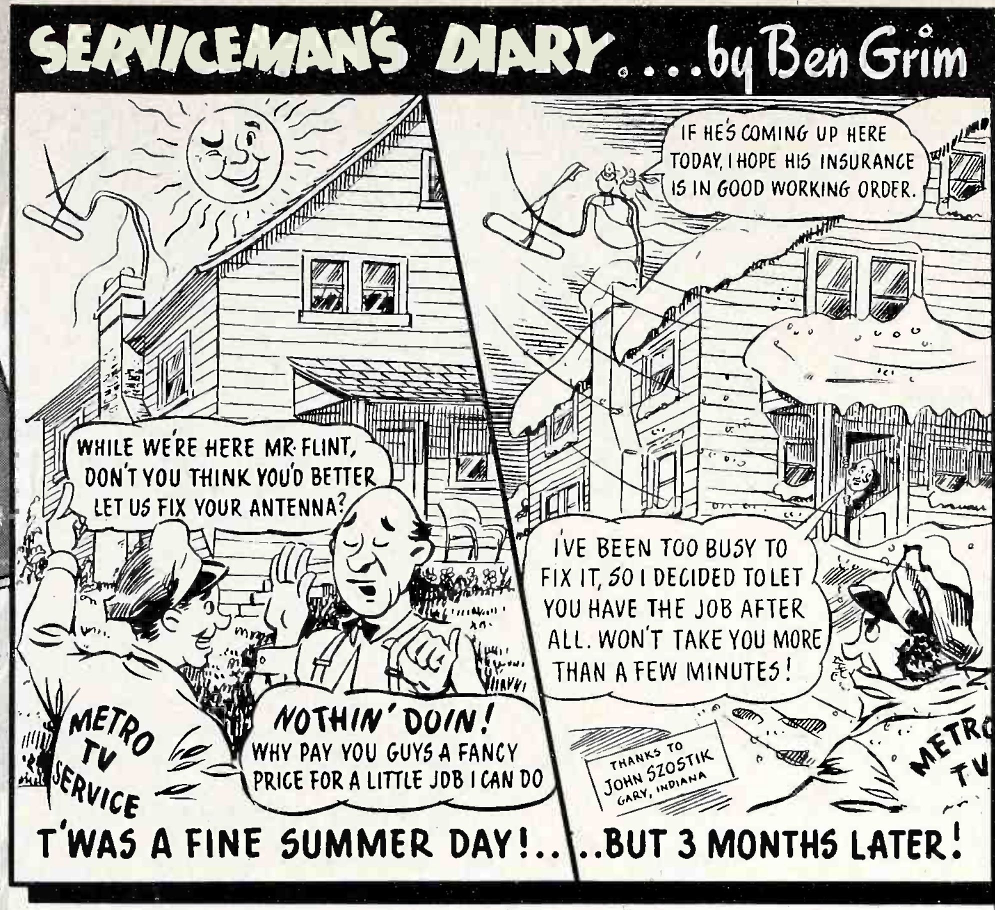

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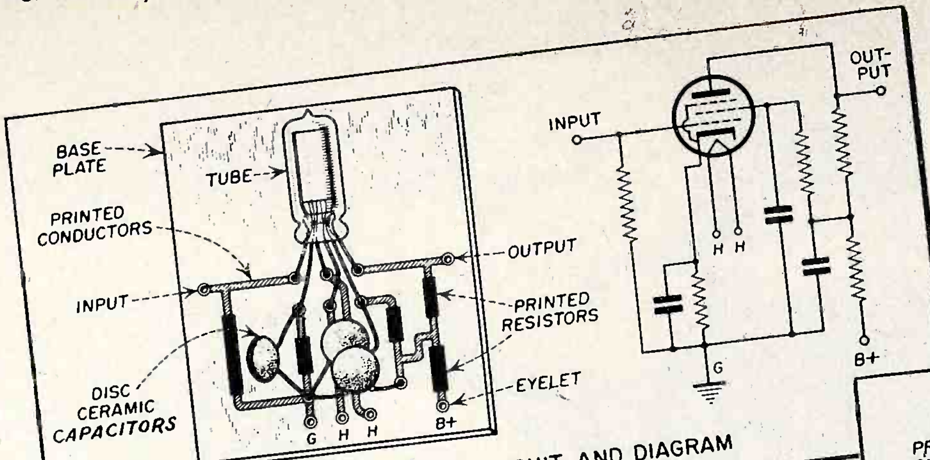
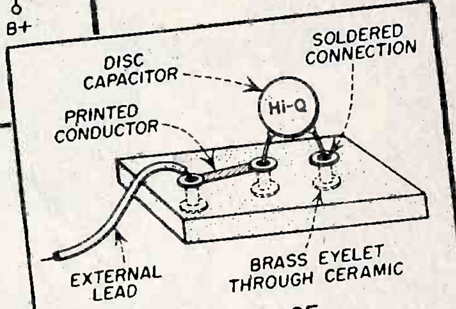
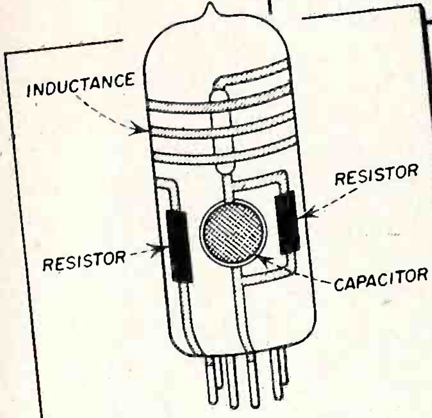


TYPICAL PRINTED CIRCUIT AND DIAGRAM
FIG. 1



METHOD OF CONNECTING WIRE LEADS
FIG. 3



PRINTED CIRCUIT ON TUBE ENVELOPE
FIG. 2

PRINTED ELECTRONIC CIRCUITS*

by the Engineering Department, Aerovox Corporation

**This material appeared originally in "The Aerovox Research Worker".*

THE reproduction of electrical circuits on insulated surfaces by various printing techniques has become a standard method of fabricating small, lightweight, economical electronic devices. The increased emphasis placed by the Armed Services and industry on miniaturization and ruggedness of electrical components has caused this innovation to assume vital importance. Printed circuitry is no longer confined to a few military devices and hearing aids, but may now be encountered in a large number of everyday equipments. These include speech amplifiers, portable receivers, citizens two-way radios, television receiver front-ends, f-m receivers, and many others. For this reason, a working knowledge of the design, production, and maintenance of such circuits will be a valuable asset to any worker in the electronics field. This article is concerned with a discussion of the general types of printed circuits, the relative advantages of each, and methods of effecting servicing repairs.

The use of printed circuitry has been revolutionary not only because it permits the fabrication of extremely small and rugged electronic components, but also because it reduces the production of such components to a simple, rapid operation which is almost completely devoid of the possibility of human error. By this method, a relatively unskilled operator can reproduce literally hundreds of complex units in the time formerly required to make one unit by old-fashioned "wire-by-wire" soldering techniques. In addition to electrical conductors, critical circuit components such as resistors, capacitors, and inductors can be "printed" into the circuit in the same operation and held to close, reproduceable tolerances. Fig. 1 shows a typical printed circuit and its schematic diagram.

Printed circuits are classified according to the method used to reproduce them. There are, at present, six general types. These processes are: painting, spraying, vacuum evaporation, chemical processing, metal stamping, and powdered metal dusting. Each of these general categories will now be discussed in some detail.

Printing Techniques

Probably the most widely used process for producing printed circuits is the *painting* technique. In this method, the conductors and other components of the circuit being fabricated are painted on the insulating surface which acts as the base for the circuit. The paint may be applied by hand with a brush, although in production operations the silk-screen stenciling process is more frequently used. Thin ceramic or plastic sheets may be employed for the base, or a metallic surface covered with an insulating lacquer may be used. In special instances, the glass envelope of a vacuum tube has been utilized as a base for its associated printed circuit. See Fig. 2.

The paint used for electrical conductors consists of a powdered metal such as copper or silver in suspension in a liquid binder. This conducting paint is applied to the surface of the insulating base to form the "wires" of the circuit. Other paint, made up of a resistive material such as carbon, may be applied in specific amounts to form resistors. Capacitors may be made by printing the plates on opposite sides of the base plate, if the required capacitance is small. Otherwise, small capacitors (such as the Aerovox Hi-Q BPD type disc ceramic) are connected to the printed circuit as in Fig. 3. It is interesting to note that these capacitors are manufacured by processes which are essentially printed circuit techniques. Inductances are produced by painting spirals of conducting paint on the surface of the ceramic or other base material. "Cross-overs" in the wiring are made by planting one conductor directly over the other with a layer of insulating material such as lacquer between, or by "detouring" one conductor to the other side of the plate for a short distance by means of metal rivets or eyelets through the insulator, as is illustrated in Fig. 4.

When all printed components have been painted in place, the entire assembly is "fired" at an elevated temperature to fuse the metal particles together and bond the circuit to the base plate. Temperatures ranging from room temperature for plastic bases to as high as 800 degrees C. for ceramics are used.

Vacuum tubes, external leads, and other components not printed are soldered to eyelets in the base plate as in Figs. 1 and 3. To take maximum advantage of the space-saving properties of printed circuits, tubes of the subminiature type are usually employed.

(Continued on page 17)

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MEMBER

Curtain Time

Transistors and Replacement Parts

The last few months have witnessed increased activity in the publicity given to transistors and other semi-conductors. In fact, almost the entire November, 1952 issue of the *Proceedings of the IRE* was devoted to this fabulous device. One manufacturer already is offering one type of transistor for sale to experimenters.

No one has any doubt about the impact of the transistor on the entire electronic industry. This will occur when there are no uncertainties about its reproducibility in large quantities and with consistent performance characteristics — application to all present uses of vacuum tubes over the full gamut of frequencies. When all of this comes to pass, the effect will be the equivalent of a revolution in electronic components and design.

The miniaturization of all equipment will be one manifestation, although this program involving subminiature vacuum tubes and transistors, has been going on for years under the impetus of the Armed Forces equipment requirements. The trend to transistors or some other devices made of materials showing similar behavior will, without question, shrink the physical dimensions of electronic equipment to a small fraction of even the smallest vacuum tube device made today.

Forgetting vacuum tubes for the moment, a tremendous effect seems likely on companion units presently being used to supply operating power to the vacuum tubes. A great portion of the energy supplied to vacuum tubes is wasted in heat. This is not so in transistors; hence those devices which supply operating power to the vacuum tubes in equipment are subject to change to a great degree — if not elimination in their present form.

All of this will not happen overnight. Engineers involved in the research of transistor and similarly behaving materials are very reluctant to forecast when the change from vacuum tubes to some semi-conductor type of device will take place; estimates range from 4 years to 8 years. But who can tell? In the meantime, present-day designed equipments are still being sold in great quantities to the public. It is not a wild guess to say that before any major engineering change takes place in electronic equipments — television receivers especially — the nation's houses will contain from 40 to 50 million units, if not more. These receivers will require replacement parts for a long time, regardless of what radical engineering change may take place at the end of four or five years.

It is said that color television is on its way. It is highly doubtful if it will be a transistor-equipped receiver when it arrives, despite the fact that such a black and white receiver equivalent to 34 tubes has been shown already. All sound evaluations contend that the arrival of color television in a year or two, will still make use of vacuum tubes and present types of complementary equipments.

All in all, a tremendous market for replacement parts exists — and is destined to increase substantially in the immediate future. The concern which need be felt by those who are producing and selling these parts is a matter of the nature of their planning. How far in the future do they look? The receivers in the field — all kinds of receivers — must be serviced, and they require replacement parts. The table model radio displaced the console radio — but those consoles which were in people's homes were not discarded. They were serviced until television came along to grab the public's interest.

The birth of a "hot" war may change some of this. If past performance is any sort of a barometer, an acceleration of technological development is a certainty. A part of this will be the transistor or its equivalent because of the unbounded interest in miniaturization of electronic devices for military uses. If this occurs, semi-conductor devices will emerge full fledged much sooner than would be the case with just a cold war in progress. But even then, public holding in electronic equipment will not be thrown away; they will require service and so, replacement part production, selling, and installation.

Summarizing the whole thing, there is every reason why all individuals affiliated with the electronic industry should take note of the progress being made in the semi-conductor phase of the art. The tube manufacturers have been doing this for a long time. But we can't see any reason for concern about inventories in parts manufacturing establishments, parts jobbers stocks, or service technician's parts stocks. Everyone will sell what they have, and what they will make and buy, for years to come.

TV Service

Questions asked here and there among those who are in a position to know indicate a definite improvement in the level of competency being demonstrated by TV service technicians. Taking into account the television receiver sales during 1952, and the total number in use across the nation, the proportion of complaints has decreased. This is especially true in the largely populated areas, where greatest density of receivers prevails.

Chassis Coding

The matter of chassis coding is still a problem in the field. In view of the practice by many television receiver manufacturers to show different schematics representative of different production runs, especially when changes have been made, it is of the utmost importance that the service technician be able to correlate correctly, with the appropriate schematic, the chassis in for service.

We don't know what the answer is, but isn't it possible to establish some common method of coding and also a common location for the coding symbol on the chassis? The former may be difficult because of the different systems firmly rooted in the factories, but the latter is not faced with the same problems. Even if the entire issue is not settled for some time, taking care of one detail at a time would help.

John F. Rider

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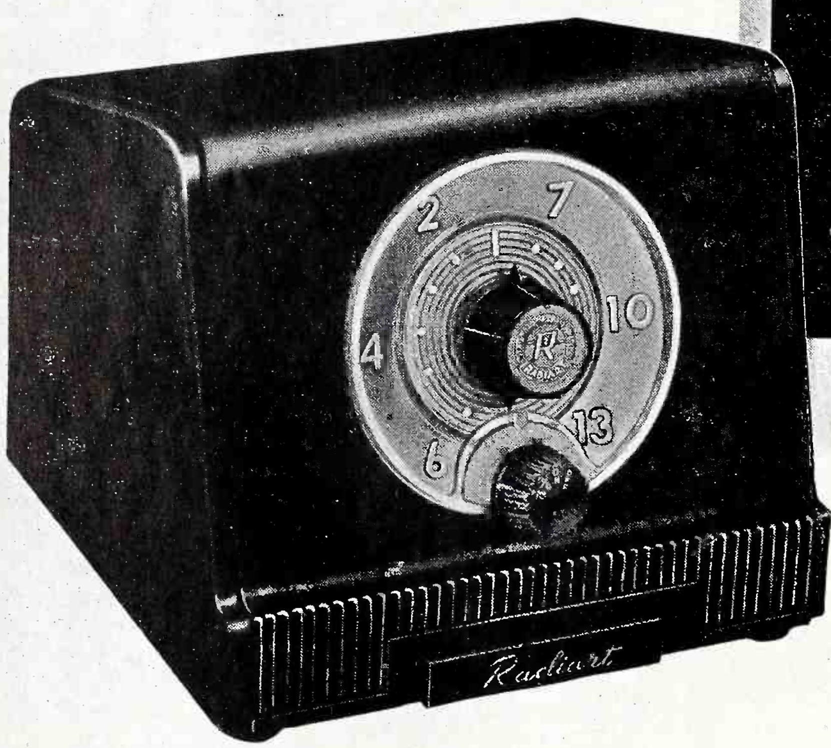

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Replacement Parts in TV Receivers

Part I - Capacitors (cont'd)

by John F. Rider

This is the fourth in a series of articles on "Replacement Parts in TV Receivers." "Capacitors" will be continued next month.

Preceding paragraphs dealt with the identification of capacitors according to their physical construction. This base gives rise to the major type categories. But in the final analysis the suitability of a capacitor for a particular use is only in part determined by its physical construction. Every capacitor within a major type group is not necessarily suitable for every application even if the function indicates the general category of type from which the selection should be made. Still another basis of selection must be applied in order to establish suitability.

For instance a mica capacitor is generally considered to be a suitable type of capacitor for use in tuned circuits. The same may be said for the ceramic dielectric unit. Yet every version of these two general types of units is not suitable for use in every resonant circuit. The same applies to the paper dielectric and the electrolytic capacitors relative to portions of the TV receiver which contain these types. The final indicator in the suitability of use are the constants of the capacitor.

Constants of Capacitors

The suitability of a capacitor for a particular application is determined by many factors. Among these are

a. physical size
b. capacitance
c. operating voltage rating
d. allowable variation in capacitance from rated value
e. required change in capacitance with temperature
f. allowable change in capacitance with temperature
g. maximum temperature for normal operation
h. permissible electrical losses
i. insulation resistance
j. resonant frequency
k. test voltage rating
l. leakage current (if applicable)

and several others.

With the exception of the physical dimensions, the other factors express the electrical qualifications of the component, and when stated in particular standardized terms, are the constants of the capacitor. Some of the terminology already listed are examples of terms which are constants, as for instance, items *a,b,c,i,j,k* and *l*. Item *d* is expressed by the constant "capacitance tolerance"; item *e* is "temperature coefficient" and item *f* is "tolerance in temperature coefficient". Item *g* is expressed by "operating temperature", and item *h* by "power factor" and several others.

Because of the limitations in capabilities imposed by physical construction, or because of the capabilities given to a capacitor by its physical construction, each main type of capacitor has its own set of constants. Some of the constants are common to all types of capacitors because of the very nature of the device. A few examples of these are the physical size, the capacitance, the operating voltage and the electrical losses. When expressed numerically, they may differ widely — again because of the constructional features — but each set of constants does include them.

The selection of a particular capacitor for a particular use is a matter of comparison of the constants of the contemplated capacitor with the requirements of the circuit where it is to be used. At first thought this may seem to be a major problem to the service technician. Actually it is not so, because it already has been done by the individual who designed the circuit. In fact the entire problem is simplified because the receiver manufacturer's service literature contains the electrical specifications for the capacitors required at every point. All of the constants are not given, but a familiarity with the general order of constants applicable to that particular type of capacitor, will, when added to the details already known, lead to the correct replacement.

In the Rider Replacement Parts Program all the electrical requirements surrounding the original capacitor used in the television receiver are known, and these are compared with the electrical constants of the replacement items; then the suitable replacement is listed, that is, if there is one. A number of different types of capacitors can satisfy some of the original design requirements, but only after consideration of all of the constants is it possible to select which particular type of capacitor is suitable, or in some instances, which types are the equivalent of each other for a particular use. Examples of these will be given in a later article.

Physical Size

The physical size requirement is listed as one of the constants. Perhaps this is taking some license with the stricter meaning of constants but it does no harm. It is one of those descriptive terms which offers substantial leeway in the selection. At the factory end the physical size relates to most convenient production, satisfying space limitations inside or around other components, electrical performance when operation is at very high or ultra-high frequencies, and finally, to some extent the matter of economy. From the service technician's viewpoint, the physical size requirement is the one with the least problem, providing that when a limitation exists, it is realized.

We have illustrated the range of physical dimensions within which capacitors of different types are generally available. It was seen that each type comes in different sizes. In some categories of units the full range of sizes is available on the replacement market; in others it is not. But fortunately the manner of use of a capacitor in a television receiver does not always demand complete conformance with the physical size specification, assuming that the electrical requirements can be satisfied.

For example, when a capacitor is located inside of some other component with fixed boundaries, such as an i-f or similar transformer can, or a deflection yoke, it is necessary that the replacement be of similar physical dimensions, or smaller, in order to fit within the same space. At the moment we are neglecting the possibility that the technician may not be interested in replacing a capacitor in an i-f transformer; he would rather replace the entire unit, which after all, does make sense when all factors are considered. Another example is the capa-

(Continued on next page)

citor which is used in a critical circuit where space is at a premium and the distributed capacitance must be kept to a minimum, or when the lead length is important. The larger the unit in these cases, the lesser is the possibility of keeping the lead length to the dimension used for the original component.

It is not beyond the realm of the imagination that a service technician may feel that the replacement of a fixed tuning capacitor inside of a transformer can be accomplished by locating the component outside the can. This is bad practice, and should not be done. The performance of the transformer can be affected adversely and feedback problems may arise.

Finally there is the case of the can type of electrolytic capacitor for which a mounting plate already exists in the receiver. It is conceivable that a new mounting plate suitable for a larger or smaller sized replacement can be used insead of the old one, but this involves the unwarranted expenditure of time and is justified only when the proper replacement is not procurable. Or, it is conceivable that a completely new mounting arrangement will be used, such as locating the replacement beneath the chassis. Of course it can be done, but we feel that in the latter cases, which are not too numerous to begin with, the physical features of the chassis should be retained by procuring the part that fits the chassis properly.

As to capacitors which are located on the underside of the chassis, the physical dimensional requirements are not of major import, providing, as we have said before, that the electrical requirements are satisfied. However, it always is best to duplicate the original size, but if there is to be a difference, it is best and most convenient to work with the smallest physical sizes rather than the reverse.

Capacitance and Capacitance Tolerance

In the list of electrical qualifications and in any list of constants of capacitors, these two items are shown individually. In reality they are closely related; hence are treated together here. Moreover, they are associated with all basic categories of capacitors being treated in this replacement parts series.

All capacitors bear some identification which states the capacitance rating of the unit. Sometimes the value is simply stated on the box which contains the unit, as usually is the case with variable capacitors. In the case of fixed units of all kinds, the value is marked on a label attached to the capacitor, or it appears as some form of coding impressed on the unit. Whether the label or coding expresses the capacitance in microfarads or micromicrofarads is unimportant because one is convertible into the other. A more important thing is the realization that the value of capacitance so shown is an *approximate* value. Frequently it is referred to as the *nominal* value.

By approximate or nominal we mean a value corresponding to the standard value within a certain leeway or tolerance. As a matter of convenience, lowest cost, and other production factors, the radio and television industry has agreed upon certain values of capacitance for each type of capacitor as being "standard" values. Design engineers try to build their equipments around these values. Capacitor manufacturers in turn build capacitors to approximate these standard values within a certain tolerance (expressed as a percentage of the rated value) and label them accordingly.

Although the standard values of capacitance are not the same for all basic categories of capacitors, at least do not begin at the same low limit and end at the same high limit, there is a range of capacitance in which the paper dielectric, mica dielectric, and ceramic dielectric afford more or less the same standard values, but not exactly the same. Such a list would begin at about 0.0001 μf and end at about 0.01 μf. It must be understood however that operating voltage ratings will tend to modify the range of standard values in all three types. As an illustration we might point out that the usual lowest standard value of capacitance in paper dielectric capacitors rated below 2000 volts working, is 0.001 μf, and even this is increased to perhaps several times that value when the working voltage is below 600 volts.

Mica dielectric and ceramic dielectric capacitors are available in like standard values from about 1 μμf to about 0.01 μf, but even in this group, especially between a fraction of 1 μμf and about 70 μμf, the preponderant selection of ceramic capacitors for many uses by design engineers has lead to the creation of standard values which differ from each other in very small steps, perhaps 2 or 3 μμf.

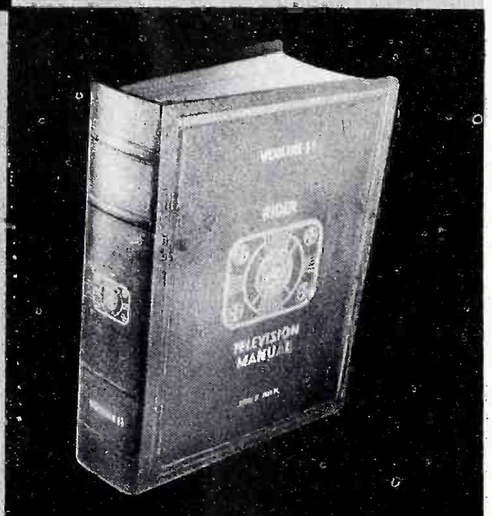
The electrolytic capacitor is in a class by itself as far as standard values are concerned. They begin at about 4 μf and extend up into the thousands of microfarads. But here too the particular type and the working voltage rating sets limits, as for example about 50 μf is the limit at 450 volts, whereas 5000 μf units are available at 6 volts.

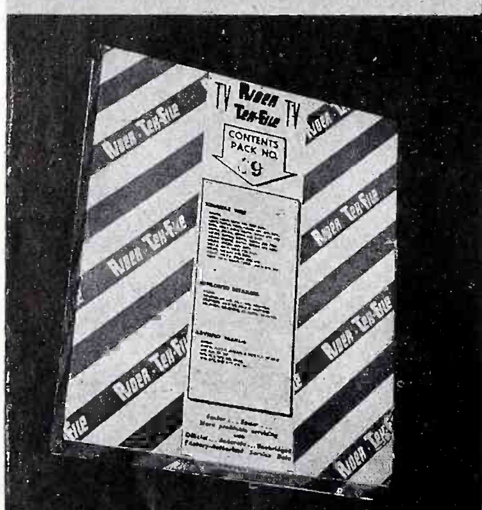
Capacitance Tolerance. Concerning the association between standard values and tolerance, by definition, tolerance is the acceptable departure from a rated value. In the television industry, for that matter in the entire electronic industry, capacitance tolerance is expressed in two ways. One is in terms of percentage of the rated value, the other is in terms of a certain amount of capacitance. For instance when the capacitance is less than 10 μμf, and the unit is a ceramic dielectric capacitor, the + and − tolerance ratings may be 0.1μμf, 0.25 μμf, 0.5 μμf, 1.0 μμf or 2.0 μμf, depending entirely on the degree of accuracy required by the circuit involved. As a rule, capacitors of this kind used in television receivers bear either + or − 0.25μμf or 0.5 μμf tolerance ratings.

In the case of mica capacitors up to and including 10 μμf, two minimum tolerance ratings exist. For the plain foil mica, the minimum tolerance is 1.0 μμf, whereas for the silver mica it is 0.5 μμf.

When the capacitance exceeds 10 μμf, the capacitance tolerance is expressed in

(Continued on page 20)





The Cosine Yoke

(Continued from page 1)

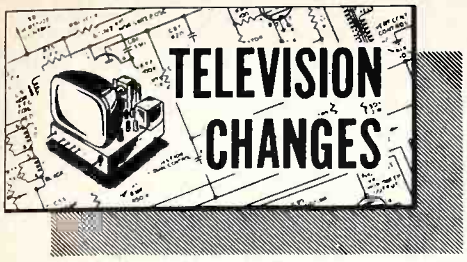
with horizontal lines of force. This magnetic field produces vertical deflection. Part B of the figure shows a cross section of the windings of the cosine yoke. Windings which produce horizontal and vertical deflections are labeled. Part C is an enlarged view of one of the horizontal windings with the window and butting edge of the winding shown.

Note that the cosine distribution must be designed into both vertical and horizontal windings, but in different amounts. This is true because the deflection components of both magnetic fields are not the same due to the raster being wider than it is high. The size of the window in both horizontal and vertical coil assemblies affects the over-all distribution and hence the spot focusing in the corners of the picture.

The cosine distribution curve is a design detail and has no direct significance to the serivce man. Suffice it to say that the winding thickness varies in a cosinusoidal manner. Some windings claim to be cosine squared in character, which means that the winding thickness increases faster than in a normal cosine yoke.

In general a cosine yoke can be distinguished from a conventional-style yoke by inspecting the size of the winding window. Cosine yokes have narrow windows. This is natural, since the winding starts nearer to the center line of the assembly, and thus has farther to spread while increasing its thickness. The horizontal winding window can be readily seen, since this winding is on the inside of the yoke and lies along the neck of the tube.

Finally, in checking an old yoke when considering replacement with a cosine yoke, note that the cosine yokes probably have higher horizontal-winding inductance than conventional designs and replacement might result in poor performance and probably give ringing in the picture. Also, another condition to watch out for is whether the shape of the raster has been changed, since better corner focus may have been obtained at the expense of pincushioning of the raster. Some cosine yokes produce pincushioning that must be removed by placing small permanent magnets (held on brackets) around the neck of the tube. These anti-pincushioning magnets must be readjusted in making a replacement. A cosine yoke with such magnets cannot be used with metal picture tubes since the cone may become permanently magnetized and thus distort the raster.



In compliance with the many requests we have received from our readers, this and future issues of SUCCESSFUL SERVICING will again contain the feature, TV PRODUCTION CHANGES.

The Rider Manual pages and TEK-FILE pack which include the original data and shematics to which the following production changes apply, appear in the index on page 24 of this issue.

ANDREA **MODEL T-VL12**
CHASSIS VL12

Service Data Addenda (Coil and Transformer Resistances)

Low-Voltage Transformer, T12, Part. No. ST-3033
- Primary: .8 ohm
- High-voltage secondary: 38 ohms, (center tap)
- 5v secondary (yellow leads): .1 ohm
- 6v secondary (green leads): .1 ohm
- 6v secondary (blue leads): .3 ohm

High-Voltage Transformer, T8, Part No. ST-3018-1
- Terminals 1-2: 90 ohms
- Terminals 2-3: 180 ohms
- Terminals 4-5: 9 ohms
- Terminals 5-6: .3 ohm

Vertical-Output Transformer, T7, Part No. ST-3030
- Blue-red leads: 600 ohms
- Green-yellow leads: 10 ohms

Vertical-Blocking Transformer, T6, Part No. ST-3029
- Blue-red leads: 150 ohms
- Green-yellow leads: 900 ohms

Horizontal-Oscillator Transformer, L18, Part No. SA-335
- Terminals A-F: 75 ohms
- Terminals C-D: 43 ohms

Deflection Yoke, L17, Part No. ST-3034
- Horizontal winding: 13.5 ohms
- Vertical winding: 70 ohms

Focus Coil, L14, Part No. ST-3032
- 1300 ohms

Horizontal-Linearity Control, L20, Part No. SA-315-1
- 35 ohms

Width Coil, L19, Part No. SA-336
- .5 ohm

Speaker Output Transformer, T11, Part No. SL-4009
- Primary: 400 ohms
- Secondary: .5 ohm

Filter Choke, L22, Part No. 3031
- 100 ohms

MAGNAVOX
CHASSIS CT-270, 271, 272, 273, 274

R-F Unit

These chassis use r-f tuner unit No. 700349.

GAMBLE-SKOGMO (CORONADO) **MODELS 05TV1-43-9014A, 15RA2-43-9105A**
CHASSIS 16AY210

Circuit Changes, Video Amplifier

The following component changes were made in the video amplifier circuit:

Ref. No.	*Old Part Number*	*New Part Number*	*Description*
R35	C-9B1-70	C-9B1-66	2,200 ohms, ½ watt, 10%
R38	C-9B2-64	C-9B-62	1,000 ohms, ½ watt, 10%
R123	C-9B4-21	C-9B2-70	4,700 ohms, 1 watt, 10%
R127	new part added	C-9B4-82	47K ohms, 2 watts, 10%
C122	new part added	C-8G-11892	22 μμf, ceramic
L20	A-16A-18685	A-16A-19486	240 μh peaking coil
L21	A-16A-18685	A-16A-19485	380 μh peaking coil

NOTE: Chassis code numbered 124023 or higher incorporate this change.

MITCHELL
MODELS T16-2KB, T16-2KM, T16-B, T16-M

Production Change (Tube Substitution)

In some receivers, a 6SN7 is used in place of a 12AU7 for the d-c restorer and sync separator stage. This is done by making the following wiring changes:

1. Filaments: Connect pins 5 and 9 of the 12AU7 to pins 7 and 8 of the 6SN7, respectively. Disconnect pin 4 of the 12AU7.
2. Cathodes: Connect pins 3 and 8 of the 12AU7 to pins 6 and 3 of the 6SN7, respectively.
3. Grids: Connect pins 2 and 7 of the 12AU7 to pins 4 and 1 of the 6SN7, respectively.
4. Plates: Connect pins 1 and 6 of the 12AU7 to pins 5 and 2 of the 6SN7, respectively.

HOFFMAN
MODEL 612
CHASSIS 142

Hoffman Model 612 is a 24 tube table model with a 6 inch speaker and an audio power output of 3.0 watts. A 12 inch picture tube is used. Its major components are:
- Chassis – 142
- Speaker – 6" PM (Part No. 9062 voice coil, 3.2 ohms at 400 cps.)
- Cabinet – Part No. 7533
- Escutcheon Frame – Part No. 2277
- Filter Plate Glass – Part No. 734
- Picture tube – 12KP4, 12LP4, L2QP4

SYLVANIA
MODEL 74M
CHASSIS 1-356(C05)

Sound I-F Limiter (Circuit Change)

1. Resistor R-104 (120 ohm) is removed from the cathode (pin 7) of the Sound I-F Limiter (V-10, 6AU6) and the cathode is connected directly to ground.
2. Capacitor C-104 (.2μf, 400v), connected from the bottom of T-52 (sound discriminator transformer primary) to ground, is removed from the circuit.
3. Resistors R-105 (33K, ½w) and R-106 (10K, ½w), connected to the screen grid of the Sound I-F Limiter (pin 6 of V-10, 6AU6), are removed from the circuit.
4. Pin 6 of V-10 is connected to the bottom of T-52.
5. Resistor R-107 (33K, ½w), connected between the bottom of T-52 and the +125v supply, is changed to 22K, ½w (Service Part 181-0223).

NOTE: Chassis coded C06 (Serial Nos. beginning 5606-) incorporate this change.

SYLVANIA
MODELS 22M-1, 23B, 23M, 24M-1
CHASSIS 1-387-1

3rd Video I-F Stage (Resistor Change)

Resistor R-140, in the grid circuit (pin 1) of the 3rd video i-f tube (V-5, 6BA6), is changed from 27K, ½w to 22K, ½w (Service Part 181-02235).

NOTE: Chassis coded C01 (Serial Nos. beginning 87101-) incorporate this change.

DEALERS GETTING WESTINGHOUSE TUBES PROFIT FROM HEAVY LOCAL ADVERTISING AT NO COST

Service dealers are getting powerful local advertising support from new Westinghouse RELIATRON™ Tube Distributors. In cities now served by Westinghouse Distributors, dealers get local newspaper advertising, a complete kit of store display and imprinted mailing material.

All of it—local ads and kits—are designed to build TV-radio service business in the dealer's local area.

Best of all, none of it costs the dealer a penny!

You can get your store listed in two local newspaper ads at no charge, and get a kit to boot. If Westinghouse Tubes are now sold in your area, see your Westinghouse Distributor and take advantage of this $900-worth-of-advertising-at-no-cost offer.

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COMING YOUR WAY

If Westinghouse Tubes are not yet distributed in your area, be patient. Distributors are being established in all market areas as fast as product availability and good service permit.

You'll soon have the chance to buy RELIATRON Tubes. Keep this tremendous opportunity in mind: you'll get newspaper advertising at no cost! Imprinted material for mailings! Imprinted signs for your window!

All of it is local advertising which sells your service in your own area where it counts.

For the name of your Westinghouse Distributor, or the approximate date when Westinghouse Tubes will be available in your area, drop a postal card to Dept. M-201 or have your regular distributor contact Dept. M-201 for information on how he can better serve you.

YOU CAN BE SURE...IF IT'S **Westinghouse**

RELIATRON TUBES™

WESTINGHOUSE ELECTRIC CORPORATION, ELECTRONIC TUBE DIVISION, ELMIRA, N. Y.

To All Purchasers of:

RIDER'S TV 10

Please do not forget to fill in the registration coupon on the first page of your Rider TV 10 Manual and send it to us if you have not done so already. We will forward the replacements parts listing corrections direct to your address. Also, by returning this coupon to us, you will be assured of having your name on our mailing list for exclusive, replacement parts information that will be available to TV 10 owners. Do Not send us the replacement parts pages!

Here are more data that will keep your RIDER'S DEPENDABLE REPLACEMENT PARTS LISTING published in TV Volume 10 up to date.

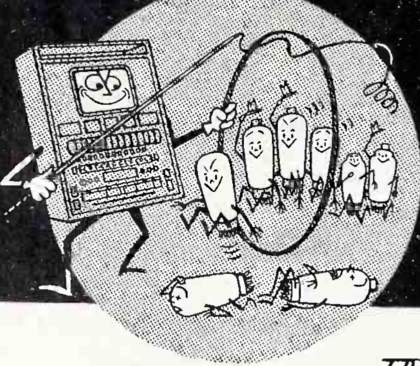
ADDITIONS TO PHILCO VARIABLE RESISTANCE CONTROLS SECTION:

PHILCO Part No.	REPLACEMENTS																	
	CLAROSTAT				IRC							MALLORY						
	Cat. No.	Kit No.	Inner Shaft	Switch No.	Stock No.	Kit. No.	Panel Elem.	Rear Elem.	Outer Shaft	Inner Shaft	Switch No.	Stock No.	Kit. No.	Panel Elem.	Rear Elem.	Outer Shaft	Inner Shaft	Switch No.
33-5546-41	A43-10K		FKS 1/4		WK-10000													
33-5546-49	A10-10K		FKS 1/4		4WK-10000							M10MP						
33-5563-42	RTV-345				QJ-391		W17-111	WR11-116	P3-129	R8-213								
33-5563-43	RTV-241				QJ-302	K-2	B11-125	B11-130	P1-200	R1-216								
33-5563-44	RTV-360				QJ-340	K-2	B12-141	B18-139X	P1-200	R1-216	76-1							
33-5563-50	RTV-358				QJ-356	K-2	B11-123	B11-130	P1-200	R1-216				UF54L	UR25AL			
33-5563-51	RTV-359				QJ-357	K-3	W17-111	B11-128	P3-131	R1-216				WF252	UR15L			
33-5564-14	AT-116		FS-3	SWA	Q18-139X							UT451						US26
33-5565-17	AG-55-S		FKS 1/4		Q11-130							SU46						
33-5565-30	AG-44-S		FKS 1/4		Q11-123							SU35						
33-5565-31	AG-85-S		FKS 1/4		Q11-14							SU67						
33-5565-32	AG-84-S		FKS 1/4		Q11-239							SU565						

ADDITIONS AND CORRECTIONS TO FIXED CAPACITORS SECTION:

Set Mfr.	Set Mfr.'s Original Part No.	
Belmont	8C-18487	Add AFH4-82 to Aerovox column.
Packard-Bell	23936	Change BPD-.0015 mf to SI-2-1500 mmf in Aerovox column.
"	"	Change K071 to G071 in Cornell-Dubilier column.
"	"	Change DC-5215 to UC-5212 in Mallory column.
"	"	Change 5HK-D15 to 5GA-D15 in Sprague column.
"	23955	Change K078 to KD077 in Cornell-Dubilier column.
"	"	Change UC-5240 to DCD524 in Mallory column.
"	"	Change 5DA-D4 to 5HK-2D4 in Sprague column.
"	23956	Change 1468L-HV 47 mmf to HVD30-47 mmf 10% in Aerovox column.
"	"	Delete 5P20Q47 in Cornell-Dubilier column. No replacement.
"	"	Delete MCL-447 in Mallory column. No replacement.
"	"	Change 60GAB-Q47K to 20GAB-Q47K in Sprague column.
"	23967	Change 1468L-HV-100 mmf to HVD15-470 mmf in Aerovox column.
"	"	Delete 5P10T47 in Cornell-Dubilier column. No replacement.
"	"	Delete MCK-347 in Mallory column. No replacement.
"	23959	Change MMA20T5 to MMC-20T5 in Cornell-Dubilier column.
Philco	30-2417-3	Add PRS50-10 to Aerovox column.
"	"	Add BR-105 to Cornell-Dubilier column.
"	"	Add TC-32 to Mallory column.
"	"	Add TVA-1304 to Sprague column.
"	30-2417-7	Add BBR-2-50T to Cornell-Dubilier column.
"	30-2570-57	Add D111 to Cornell-Dubilier column.
"	"	Add FP476 to Mallory column.
"	30-2570-66	Add XA004 to Cornell-Dubilier column.
"	"	Add FP117 to Mallory column.
"	30-2584-9	Add D111* to Cornell-Dubilier column.
"	"	Add FP344.5 to Mallory column.
"	30-2584-15	Add UPT 435 to Cornell-Dubilier column.
"	"	Add FP225-TC72** to Mallory column.
Stromberg-Carlson	111082	Change PRS 15/500 to PRS 12/500 in Aerovox column.
"	111094	Change TVL-2764 to TVL-4840*** in Sprague column.
"	"	Change FP238 to FP476*** in Mallory column.
"	111095	Change FP476* to FP238 in Mallory column. Delete "Remarks" column.
"	"	Change TVL-4840* to TVL-2764 in Sprague column. Delete "Remarks" column.

*Parallel 20 mf and one 20mf/3000VDC section to replace original 30 mf section.
**TC72 tubular electrolytic used in place of 10mf/450V section of original unit.
***Omit one 10 mf section.

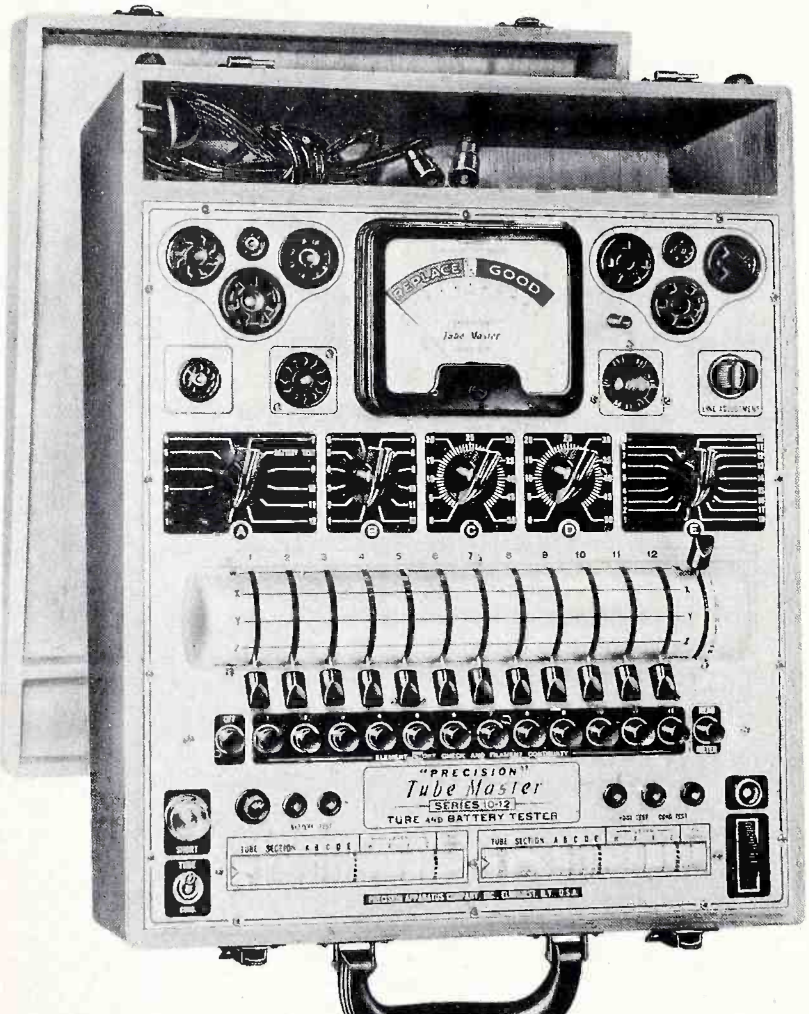


THE INSTRUMENT THAT DEMANDS
OVERALL PERFORMANCE
FROM THE TUBE UNDER TEST!

-PRECISION- SERIES 10-12

*Electronamic** Tube PERFORMANCE Tester

with 12 element free-point Master Lever Selector System



To test modern tubes for only one characteristic will not necessarily reveal ***OVERALL*** PERFORMANCE CAPABILITIES. **Modern tube circuits look for more than just mutual conductance or other single factor.**

It has been conclusively proven that even though a tube may work well in one circuit, it might fail to work in another—simply because **different circuits demand different relative performance characteristics**, such as amplification factor, plate resistance, power output, emissive capability, etc.

In the PRECISION "ELECTRONAMIC" Circuit, the tube under test is made to *perform* under appropriately phased and selected individual element potentials, encompassing a wide range of plate family characteristic curves. This COMPLETE PATH OF OPERATION is electronically integrated by the indicating meter circuit in the positive performance terms of *Replace-Weak-Good.*

The efficiency of this "Electronamic" test results from encompassing several fundamental tube characteristics, NOT JUST ONE. Accordingly, when a tube passes this demanding **OVERALL PERFORMANCE test**, it can be relied upon, to a very high degree, to work satisfactorily.

*REG. U. S. PAT. OFF. T. M. 438,006

MODEL 10-12-P (illustrated): in sloping, portable hardwood case with tool compartment and hinged removable cover. Sizes 13¾" x 17¼" x 6¾" **$104.50**
MODEL 10-12-C (Counter Type) **$109.25**
MODEL 10-12-PM (Panel Mount) **$109.25**

Compare these features

- ★ Facilities to 12 element prongs.
- ★ Filament voltages from ¾ to 117 V.
- ★ Tests Noval 9 pins; 5 and 7 pin acorns; double-capped H.F. amplifiers; low power transmitting tubes, etc., regardless of filament or any other element pin positions.
- ★ Isolates each tube element regardless of multiple pin positions.
- ★ Dual Hi-Lo short check sensitivity for special purpose tube selection.
- ★ Simplified, High Speed, 12 element Short-Check system, uses consecutive push-button switching.
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- ★ 4½" Full Vision Meter.
- ★ Built-in Dual-Window, high speed, geared roller chart.
- ★ Free Replacement Roll Charts & supplementary tube test data service.

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AM · FM · TV

PRINTED ELECTRONIC CIRCUITS

(Continued from page 3)

The painting technique has the advantage of requiring a minimum of auxiliary equipment and so has been the most popular type for experimentation and design work with printed circuits. It is also the best method to use in making repairs on printed circuits, as will be discussed later.

The *spraying* method of reproducing printed circuits differs from the painting technique in that the conductors are sprayed onto the surface of the base. Both molten metals and metallic conducting paints may be applied in this manner. In some processes, stencils are used to define the circuit conductors. In others, grooves are machined or molded in the base material where a conductor or other circuit component is desired. Grooves may also be formed by sand-blasting through a stencil. Metal is then sprayed over the entire base plate, filling the grooves and covering the spaces between. The surface is then milled off, removing the excess metal and leaving only that in the grooves. High conductivity is obtained by this method since relatively large conductors are formed in the grooves. Standard tube sockets and other components are sometimes connected to sprayed circuits by mounting them on the opposite side of the base plate so that the terminals protrude through holes into the grooves. Then, when the circuit is sprayed, connections are automatically made to the conductors. Circuit cross-overs are made in a manner similar to that employed in the painting process. Resistors, capacitors, and inductances may also be formed by spraying.

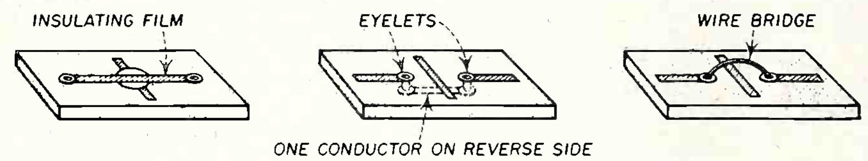
The *vacuum evaporation* process of circuit printing consists of evaporating a metal such as silver, copper, or nickel onto the surface of the dielectric material by melting the metal in a vacuum. A mask or stencil on the surface of the insulator is used to outline the circuit desired. In one such process, called "cathode sputtering", a high voltage is applied between the source of metal vapor (the cathode) and the work upon which it is to be deposited (the anode). The metal vapor is thus drawn to the work by electrostatic forces. Only a "rough" vacuum, such as can be produced by a good mechanical vacuum pump, is required for this process.

Another vacuum process used is very similar to cathode sputtering except that no voltage is applied between the cathode and the work. Metal evaporated from a heated filament, or other source of metal vapor, is distilled on the printed circuit plate placed over it. In either type of vacuum processing, it is unnecessary to further heat treat or fire the deposited metal. Only thin films are usually deposited in this manner. If greater conductivity is required, conductors may be built up by electroplating.

In the *chemical-deposition* methods of making printed circuits, the techniques employed are similar to those used in silvering mirrors. A silvering solution, consisting of ammonia and silver nitrate mixed with a reducing agent, is poured on the chemically clean surface to be coated. The confines of the solution are controlled by an adhesive stencil. The metal films obtained are usually too thin to permit direct soldering, but may be built up by repeated coatings or by plating. The chemical processes have not been applied as extensively as those discussed above.

The *metal stamping* technique has been used principally to print loop antennas on the back covers of radio receivers. However, other types of circuit wiring have been produced by this method. A die, bearing the outline of the desired circuit, is used to press a thin metal foil into the surface of a plastic or other insulator. In the same operation the sharp edges of the die cut the metal sheet to the desired shape. The metal sheet may be backed by an adhesive to insure a good bond. Circuits made in this manner have good conductivity.

The last general type of printed circuit is produced by a process known as "dusting". In this method, a powdered metal is dusted onto the insulating base plate and fired in place. The cricuit outline is defined either by coating the entire insulator with a sticky substance and applying the metal powder through a stencil, or by applying the bonding substance through the stencil and then dusting on the powder so that it is held in place by the adhesive until fired.



TYPES OF CONDUCTOR "CROSS-OVERS"
FIG. 4

Servicing Printed Circuits

As was mentioned above, the most convenient method of making repairs and replacements in printed circuits is the brush-applied painting technique. Kits of such paints, including both conductor and resistor mixtures, are commercially available.

(Continued on page 18)

PRINTED ELECTRONIC CIRCUITS

(Continued from page 17)

Most of these paints require no heat for drying, so that they may be used for repairing circuits having parts which cannot be subjected to high temperatures. This is an important precaution when working with circuits printed on certain types of plastic.

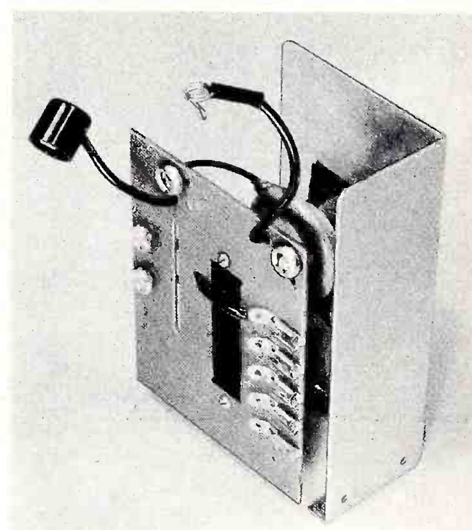
Although subminiature tube sockets are sometimes used with printed circuits, tubes are frequently connected directly to metal eyelets in the base plate, as in Fig. 1. When replacing tubes connected in this manner, care must be exercised to avoid the use of excessive heat during soldering operations. Soldered connections may also be made directly to printed conductors if the base material will stand the heat involved. A solder containing a small percentage of silver should be used for best results. Where soldering is inadvisable, connections to tube leads and other wires should be made with metallic paint.

Printed resistors which have become defective may be repaired or replaced by the painting technique. Defective resistors are located in the usual manner with an ohmmeter. If it becomes necessary to "disconnect" a printed resistor from the circuit for a resistance check, this may be accomplished by scratching through the printed conductor lead with a sharp instrument. If defective, the resistor may be repaired with resistive paint. It will usually be found to be open or high in value. In such cases, additional resistive paint should be applied over the old resistor to reduce its resistance to the proper value. Some commercial printed circuits have a protective layer of lacquer over the conductors and particularly over resistors to prevent moisture absorption. This coating must be completely removed before repairing resistors. If attempts to repair defective resistors are unsuccessful, the old coating should be removed completely and a new resistor painted in its place. The proper dimensions may be determined by trial and error, keeping in mind that the resistance is directly proportional to the length, and inversely proportional to width and thickness. The resistance material must make good contact with the printed conductors at the ends. Breaks introduced in the conductors to isolate resistors may be repaired with a bridge of conducting paint.

New Horizontal Output Transformer May Be Replaced Easily

One component with a high mortality rate is the horizontal-output transformer. Not much was done to alleviate the replacement problem. To those who have undertaken such replacement, the tedious and delicate procedure can be well appreciated.

In the new Stewart-Warner 9300 television chassis, a realistic approach has been taken to the problem. The horizontal-output transformer (shown here) is simply mounted



New Horizontal Output Transformer.

and connectors are employed rather than soldered leads. With this transformer, it is not necessary to remove the high-voltage rectifier tube socket from the chassis merely to replace the filament leads, nor is it necessary to postpone replacement of the transformer as a last resort because of the work involved.

To replace the horizontal-output transformer, it is only necessary to remove two sheet metal screws and unplug the leads. The entire replacement procedure does not require much more than five minutes, and can be done in the customer's home without removing the chassis and without the use of a soldering iron.

TV SUPPLEMENTARY SHEET NO. 1

MODEL & CHASSIS	PART #	CATALOG #	FUNCTION	DESCRIPTION	LIST PRICE
ADMIRAL					
22A2,A 22M1 22Y1	75B1-50	AG-83-S KSS-3	Tone	2 Meg. Ω carbon	$1.25
	75B11-20	RTV-327	Contrast/ Vol./Sw.	1500/1 Meg. Tap 500K Ω Conc. Dual carbon--SPST	$4.30
	75B13-3	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	75B13-7	AG-15-S FKS-1/4	Vert. Lin.	3000 Ω carbon	$1.25
	75B13-12	AG-49-S KSS-3	Bright.	100K Ω carbon	$1.25
	75B13-13	AG-40-S KSS-3	Hor. Hold	25K Ω carbon	$1.25
	75B13-14	AG-61-S KSS-3	Vert. Hold	1 Meg. Ω carbon	$1.25
	75B13-16	A43-750 KSS-3	Focus	750 Ω 2W-W.W.	$1.25
AMBASSADOR					
C1720 C2020 C2420 CD2020 T1720 T2020	131-0001	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	131-0002	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	131-0003	RTV-1	Contrast Vol./Sw.	10K/1Meg. Tap 200K Ω Conc. Dual carbon--SPST	$3.70
	131-0012	AG-44-S KSS-3	Hor. Hold	50K Ω carbon	$1.25
	131-0012	AG-44-S KSS-3	Bright.	50K Ω carbon	$1.25
	131-0013	AG-61-S KSS-3	Vert. Hold	1 Meg. Ω carbon	$1.25
	131-0014	RTV-10	Focus	5000 Ω 4W-W.W.	$1.85
14MT,MTS 16MT,MTS 17MC,MCS, MT,MTS 20MC,MCSMT, MTS	VC-12120B	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	VC-12121C	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	VC-12127B	RTV-297	Contrast. Vol./Sw.	750 Tap 500/250K Ω Conc. Dual--SPST	$4.30
	VC-12130	AG-49-S KSS-3	Bright.	100K Ω carbon	$1.25
	VC-12131	AG-44-S KSS-3	Hor. Hold	50K Ω carbon	$1.25
	VC-12132B	AG-83-S KSS-3	Vert. Hold	1.3 Meg. Ω carbon	$1.25
AM-17C, CB,C1M ET,T1M	PT-1002	RTV-252	Contrast Vol./Sw.	750 Tap 250/250K 2W-W.W./carbon Conc. Dual--SPST	$4.30
AM-20C,T PL-17CB,CG, PG,TM 20C 23P	PT-1004	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	PT-1005	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	PT-1007	AG-49-S KSS-3	Bright	100K Ω carbon	$1.25
	PT-1008	AG-61-S KSS-3	Vert. Hold	1 Meg. Ω carbon	$1.25
	PT-1009	AG-44-S KSS-3	Hor. Hold	50K Ω carbon	$1.25
20PC 20PCS 20PCS2	VC-12120B	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25

MODEL & CHASSIS	PART #	CATALOG #	FUNCTION	DESCRIPTION	LIST PRICE
AMBASSADOR					
	VC-12121C	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.24
	VC-12127B	RTV-297	Contrast/ Vol./Sw.	750 Tap 500/250K Ω Conc. Dual carbon SPST	$4.30
	VC-12131C	AG-44-S KSS-3	Hor. Hold	50K Ω carbon	$1.25
	VC-12132C	AG-83-S KSS-3	Vert. Hold	1.3 Meg. Ω carbon	$1.25
	VC-12135	AG-49-S FKS-1/4	Bright	100K Ω carbon	$1.25
ANDREA 2C-VL20	GRV-812-1	AG-83-S FKS-1/4	Height	2 Meg. Ω carbon	$1.25
	GRV-824	A43-2000 FKS-1/4	Vert. Lin.	2000 Ω 2W-W.W.	$1.25
	GRV-830	AG-60-Z FS-3/SWB	Vol./Sw.	500K Ω carbon--SPST	$1.25 .60
CHASSIS VL-20	GRV-831	RTV-75	Hor./Vert Hold	50K/2 Meg. Conc. Dual carbon	$3.10
	GRV-834	RTV-300	Bright./ Contrast	20K/5000Ω 4W-W.W./ carbon Conc. Dual	$4.05
ARTONE AR14L AR17L 17CD 17CRR 17ROG 20CD 203D 1000 1001 2nd Run	P-2	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	P-5	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	P-7	AG-60-Z FS-3/SWB	Vol./Sw.	500K Ω carbon SPST	$1.25 .60
	P-12	AG-8-S FKS-1/4	AM-Rejection	1000 Ω carbon	$1.25
	PD-5	RTV-146	Vert./Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	$3.10
	PD-6	RTV-253	Contrast/ Bright.	2000/100K Ω Conc. Dual carbon	$3.10
MST-12 MST 14 14TR 16TR 17CD 17CRR 17ROG 20CD 20TR 112X 203D 312 819 3163CR 8163CR 8193CM 1st Run	P-2	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	P-5	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	P-6	A10-1500 FKS-1/4	Focus	1500 Ω 4W-W.W.	$1.85
	P-7	AG-60-Z FS-3/SWB	Vol./Sw.	500K Ω carbon SPST	$1.25 .60
	PD-4	RTV-145	Contrast/ Bright.	750 Tap 250/100K Ω 2W-W.W./carbon Conc. Dual	$3.70
	PD-5	RTV-146	Vert./Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	$3.10
ARVIN 5175 5176	E22464-17	RTV-258	Contrast/ Vol./Sw.	25K/3 Meg. Tap 1 Meg. Conc. Dual carbon--SPST	$4.30
	E22464-20	RTV-259	Vert. Lin./ Height	3000/2.5 Meg. 2W-W.W./carbon Conc. Dual	$3.10
CHASSIS TE320	E22464-34	AG-49-S KSS-3	Bright.	100K Ω carbon	$1.25
	E22464-35	Order from MFR.	Tone/ Phono Sw.		
	E22464-36	AG-83-S KSS-3	Vert. Hold	1.5 Meg. Ω carbon	$1.25
	E22464-37	AG-44-S KSS-3	Hor. Hold	50K Ω carbon	$1.25

Replacement Parts

(Continued from page 8)

percentages, and sometimes in a value of capacitance, whichever is the greater of the two. As to *minimum* tolerances, they vary with the type of component. For example the minimum tolerance generally considered in ceramic dielectric capacitors and in silver mica capacitors is ± 1 percent. In the plain foil mica dielectric unit it is ± 2 percent, whereas in paper dielectric capacitors it is ± 5 percent. In electrolytic capacitors the minimum tolerance is 10 percent.

While on the subject of tolerances it is necessary to comment that the minimum tolerances quoted here are not necessarily the standard tolerances which are used for components in television (and radio) receivers. The high order of accuracy indicated by these minimum tolerances are seldom applied to household electronic equipments. The figures used are much more liberal, but none the less important as far as accomplishing a desired result, hence demanding recognition by the service technician who is making a replacement. It is because of this that television receiver manufacturers frequently list the capacitance tolerance in their service literature, and why the Rider Replacement Parts Program listings of capacitors always state the capacitance tolerance.

Each type of capacitor bears a standard tolerance figure plus and minus. The list shown below indicates the range of tolerances associated with capacitors used in household electronic appliances such as television and radio receivers. Attention is called to the fact that we have omitted the full gamut of capacitance tolerances which are *available* on request from capacitor manufacturers; instead we show only those values which appear in the capacitor specifications set by the receiver manufacturers for capacitors used in their television and radio receivers, and whatever other electronic products they make for public consumption. The list which follows applies to capacitors in excess of 10 $\mu\mu f$. Lower values of capacitance have already been dealt with.

It is understandable that every single capacitance tolerance figure which is used in the industry is not listed here. But it can be said that those which represent the vast majority are included.

It also is important to state that the letter code shown on this listing corresponds to the coding in capacitor specifications contained in capacitor manufacturers' catalogs and in *RTMA* as well as *JAN* specifications. We have however omitted the letter coding indicative of 1, 2 and 3 percent capacitance tolerances. These are F, G and H respectively, although the letter H when applied to ceramic units indicates 2.5 percent.

Finally, attention is called to the possibility of confusion between the capacitance tolerance code letters and the Temperature Coefficient as well as the Temperature Coefficient Tolerance code letters. While similar code letters apply to all of these, their meanings are completely different.

Type of Capacitor	*Standard Industry Capacitance Tolerance in Percent*	*Capacitance Tolerance Values Used in Percent*	*Letter Code*
Mica			
(Plain)	± 20	± 20	M
		± 10	K
(Silver)	± 5	± 10	K
		± 5	J
Ceramic			
(GP)#	± 20	± 20	M
		± 10	K
		± 5	J
(GMV)*	+ 100 and − 0	+ 100 − 0	
		+ 100 − 20	
(TC)**	± 10	± 10	K
		± 5	J
Paper Dielectric	± 20	± 20	M
		± 10	K
		± 5	J
		+ 60 − 25	
		+ 40 − 20	
		+ 40 − 15	
		+ 40 − 10	
		+ 20 − 10	
Electrolytic			
(Tubular)		+ 100 − 10	
		+ 150 − 10	
		+ 250 − 10	
(Can)		+ 40 − 10	
		+ 50 − 10	
		+ 100 − 10	
		+ 150 − 10	

\# General Purpose
* Guaranteed Minimum Value
** Temperature Compensating

Applications of Capacitance and Capacitance Tolerance. How are these two constants used? . . . To begin with, the capacitance required in a circuit is a function of the design of the system which uses it. Among the constants of the circuit is the amount of capacitance required. But seldom, if ever, is this value an absolutely precise one; invariably it is an approximation, although it is stated as a definite amount as that value which most closely approximates the nearest standard value. We refer to it as an approximation because the capacitance value indicated is ± a certain amount of capacitance. For instance the capacitance specified by a receiver manufacturer for a circuit may be 0.0022 μf ± 10 percent. Assuming all other conditions satisfied, any value of capacitance between 0.00198 μf and 0.00242 μf seems suitable.

The conclusions accompanying the example are correct except for one additional consideration. Suppose we deal with the 0.0022 μf unit. In order to be a suitable replacement within the stated 10 percent capacitance limits, the value must be a measured value for the replacement unit. If this is not so, but instead a capacitor labelled

(Continued on page 23)

A monthly summary of product developments and price changes supplied by RADIO'S MASTER, the Industry's Official Buying Guide, available through local parts distributors.

COMMENT: Since the last reported period, fewer manufacturers were engaged in "change activity". TV and radio receiving tube manufacturers are continuing their tendency toward increasing prices, while other product group price changes remain spotty with no apparent trend.

New Items

AEROVOX — Introduced a number of new items including AFH triple and quad electrolytic capacitors.

AMERICAN ELECTRONICS — Added No. 4-01, Code Booklet at $.50 dealer net . . . No. 103-01, Advanced Course at $6.95 dealer net and Individual Records at $1.40 dealer net.

AMERICAN PHENOLIC — Added Model 114-053, UHF bo-ty antenna at $3.00 dealer net . . . Model 114-560, UHF bo-ty reflector at $1.65 dealer net and Model 114-558, UHF bo-ty stacking harness at $.36 pr/dealer net.

BELL SOUND SYSTEM — Added Model 372MB, 30 watt mobile amplifier at $165.00 dealer net.

BRIDGEPORT BRASS — Added plastic spray Model 603 at $1.95 dealer net.

CLAROSTAT — Added TV replacement controls RTV 384 to 390 inclusive.

CORNELL-DUBILIER — Added Model V-8, VHF antenna at $25.50 dealer net . . . Model U-4, UHF antenna at $5.97 dealer net and Model 110T22, vibrator converter at $47.31 dealer net.

CREST LABS. — Added Model LVB-117, line voltage booster at $10.08 dealer net.

EBY SALES — Added laminated miniature sockets No. 49-6H at $1.35 dealer net and No. 49-7H at $1.80 dealer net.

GENERAL ELECTRIC — Added germanium transistors 4JA1A1 at $1.95 dealer net . . . 4JA1A2 at $3.85 dealer net . . . 4JA1A3 at $4.80 dealer net and 4JA2A4 at $5.30 dealer net. Also added Model UPX-009, pickup and transcription arm at $9.33 dealer net . . . Model RPX-051, triple play variable reluctance cartridge at $5.28 dealer net and Model RPX-042, variable reluctance cartridge at $4.35 dealer net.

GON-SET — Added No. 1499, UHF line at $7.08/100 ft. dealer net . . . No. 3027, cascade pre-amplifier at $19.95 dealer net and No. 3028, signal slicer at $29.95 dealer net.

ILLINOIS RESEARCH LABS. — Added Silencer in quart size at $6.50 dealer net and introduced Sta-clear, new chemical solution for keeping static attracted dust from accumulating on picture tube at $1.00 dealer net. (4 oz. bottle).

KENWOOD ENGINEERING — Added Model 12W, 12" wall bracket and Model 7W, 7" wall bracket.

MERIT TRANSFORMER — Added Model HVO-11, transformer at $5.40 dealer net.

MINNESOTA MINING — Added 7" (1200') professional reel and box (plastic) at $1.25 list.

RADIO CITY PRODUCTS — Added a number of new items including Model 345, super vacuum tube voltmeter at $47.50 dealer net and Model 8873, TV servishop at $139.95 dealer net.

R.C.A. — Added radio receiving tubes 6AR5 at $1.65 list . . . 6AX4GT at $2.40 list and 6K8G at $3.30 list. Also added electron tubes 3C45 at $17.80 list . . . 91 at $30.00 list . . . 5718 at $8.65 list and 6211 at $2.95 list.

RAYTHEON — Added 6AH6V, radio receiving tube at $3.90 list, a miniature sharp cut-off pentode having high transconductance and low input and output capacitances, and is designed specifically for television amplifier applications.

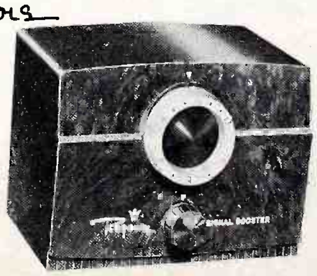
REEVES SOUNDCRAFT — Added soundcraft 45 rpm recording disc at $.66 dealer net.

STANDARD TRANSFORMER CORP. — Added deflection yokes Model DY-11A at $6.00 dealer net and Model DY-12A at $6.00 dealer net.

STROMBERG-CARLSON — Added a number of new items including No. AP-51, power amplifier at $157.50 list and TR-13, line transformer at $3.50 list.

SYLVANIA — Added radio receiving tubes 6T4 at $3.55 list . . . 1XRB at $2.65 list . . . 40B2 at $2.05 list . . . 6SN76TA at $2.20 list and sub-miniature tubes 1T6 at $2.05 list . . . 6BF7 at $1.85 dealer net and 6BG7 at $1.85 dealer net.

(Continued on page 24)



Replacement Parts

(Continued from page 20)

with the standard value of say 0.002 µf (which is within tolerance of the original) is contemplated, what must be its tolerance? If it conforms with standard industry practice, namely ± 20 percent, then it could have any value between 0.0016 µf and 0.0024 µf. Obviously it would be within tolerance on the high side but not on the low side.

Suppose that the contemplated replacement rated at 0.002 µf was within a ± tolerance of 10 percent, what then? On the low side it would have a value of 0.0018 µf and on the high side it would be 0.0022 µf. Again it is within tolerance on the high side but outside the tolerance on the low side.

Suppose we consider the next higher standard value, say 0.0025 µf for the replacement. Would any normal tolerance satisfy? With a rating of ± 10 percent, the low limit would be 0.00225 µf and the high limit would be 0.00275 µf. Now the contemplated replacement is within tolerance on the low side but beyond tolerance on the high side . . . Is there any answer?

Of course there is! But before we describe it, we might present another practical question — how important is the capacitance tolerance? . . . A simple reply is to say that it all depends on the circuit where the capacitor is used. But this is a very indefinite answer. We know that bypassing capacitance values are not as important as capacitance values related to time constant circuits, or resonant circuits or coupling circuits. But does it make sense to set up a tolerance on the tolerance in each and every particular application of a capacitor? . . . To do this involves something else — namely complete knowledge concerning the conditions established by the design engineer in every section of a television receiver which he designed . . . This is very difficult to determine. It is much easier to recognize the requirements established in the design of the receiver as indicated by the constants of the capacitor, and to satisfy these requirements of capacitance and capacitance tolerance.

To do this is simple. It means nothing more than the procurement of a capacitor rated at the same nominal capacitance and capacitance tolerance as the original. This is no problem because design engineers are using standard values, and capacitor manufacturers, are making them. We admit that procurement practice of this kind for replacement purposes is somewhat of a departure from past tactics, but to adopt it makes most sense, because it enhances the possibility of making the proper repair and attaining best performance from the receiver.

The above suggestion to follow the capacitance tolerance stipulated for the original is subject to some qualifications, especially in the case of paper dielectric and electrolytic capacitors. Some of the tolerance percentages are different for the + side than for the — side, as for example + 60 percent and — 20 percent. In that event a variety of selections is available. Assuming the same nominal value of capacitance, say 0.005 µf for the original and the contemplated replacement component, a replacement rated at any value of + tolerance between 0 and 60 percent and — tolerance between 0 and 20 percent obviously is suitable.

But the leeway for selection is even greater than described. With a 60 percent tolerance on the + side, the upper limit is 0.008 µf. On the — side, it is 0.004 µf. Under the circumstances, any standard value of capacitance which, with its rated tolerance limits falls within these two extremes of capacitance, is suitable as a replacement as far as capacitance is concerned. Naturally, any capacitor whose *measured* values fall within these limits is satisfactory capacitance-wise.

The use of + 60 percent and — 20 percent as capacitance tolerances are purely illustrative. It could just as soon be + 100 percent and — 10 percent, as in some electrolytic capacitors. The same reasoning applies to *any* other set of capacitance values established by the tolerance limits for any type of capacitor. The more liberal the capacitance tolerance figures, the easier is it to find a suitable replacement in terms of capacitance. It is only when the capacitance is relatively small, say between 10 µµf and 100 µµf and the tolerance is severe, say 5 percent or even 10 percent in both directions — that it becomes difficult to find a replacement other than one which parallels the original in nominal capacitance and tolerance. Occasionally this happens with higher values of capacitance.

Two other items warrant comment, even if not complete at this time. One of these pertains to possible misinterpretation of these references to satisfying the capacitance requirement. This should not be construed as implying that as long as this constant and the tolerance constant requirements are met, free interchangeability exists between capacitor types. This is not so, for reasons which will become evident when the other constants are discussed.

The second item is a slight elaboration of a point already raised concerning capacitors rated at 10 µµf and less. There isn't too much margin in these values for the selection of one standard value for another, based on the capacitance tolerance. One or two micromicrofarads do not seem like too much capacitance but when dealing with very small values to begin with, they represent high percentages. Moreover the selection of these small values is based on engineering requirement, and it is best servicing practice to comply with these needs, even if the reasons for their existence are not immediately apparent.

Radio's Master Reports

(Continued from page 20)

TRICRAFT PRODUCTS — Added Model U-1, UHF antenna at $7.50 dealer net.

TRIPLETT ELECTRICAL INSTR. — Added No. 9989, signal tracing probe at $9.50 dealer net, for use with Model 3441 TV-FM oscilloscope and BV adaptor for TV picture tube tests at $7.90 dealer net.

TV WIRE PRODUCTS — Added new series, formvar covered copperweld, at $4.72 dealer net, per 100 feet and at $47.21 dealer net, per 1000 feet.

VACO PRODUCTS — Added No. RT-14, handy service kit, complete with 7 nut drivers, 2 Philips and 3 regular drivers plus extension piece at $7.34 dealer net.

WEBSTER-ELECTRIC — Added No. 90-25, separate teletalk amplifier for paging at $120.00 list and 15 pair plastic interstation cable and junction box at $.34 list (on reel).

Discontinued Items

ADVANCE ELECTRIC & RELAY — Discontinued Model 400M, transmitter relay.

AMERICAN PHENOLIC — Discontinued Model 14-358, twin lead transmission wire . . . Model 187-072 and Model 187-079, molded polethylene rims and Model 509, rotator. Model 14-298, 100, 500, 1000 feet, remote control wire, temporarily discontinued.

CLAROSTAT — Discontinued wire wound control 43-7000.

ELECTRONIC TECHNICAL INSTITUTE — Discontinued Model 5207, Novice 80-M transmitter kit.

GENERAL ELECTRIC — Discontinued Model RPX-046, broadcast type variable reluctance cartridge. Also discontinued G-10 series of transistors.

GON-SET — Discontinued Model 3005, tri-band amateur converter and their Gonset radarray series.

KENWOOD ENGINEERING—Discontinued Model 140, 7" wall bracket.

POTTER & BRUMFIELD — Discontinued LC and LP series of plate circuit relays.

SHURE BROS. — Discontinued Model 55 and Model 556, multi-impedance, super-cardiod microphones.

SIMPSON ELECTRIC — Discontinued Model 340, signal generator.

STROMBERG-CARLSON — Model RD-22, driver unit, discontinued.

SUPREME, INC. — Discontinued Model 675, signal generator.

WEBSTER-ELECTRIC — Discontinued Model 53D50, teletalk amplifier for paging and Model 5C45, speaker microphone.

WIRT PRODUCTS — Discontinued auto radio ignition suppressors S-915 and S-918.

Price Increases

ASTATIC CORP. — Increased price on "scanafar" booster, Model CT-1 to $21.00 dealer net.

BLONDER-TONGUE — Increased price on Model MT-1, matching transformer to $3.90 dealer net.

CORNELL-DUBILIER — Increased price on Model 8BD, "hi-ball" auto aerial to $3.03 dealer net.

DUMONT LABS. — Increased price on two 12", one 16", four 17", four 20", and three 21" TV picture tubes.

FISHER RADIO CORP. — Master audio control, Model 50-C, increased to $97.50 dealer net.

GENERAL ELECTRIC — Radio receiving tube 6BA7 increased to $2.50 list. Also increased one 12", three 17", one 20" and one 21" TV picture tubes.

GON-SET — Increased price on Model 1531, rhombic UHF antenna, with 9' mast to $7.77 dealer net.

HICKOK ELECTRICAL INSTR. — Increased price on Model 605, portable all-purpose tube and set tester to $184.50 dealer net.

R.C.A. — Increased price on Model WO-88A, 5" oscilloscope to $169.50 user price. Also increased power tube fittings 202F1 to $23.85 user price . . . 211F1 to $28.20 user price and 228F1 to $67.60 user price.

STROMBERG-CARLSON — Increased price on a number of items including No. MD-38S, dynamic microphone to $70.00 list.

SYLVANIA — Increased price on three 17", two 20" and one 27" TV picture tube.

V-M CORP. — Increased price on record changers No. 150 to $33.47 dealer net . . . No. 972 to $40.17 dealer net and No. 985 to $53.57 dealer net. (West Coast prices slightly higher)

Price Decreases

CREST LABS. — Decreased price on cathode ray tube rejuvenators Model B to $3.15 dealer net . . . Model C to $2.20 dealer net and Model D to $2.60 dealer net.

ELECTRONS, INC. — Decreased price on grid control rectifier EL C6M to $31.00 dealer net.

GENERAL ELECTRIC — Decreased price on TV picture tubes 16KP4 and 16KP4A.

GON-SET — Decreased price on Gonset line to $6.24 dealer net/100 feet.

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INDEX OF CHANGES

Model No.	*Manual Page From*	*Manual Page To*	*Tek-File Pack*
Andrea T-VL12 Ch. VL12	6-1	6-10	43
Gamble-Skogmo 05TV1-43-9014A 15RA2-43-9105A Ch. 16AY210	6-1	6-16	31
Hoffman 612 Ch. 142	5-8	5-16	35
Magnavox Ch. CT-270, 271, 272, 273, 274	7-14	7-28	30
Mitchell T16-2KB T16-2KM, T16-B, T16-M	6-1	6-4	45
Sylvania 23M-1, 23B, 23M, 24M-1 Ch. 1-387-1	8-118	8-139	13
Sylvania 74M Ch. 1-356 (C05)	8-160	8-173	13

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SUCCESSFUL *Servicing*

FEBRUARY 1953

the cosine yoke

by harry e. thomas

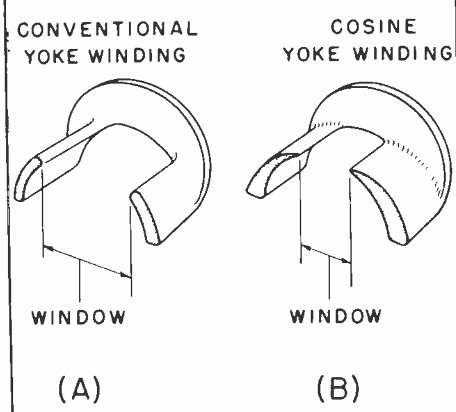

Fig. 1. Cross section of yoke winding.

In physical appearance deflection yokes for tv receivers have changed but little since the early models. However, electrically and magnetically the changes have been considerable.

In size, for instance, the first yokes were about three inches long and were designed to be used with small picture tubes having deflection angles of about 50 degrees. Present-day yokes run a maximum of two and one half inches long and are used for 66-degree and 70-degree tubes.

Electrically the old-style yokes used lower inductance horizontal coils (8 mh) while modern coils have inductances which run from 13 to 30 mh. At the same time, vertical windings have grown somewhat smaller, with inductances of about 30 to 40 mh, against the early 50 mh windings.

Magnetically, modern design employs ferrite cores in a yoke known as the *cosine yoke*. This yoke gives a notable improvement in focusing at the edges of the picture. This deficiency in performance of earlier yokes was generally ignored because of the use of smaller picture tubes. The design of these early yokes was primarily concerned with sensitivity of deflection and toward obtaining a perfectly rectangular raster with no sagging inward or bulging outward of the sides. The sagging inward is called "pincushioning" while the bulging outward is known as "barrelling."

The means employed to construct a cosine yoke involves the correct distribution of the winding. The cross section of the winding is not uniform as in the case of older yokes (see part A of Fig. 1). The turns near the inside of the winding are in a thin layer, and pile up to successively increasing thickness as the winding progresses away from the window (see part B of the figure). As a result of this type of winding arrangement, the distribution of magnetic flux threading through the neck of the tube is more uniform than with the old-style yokes. Because of this more uniform field, the focus of the spot toward the edges and the corners of the picture-tube raster is considerably improved.

As the electron beam, which has a definite thickness, passed through the nonuniform field produced by the conventional yoke, different portions of that beam experienced differing amounts of deflection force. As a result, an elongated spot was produced at the raster edges that resulted in an out-of-focus condition. By causing the beam to travel through the more uniform field produced by the cosine yoke, uniform deflection of all parts of the electron beam occur, and a 500 minimum amount of defocusing takes place.

The arrangement of the conventional windings around the picture-tube neck can be seen in part A of Fig. 2. The deflection coils are shown in cross section here. The horizontal windings produce a magnetic field with vertical lines of force. This magnetic field produces horizontal deflection. The vertical windings produce a magnetic field

(Continued on page 10)

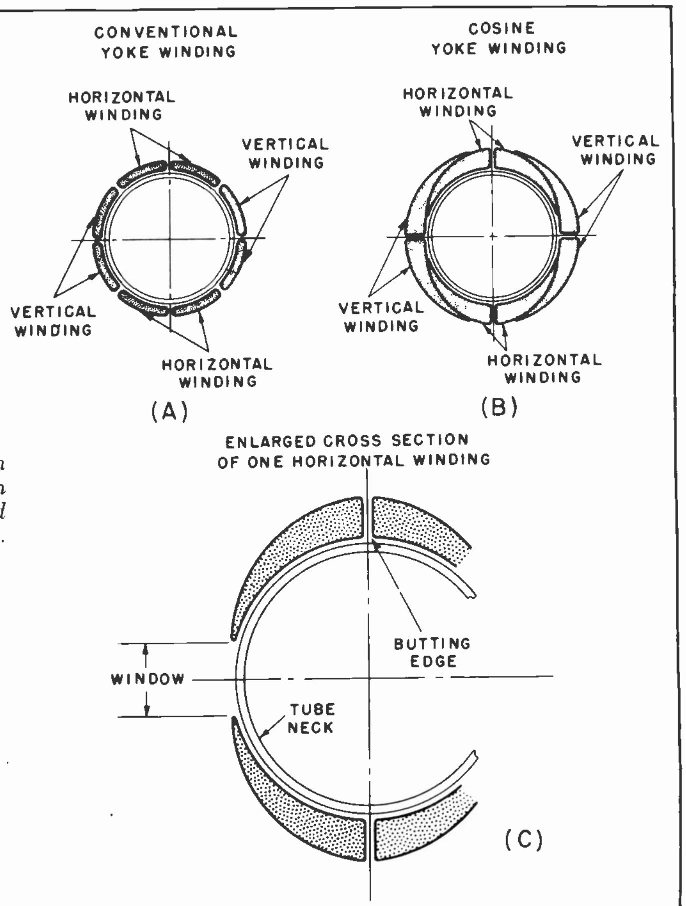

Fig. 2. Distribution of windings (shown in cross section) around neck of picture tube.

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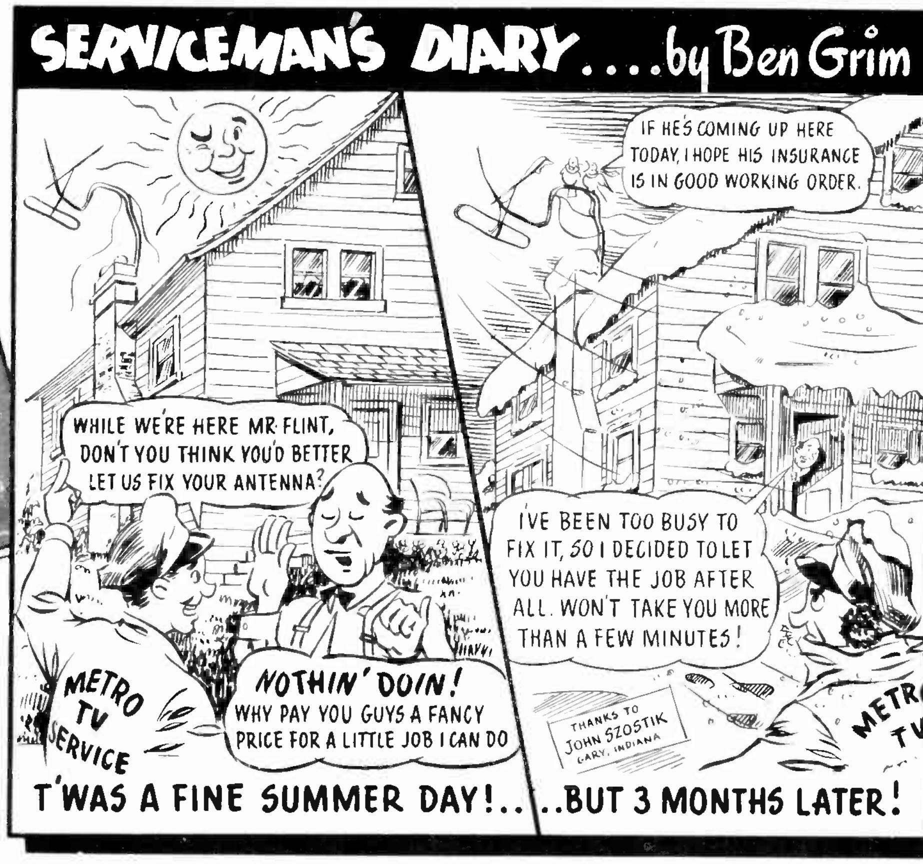

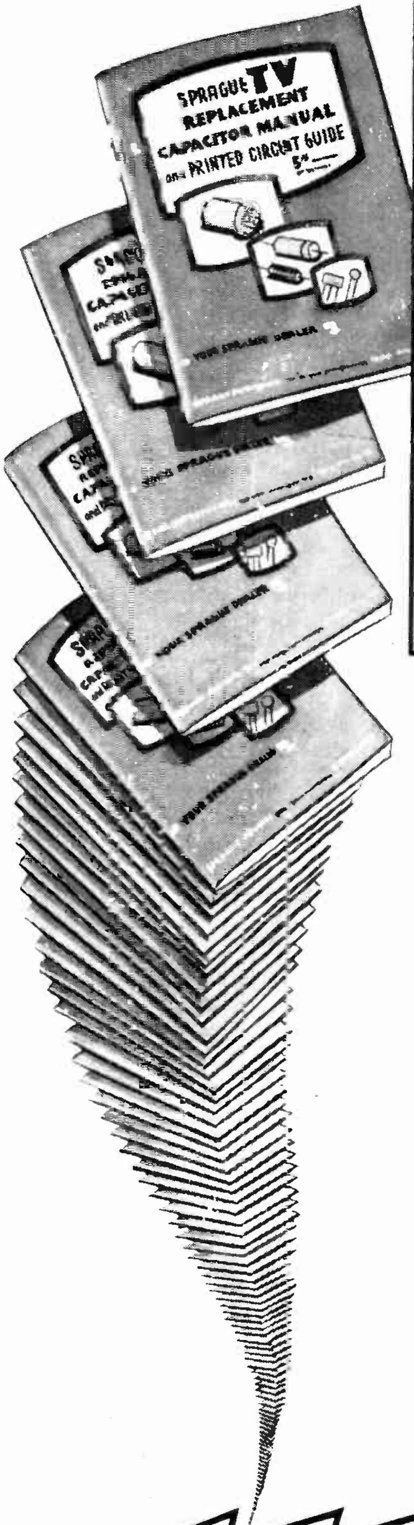

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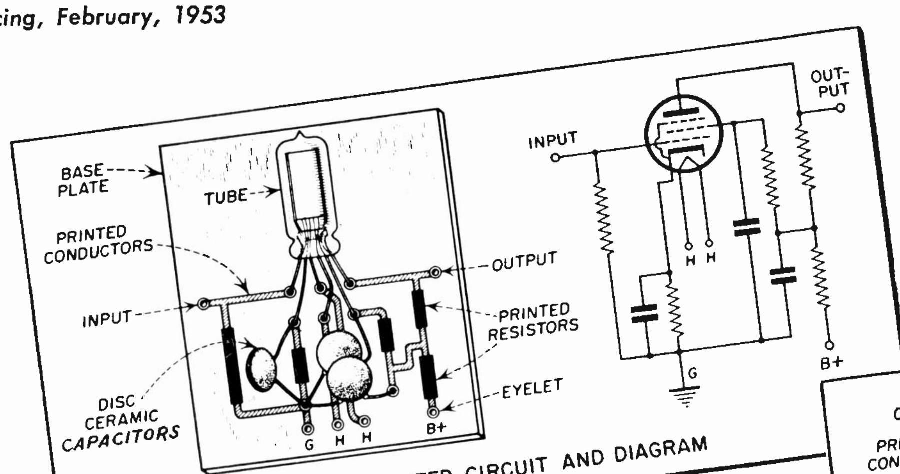
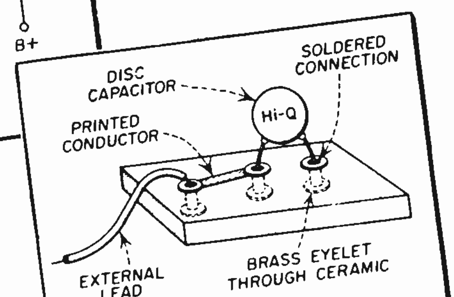
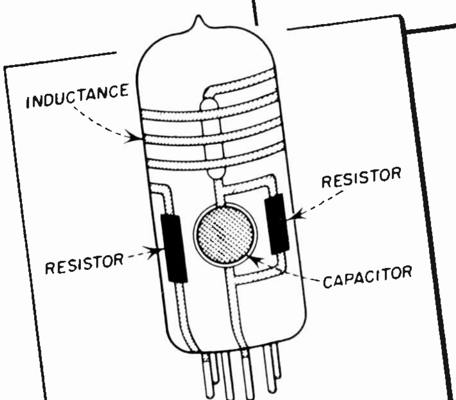


TYPICAL PRINTED CIRCUIT AND DIAGRAM
FIG. 1



METHOD OF CONNECTING WIRE LEADS
FIG. 3



PRINTED CIRCUIT ON TUBE ENVELOPE
FIG. 2

PRINTED ELECTRONIC CIRCUITS*

by the Engineering Department,
Aerovox Corporation

*This material appeared originally in "The Aerovox Research Worker".

The reproduction of electrical circuits on insulated surfaces by various printing techniques has become a standard method of fabricating small, lightweight, economical electronic devices. The increased emphasis placed by the Armed Services and industry on miniaturization and ruggedness of electrical components has caused this innovation to assume vital importance. Printed circuitry is no longer confined to a few military devices and hearing aids, but may now be encountered in a large number of everyday equipments. These include speech amplifiers, portable receivers, citizens two-way radios, television receiver front-ends, f-m receivers, and many others. For this reason, a working knowledge of the design, production, and maintenance of such circuits will be a valuable asset to any worker in the electronics field. This article is concerned with a discussion of the general types of printed circuits, the relative advantages of each, and methods of effecting servicing repairs.

The use of printed circuitry has been revolutionary not only because it permits the fabrication of extremely small and rugged electronic components, but also because it reduces the production of such components to a simple, rapid operation which is almost completely devoid of the possibility of human error. By this method, a relatively unskilled operator can reproduce literally hundreds of complex units in the time formerly required to make one unit by old-fashioned "wire-by-wire" soldering techniques. In addition to electrical conductors, critical circuit components such as resistors, capacitors, and inductors can be "printed" into the circuit in the same operation and held to close, reproduceable tolerances. Fig. 1 shows a typical printed circuit and its schematic diagram.

Printed circuits are classified according to the method used to reproduce them. There are, at present, six general types. These processes are: painting, spraying, vacuum evaporation, chemical processing, metal stamping, and powdered metal dusting. Each of these general categories will now be discussed in some detail.

Printing Techniques

Probably the most widely used process for producing printed circuits is the *painting* technique. In this method, the conductors and other components of the circuit being fabricated are painted on the insulating surface which acts as the base for the circuit. The paint may be applied by hand with a brush, although in production operations the silk-screen stenciling process is more frequently used. Thin ceramic or plastic sheets may be employed for the base, or a metallic surface covered with an insulating lacquer may be used. In special instances, the glass envelope of a vacuum tube has been utilized as a base for its associated printed circuit. See Fig. 2.

The paint used for electrical conductors consists of a powdered metal such as copper or silver in suspension in a liquid binder. This conducting paint is applied to the surface of the insulating base to form the "wires" of the circuit. Other paint, made up of a resistive material such as carbon, may be applied in specific amounts to form resistors. Capacitors may be made by printing the plates on opposite sides of the base plate, if the required capacitance is small. Otherwise, small capacitors (such as the Aerovox Hi-Q BPD type disc ceramic) are connected to the printed circuit as in Fig. 3. It is interesting to note that these capacitors are manufacured by processes which are essentially printed circuit techniques. Inductances are produced by painting spirals of conducting paint on the surface of the ceramic or other base material. "Cross-overs" in the wiring are made by planting one conductor directly over the other with a layer of insulating material such as lacquer between, or by "detouring" one conductor to the other side of the plate for a short distance by means of metal rivets or eyelets through the insulator, as is illustrated in Fig. 4.

When all printed components have been painted in place, the entire assembly is "fired" at an elevated temperature to fuse the metal particles together and bond the circuit to the base plate. Temperatures ranging from room temperature for plastic bases to as high as 800 degrees C. for ceramics are used.

Vacuum tubes, external leads, and other components not printed are soldered to eyelets in the base plate as in Figs. 1 and 3. To take maximum advantage of the space-saving properties of printed circuits, tubes of the subminiature type are usually employed.

(Continued on page 17)

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MEMBER

Curtain Time

Transistors and Replacement Parts

The last few months have witnessed increased activity in the publicity given to transistors and other semi-conductors. In fact, almost the entire November, 1952 issue of the *Proceedings of the IRE* was devoted to this fabulous device. One manufacturer already is offering one type of transistor for sale to experimenters.

No one has any doubt about the impact of the transistor on the entire electronic industry. This will occur when there are no uncertainties about its reproducibility in large quantities and with consistent performance characteristics – application to all present uses of vacuum tubes over the full gamut of frequencies. When all of this comes to pass, the effect will be the equivalent of a revolution in electronic components and design.

The miniaturization of all equipment will be one manifestation, although this program involving subminiature vacuum tubes and transistors, has been going on for years under the impetus of the Armed Forces equipment requirements. The trend to transistors or some other devices made of materials showing similar behavior will, without question, shrink the physical dimensions of electronic equipment to a small fraction of even the smallest vacuum tube device made today.

Forgetting vacuum tubes for the moment, a tremendous effect seems likely on companion units presently being used to supply operating power to the vacuum tubes. A great portion of the energy supplied to vacuum tubes is wasted in heat. This is not so in transistors; hence those devices which supply operating power to the vacuum tubes in equipment are subject to change to a great degree – if not elimination in their present form.

All of this will not happen overnight. Engineers involved in the research of transistor and similarly behaving materials are very reluctant to forecast when the change from vacuum tubes to some semi-conductor type of device will take place; estimates range from 4 years to 8 years. But who can tell? In the meantime, present-day designed equipments are still being sold in great quantities to the public. It is not a wild guess to say that before any major engineering change takes place in electronic equipments – television receivers especially – the nation's houses will contain from 40 to 50 million units, if not more. These receivers will require replacement parts for a long time, regardless of what radical engineering change may take place at the end of four or five years.

It is said that color television is on its way. It is highly doubtful if it will be a transistor-equipped receiver when it arrives, despite the fact that such a black and white receiver equivalent to 34 tubes has been shown already. All sound evaluations contend that the arrival of color television in a year or two, will still make use of vacuum tubes and present types of complementary equipments.

All in all, a tremendous market for replacement parts exists – and is destined to increase substantially in the immediate future. The concern which need be felt by those who are producing and selling these parts is a matter of the nature of their planning. How far in the future do they look? The receivers in the field – all kinds of receivers – must be serviced, and they require replacement parts. The table model radio displaced the console radio – but those consoles which were in people's homes were not discarded. They were serviced until television came along to grab the public's interest.

The birth of a "hot" war may change some of this. If past performance is any sort of a barometer, an acceleration of technological development is a certainty. A part of this will be the transistor or its equivalent because of the unbounded interest in miniaturization of electronic devices for military uses. If this occurs, semi-conductor devices will emerge full fledged much sooner than would be the case with just a cold war in progress. But even then, public holding in electronic equipment will not be thrown away; they will require service and so, replacement part production, selling, and installation.

Summarizing the whole thing, there is every reason why all individuals affiliated with the electronic industry should take note of the progress being made in the semi-conductor phase of the art. The tube manufacturers have been doing this for a long time. But we can't see any reason for concern about inventories in parts manufacturing establishments, parts jobbers stocks, or service technician's parts stocks. Everyone will sell what they have, and what they will make and buy, for years to come.

TV Service

Questions asked here and there among those who are in a position to know indicate a definite improvement in the level of competency being demonstrated by TV service technicians. Taking into account the television receiver sales during 1952, and the total number in use across the nation, the proportion of complaints has decreased. This is especially true in the largely populated areas, where greatest density of receivers prevails.

Chassis Coding

The matter of chassis coding is still a problem in the field. In view of the practice by many television receiver manufacturers to show different schematics representative of different production runs, especially when changes have been made, it is of the utmost importance that the service technician be able to correlate correctly, with the appropriate schematic, the chassis in for service.

We don't know what the answer is, but isn't it possible to establish some common method of coding and also a common location for the coding symbol on the chassis? The former may be difficult because of the different systems firmly rooted in the factories, but the latter is not faced with the same problems. Even if the entire issue is not settled for some time, taking care of one detail at a time would help.

John F. Rider

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Replacement Parts in TV Receivers

Part I - Capacitors (cont'd)

This is the fourth in a series of articles on "Replacement Parts in TV Receivers." "Capacitors" will be continued next month.

by John F. Rider

Preceding paragraphs dealt with the identification of capacitors according to their physical construction. This base gives rise to the major type categories. But in the final analysis the suitability of a capacitor for a particular use is only in part determined by its physical construction. Every capacitor within a major type group is not necessarily suitable for every application even if the function indicates the general category of type from which the selection should be made. Still another basis of selection must be applied in order to establish suitability.

For instance a mica capacitor is generally considered to be a suitable type of capacitor for use in tuned circuits. The same may be said for the ceramic dielectric unit. Yet every version of these two general types of units is not suitable for use in every resonant circuit. The same applies to the paper dielectric and the electrolytic capacitors relative to portions of the TV receiver which contain these types. The final indicator in the suitability of use are the constants of the capacitor.

Constants of Capacitors

The suitability of a capacitor for a particular application is determined by many factors. Among these are

a. physical size
b. capacitance
c. operating voltage rating
d. allowable variation in capacitance from rated value
e. required change in capacitance with temperature
f. allowable change in capacitance with temperature
g. maximum temperature for normal operation
h. permissible electrical losses
i. insulation resistance
j. resonant frequency
k. test voltage rating
l. leakage current (if applicable)

and several others.

With the exception of the physical dimensions, the other factors express the electrical qualifications of the component, and when stated in particular standardized terms, are the constants of the capacitor. Some of the terminology already listed are examples of terms which are constants, as for instance, items *a,b,c,i,j,k* and *l*. Item *d* is expressed by the constant "capacitance tolerance"; item *e* is "temperature coefficient" and item *f* is "tolerance in temperature coefficient". Item *g* is expressed by "operating temperature", and item *h* by "power factor" and several others.

Because of the limitations in capabilities imposed by physical construction, or because of the capabilities given to a capacitor by its physical construction, each main type of capacitor has its own set of constants. Some of the constants are common to all types of capacitors because of the very nature of the device. A few examples of these are the physical size, the capacitance, the operating voltage and the electrical losses. When expressed numerically, they may differ widely – again because of the constructional features – but each set of constants does include them.

The selection of a particular capacitor for a particular use is a matter of comparison of the constants of the contemplated capacitor with the requirements of the circuit where it is to be used. At first thought this may seem to be a major problem to the service technician. Actually it is not so, because it already has been done by the individual who designed the circuit. In fact the entire problem is simplified because the receiver manufacturer's service literature contains the electrical specifications for the capacitors required at every point. All of the constants are not given, but a familiarity with the general order of constants applicable to that particular type of capacitor, will, when added to the details already known, lead to the correct replacement.

In the Rider Replacement Parts Program all the electrical requirements surrounding the original capacitor used in the television receiver are known, and these are compared with the electrical constants of the replacement items; then the suitable replacement is listed, that is, if there is one. A number of different types of capacitors can satisfy some of the original design requirements, but only after consideration of all of the constants is it possible to select which particular type of capacitor is suitable, or in some instances, which types are the equivalent of each other for a particular use. Examples of these will be given in a later article.

Physical Size

The physical size requirement is listed as one of the constants. Perhaps this is taking some license with the stricter meaning of constants but it does no harm. It is one of those descriptive terms which offers substantial leeway in the selection. At the factory end the physical size relates to most convenient production, satisfying space limitations inside or around other components, electrical performance when operation is at very high or ultra-high frequencies, and finally, to some extent the matter of economy. From the service technician's viewpoint, the physical size requirement is the one with the least problem, providing that when a limitation exists, it is realized.

We have illustrated the range of physical dimensions within which capacitors of different types are generally available. It was seen that each type comes in different sizes. In some categories of units the full range of sizes is available on the replacement market; in others it is not. But fortunately the manner of use of a capacitor in a television receiver does not always demand complete conformance with the physical size specification, assuming that the electrical requirements can be satisfied.

For example, when a capacitor is located inside of some other component with fixed boundaries, such as an i-f or similar transformer can, or a deflection yoke, it is necessary that the replacement be of similar physical dimensions, or smaller, in order to fit within the same space. At the moment we are neglecting the possibility that the technician may not be interested in replacing a capacitor in an i-f transformer; he would rather replace the entire unit, which after all, does make sense when all factors are considered. Another example is the capa-

(Continued on next page)

citor which is used in a critical circuit where space is at a premium and the distributed capacitance must be kept to a minimum, or when the lead length is important. The larger the unit in these cases, the lesser is the possibility of keeping the lead length to the dimension used for the original component.

It is not beyond the realm of the imagination that a service technician may feel that the replacement of a fixed tuning capacitor inside of a transformer can be accomplished by locating the component outside the can. This is bad practice, and should not be done. The performance of the transformer can be affected adversely and feedback problems may arise.

Finally there is the case of the can type of electrolytic capacitor for which a mounting plate already exists in the receiver. It is conceivable that a new mounting plate suitable for a larger or smaller sized replacement can be used insead of the old one, but this involves the unwarranted expenditure of time and is justified only when the proper replacement is not procurable. Or, it is conceivable that a completely new mounting arrangement will be used, such as locating the replacement beneath the chassis. Of course it can be done, but we feel that in the latter cases, which are not too numerous to begin with, the physical features of the chassis should be retained by procuring the part that fits the chassis properly.

As to capacitors which are located on the underside of the chassis, the physical dimensional requirements are not of major import, providing, as we have said before, that the electrical requirements are satisfied. However, it always is best to duplicate the original size, but if there is to be a difference, it is best and most convenient to work with the smallest physical sizes rather than the reverse.

Capacitance and Capacitance Tolerance

In the list of electrical qualifications and in any list of constants of capacitors, these two items are shown individually. In reality they are closely related; hence are treated together here. Moreover, they are associated with all basic categories of capacitors being treated in this replacement parts series.

All capacitors bear some identification which states the capacitance rating of the unit. Sometimes the value is simply stated on the box which contains the unit, as usually is the case with variable capacitors. In the case of fixed units of all kinds, the value is marked on a label attached to the capacitor, or it appears as some form of coding impressed on the unit. Whether the label or coding expresses the capacitance in microfarads or micromicrofarads is unimportant because one is convertible into the other. A more important thing is the realization that the value of capacitance so shown is an *approximate* value. Frequently it is referred to as the *nominal* value.

By approximate or nominal we mean a value corresponding to the standard value within a certain leeway or tolerance. As a matter of convenience, lowest cost, and other production factors, the radio and television industry has agreed upon certain values of capacitance for each type of capacitor as being "standard" values. Design engineers try to build their equipments around these values. Capacitor manufacturers in turn build capacitors to approximate these standard values within a certain tolerance (expressed as a percentage of the rated value) and label them accordingly.

Although the standard values of capacitance are not the same for all basic categories of capacitors, at least do not begin at the same low limit and end at the same high limit, there is a range of capacitance in which the paper dielectric, mica dielectric, and ceramic dielectric afford more or less the same standard values, but not exactly the same. Such a list would begin at about 0.0001 μf and end at about 0.01 μf. It must be understood however that operating voltage ratings will tend to modify the range of standard values in all three types. As an illustration we might point out that the usual lowest standard value of capacitance in paper dielectric capacitors rated below 2000 volts working, is 0.001 μf, and even this is increased to perhaps several times that value when the working voltage is below 600 volts.

Mica dielectric and ceramic dielectric capacitors are available in like standard values from about 1 $\mu\mu$f to about 0.01 μf, but even in this group, especially between a fraction of 1 $\mu\mu$f and about 70 $\mu\mu$f, the preponderant selection of ceramic capacitors for many uses by design engineers has lead to the creation of standard values which differ from each other in very small steps, perhaps 2 or 3 $\mu\mu$f.

The electrolytic capacitor is in a class by itself as far as standard values are concerned. They begin at about 4 μf and extend up into the thousands of microfarads. But here too the particular type and the working voltage rating sets limits, as for example about 50 μf is the limit at 450 volts, whereas 5000 μf units are available at 6 volts.

Capacitance Tolerance. Concerning the association between standard values and tolerance, by definition, tolerance is the acceptable departure from a rated value. In the television industry, for that matter in the entire electronic industry, capacitance tolerance is expressed in two ways. One is in terms of percentage of the rated value, the other is in terms of a certain amount of capacitance. For instance when the capacitance is less than 10 $\mu\mu$f, and the unit is a ceramic dielectric capacitor, the + and − tolerance ratings may be 0.1$\mu\mu$f, 0.25 $\mu\mu$f, 0.5 $\mu\mu$f, 1.0 $\mu\mu$f or 2.0 $\mu\mu$f, depending entirely on the degree of accuracy required by the circuit involved. As a rule, capacitors of this kind used in television receivers bear either + or − 0.25$\mu\mu$f or 0.5 $\mu\mu$f tolerance ratings.

In the case of mica capacitors up to and including 10 $\mu\mu$f, two minimum tolerance ratings exist. For the plain foil mica, the minimum tolerance is 1.0 $\mu\mu$f, whereas for the silver mica it is 0.5 $\mu\mu$f.

When the capacitance exceeds 10 $\mu\mu$f, the capacitance tolerance is expressed in

(Continued on page 20)

The Cosine Yoke

(Continued from page 1)

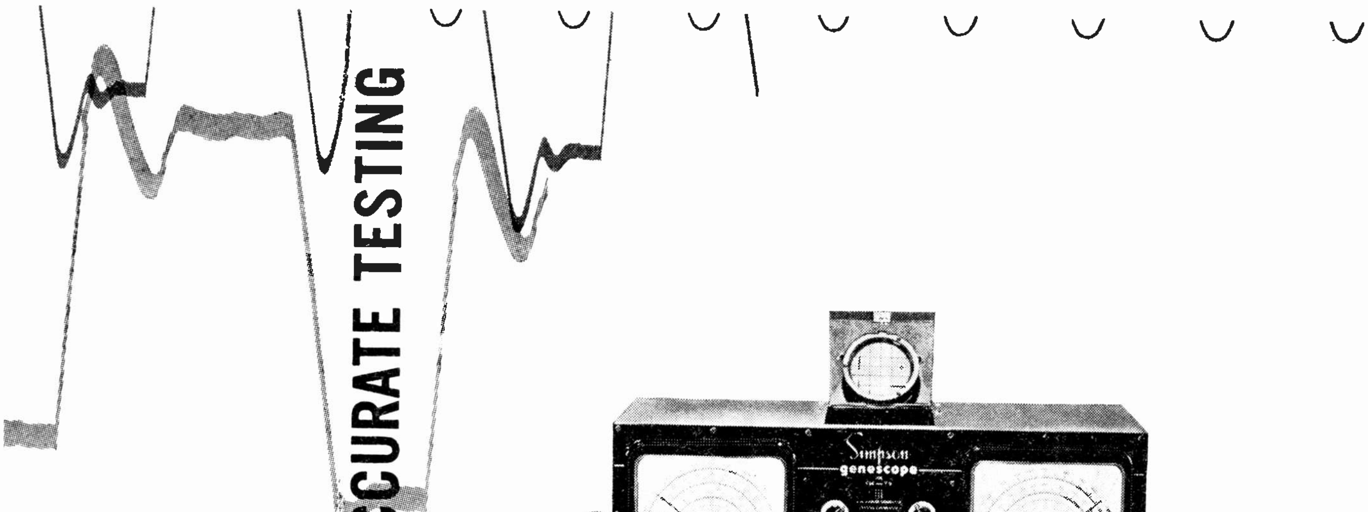
with horizontal lines of force. This magnetic field produces vertical deflection. Part B of the figure shows a cross section of the windings of the cosine yoke. Windings which produce horizontal and vertical deflections are labeled. Part C is an enlarged view of one of the horizontal windings with the window and butting edge of the winding shown.

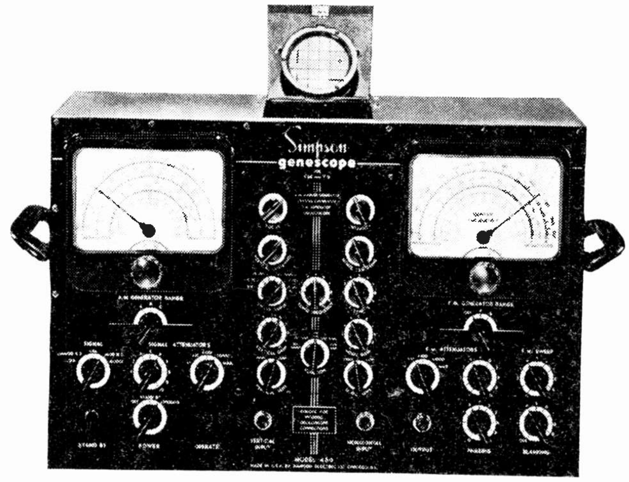
Note that the cosine distribution must be designed into both vertical and horizontal windings, but in different amounts. This is true because the deflection components of both magnetic fields are not the same due to the raster being wider than it is high. The size of the window in both horizontal and vertical coil assemblies affects the over-all distribution and hence the spot focusing in the corners of the picture.

The cosine distribution curve is a design detail and has no direct significance to the serivce man. Suffice it to say that the winding thickness varies in a cosinusoidal manner. Some windings claim to be cosine squared in character, which means that the winding thickness increases faster than in a normal cosine yoke.

In general a cosine yoke can be distinguished from a conventional-style yoke by inspecting the size of the winding window. Cosine yokes have narrow windows. This is natural, since the winding starts nearer to the center line of the assembly, and thus has farther to spread while increasing its thickness. The horizontal winding window can be readily seen, since this winding is on the inside of the yoke and lies along the neck of the tube.

Finally, in checking an old yoke when considering replacement with a cosine yoke, note that the cosine yokes probably have higher horizontal-winding inductance than conventional designs and replacement might result in poor performance and probably give ringing in the picture. Also, another condition to watch out for is whether the shape of the raster has been changed, since better corner focus may have been obtained at the expense of pincushioning of the raster. Some cosine yokes produce pincushioning that must be removed by placing small permanent magnets (held on brackets) around the neck of the tube. These anti-pincushioning magnets must be readjusted in making a replacement. A cosine yoke with such magnets cannot be used with metal picture tubes since the cone may become permanently magnetized and thus distort the raster.

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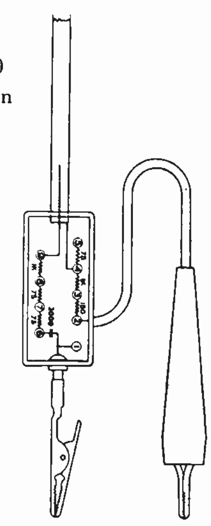

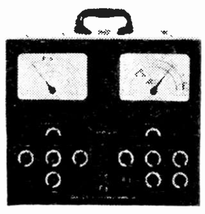

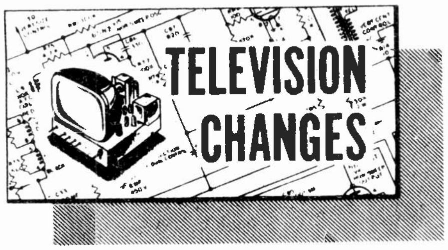

In compliance with the many requests we have received from our readers, this and future issues of SUCCESSFUL SERVICING will again contain the feature, TV PRODUCTION CHANGES.

The Rider Manual pages and TEK-FILE pack which include the original data and shematics to which the following production changes apply, appear in the index on page 24 of this issue.

ANDREA **MODEL T-VL12**
CHASSIS VL12

Service Data Addenda (Coil and Transformer Resistances)

Low-Voltage Transformer, T12, Part. No. ST-3033
- Primary: .8 ohm
- High-voltage secondary: 38 ohms, (center tap)
- 5v secondary (yellow leads): .1 ohm
- 6v secondary (green leads): .1 ohm
- 6v secondary (blue leads): .3 ohm

High-Voltage Transformer, T8, Part No. ST-3018-1
- Terminals 1-2: 90 ohms
- Terminals 2-3: 180 ohms
- Terminals 4-5: 9 ohms
- Terminals 5-6: .3 ohm

Vertical-Output Transformer, T7, Part No. ST-3030
- Blue-red leads: 600 ohms
- Green-yellow leads: 10 ohms

Vertical-Blocking Transformer, T6, Part No. ST-3029
- Blue-red leads: 150 ohms
- Green-yellow leads: 900 ohms

Horizontal-Oscillator Transformer, L18, Part No. SA-335
- Terminals A-F: 75 ohms
- Terminals C-D: 43 ohms

Deflection Yoke, L17, Part No. ST-3034
- Horizontal winding: 13.5 ohms
- Vertical winding: 70 ohms

Focus Coil, L14, Part No. ST-3032
- 1300 ohms

Horizontal-Linearity Control, L20, Part No. SA-315-1
- 35 ohms

Width Coil, L19, Part No. SA-336
- .5 ohm

Speaker Output Transformer, T11, Part No. SL-4009
- Primary: 400 ohms
- Secondary: .5 ohm

Filter Choke, L22, Part No. 3031
- 100 ohms

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MAGNAVOX
CHASSIS CT-270, 271, 272, 273, 274

R-F Unit

These chassis use r-f tuner unit No. 700349.

GAMBLE-SKOGMO (CORONADO) **MODELS 05TV1-43-9014A, 15RA2-43-9105A**
CHASSIS 16AY210

Circuit Changes, Video Amplifier

The following component changes were made in the video amplifier circuit:

Ref. No.	*Old Part Number*	*New Part Number*	*Description*
R35	C-9B1-70	C-9B1-66	2,200 ohms, ½ watt, 10%
R38	C-9B2-64	C-9B-62	1,000 ohms, ½ watt, 10%
R123	C-9B4-21	C-9B2-70	4,700 ohms, 1 watt, 10%
R127	new part added	C-9B4-82	47K ohms, 2 watts, 10%
C122	new part added	C-8G-11892	22 μμf, ceramic
L20	A-16A-18685	A-16A-19486	240 μh peaking coil
L21	A-16A-18685	A-16A-19485	380 μh peaking coil

NOTE: Chassis code numbered 124023 or higher incorporate this change.

•

MITCHELL
MODELS T16-2KB, T16-2KM, T16-B, T16-M

Production Change (Tube Substitution)

In some receivers, a 6SN7 is used in place of a 12AU7 for the d-c restorer and sync separator stage. This is done by making the following wiring changes:

1. Filaments: Connect pins 5 and 9 of the 12AU7 to pins 7 and 8 of the 6SN7, respectively. Disconnect pin 4 of the 12AU7.
2. Cathodes: Connect pins 3 and 8 of the 12AU7 to pins 6 and 3 of the 6SN7, respectively.
3. Grids: Connect pins 2 and 7 of the 12AU7 to pins 4 and 1 of the 6SN7, respectively.
4. Plates: Connect pins 1 and 6 of the 12AU7 to pins 5 and 2 of the 6SN7, respectively.

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HOFFMAN
MODEL 612
CHASSIS 142

Hoffman Model 612 is a 24 tube table model with a 6 inch speaker and an audio power output of 3.0 watts. A 12 inch picture tube is used. Its major components are:
- Chassis – 142
- Speaker – 6" PM (Part No. 9062 voice coil, 3.2 ohms at 400 cps.)
- Cabinet – Part No. 7533
- Escutcheon Frame – Part No. 2277
- Filter Plate Glass – Part No. 734
- Picture tube – 12KP4, 12LP4, L2QP4

•

SYLVANIA
MODEL 74M
CHASSIS 1-356(C05)

Sound I-F Limiter (Circuit Change)

1. Resistor R-104 (120 ohm) is removed from the cathode (pin 7) of the Sound I-F Limiter (V-10, 6AU6) and the cathode is connected directly to ground.
2. Capacitor C-104 (.2μf, 400v), connected from the bottom of T-52 (sound discriminator transformer primary) to ground, is removed from the circuit.
3. Resistors R-105 (33K, ½w) and R-106 (10K, ½w), connected to the screen grid of the Sound I-F Limiter (pin 6 of V-10, 6AU6), are removed from the circuit.
4. Pin 6 of V-10 is connected to the bottom of T-52.
5. Resistor R-107 (33K, ½w), connected between the bottom of T-52 and the +125v supply, is changed to 22K, ½w (Service Part 181-0223).

NOTE: Chassis coded C06 (Serial Nos. beginning 5606-) incorporate this change.

•

SYLVANIA
MODELS 22M-1, 23B, 23M, 24M-1
CHASSIS 1-387-1

3rd Video I-F Stage (Resistor Change)

Resistor R-140, in the grid circuit (pin 1) of the 3rd video i-f tube (V-5, 6BA6), is changed from 27K, ½w to 22K, ½w (Service Part 181-02235).

NOTE: Chassis coded C01 (Serial Nos. beginning 87101-) incorporate this change.

DEALERS GETTING WESTINGHOUSE TUBES PROFIT FROM HEAVY LOCAL ADVERTISING AT NO COST

Service dealers are getting powerful local advertising support from new Westinghouse RELIATRON™ Tube Distributors. In cities now served by Westinghouse Distributors, dealers get local newspaper advertising, a complete kit of store display and imprinted mailing material.

All of it—local ads and kits—are designed to build TV-radio service business in the dealer's local area.

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You can get your store listed in two local newspaper ads at no charge, and get a kit to boot. If Westinghouse Tubes are now sold in your area, see your Westinghouse Distributor and take advantage of this $900-worth-of-advertising-at-no-cost offer.

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All of it is local advertising which sells your service in your own area where it counts.

For the name of your Westinghouse Distributor, or the approximate date when Westinghouse Tubes will be available in your area, drop a postal card to Dept. M-201 or have your regular distributor contact Dept. M-201 for information on how he can better serve you.

YOU CAN BE SURE...IF IT'S **Westinghouse**

RELIATRON™ TUBES

WESTINGHOUSE ELECTRIC CORPORATION, ELECTRONIC TUBE DIVISION, ELMIRA, N. Y.

To All Purchasers of:

RIDER'S TV 10

Please do not forget to fill in the registration coupon on the first page of your Rider TV 10 Manual and send it to us if you have not done so already. We will forward the replacements parts listing corrections direct to your address. Also, by returning this coupon to us, you will be assured of having your name on our mailing list for exclusive, replacement parts information that will be available to TV 10 owners. Do Not send us the replacement parts pages!

Here are more data that will keep your RIDER'S DEPENDABLE REPLACEMENT PARTS LISTING published in TV Volume 10 up to date.

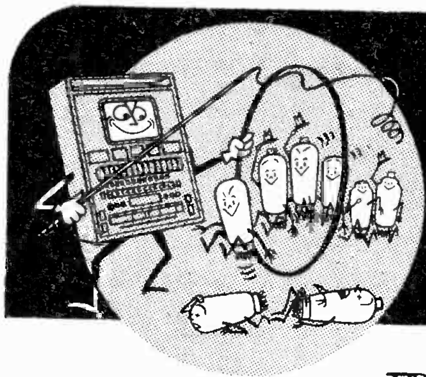
ADDITIONS TO PHILCO VARIABLE RESISTANCE CONTROLS SECTION:

PHILCO Part No.	REPLACEMENTS																	
	CLAROSTAT				I R C							MALLORY						
	Cat. No.	Kit No.	Inner Shaft	Switch No.	Stock No.	Kit. No.	Panel Elem.	Rear Elem.	Outer Shaft	Inner Shaft	Switch No.	Stock No.	Kit. No.	Panel Elem.	Rear Elem.	Outer Shaft	Inner Shaft	Switch No.
33-5546-41	A43-10K		FKS 1/4		WK-10000													
33-5546-49	A10-10K		FKS 1/4		4WK-10000							M10MP						
33-5563-42	RTV-345				QJ-391		W17-111	WR11-116	P3-129	R8-213								
33-5563-43	RTV-241				QJ-302	K-2	B11-125	B11-130	P1-200	R1-216								
33-5563-44	RTV-360				QJ-340	K-2	B12-141	B18-139X	P1-200	R1-216	76-1							
33-5563-50	RTV-358				QJ-356	K-2	B11-123	B11-130	P1-200	R1-216				UF54L	UR25AL			
33-5563-51	RTV-359				QJ-357	K-3	W17-111	B11-128	P3-131	R1-216				WF252	UR15L			
33-5564-14	AT-116		FS-3	SWA	Q18-139X							UT451						US26
33-5565-17	AG-55-S		FKS 1/4		Q11-130							SU46						
33-5565-30	AG-44-S		FKS 1/4		Q11-123							SU35						
33-5565-31	AG-85-S		FKS 1/4		Q11-14							SU67						
33-5565-32	AG-84-S		FKS 1/4		Q11-239							SU565						

ADDITIONS AND CORRECTIONS TO FIXED CAPACITORS SECTION:

Set Mfr.	Set Mfr.'s Original Part No.	
Belmont	8C-18487	Add AFH4-82 to Aerovox column.
Packard-Bell	23936	Change BPD-.0015 mf to SI-2-1500 mmf in Aerovox column.
''	''	Change K071 to G071 in Cornell-Dubilier column.
''	''	Change DC-5215 to UC-5212 in Mallory column.
''	''	Change 5HK-D15 to 5GA-D15 in Sprague column.
''	23955	Change K078 to KD077 in Cornell-Dubilier column.
''	''	Change UC-5240 to DCD524 in Mallory column.
''	''	Change 5DA-D4 to 5HK-2D4 in Sprague column.
''	23956	Change 1468L-HV 47 mmf to HVD30-47 mmf 10% in Aerovox column.
''	''	Delete 5P20Q47 in Cornell-Dubilier column. No replacement.
''	''	Delete MCL-447 in Mallory column. No replacement.
''	''	Change 60GAB-Q47K to 20GAB-Q47K in Sprague column.
''	23967	Change 1468L-HV-100 mmf to HVD15-470 mmf in Aerovox column.
''	''	Delete 5P10T47 in Cornell-Dubilier column. No replacement.
''	''	Delete MCK-347 in Mallory column. No replacement.
''	23959	Change MMA20T5 to MMC-20T5 in Cornell-Dubilier column.
Philco	30-2417-3	Add PRS50-10 to Aerovox column.
''	''	Add BR-105 to Cornell-Dubilier column.
''	''	Add TC-32 to Mallory column.
''	''	Add TVA-1304 to Sprague column.
''	30-2417-7	Add BBR-2-50T to Cornell-Dubilier column.
''	30-2570-57	Add D111 to Cornell-Dubilier column.
''	''	Add FP476 to Mallory column.
''	30-2570-66	Add XA004 to Cornell-Dubilier column.
''	''	Add FP117 to Mallory column.
''	30-2584-9	Add D111* to Cornell-Dubilier column.
''	''	Add FP344.5 to Mallory column.
''	30-2584-15	Add UPT 435 to Cornell-Dubilier column.
''	''	Add FP225-TC72** to Mallory column.
Stromberg-Carlson	111082	Change PRS 15/500 to PRS 12/500 in Aerovox column.
''	111094	Change TVL-2764 to TVL-4840*** in Sprague column.
''	''	Change FP238 to FP476*** in Mallory column.
''	111095	Change FP476* to FP238 in Mallory column. Delete "Remarks" column.
''	''	Change TVL-4840* to TVL-2764 in Sprague column. Delete "Remarks" column.

*Parallel 20 mf and one 20mf/3000VDC section to replace original 30 mf section.
**TC72 tubular electrolytic used in place of 10mf/450V section of original unit.
***Omit one 10 mf section.

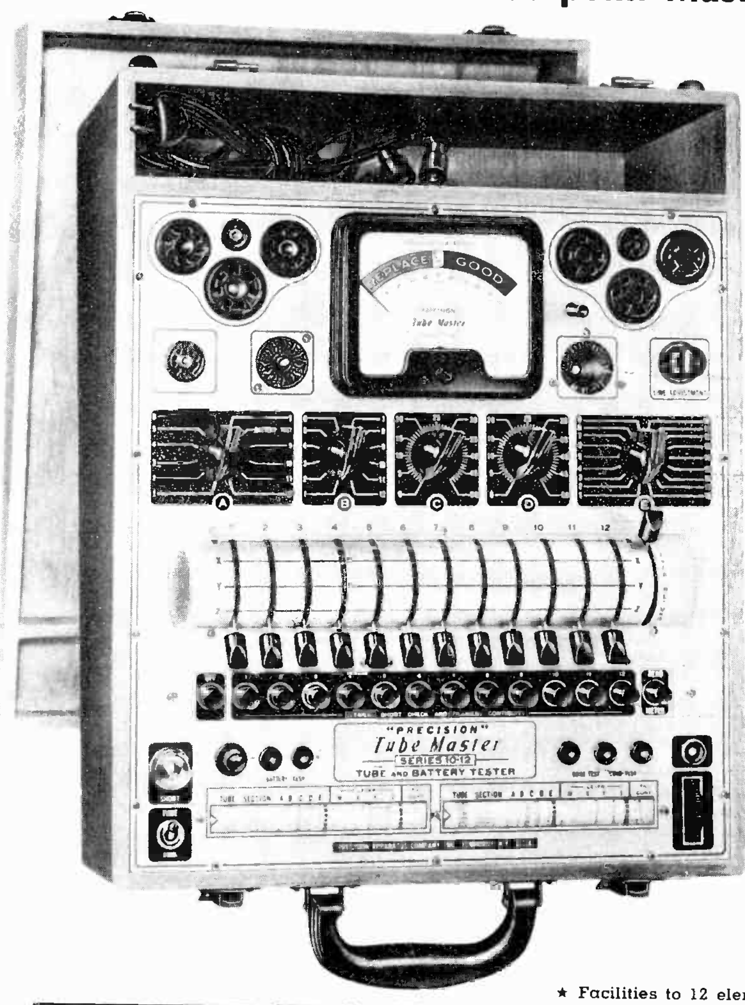


THE INSTRUMENT THAT DEMANDS **OVERALL PERFORMANCE** FROM THE TUBE UNDER TEST!

-PRECISION- SERIES 10-12

*Electronamic** Tube PERFORMANCE Tester

with 12 element free-point Master Lever Selector System



To test modern tubes for only one characteristic will not necessarily reveal ***OVERALL*** PERFORMANCE CAPABILITIES. Modern tube circuits look for more than just mutual conductance or other single factor.

It has been conclusively proven that even though a tube may work well in one circuit, it might fail to work in another—simply because **different circuits demand different relative performance characteristics,** such as amplification factor, plate resistance, power output, emissive capability, etc.

In the PRECISION "ELECTRONAMIC" Circuit, the tube under test is made to *perform* under appropriately phased and selected individual element potentials, encompassing a wide range of plate family characteristic curves. This COMPLETE PATH OF OPERATION is electronically integrated by the indicating meter circuit in the positive performance terms of *Replace-Weak-Good.*

The efficiency of this "Electronamic" test results from encompassing several fundamental tube characteristics, NOT JUST ONE. Accordingly, when a tube passes this demanding **OVERALL PERFORMANCE test,** it can be relied upon, to a very high degree, to work satisfactorily.

*REG. U.S. PAT. OFF. T.M. 438,006

MODEL 10-12-P (illustrated): in sloping, portable hardwood case with tool compartment and hinged removable cover. Sizes 13¾" x 17¼" x 6¾" **$104.50**
MODEL 10-12-C (Counter Type) **$109.25**
MODEL 10-12-PM (Panel Mount) **$109.25**

Compare these features

- ★ Facilities to 12 element prongs.
- ★ Filament voltages from ¾ to 117 V.
- ★ **Tests Noval 9 pins;** 5 **and** 7 **pin acorns; double-capped H.F. amplifiers; low power transmitting tubes, etc., regardless of filament or any other element pin positions.**
- ★ **Isolates each tube element regardless of multiple pin positions.**
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- ★ **Free Replacement Roll Charts & supplementary tube test data service.**

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PRINTED ELECTRONIC CIRCUITS

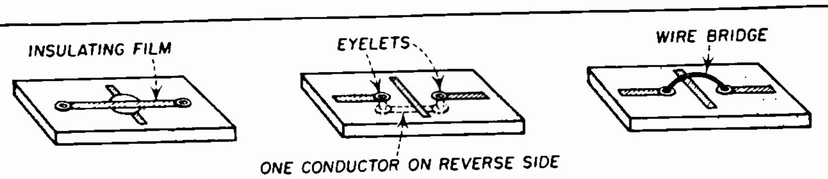
(Continued from page 3)

The painting technique has the advantage of requiring a minimum of auxiliary equipment and so has been the most popular type for experimentation and design work with printed circuits. It is also the best method to use in making repairs on printed circuits, as will be discussed later.

The *spraying* method of reproducing printed circuits differs from the painting technique in that the conductors are sprayed onto the surface of the base. Both molten metals and metallic conducting paints may be applied in this manner. In some processes, stencils are used to define the circuit conductors. In others, grooves are machined or molded in the base material where a conductor or other circuit component is desired. Grooves may also be formed by sand-blasting through a stencil. Metal is then sprayed over the entire base plate, filling the grooves and covering the spaces between. The surface is then milled off, removing the excess metal and leaving only that in the grooves. High conductivity is obtained by this method since relatively large conductors are formed in the grooves. Standard the work. Metal evaporated from a heated filament, or other source of metal vapor, is distilled on the printed circuit plate placed over it. In either type of vacuum processing, it is unnecessary to further heat treat or fire the deposited metal. Only thin films are usually deposited in this manner. If greater conductivity is required, conductors may be built up by electroplating.

In the *chemical-deposition* methods of making printed circuits, the techniques employed are similar to those used in silvering mirrors. A silvering solution, consisting of ammonia and silver nitrate mixed with a reducing agent, is poured on the chemically clean surface to be coated. The confines of the solution are controlled by an adhesive stencil. The metal films obtained are usually too thin to permit direct soldering, but may be built up by repeated coatings or by plating. The chemical processes have not been applied as extensively as those discussed above.

The *metal stamping* technique has been used principally to print loop antennas on the back covers of radio receivers. However,



TYPES OF CONDUCTOR "CROSS-OVERS"
FIG. 4

tube sockets and other components are sometimes connected to sprayed circuits by mounting them on the opposite side of the base plate so that the terminals protrude through holes into the grooves. Then, when the circuit is sprayed, connections are automatically made to the conductors. Circuit cross-overs are made in a manner similar to that employed in the painting process. Resistors, capacitors, and inductances may also be formed by spraying.

The *vacuum evaporation* process of circuit printing consists of evaporating a metal such as silver, copper, or nickel onto the surface of the dielectric material by melting the metal in a vacuum. A mask or stencil on the surface of the insulator is used to outline the circuit desired. In one such process, called "cathode sputtering", a high voltage is applied between the source of metal vapor (the cathode) and the work upon which it is to be deposited (the anode). The metal vapor is thus drawn to the work by electrostatic forces. Only a "rough" vacuum, such as can be produced by a good mechanical vacuum pump, is required for this process.

Another vacuum process used is very similar to cathode sputtering except that no voltage is applied between the cathode and

other types of circuit wiring have been produced by this method. A die, bearing the outline of the desired circuit, is used to press a thin metal foil into the surface of a plastic or other insulator. In the same operation the sharp edges of the die cut the metal sheet to the desired shape. The metal sheet may be backed by an adhesive to insure a good bond. Circuits made in this manner have good conductivity.

The last general type of printed circuit is produced by a process known as "dusting". In this method, a powdered metal is dusted onto the insulating base plate and fired in place. The cricuit outline is defined either by coating the entire insulator with a sticky substance and applying the metal powder through a stencil, or by applying the bonding substance through the stencil and then dusting on the powder so that it is held in place by the adhesive until fired.

Servicing Printed Circuits

As was mentioned above, the most convenient method of making repairs and replacements in printed circuits is the brush-applied painting technique. Kits of such paints, including both conductor and resistor mixtures, are commercially available.

(Continued on page 18)

PRINTED ELECTRONIC CIRCUITS

(Continued from page 17)

Most of these paints require no heat for drying, so that they may be used for repairing circuits having parts which cannot be subjected to high temperatures. This is an important precaution when working with circuits printed on certain types of plastic.

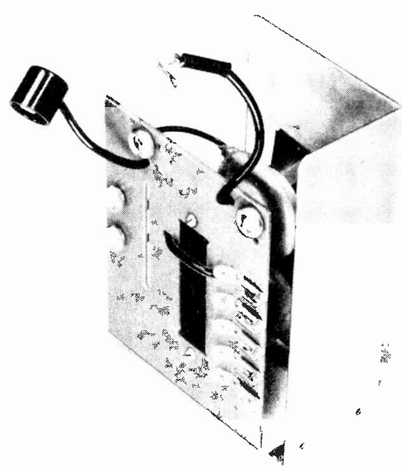
Although subminiature tube sockets are sometimes used with printed circuits, tubes are frequently connected directly to metal eyelets in the base plate, as in Fig. 1. When replacing tubes connected in this manner, care must be exercised to avoid the use of excessive heat during soldering operations. Soldered connections may also be made directly to printed conductors if the base material will stand the heat involved. A solder containing a small percentage of silver should be used for best results. Where soldering is inadvisable, connections to tube leads and other wires should be made with metallic paint.

Printed resistors which have become defective may be repaired or replaced by the painting technique. Defective resistors are located in the usual manner with an ohmmeter. If it becomes necessary to "disconnect" a printed resistor from the circuit for a resistance check, this may be accomplished by scratching through the printed conductor lead with a sharp instrument. If defective, the resistor may be repaired with resistive paint. It will usually be found to be open or high in value. In such cases, additional resistive paint should be applied over the old resistor to reduce its resistance to the proper value. Some commercial printed circuits have a protective layer of lacquer over the conductors and particularly over resistors to prevent moisture absorption. This coating must be completely removed before repairing resistors. If attempts to repair defective resistors are unsuccessful, the old coating should be removed completely and a new resistor painted in its place. The proper dimensions may be determined by trial and error, keeping in mind that the resistance is directly proportional to the length, and inversely proportional to width and thickness. The resistance material must make good contact with the printed conductors at the ends. Breaks introduced in the conductors to isolate resistors may be repaired with a bridge of conducting paint.

New Horizontal Output Transformer May Be Replaced Easily

One component with a high mortality rate is the horizontal-output transformer. Not much was done to alleviate the replacement problem. To those who have undertaken such replacement, the tedious and delicate procedure can be well appreciated.

In the new Stewart-Warner 9300 television chassis, a realistic approach has been taken to the problem. The horizontal-output transformer (shown here) is simply mounted



New Horizontal Output Transformer.

and connectors are employed rather than soldered leads. With this transformer, it is not necessary to remove the high-voltage rectifier tube socket from the chassis merely to replace the filament leads, nor is it necessary to postpone replacement of the transformer as a last resort because of the work involved.

To replace the horizontal-output transformer, it is only necessary to remove two sheet metal screws and unplug the leads. The entire replacement procedure does not require much more than five minutes, and can be done in the customer's home without removing the chassis and without the use of a soldering iron.

TV SUPPLEMENTARY SHEET NO. 1

MODEL & CHASSIS	PART #	CATALOG #	FUNCTION	DESCRIPTION	LIST PRICE
ADMIRAL					
22A2,A 22M1 22Y1	75B1-50	AG-83-S KSS-3	Tone	2 Meg. Ω carbon	$1.25
	75B11-20	RTV-327	Contrast/ Vol./Sw.	1500/1 Meg. Tap 500K Ω Conc. Dual carbon--SPST	$4.30
	75B13-3	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	75B13-7	AG-15-S FKS-1/4	Vert. Lin.	3000 Ω carbon	$1.25
	75B13-12	AG-49-S KSS-3	Bright.	100K Ω carbon	$1.25
	75B13-13	AG-40-S KSS-3	Hor. Hold	25K Ω carbon	$1.25
	75B13-14	AG-61-S KSS-3	Vert. Hold	1 Meg. Ω carbon	$1.25
	75B13-16	A43-750 KSS-3	Focus	750 Ω 2W-W.W.	$1.25
AMBASSADOR					
C1720 C2020 C2420 CD2020 T1720 T2020	131-0001	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	131-0002	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	131-0003	RTV-1	Contrast Vol./Sw.	10K/1Meg. Tap 200K Ω Conc. Dual carbon--SPST	$3.70
	131-0012	AG-44-S KSS-3	Hor. Hold	50K Ω carbon	$1.25
	131-0012	AG-44-S KSS-3	Bright.	50K Ω carbon	$1.25
	131-0013	AG-61-S KSS-3	Vert. Hold	1 Meg. Ω carbon	$1.25
	131-0014	RTV-10	Focus	5000 Ω 4W-W.W.	$1.85
14MT,MTS 16MT,MTS 17MC,MCS, MT,MTS 20MC,MCSMT, MTS	VC-12120B	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	VC-12121C	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	VC-12127B	RTV-297	Contrast. Vol./Sw.	750 Tap 500/250K Ω Conc. Dual--SPST	$4.30
	VC-12130	AG-49-S KSS-3	Bright.	100K Ω carbon	$1.25
	VC-12131	AG-44-S KSS-3	Hor. Hold	50K Ω carbon	$1.25
	VC-12132B	AG-83-S KSS-3	Vert. Hold	1.3 Meg. Ω carbon	$1.25
AM-17C, CB,C1M ET,T1M	PT-1002	RTV-252	Contrast Vol./Sw.	750 Tap 250/250K 2W-W.W./carbon Conc. Dual--SPST	$4.30
AM-20C,T PL-17CB,CG, PG,TM 20C 23P	PT-1004	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	PT-1005	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	PT-1007	AG-49-S KSS-3	Bright	100K Ω carbon	$1.25
	PT-1008	AG-61-S KSS-3	Vert. Hold	1 Meg. Ω carbon	$1.25
	PT-1009	AG-44-S KSS-3	Hor. Hold	50K Ω carbon	$1.25
20PC 20PCS 20PCS2	VC-12120B	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
AMBASSADOR					
	VC-12121C	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.24
	VC-12127B	RTV-297	Contrast/ Vol./Sw.	750 Tap 500/250K Ω Conc. Dual carbon SPST	$4.30
	VC-12131C	AG-44-S KSS-3	Hor. Hold	50K Ω carbon	$1.25
	VC-12132C	AG-83-S KSS-3	Vert. Hold	1.3 Meg. Ω carbon	$1.25
	VC-12135	AG-49-S FKS-1/4	Bright	100K Ω carbon	$1.25
ANDREA 2C-VL20	GRV-812-1	AG-83-S FKS-1/4	Height	2 Meg. Ω carbon	$1.25
	GRV-824	A43-2000 FKS-1/4	Vert. Lin.	2000 Ω 2W-W.W.	$1.25
CHASSIS VL-20	GRV-830	AG-60-Z FS-3/SWB	Vol./Sw.	500K Ω carbon--SPST	$1.25 .60
	GRV-831	RTV-75	Hor./Vert Hold	50K/2 Meg. Conc. Dual carbon	$3.10
	GRV-834	RTV-300	Bright./ Contrast	20K/5000Ω 4W-W.W./ carbon Conc. Dual	$4.05
ARTONE AR14L AR17L 17CD 17CRR 17ROG 20CD 203D 1000 1001 2nd Run	P-2	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	P-5	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	P-7	AG-60-Z FS-3/SWB	Vol./Sw.	500K Ω carbon SPST	$1.25 .60
	P-12	AG-8-S FKS-1/4	AM-Rejection	1000 Ω carbon	$1.25
	PD-5	RTV-146	Vert./Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	$3.10
	PD-6	RTV-253	Contrast/ Bright.	2000/100K Ω Conc. Dual carbon	$3.10
MST-12 MST 14 14TR 16TR 17CD 17CRR 17ROG 20CD 20TR 112X 203D 312 819 3163CR 8163CR 8193CM 1st Run	P-2	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	P-5	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	P-6	A10-1500 FKS-1/4	Focus	1500 Ω 4W-W.W.	$1.85
	P-7	AG-60-Z FS-3/SWB	Vol./Sw.	500K Ω carbon SPST	$1.25 .60
	PD-4	RTV-145	Contrast/ Bright.	750 Tap 250/100K Ω 2W-W.W./carbon Conc. Dual	$3.70
	PD-5	RTV-146	Vert./Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	$3.10
ARVIN 5175 5176	E22464-17	RTV-258	Contrast/ Vol./Sw.	25K/3 Meg. Tap 1 Meg. Conc. Dual carbon--SPST	$4.30
	E22464-20	RTV-259	Vert. Lin./ Height	3000/2.5 Meg. 2W-W.W./carbon Conc. Dual	$3.10
CHASSIS TE320	E22464-34	AG-49-S KSS-3	Bright.	100K Ω carbon	$1.25
	E22464-35	Order from MFR.	Tone/ Phono Sw.		
	E22464-36	AG-83-S KSS-3	Vert. Hold	1.5 Meg. Ω carbon	$1.25
	E22464-37	AG-44-S KSS-3	Hor. Hold	50K Ω carbon	$1.25

Replacement Parts

(Continued from page 8)

percentages, and sometimes in a value of capacitance, whichever is the greater of the two. As to *minimum* tolerances, they vary with the type of component. For example the minimum tolerance generally considered in ceramic dielectric capacitors and in silver mica capacitors is ± 1 percent. In the plain foil mica dielectric unit it is ± 2 percent, whereas in paper dielectric capacitors it is ± 5 percent. In electrolytic capacitors the minimum tolerance is 10 percent.

While on the subject of tolerances it is necessary to comment that the minimum tolerances quoted here are not necessarily the standard tolerances which are used for components in television (and radio) receivers. The high order of accuracy indicated by these minimum tolerances are seldom applied to household electronic equipments. The figures used are much more liberal, but none the less important as far as accomplishing a desired result, hence demanding recognition by the service technician who is making a replacement. It is because of this that television receiver manufacturers frequently list the capacitance tolerance in their service literature, and why the Rider Replacement Parts Program listings of capacitors always state the capacitance tolerance.

Each type of capacitor bears a standard tolerance figure plus and minus. The list shown below indicates the range of tolerances associated with capacitors used in household electronic appliances such as television and radio receivers. Attention is called to the fact that we have omitted the full gamut of capacitance tolerances which are *available* on request from capacitor manufacturers; instead we show only those values which appear in the capacitor specifications set by the receiver manufacturers for capacitors used in their television and radio receivers, and whatever other electronic products they make for public consumption. The list which follows applies to capacitors in excess of 10 μμf. Lower values of capacitance have already been dealt with.

It is understandable that every single capacitance tolerance figure which is used in the industry is not listed here. But it can be said that those which represent the vast majority are included.

It also is important to state that the letter code shown on this listing corresponds to the coding in capacitor specifications contained in capacitor manufacturers' catalogs and in *RTMA* as well as *JAN* specifications. We have however omitted the letter coding indicative of 1, 2 and 3 percent capacitance tolerances. These are F, G and H respectively, although the letter H when applied to ceramic units indicates 2.5 percent.

Finally, attention is called to the possibility of confusion between the capacitance tolerance code letters and the Temperature Coefficient as well as the Temperature Coefficient Tolerance code letters. While similar code letters apply to all of these, their meanings are completely different.

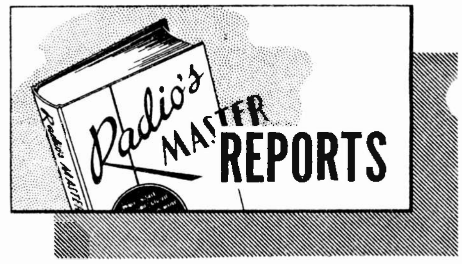
Type of Capacitor	*Standard Industry Capacitance Tolerance in Percent*	*Capacitance Tolerance Values Used in Percent*	*Letter Code*
Mica			
(Plain)	± 20	± 20	M
		± 10	K
(Silver)	± 5	± 10	K
		± 5	J
Ceramic			
(GP)#	± 20	± 20	M
		± 10	K
		± 5	J
(GMV)*	+ 100 and − 0	+ 100 − 0	
		+ 100 − 20	
(TC)**	± 10	± 10	K
		± 5	J
Paper Dielectric	± 20	± 20	M
		± 10	K
		± 5	J
		+ 60 − 25	
		+ 40 − 20	
		+ 40 − 15	
		+ 40 − 10	
		+ 20 − 10	
Electrolytic			
(Tubular)		+ 100 − 10	
		+ 150 − 10	
		+ 250 − 10	
(Can)		+ 40 − 10	
		+ 50 − 10	
		+ 100 − 10	
		+ 150 − 10	

General Purpose
* Guaranteed Minimum Value
** Temperature Compensating

Applications of Capacitance and Capacitance Tolerance. How are these two constants used? . . . To begin with, the capacitance required in a circuit is a function of the design of the system which uses it. Among the constants of the circuit is the amount of capacitance required. But seldom, if ever, is this value an absolutely precise one; invariably it is an approximation, although it is stated as a definite amount as that value which most closely approximates the nearest standard value. We refer to it as an approximation because the capacitance value indicated is ± a certain amount of capacitance. For instance the capacitance specified by a receiver manufacturer for a circuit may be 0.0022 μf ± 10 percent. Assuming all other conditions satisfied, any value of capacitance between 0.00198 μf and 0.00242 μf seems suitable.

The conclusions accompanying the example are correct except for one additional consideration. Suppose we deal with the 0.0022 μf unit. In order to be a suitable replacement within the stated 10 percent capacitance limits, the value must be a measured value for the replacement unit. If this is not so, but instead a capacitor labelled

(Continued on page 23)



A monthly summary of product developments and price changes supplied by RADIO'S MASTER, the Industry's Official Buying Guide, available through local parts distributors.

COMMENT: Since the last reported period, fewer manufacturers were engaged in "change activity". TV and radio receiving tube manufacturers are continuing their tendency toward increasing prices, while other product group price changes remain spotty with no apparent trend.

New Items

AEROVOX — Introduced a number of new items including AFH triple and quad electrolytic capacitors.

AMERICAN ELECTRONICS — Added No. 4-01, Code Booklet at $.50 dealer net . . . No. 103-01, Advanced Course at $6.95 dealer net and Individual Records at $1.40 dealer net.

AMERICAN PHENOLIC — Added Model 114-053, UHF bo-ty antenna at $3.00 dealer net . . . Model 114-560, UHF bo-ty reflector at $1.65 dealer net and Model 114-558, UHF bo-ty stacking harness at $.36 pr/dealer net.

BELL SOUND SYSTEM — Added Model 372MB, 30 watt mobile amplifier at $165.00 dealer net.

BRIDGEPORT BRASS — Added plastic spray Model 603 at $1.95 dealer net.

CLAROSTAT — Added TV replacement controls RTV 384 to 390 inclusive.

CORNELL-DUBILIER — Added Model V-8, VHF antenna at $25.50 dealer net . . . Model U-4, UHF antenna at $5.97 dealer net and Model 110T22, vibrator converter at $47.31 dealer net.

CREST LABS. — Added Model LVB-117, line voltage booster at $10.08 dealer net.

EBY SALES — Added laminated miniature sockets No. 49-6H at $1.35 dealer net and No. 49-7H at $1.80 dealer net.

GENERAL ELECTRIC — Added germanium transistors 4JA1A1 at $1.95 dealer net . . . 4JA1A2 at $3.85 dealer net . . . 4JA1A3 at $4.80 dealer net and 4JA2A4 at $5.30 dealer net. Also added Model UPX-009, pickup and transcription arm at $9.33 dealer net . . . Model RPX-051, triple play variable reluctance cartridge at $5.28 dealer net and Model RPX-042, variable reluctance cartridge at $4.35 dealer net.

GON-SET — Added No. 1499, UHF line at $7.08/100 ft. dealer net . . . No. 3027, cascade pre-amplifier at $19.95 dealer net and No. 3028, signal slicer at $29.95 dealer net.

ILLINOIS RESEARCH LABS. — Added Silencer in quart size at $6.50 dealer net and introduced Sta-clear, new chemical solution for keeping static attracted dust from accumulating on picture tube at $1.00 dealer net. (4 oz. bottle).

KENWOOD ENGINEERING — Added Model 12W, 12" wall bracket and Model 7W, 7" wall bracket.

MERIT TRANSFORMER — Added Model HVO-11, transformer at $5.40 dealer net.

MINNESOTA MINING — Added 7" (1200') professional reel and box (plastic) at $1.25 list.

RADIO CITY PRODUCTS — Added a number of new items including Model 345, super vacuum tube voltmeter at $47.50 dealer net and Model 8873, TV servishop at $139.95 dealer net.

R.C.A. — Added radio receiving tubes 6AR5 at $1.65 list . . . 6AX4GT at $2.40 list and 6K8G at $3.30 list. Also added electron tubes 3C45 at $17.80 list . . . 91 at $30.00 list . . . 5718 at $8.65 list and 6211 at $2.95 list.

RAYTHEON — Added 6AH6V, radio receiving tube at $3.90 list, a miniature sharp cut-off pentode having high transconductance and low input and output capacitances, and is designed specifically for television amplifier applications.

REEVES SOUNDCRAFT — Added soundcraft 45 rpm recording disc at $.66 dealer net.

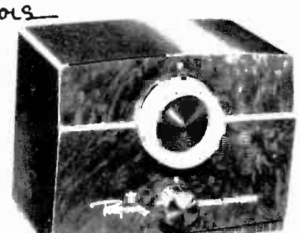
STANDARD TRANSFORMER CORP. — Added deflection yokes Model DY-11A at $6.00 dealer net and Model DY-12A at $6.00 dealer net.

STROMBERG-CARLSON — Added a number of new items including No. AP-51, power amplifier at $157.50 list and TR-13, line transformer at $3.50 list.

SYLVANIA — Added radio receiving tubes 6T4 at $3.55 list . . . 1XRB at $2.65 list . . . 40B2 at $2.05 list . . . 6SN76TA at $2.20 list and sub-miniature tubes 1T6 at $2.05 list . . . 6BF7 at $1.85 dealer net and 6BG7 at $1.85 dealer net.

(Continued on page 24)

Thomas A. White
president: Jensen Manufacturing Company, Chicago, Illinois
says: "In every field there's one leader
.... in boosters it's Regency"
the largest selling booster at any price



Replacement Parts

(Continued from page 20)

with the standard value of say 0.002 μf (which is within tolerance of the original) is contemplated, what must be its tolerance? If it conforms with standard industry practice, namely ± 20 percent, then it could have any value between 0.0016 μf and 0.0024 μf. Obviously it would be within tolerance on the high side but not on the low side.

Suppose that the contemplated replacement rated at 0.002 μf was within a ± tolerance of 10 percent, what then? On the low side it would have a value of 0.0018 μf and on the high side it would be 0.0022 μf. Again it is within tolerance on the high side but outside the tolerance on the low side.

Suppose we consider the next higher standard value, say 0.0025 μf for the replacement. Would any normal tolerance satisfy? With a rating of ± 10 percent, the low limit would be 0.00225 μf and the high limit would be 0.00275 μf. Now the contemplated replacement is within tolerance on the low side but beyond tolerance on the high side . . . Is there any answer?

Of course there is! But before we describe it, we might present another practical question — how important is the capacitance tolerance? . . . A simple reply is to say that it all depends on the circuit where the capacitor is used. But this is a very indefinite answer. We know that bypassing capacitance values are not as important as capacitance values related to time constant circuits, or resonant circuits or coupling circuits. But does it make sense to set up a tolerance on the tolerance in each and every particular application of a capacitor? . . . To do this involves something else — namely complete knowledge concerning the conditions established by the design engineer in every section of a television receiver which he designed . . . This is very difficult to determine. It is much easier to recognize the requirements established in the design of the receiver as indicated by the constants of the capacitor, and to satisfy these requirements of capacitance and capacitance tolerance.

To do this is simple. It means nothing more than the procurement of a capacitor rated at the same nominal capacitance and capacitance tolerance as the original. This is no problem because design engineers are using standard values, and capacitor manufacturers are making them. We admit that procurement practice of this kind for replacement purposes is somewhat of a departure from past tactics, but to adopt it makes most sense, because it enhances the possibility of making the proper repair and attaining best performance from the receiver.

The above suggestion to follow the capacitance tolerance stipulated for the original is subject to some qualifications, especially in the case of paper dielectric and electrolytic capacitors. Some of the tolerance percentages are different for the + side than for the — side, as for example + 60 percent and — 20 percent. In that event a variety of selections is available. Assuming the same nominal value of capacitance, say 0.005 μf for the original and the contemplated replacement component, a replacement rated at any value of + tolerance between 0 and 60 percent and — tolerance between 0 and 20 percent obviously is suitable.

But the leeway for selection is even greater than described. With a 60 percent tolerance on the + side, the upper limit is 0.008 μf. On the — side, it is 0.004 μf. Under the circumstances, any standard value of capacitance which, with its rated tolerance limits falls within these two extremes of capacitance, is suitable as a replacement as far as capacitance is concerned. Naturally, any capacitor whose *measured* values fall within these limits is satisfactory capacitance-wise.

The use of + 60 percent and — 20 percent as capacitance tolerances are purely illustrative. It could just as soon be + 100 percent and — 10 percent, as in some electrolytic capacitors. The same reasoning applies to *any* other set of capacitance values established by the tolerance limits for any type of capacitor. The more liberal the capacitance tolerance figures, the easier is it to find a suitable replacement in terms of capacitance. It is only when the capacitance is relatively small, say between 10 μμf and 100 μμf and the tolerance is severe, say 5 percent or even 10 percent in both directions — that it becomes difficult to find a replacement other than one which parallels the original in nominal capacitance and tolerance. Occasionally this happens with higher values of capacitance.

Two other items warrant comment, even if not complete at this time. One of these pertains to possible misinterpretation of these references to satisfying the capacitance requirement. This should not be construed as implying that as long as this constant and the tolerance constant requirements are met, free interchangeability exists between capacitor types. This is not so, for reasons which will become evident when the other constants are discussed.

The second item is a slight elaboration of a point already raised concerning capacitors rated at 10 μμf and less. There isn't too much margin in these values for the selection of one standard value for another, based on the capacitance tolerance. One or two micromicrofarads do not seem like too much capacitance but when dealing with very small values to begin with, they represent high percentages. Moreover the selection of these small values is based on engineering requirement, and it is best servicing practice to comply with these needs, even if the reasons for their existence are not immediately apparent.

Radio's Master Reports

(Continued from page 20)

TRICRAFT PRODUCTS — Added Model U-1, UHF antenna at $7.50 dealer net.

TRIPLETT ELECTRICAL INSTR. — Added No. 9989, signal tracing probe at $9.50 dealer net, for use with Model 3441 TV-FM oscilloscope and BV adaptor/ for TV picture tube tests at $7.90 dealer net.

TV WIRE PRODUCTS — Added new series, formvar covered copperweld, at $4.72 dealer net, per 100 feet and at $47.21 dealer net, per 1000 feet.

VACO PRODUCTS — Added No. RT-14, handy service kit, complete with 7 nut drivers, 2 Philips and 3 regular drivers plus extension piece at $7.34 dealer net.

WEBSTER-ELECTRIC — Added No. 90-25, separate teletalk amplifier for paging at $120.00 list and 15 pair plastic interstation cable and junction box at $.34 list (on reel).

Discontinued Items

ADVANCE ELECTRIC & RELAY — Discontinued Model 400M, transmitter relay.

AMERICAN PHENOLIC — Discontinued Model 14-358, twin lead transmission wire . . . Model 187-072 and Model 187-079, molded polethylene rims and Model 509, rotator. Model 14-298, 100, 500, 1000 feet, remote control wire, temporarily discontinued.

CLAROSTAT — Discontinued wire wound control 43-7000.

ELECTRONIC TECHNICAL INSTITUTE — Discontinued Model 5207, Novice 80-M transmitter kit.

GENERAL ELECTRIC — Discontinued Model RPX-046, broadcast type variable reluctance cartridge. Also discontinued G-10 series of transistors.

GON-SET — Discontinued Model 3005, tri-band amateur converter and their Gonset radarray series.

KENWOOD ENGINEERING—Discontinued Model 140, 7" wall bracket.

POTTER & BRUMFIELD — Discontinued LC and LP series of plate circuit relays.

SHURE BROS. — Discontinued Model 55 and Model 556, multi-impedance, super-cardiod microphones.

SIMPSON ELECTRIC — Discontinued Model 340, signal generator.

STROMBERG-CARLSON — Model RD-22, driver unit, discontinued.

SUPREME, INC. — Discontinued Model 675, signal generator.

WEBSTER-ELECTRIC — Discontinued Model 53D50, teletalk amplifier for paging and Model 5C45, speaker microphone.

WIRT PRODUCTS — Discontinued auto radio ignition suppressors S-915 and S-918.

Price Increases

ASTATIC CORP. — Increased price on "scanafar" booster, Model CT-1 to $21.00 dealer net.

BLONDER-TONGUE — Increased price on Model MT-1, matching transformer to $3.90 dealer net.

CORNELL-DUBILIER — Increased price on Model 8BD, "hi-ball" auto aerial to $3.03 dealer net.

DUMONT LABS. — Increased price on two 12", one 16", four 17", four 20", and three 21" TV picture tubes.

FISHER RADIO CORP. — Master audio control, Model 50-C, increased to $97.50 dealer net.

GENERAL ELECTRIC — Radio receiving tube 6BA7 increased to $2.50 list. Also increased one 12", three 17", one 20" and one 21" TV picture tubes.

GON-SET — Increased price on Model 1531, rhombic UHF antenna, with 9' mast to $7.77 dealer net.

HICKOK ELECTRICAL INSTR. — Increased price on Model 605, portable all-purpose tube and set tester to $184.50 dealer net.

R.C.A. — Increased price on Model WO-88A, 5" oscilloscope to $169.50 user price. Also increased power tube fittings 202F1 to $23.85 user price . . . 211F1 to $28.20 user price and 228F1 to $67.60 user price.

STROMBERG-CARLSON — Increased price on a number of items including No. MD-38S, dynamic microphone to $70.00 list.

SYLVANIA — Increased price on three 17", two 20" and one 27" TV picture tube.

V-M CORP. — Increased price on record changers No. 150 to $33.47 dealer net . . . No. 972 to $40.17 dealer net and No. 985 to $53.57 dealer net. (West Coast prices slightly higher)

Price Decreases

CREST LABS. — Decreased price on cathode ray tube rejuvenators Model B to $3.15 dealer net . . . Model C to $2.20 dealer net and Model D to $2.60 dealer net.

ELECTRONS, INC. — Decreased price on grid control rectifier EL C6M to $31.00 dealer net.

GENERAL ELECTRIC — Decreased price on TV picture tubes 16KP4 and 16KP4A.

GON-SET — Decreased price on Gonset line to $6.24 dealer net/100 feet.

R.C.A. — Decreased price on radio receiving tube 6L6G to $3.00 list and electron tube 5654-t to $4.90 list.

WIRT PRODUCTS — Decreased price on slide switches SW 723 to SW 726.

INDEX OF CHANGES

Model No.	*Manual Page From*	*Manual Page To*	*Tek-File Pack*
Andrea T-VL12 Ch. VL12	6-1	6-10	43
Gamble-Skogmo 05TV1-43-9014A 15RA2-43-9105A Ch. 15AY213	6-1	6-16	31
Hoffman 612 Ch. 142	5-8	5-16	35
Magnavox Ch. CT-270, 271, 272, 273, 274	7-14	7-28	30
Mitchell T16-2KB T16-2KM, T16-B, T16-M	6-1	6-4	45
Sylvania 23M-1, 23B, 23M, 24M-1 Ch. 1-387-1	8-118	8-139	13
Sylvania 74M Ch. 1-356 (C05)	8-160	8-173	13

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MARCH 1953

with TEK-FILE INDEX

TV Interference and Its Remedies

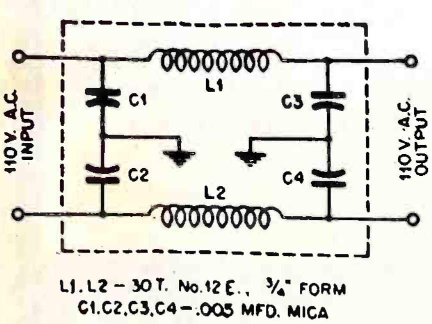
by Samuel L. Marshall

This material is excerpted from the John F. Rider Publication, TV INSTALLATION TECHNIQUES, by Samuel L. Marshall.

Electrical TV Interference Picked Up in the Antenna. Electrical disturbances caused by car ignition, static, motors, appliances, power lines, etc., are inherently broadband in nature, covering the entire radio spectrum. As such, they are difficult to deal with if picked up by the antenna proper. However, if such disturbances are picked up primarily by the downlead, (which is most often the case) then the most appropriate action to take is to install a downlead of low-loss shielded twinlead or coaxial cable.

Automobile ignition interference may be reduced by twisting the downlead if twin-lead is used; by using low-loss coax or shielded two-wire line for the downlead; and by employing an antenna, such as a Lazy-H, which attenuates *vertically* polarized signals. Sometimes the installation of a very high antenna will increase the signal to noise ratio to an extent where such interference become negligible. Where overhead power and trolley lines produce TVI, it is advisable to install the antenna as far away, and as high above, these lines as possible.

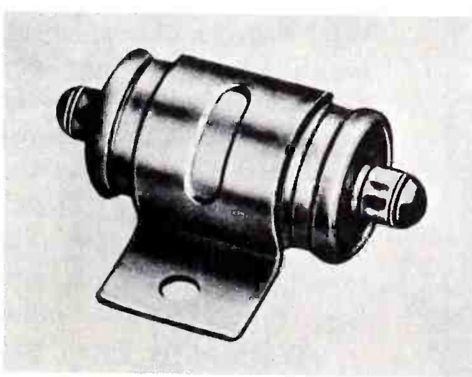
TVI Pickup in the Receiver Through the Power Line. A great deal of interference may be caused by r-f disturbances entering the receiver via the line. A good test for this is to disconnect the antenna. If the noise pattern still remains, the trouble is being introduced through the line. Line filters, which will shortly be described in detail, are generally the solution to problems of this nature.



Courtesy Aerovox

Fig. 1. Low-pass line filter.

TVI Pickup in Receiver Components. Poorly shielded receivers may pick up signals directly via their component parts in addition to the antenna. Sometimes this results in complicated service difficulties such as leading ghosts, and pickup of i-f signals in the video i-f stages. Complete shielding of the receiver is the only solution to interference problems of this nature. An effective means of shielding a receiver, which was mentioned previously, is to line the cabinet completely with copper screen.



Courtesy Sprague

Fig. 2. Non-resonant line filter for TV applications.

TVI Filters. TVI filters fall into three categories:

1. Low-pass filters, which are designed to permit signals to pass through, and attenuate high-frequency signals.
2. High-pass filters, which are designed to permit high-frequency filters to pass through, and attenuate low-frequency filters.
3. Resonant filters, which are tuned to certain unwanted frequencies and may either offer a high impedance to the passage of these frequencies into the receiver, or short-circuit them to ground.

Low-pass line filters are mostly used to eliminate line TVI. A typical filter of this type is shown in Fig. 1. It consists of a balanced network of series chokes and shunt-connected capacitors designed to permit ready passage of the 60-cycle line current, and to short circuit or greatly attenuate any high-frequency currents present in the line. The entire unit can be easily constructed by the serviceman. On completion, it should be housed in a suitably grounded metal container. Many commercial line filters of this type are readily available.

Recent developments in low-pass line filters have resulted in a special type of capacitor which is designed primarily for

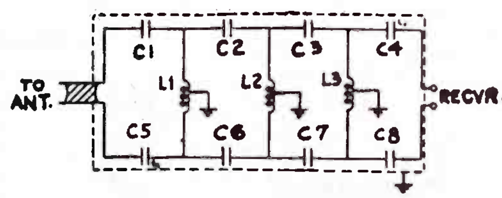


TABLE OF VALUES

L1 = 0.5 μh	C3 = 12 mmfd
L2 = 0.5 μh	C4 = 24 mmfd
L3 = 0.5 μh	C5 = 24 mmfd
	C6 = 12 mmfd
C1 = 24 mmfd	C7 = 12 mmfd
C2 = 12 mmfd	C8 = 24 mmfd

Courtesy Jerrold Electronics

Fig. 3. High-pass filter in 300-ohm line for eliminating signals lower than 45 mc.

TV and other high-frequency applications. Conventional bypass capacitors have resonant characteristics at relatively low frequencies, and are therefore ineffective for bypassing the very high TV frequencies present in the line. This new type of capacitor is constructed so that it simulates a lossy transmission line at high frequencies, resulting in an attenuation of these frequencies over a broad bandwidth.

An illustration of a typical commercial unit is shown in Fig. 2. It must be borne in mind that these devices are of the feed-thru variety; that is, they are placed in series with the line, both center terminals being opposite ends of a feed-thru conductor which is connected to one foil of the capacitor internally. If the two end terminals are connected across the line, a short circuit will occur. Excellent results have been reported with these units.

As mentioned previously, high-pass filters are designed to attenuate r-f signals below

(Continued on page 28)

Image Frequencies in Superhets

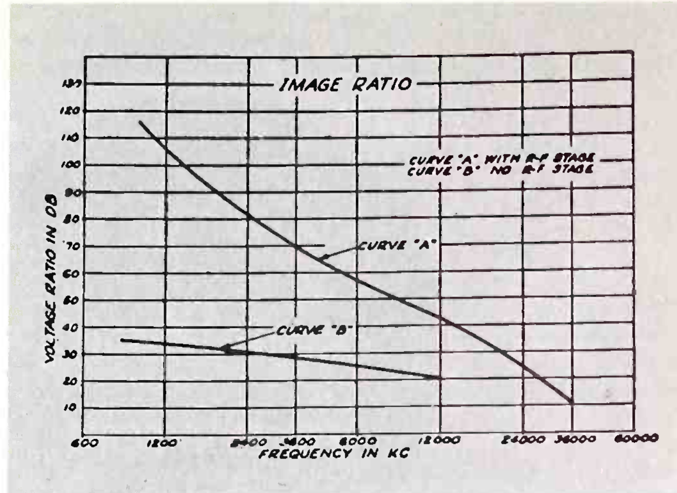


Fig. 2. Curves showing the improvement in image ratio which results when an r-f stage precedes the mixer.

In the operation of a superheterodyne receiver, the local oscillator heterodynes, or beats with, the incoming signal and produces in the mixer a signal at the intermediate frequency which has all the characteristics of the desired incoming signal.

Since the selectivity of the mixer input stage is not sufficient to eliminate undesired signals completely, interference may result due to the fact that the local oscillator in the receiver will heterodyne not only the desired signal, but also an undesired one, so that both are fed to the i-f amplifier. One type of interference which may result from this condition is known as image-frequency response.

To understand what is meant by image frequency, let us consider the block diagram, Fig. 1, which represents a typical superheterodyne which employs no r-f stage. It is assumed that a 10,000-kc signal is being picked up by the antenna and fed to the mixer input circuit. The receiver is tuned to 10,000 ks; the i-f is 450 kc, hence the local oscillator in the receiver is functioning at 10,450 kc. This is the normal condition of operation.

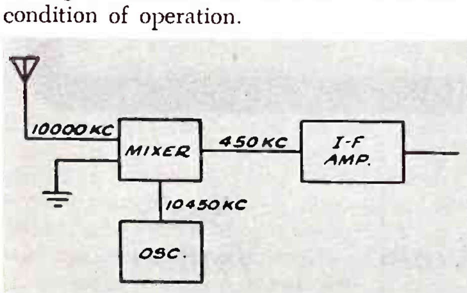


Fig. 1. Block diagram showing superhet with r-f stage.

The i-f amplifier being tuned to 450 kc, any 450-kc signal present in the mixer output circuit will be amplified. When the receiver is tuned to 10,000 kc, a 10-mc signal will be present in the mixer circuit. The local oscillator signal at 10,450 kc combines with the incoming signal to produce a new signal which represents the sum and difference of the two frequencies present in the mixer. The difference between 10,450 kc and 10,000 kc is 450 kc, and since the i-f amplifier is tuned to this frequency, the signal will be amplified. The sum frequency, which is equal to 10,450 plus 10,000 or 20,450 kc, will also be present but will not be amplified because the i-f amplifier is not tuned to this frequency.

Now let us assume, that in addition to the desired signal of 10,000 kc to which the receiver is tuned, a strong signal of 10,900 kc is present in the mixer. This could be the case, since there is but a single tuned circuit and ordinarily this is not sufficient to cut out completely a strong signal which does not differ by a large percentage in frequency from that of the desired signal.

The 10,900-kc signal, when mixed with the 10,450-kc signal supplied by the local oscillator, produces a difference frequency equal to 10,900 –10,450 or 450 kc. Since this is the frequency to which the i-f amplifier is tuned, the undesired signal will be amplified along with the desired signal, representing the difference between 10,000 and 10,450 kc, and interference will result. The frequency at which this interference results is called the *image frequency*.

Relation of Image Frequency to Desired Frequency

Now let us see what relation the image frequency bears to the desired signal frequency. If the receiver is tuned to 10,000 kc and, as we have shown, the image frequency under such conditions is at 10,900 kc, the difference between 10,000 kc and 10,900 kc is 900, which is equal to twice the assumed intermediate frequency of 450 kc. If the intermediate frequency were 465 kc, then the local oscillator would function at 10,465 kc when the receiver was tuned to 10,000 kc. Also, a signal of 10,930 kc would produce an image frequency response. The difference between the desired and undesired signal frequencies would then be 10,930 –10,000 or 930 kc. Again we see that the image frequency response occurs at a frequency which differs from that of the desired signal by twice the intermediate frequency. And we may set this up as a rule, that the image frequency will always differ from that of the desired signal frequency by twice the intermediate frequency.

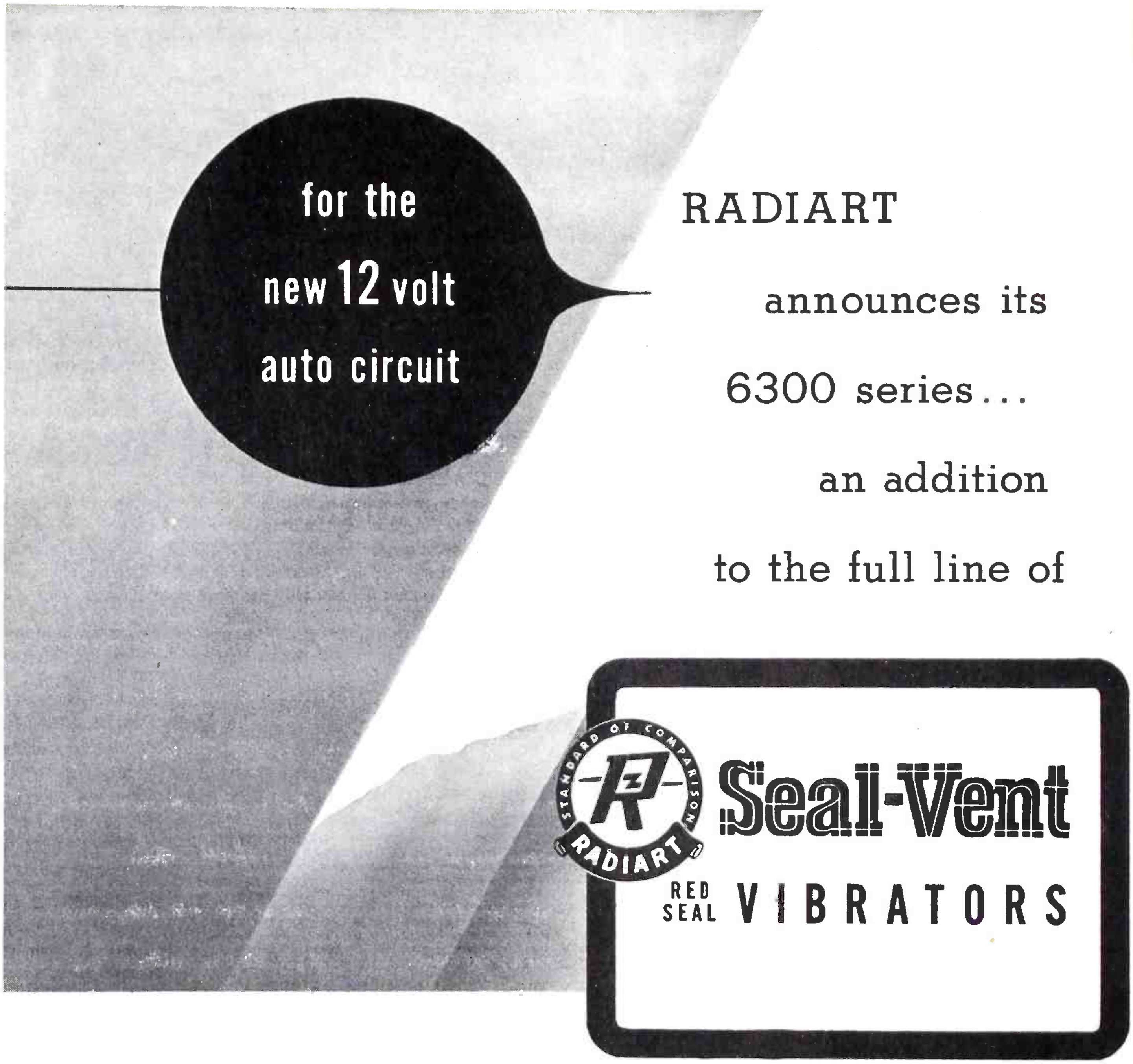
In the examples above, we have seen that the image frequency is also higher in frequency than that of the incoming signal. In some receivers, particularly on shortwave bands, the oscillator functions at a frequency which is lower than that of the incoming signal. For instance, if the receiver is tuned to 10,000 kc and the set oscillator operates at 9,550 kc, an i-f signal, representing the difference between 10,000 kc and 9,550 kc, or 450 kc, is produced.

Now, if a 10,900-kc signal were also present in the mixer circuit, the beat between it and the local oscillator would result in the production of a signal frequency of 10,900 – 9,550 or 1,350 kc. Since the i-f amplifier is tuned to 450 kc and not 1,350 kc, no interference will result. Therefore, 10,900 kc, though it differs by twice the i-f from the desired signal frequency, will not produce interference when the oscillator frequency is lower than that of the signal frequency to which the receiver is tuned.

However, if a signal of 9,100 kc instead of 10,900 kc were present in the mixer circuit, when the set is tuned to 10,000 kc and the oscillator is functioning at a frequency of 9,550 kc, which is 450 kc *lower* than that to which the receiver is tuned, a signal representing the difference between 9,550 kc and 9,100 kc or 450 kc will be formed and will therefore pass through the 450-kc i-f amplifier and cause interference. This 9,100-kc signal, you will note, also differs from the desired signal frequency or 10,000 kc, by 900 kc, an amount which is also equal to twice the intermediate frequency. This then is the image frequency when the oscillator is lower in frequency than that of the incoming signal.

So we may see from the above illustrations that *the image frequency always differs from the desired signal frequency by an amount which is equal to twice the intermediate frequency.* Also, that when the set oscillator operates at a frequency which is higher than that to which the receiver is

(Continued on page 8)



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RTMA Pilot School

The RTMA Service Committee comprised of the Service Managers of the RTMA members receiver manufacturers fathered an idea about two years ago — it was a long range program with a number of objectives. Among these was the upgrading of practicing television service technicians — also an increase in the number of competent personnel trained to perform duties as television technicians. The method proposed was to be the preparation of an RTMA sponsored and supervised course of instruction capable of accomplishing these objectives. The RTMA Service Committee did not propose to go into the educational field in competition with existing schools — what it did hope to do was to sponsor and initiate a comprehensive training course and program — then make samples of it available without charge to any educational institution which contemplated setting up a television technicians' training course as a part of its educational effort.

The idea went through the ringer for quite some time. It came to a head not too long ago. Being an industry-wide effort, it has for its sponsors and financiers the RTMA as a whole — especially the receiver, test euipment, parts, and tube manufacturer members.

After a great deal of deliberation the New York Trade School in New York was chosen as the place where the course would be written and tried out to prove its practicability. The reason for selecting this institution, was its existence for more than 73 years as a philanthropy — and teaching a number of trades in cooperation with various industries — was its location in the center of the greatest television receiver population; also that it was free of all political connections and finally because it had an excellent scholastic standing.

In cooperation with an RTMA advisory sub-committee on education — having as its Course Director an exceptionally competent educator long experienced in radio and television training programs — the course, the laboratory, and lecture room facilities now are in the process of organization and construction. The Course Director was selected by the RTMA Service Committee Educational Sub-Committee and is being paid for by the RTMA.

Without question the entire project is worthy of the greatest respect, recognition and best wishes for success. Its experimental nature is one of its greatest attributes. Not only will the students gain the greatest amount of benefit from the most up-to-date instruction — and the very latest equipment — but, also the course planned will be tried and proven, all the while reflecting the television industry's needs. This should be of utmost interest to those institutes, which for a long time have wished to open classes in television servicing but have encountered many obstacles in the formulation of their program.

According to reports the school will be in operation by September, 1953 and the RTMA feels that complete information on the first course to be given, for the upgrading of practicing television technicians, will be ready for distribution by the end of 1953 if not sooner. This information will be the complete course content, time schedule, and laboratory and lecture room requirements, space and equipment needed — in fact everything which will enable interested schools to initiate similar programs.

There is no reason why this entire project should not be a complete success. Understandably the RTMA cannot set up and equip schools in all parts of the nation — so it is doing the next best thing, namely creating an experimental school for preparing and trying Training Programs — and making the information, so developed, available to all who wish to use it.

All communications should be addressed to Mr. A. Coumont, RTMA Headquarters, Suite 800, Wyatt Bldg., 777 — 14th Street, N.W., Washington, D.C.

Time Is Money

It is not easy to convince television technicians that it is very important to check the contents of service manuals in order to ascertain the variations made in chassis during different production runs. This has been a matter of grave concern for years, and with the expanding television market, it is prone to become even more so. It is understandable that changes are made during the production of a receiver. Quite frequently a change in one component necessitates changes in other components. Finally variations of this kind do not necessarily give rise to different chassis numbers in all instances.

The possibility of facing such situations is a daily occurence. The only answer is to devote a few minutes to the examination of the service information in order to establish whether or not only one version of the chassis was produced, or if differences between the chassis on the bench and the schematic may be expected. Time spent this way is not wasted; just the reverse, it can save a great deal of time in the long run.

For instance vertical output tubes have been changed during production runs, and this called for a change in the vertical output transformer. In other instances the horizontal output transformer was changed, and it called for a new yoke and a new width coil. As many as four or five different speakers may be used with a series of chassis used in different cabinet models . . . These are just a few of hundreds of examples. There just is no way of getting around the necessity for having complete data about the contents of the receiver chassis, and using it to the fullest extent. And this — before the service job is tackled. Let's remember that "haste does make waste".

John F. Rider

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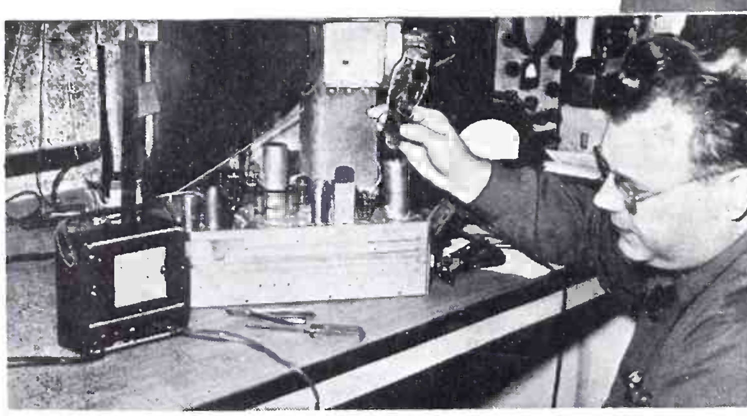

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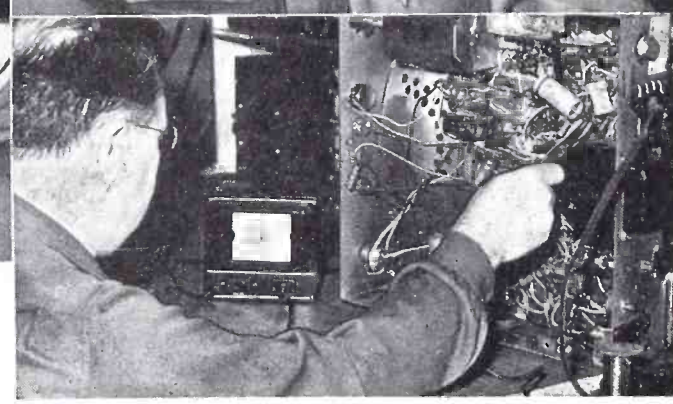

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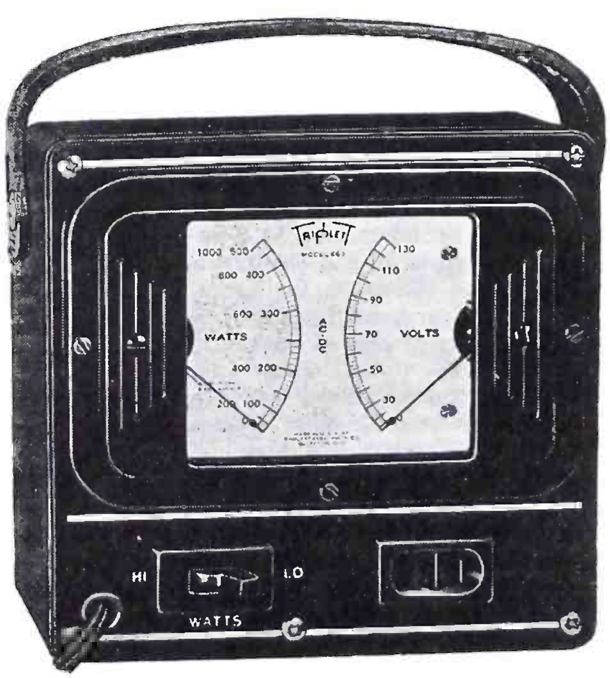

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Replacement Parts in TV Receivers

(Part 1-Capacitors con'td)

This is the fifth in a series of articles on "Replacement Parts in TV Receivers." "Capacitors" will be continued next month.

by John F. Rider

Operating and Test Voltage Rating

Operating and test voltage ratings of solid dielectric capacitors make a long story. A variety of details are involved. Space limitations do not allow a complete discussion. Therefore this series simply highlights those parts which have a bearing on the problem of replacement of capacitors in television and other receivers.

All mica, ceramic, and paper dielectric capacitors bear two values of voltage rating as electrical constants of the device. One of these is the *operating* or *working* voltage rating and the other is the *test* voltage rating. The electrolytic variety of capacitor also bears a working voltage rating, but because of its behavior, this type of capacitor requires the consideration of more than just voltage rating when determining the suitability of a unit for a certain application. So for the moment we shall hold discussion in abeyance and speak about the other kinds of dielectric units.

The working voltage rating is a d-c value which expresses the maximum d-c voltage that can be applied for continuous duty without fear of puncturing the dielectric. By the same token, it expresses the *peak* value of continuous duty a-c voltage which may be applied without fear of puncturing the dielectric. In this connection, the frequency is a factor; it being the characteristic behavior of a capacitor to heat more as the frequency is increased, and in so doing, reduce the limit of the working voltage.

The magnitude of voltages at very high and ultra-high frequencies encountered in television receivers is relatively low, hence frequency is not a concern with respect to the meaning of the working voltage ratings of solid dielectric capacitors used in such equipment. Therefore the only concern stemming from the working voltage rating is to see that the rating is high enough for the d-c operating voltages present in the circuit where the capacitor is used; also for the peak a-c voltages in those circuits where they occur at substantial levels. Examples of the latter are the capacitors used across deflecting-yoke windings, the high-voltage rectifier, linearity coils, width coils, etc. in general, in association with components found in the vertical and horizontal output systems.

Standardized Working Voltage Ratings. As to capacitor types, working voltage ratings have been somewhat standardized. The usual run of mica and ceramic dielectric capacitors are rated at 500 volts d-c working voltage, but to suit the needs of the television receiver, the former is available in voltage ratings up to about 3,000 volts d.c., and the latter up to ratings of 20,000 volts d.c. Some micas are available in working voltage ratings as low as 300 volts d.c.

Paper dielectric capacitors likewise are available in a range of d-c working voltage ratings, beginning at 100 volts d.c. and extending up to several thousand volts. Some receivers use paper dielectric capacitors rated at 25 and 50 volts d-c working voltage. Replacement with 100 volt d-c working voltage ratings is acceptable, sometimes even higher if it is a matter of convenience. All varieties of capacitive units are manufactured with voltage ratings in excess of those mentioned herein, but we are concerned only with those which examplify original and replacement components for television receivers.

Inasmuch as the working voltage rating of a capacitor has a great bearing on its operating life, and possibly on the life of the other equipment used with it, it is imperative that strict attention be paid to the working voltage rating when replacements are made. Under all circumstances replacements should never be rated lower than the original component in working voltage; a higher rating is alright, but never lower. This is the safest line of action.

The Test Voltage Rating. The d-c test voltage rating is self explanatory in its meaning. It is a higher figure than the voltage by from 70 to 150%. It is applied for a very short period, from 30 seconds to perhaps two minutes, as a part of the testing routine after manufacture. The important point to be made is that the d-c test voltage rating should *not* be used as an indicator of the continuous duty d-c working voltage capability. The fact that a capacitor can stand up under the short period application of a test voltage does not imply that it can be used at that figure for long periods. It is a very unsafe risk, even in an emergency. Special caution is voiced relative to the capacitors which are used in circuits where pulse voltages are prominent, and wherein an interruption of the circuit functioning, as for example when the receiver is turned off, may result in a momentary rise in voltage beyond that normally encountered, and endanger the component.

Electrolytic Capacitors. Electrolytic capacitors also bear d-c working voltage ratings. They express the maximum continuous d-c voltage which can be applied across the capacitor when it is operated within its rated temperature limits. In addition a surge voltage rating, usually about 50% higher than the working voltage in the low values up to about 100 volts, and from 10 to 15% higher than the working voltage rating in working voltage ratings between 150 and 500 volts, also is assigned. It expresses the maximum momentary voltage which the capacitor can withstand without damage. It is a factor in the application of this kind of capacitor in power supplies. When first turned on, and before the full current drain develops across the power supply, a momentary high surge voltage appears across the filter system. Bleeders minimize this effect, but it exists nevertheless.

Still another item of interest is the a-c ripple rating. The utility of an electrolytic capacitor is influenced by the amount of a-c voltage (ripple) which is present in the composite voltage that is applied across the capacitor, especially when it is used in a power-rectifying filter system. This information in specific figures appears in capacitor manufacturers' catalogs, and is one of the many important details which must receive attention when selecting recommendations for replacements.

The a-c ripple tends to deform the electrolytic film and if the ripple present across the capacitor exceeds the figure considered in the design of the unit it can damage the unit. The peak a-c ripple voltage plus the d-c voltage rating equal the peak voltage rating of the capacitor. This is a

(Continued on page 10)

Image Frequencies in Superhets

(Continued from page 3)

tuned, the image frequency will always be higher, by twice the intermediate frequency, than the desired signal frequency. And, on the other hand, when the set oscillator functions at a frequency which is lower than that of the desired signal, the image will likewise be lower in frequency than that of the desired signal.

One point which deserves particular attention in this analysis is that image frequency has nothing to do with harmonics. While interference can also be produced due to harmonics of the oscillator beating with undesired signals, this type of interference is not due to image frequency response.

The extent to which interference is produced because of image response will depend upon the strength of the interfering signal, the rejection of the input circuit, the intermediate frequency employed in the receiver, and the percentage difference in frequency between the image and the desired signal. Thus, when the intermediate frequency is 450 kc, the image frequency differs from the desired signal by 900 kc; when the i.f. is 175 kc, the image frequency is only 350 kc removed from the desired signal frequency. When the receiver is tuned to 550 kc, at the low frequency end of the standard broadcast band, and the i.f. is 450 kc, the image frequency occurs at 1,450 kc, the high frequency end of the band. The percentage difference in frequency in this instance is large. But, when the receiver is tuned to 20,000 kc under the same conditions, the image frequency at 20,900 kc differs but little in percentage from that of the desired signal. Accordingly, interference due to this cause will be much worse on shortwave bands than on the standard broadcast band.

Alignment Checks of Image Frequency

The fact that the local oscillator on shortwave bands can often be tuned to a frequency which differs from that of the desired signal by the i.f., but in the wrong direction, makes it desirable to check the alignment by making certain that the image response occurs at the proper point.

Thus when the receiver is to be aligned at 18 mc, the oscillator will normally be tuned to 18,450 kc, (if the intermediate frequency is 450 kc). But if the trimmer is screwed down too far, the oscillator frequency may be changed to 17,550 kc, which will likewise produce the required 450-kc i.f. when an 18-mc signal is tuned in.

To make certain the receiver oscillator is properly adjusted, after aligning at 18 mc, tune the test oscillator to 18,900 kc (or whatever frequency which is twice the i.f. higher than that frequency to which the receiver is tuned) and without changing any of the adjustments, note if a signal response is obtained. If the oscillator is adjusted to a frequency which is higher than that to which the set is tuned, the response should be obtained. If the set oscillator is adjusted to a frequency below that of the incoming signal, no response will result.

Image Ratio

When a receiver is tuned to a given frequency, the ratio of the input signal voltage at the image frequency to that required at the frequency to which the receiver is tuned is called the *image ratio.*

For example, suppose the receiver is tuned to 1,000 kc and the i.f. is 450 kc. Assume that a 10-microvolt signal at 1,000 kc produces a 50 milliwatt output at the receiver voice coil. Then, if a 10,000-microvolt signal is required at the image frequency of 1,900 kc to produce the same output while the receiver is tuned to 1,000 kc, the image ratio is 10,000/10 or 1,000. This voltage ratio can be expressed as 60 db.

Curves showing how the image ratio becomes lower as the frequency to which the receiver is tuned is increased are shown in Fig. 2. In this graph, Curve A is representative of the image ratios secured when an r-f stage is used ahead of the mixer in a high-grade receiver, while Curve B shows the lower image ratios which result when no r-f stage is employed.

In Curve A, the image ratio resulting when the receiver is tuned to 1,200 kc is 106 db, corresponding to a voltage ratio of 200,000 to 1. That is, the signal input at the image frequency must be 200,000 times that required at the frequency to which the receiver is tuned, to produce the same output. This ratio decreases on the higher frequency bands, because of the relatively small percentage difference in frequency between the image frequency and the desired signal frequency on such bands. At 12 mc, the image ratio is 43 db, or 140 to 1, while at 36 mc it is only 11db, or 3.5 to 1.

The improvement resulting from the use of an r-f stage is much more evident at frequencies in the broadcast band than at higher frequencies. As shown in Curve B, the image ratio secured with a representative receiver employing no r-f stage is 34 db, or 50 to 1, at 1,200 kc compared with 200,000 to 1 which is obtained with a receiver employing an r-f stage, over 4,000 times as great. Yet at 12 mc, where the image ratio on Curve B is 20 db, or 10 to 1, that obtained with the receiver employing the r-f stage is 140 to 1 at this frequency; only 14 times better. The improvement decreases more rapidly at still higher frequencies.

TV Service Training Course Given at Iowa State College

During the weeks of January 26-30 and February 9-13, an intensive course in basic television was given as part of the Engineering Extension Service of Iowa State College in Ames, Iowa under the direction of G. Ross Henninger. This course was designed to provide valuable up-grade technical training for the properly qualified radio or tv technician who has an eye to the future in the rapidly expanding field of television. The cooperative efforts of many interests were assembled at Iowa State College expressly for this course. These included electronics specialists of the Electrical Engineering faculty of the college, representatives of the Service Committee of the *Radio-Television Manufacturer's Association*, representatives of the Iowa Chapter of the *National Electronic Distributors' Association*, and professional TV service technicians actively engaged in business in Iowa. Actual instruction was given by representatives of member-companies of the RTMA as follows:

Peter G. Buttacavoli — Teleset Service Dept.
Allen B. DuMont Labs., Paterson, N. J.

Carl Finzer — TV Service Engineer
Motorola, Inc., Chicago, Ill.

Ray Guichard — Supervisor Publications and Training
Capehart-Farnsworth Corp., Ft. Wayne, Ind.

Richard D. Hershey — TV Service Engineer.
Philco Corp., Philadelphia, Pa.

G. Walter Irvine — District Service Supervisor (Electronics-TV)
General Electric Co., Washington, D.C.

P. A. Kristensen — Electronics Engineer
Engineering Research Associates, St. Paul, Minn.

Wm. H. Nelson — TV Service Engineer
Sylvania Electric Products Co., Buffalo, N. Y.

E. A. Shore — District Service Supervisor (Electronics-TV)
General Electric Co., Kansas City, Mo.

Milton S. Snitzer — Managing Editor, Radio and TV Publications
John F. Rider Publisher, Inc., New York, N. Y.

Dick Szulgit — Field Service Engineer
Motorola, Inc., Chicago, Ill.

Robert Youger — Service Engineer
Crosley Corp., Cincinnati, Ohio

Geo. Troller, Chief Field Service Engineer
Motorola, Inc., Chicago, Ill.

In addition, the following special speakers were heard:

Albert Coumont — Service Coordinator
Radio-Television Mfrs. Assn., Washington, D.C.

(Continued on page 29)

Replacement Parts in TV Receivers

(Continued from page 7)

continuous operating rating and differs from the surge voltage rating, in that it is always less. The higher the value of capacitance, the lower the permissible a-c ripple generally.

The labels on can type electrolytic capacitors state the capacitance, d-c working voltage, and the surge voltage. When recommended as a replacement in the Rider parts listings, the related operating conditions already have been taken into account. Among these factors is another characteristic of electrolytic capacitors, namely leakage current. When a d-c voltage is applied across any capacitor, an initial charging current flows through the unit. After full charge has been reached, only changes in applied voltage cause changing charging currents. In electrolytic type capacitors, a somewhat different situation prevails; the continued application of a d-c voltage results in the flow of a continuous d-c leakage current through the capacitor. The better the capacitor the less the leakage current during operation. As a rule it amounts to from .05 to perhaps .1 or .15 milliampere per microfarad depending on the voltage rating and the capacity. Information of this kind appears in capacitor manufacturers' catalogs rather than on the component labels.

When a receiver manufacturer specifies the requirements of the original electrolytics used in the receiver, he stipulates the normal leakage current per section. The replacement suggestions in the Rider listings conform with the original equipment requirements. The initial leakage current when a receiver is placed into operation usually is higher than after a period of operation. Increase in operating temperature increases the d-c leakage current.

Temperature Coefficient

One of the very prominent factors determining the stability of operation of a television receiver is constancy in frequency sensitive circuits. The resonance condition established in a circuit must be constant if the circuit is to behave properly. Some latitude exists of course, but there are many places in a television receiver where a change of either L or C with temperature can impair the performance. This comes about as the result of an increase in inductance with rising temperature. This is a characteristic of the general run of coils of all kinds. Special forms of construction can minimize these effects, but a much more economical approach to the problem of keeping an L-C circuit constant in frequency with rising temperature, is the use of a temperature compensating capacitor. This gives rise to another constant associated with mica and ceramic capacitors — namely temperature coefficient.

Temperature compensating capacitors are becoming more and more prominent in television receivers. As used, their function is to decrease in capacitance by a specific amount per degree C rise in operating temperature. When used with an inductance in a frequency sensitive circuit, the reduction in capacitance with increasing temperature offsets the increase in effective inductance. Inasmuch as the required change in capacitance often times is small relative to the total capacitance placed across the inductance, it is common practice to form the capacitive portion of the L-C circuit from two capacitors — one of conventional design, and to shunt it with a temperature compensating unit with *negative* temperature coefficient. This is symbolized in Fig. 1.

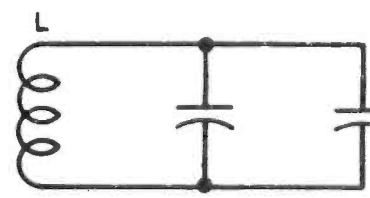


Figure 1.

The total of the two capacitors in shunt is the capacitance effective when the unit is cold; as the operating temperature rises, TC autimatically lowers in value, whereas L increases in value, thus one offsets the other and the frequency remains constant because the LC product is the same constant.

Another frequent application for negative temperature coefficient capacitors is as coupling element in oscillator circuits, or as a part of the tuned circuit as shown in Fig. 2. When it is used as a coupling or feedback link the negative temperature coefficient behavior offsets any increase in the coupled energy as the rise in circuit operating temperature causes an increase in generated signal levels. Temperature compensating capacitors are sometimes used across yoke windings.

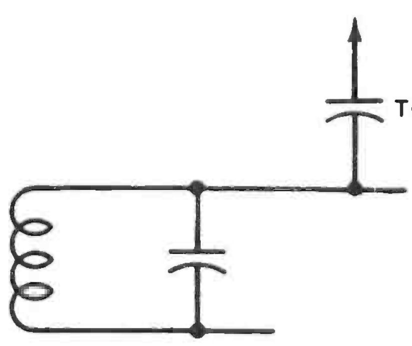


Figure 2.

Regardless of where in a television receiver a temperature compensating capacitor is used, the important point to remember is that replacement must be in kind. Failure to do so can well lead to unnecessary repeat calls and bad public relations. More and more of the receiver manufacturer's service manuals identify these units by temperature compensating characteristics. Wherever such a capacitor is referenced in Rider replacement parts listings, particular mention is made of the temperature coefficient for identification purposes. Where replacements are listed they conform with the requirements of the original equipment.

The specific change in capacitance of a capacitor with changing temperature is expressed by the *temperature cofficient* of the device. By suitable design of the capacitor, its capacitance can be made to increase or decrease in specific amounts with increase in temperature. The former is described as a *positive* temperature coefficient unit, whereas the latter is referred to as a *negative* temperature coefficient capacitor. Because of the positive temperature coefficient behavior of inductances, where temperature compensation is desired in television circuits, a negative temperature coefficient capacitor is employed. These are of main interest to us.

For example a capacitor of 250 $\mu\mu f$ (.00025 μf) ± 10%, and 1,500 volt working voltage rating, is identified by print or color code as having a temperature coefficient of N750. The letter N indicates that the capacitance decreases with increase in temperature. The number 750 after the letter N states that the decrease in capacitance is 750 parts per million per degree C increase. With a million being the base figure, the amount of change per million is the equivalent of a decimal value, for instance, 750 parts per million per degree C = 750/1,000,000 = .00075. Hence for every degree C rise in operating temperature the capacitance decreases .00075 times whatever is its actual value. If the capacitance is 250 $\mu\mu f$ and we neglect the capacitance tolerance for the moment, the decrease in capacitance per degree C rise in temperature is .00075 x 250 or .1875 $\mu\mu f$. If the manner of operation is such that a 30 degree C rise in temperature occurs the total decrease in capacitance is .1875 x 30 or 5.6 $\mu\mu f$. This amounts to 5.6/250 = .0225 or 2.25% change in capacitance. It may not seem like much, but it is important in operation in critical circuits.

It is necessary to stress that the change in capacitance due to the temperature coefficient behavior should not be confused with the capacitance tolerance rating. Neither is the former minimized in importance by whatever may be the capacitance tolerance. The capacitance tolerance reflects the limits of capacitance values suitable for use in a circuit; the temperature coefficient, on the other hand, expresses the required change in capacitance so as to offset other

(Continued on page 23)

Rider · Tek-File Index No. 8

PACKS 1-77

HOW TO USE THIS INDEX

To locate service data instantly, all you need to know is the manufacturer's name and the model or chassis number of the set.

The index is compiled alphabetically, according to manufacturer. Note the column headings at the top of each page: MODEL, PACK-FILE, PAGES.

Model numbers run in numerical sequence, starting with the smallest number under a manufacturer's name. This applies also to model numbers using letters. (i.e. model AR precedes model CG). Model numbers starting with letters precede model numbers starting with numbers.

Under the column PACK-FILE, the first number is the TEK-FILE Pack number, and the second number is the File number.

Under the column headed PAGES, the first and second numbers indicate the page where the information starts, the last number shows where the data is concluded.

As an example, let's look up ADMIRAL model 36X36AS. It shows that the information is in (1-1) Pack No. 1, ADMIRAL, File No. 1. The data (8=23-46) starts on page 8-23 and runs through page 8-46. There is also data on the ADMIRAL record changer model RC 550. It's in (1-RC2) TEK-FILE Pack No. 1, in ADMIRAL Record Changer File No. 2. The data begins on page 21-9 and ends on page 21-16.

If you remove the pages from the TEK-FILE Files and insert them in the TEK-FILE binder, you can disregard the PACK-FILE column and refer to the PAGES only.

ADMIRAL CORP.

MODEL	PACK-FILE	PAGES
4H15A, 4H15B, Ch. 20A1	40-2	4=1-37
4H16A, 4H16B, Ch. 20A1	40-2	4=1-37
4H17A, 4H17B, Ch. 20A1	40-2	4=1-37
4H18C, 4H18CN, Ch. 20B1	40-2	4=1-37
4H19C, 4H19CN, Ch. 20B1	40-2	4=1-37
4H126A, 4H126B, Ch. 21A1	40-2	4=1-37
4H126C, 4H126CN, Ch. 21A1	40-2	4=1-37
4H137A, 4H137B, Ch. 21A1	40-2	4=1-37
4H145A, 4H145B, Ch. 20B1	40-2	4=1-37
4H145C, 4H145CN, Ch. 20B1	40-2	4=1-37
4H146A, 4H146B, Ch. 20B1	40-2	4=1-37
4H146C, Ch. 20B1	40-2	4=1-37
4H147A, 4H147B, Ch. 20B1	40-2	4=1-37
4H156C, 4H156CN, Ch. 20B1	40-2	4=1-37
4H157A, 4H157B, Ch. 20B1	40-2	4=1-37
4H165A, 4H165B, Ch. 20B1	40-2	4=1-37
4H166A, 4H166B, Ch. 20B1	40-2	4=1-37
4H166C, 4H166CN, Ch. 20B1	40-2	4=1-37
4H167A, 4H167B, Ch. 20B1	40-2	4=1-37
4H167C, 4H167CN, Ch. 20B1	40-2	4=1-37
12X11, 12X12, Ch. 20Z1	40-2	4=38-62 5=8-9
14R12, 14R16, Ch. 20T1, Rev.	1-1	6=1-22
16M12, Ch. 21X1	57-4	10=29-46
16R11, 16R12, Ch. 21B1	1-1	8=23-46
20A1, 20B1, Ch.	40-2	4=1-37
20T1, 20V1, Ch., Rev.	1-1	8=1-22
20X1, Ch.	40-2	4=38-62
20X11, 20X12, Ch. 20X1	40-2	4=38-62
20X122, Ch. 20X1	40-2	4=38-62
20X136, Ch. 20Y1	40-2	4=38-62
20X145, 20X146, 20X147, Ch. 20Y1	40-2	4=38-62
20Y1, Ch.	40-2	4=38-62
20Z1, Ch.	40-2	4=38-62 5=8-9
21A1, Ch.	40-2	4=1-37
21B1, 21C1, 21D1, 21E1, Ch.	1-1	8=23-46
21H1, 21J1, Ch.	1-1	8=23-46
22X12, Ch. 20Z1	40-2	4=38-62 5=8-9
22X25, 22X26, 22X27, Ch. 20Z1	40-2	4=38-62 5=8-9
24A12, Ch. 20A1	40-2	4=1-37
24A125, Ch. 20A1	40-2	4=1-37
24A125AN, Ch. 20X1	40-2	4=38-62
24C15, 24C16, Ch. 20B1	40-2	4=1-37
24D1, 24E1, 24F1, 24G1, 24H1, Ch.	48-3	7=1-24
24R12, Ch. 20T1, Rev.	1-1	8=1-22
24X15, 24X15S, Ch. 20X1	40-2	4=38-62
24X16, 24X16S, Ch. 20X1	40-2	4=38-62
24X17S, Ch. 20X1	40-2	4=38-62
25A15, 25A16, 25A17, Ch. 21A1	40-2	4=1-37
26R12, Ch. 21B1	1-1	8=23-46
26R25, 26R26, Ch. 24H1	48-3	7=1-24
26R25A, 26R26A, Ch. 21B1	1-1	8=23-46
26R35, 26R36, 26R37, Ch. 24H1	48-3	7=1-24

ADMIRAL CORP. (Cont'd)

MODEL	PACK-FILE	PAGES
26R35A, 26R36A, 26R37A, Ch. 21B1	1-1	8=23-46
26X35, 26X36, 26X37, Ch. 24D1	48-3	7=1-24
26X45, 26X46, Ch. 24H1	48-3	7=1-24
26X55, 26X56, 26X57, Ch. 24D1	48-3	7=1-24
26X55A, 26X56A, 26X57A, Ch. 21D1	1-1	8=23-46
26X65, 26X66, 26X67, Ch. 24D1	48-3	7=1-24
26X65A, 26X66A, 26X67A, Ch. 21D1	1-1	8=23-46
26X75, 26X76, Ch. 24D1	48-3	7=1-24
26X75A, 26X76A, Ch. 21D1	1-1	8=23-46
27M12, Ch. 21X2	57-4	10=29-46
29X16, 29X17, Ch. 24F1	48-3	7=1-24
29X25, 29X26, 29X27, Ch. 24F1	48-3	7=1-24
29X25A, 29X26A, Ch. 21H1	1-1	8=23-46
30F15, 30F15A, Ch. 20B1	40-2	4=1-37
30F16, 30F16A, Ch. 20B1	40-2	4=1-37
30F17, 30F17A, Ch. 20B1	40-2	4=1-37
32X15, 32X16, Ch. 20Z1	40-2	4=38-62 5=8-9
32X26, 32X27, Ch. 20Z1	40-2	4=38-62 5=8-9
32X35, 32X36, Ch. 20Z1	40-2	4=38-62 5=8-9
34R15, 34R15A, 34R16, 34R16A, Ch. 20V1, Rev.	1-1	8=1-22
Record Changer ADMIRAL RC500	1-RC1	RCH21=1-8
36R37, 36R45, 36R46, Ch. 21C1	1-1	8=23-46
Record Changer ADMIRAL RC500	1-RC1	RCH21=1-8
ADMIRAL RC550	1-RC2	RCH21=9-16
36X35, 36X35A, Ch. 24E1	48-3	7=1-24
Record Changer ADMIRAL RC500	1-RC1	RCH21=1-8
ADMIRAL RC550	1-RC2	RCH21=9-16
36X36, 36X36A, Ch. 24E1	48-3	7=1-24
Record Changer ADMIRAL RC500	1-RC1	RCH21=1-8
ADMIRAL RC550	1-RC2	RCH21=9-16
36X36AS, 36X36S, Ch. 21E1	1-1	8=23-46
Record Changer ADMIRAL RC550	1-RC2	RCH21=9-16
36X37, 36X37A, Ch. 24E1	48-3	7=1-24
Record Changer ADMIRAL RC500	1-RC1	RCH21=1-8
ADMIRAL RC550	1-RC2	RCH21=9-16
37M25, 37M26, 37M27, Ch. 21Z1	57-4	10=29-46
39X16, 39X16A, 39X16B, Ch. 24G1	48-3	7=1-24
Record Changer ADMIRAL RC500	1-RC1	RCH21=1-8
ADMIRAL RC550	1-RC2	RCH21=9-16
39X17A, 39X17B, Ch. 24G1	48-3	7=1-24
Record Changer ADMIRAL RC500	1-RC1	RCH21=1-8
ADMIRAL RC550	1-RC2	RCH21=9-16

ADMIRAL CORP. (Cont'd)

MODEL	PACK-FILE	PAGES
39X17C, Ch. 21J1	1-1	8=23-46
Record Changer ADMIRAL RC550	1-RC2	RCH21=9-16
39X25, 39X26, Ch. 24G1	48-3	7=1-24
Record Changer ADMIRAL RC550	1-RC2	RCH21=9-16
39X25A, 39X26A, Ch. 21J1	1-1	8=23-46
Record Changer ADMIRAL RC550	1-RC2	RCH21=9-16
39X35, 39X36, Ch. 21J1	1-1	8=23-46
Record Changer ADMIRAL RC550	1-RC2	RCH21=9-16
47M15, Ch. 21W1	57-4	10=14-28
47M15A, Ch. 21Z1	57-4	10=29-46
47M16, 47M17, Ch. 21W1	57-4	10=14-28
47M35, 47M36, 47M37, Ch. 21Z1	57-4	10=29-46
57M10, 57M11, 57M12, Ch. 21Z1A	57-4	10=29-46
57M16, 57M17, Ch. 21Z1	57-4	10=29-46
121K15, 121K16, 121K17, Ch. 21M1	57-4	10=14-28
121K15A, 121K16A, 121K17A, Ch. 22M1	57-4	10=1-13
121M10, Ch. 22M1	57-4	10=1-13
121M11, 121M12, Ch. 21M1	57-4	10=14-28
121M11A, 121M12A, Ch. 22M1	57-4	10=1-13
221K45, 221K46, 221K47, Ch. 21M1	57-4	10=14-28
221K45A, 221K46A, 221K47A, Ch. 22M1	57-4	10=1-13
320R17, Ch. 21J1	1-1	8=23-46
Record Changer ADMIRAL RC550	1-RC2	RCH21=9-16
320R25, 320R26, Ch. 21J1	1-1	8=23-46
Record Changer ADMIRAL RC550	1-RC2	RCH21=9-16
321F65, 321F66, 321F67, Ch. 21N1	57-4	10=14-28
321K65, 321K66, 321K67, Ch. 21N1	57-4	10=14-28
321M25, 321M26, 321M27, Ch. 21Y1	57-4	10=14-28
321M25A, 321M26A, 321M27A, Ch. 22Y1	57-4	10=1-13
421M15, 421M16, Ch. 21Y1	57-4	10=14-28
421M35, 421M36, 421M37, Ch. 22Y1	57-4	10=1-13
520M11, 520M12, Ch. 22A2A	57-4	10=1-13
520M15, 520M16, 520M17, Ch. 22A2	57-4	10=1-13
521M15, 521M16, 521M17, Ch. 21Y1	57-4	10=14-28
521M15A, 521M16A, 521M17A, Ch. 22Y1	57-4	10=1-13

AFFILIATED RETAILERS, INC. (ARTONE)

MODEL	PACK-FILE	PAGES
AR-MST-14, AR-MST-16	48-3	6=1-9
AR-14-LG, AR-14-P	1-1	8=1-12
AR-14-TR	48-3	6=1-9
AR-16-ATR	48-3	6=1-9
AR-16-CD, AR-16-CD-3CR	40-2	5=1-8
AR-16-CR	48-3	6=1-9
AR-16-CX	40-2	5=1-8
AR-16-RO, AR-16-TR	48-3	6=1-9
AR-17-3D	48-3	6=1-9
AR-17-3DG	1-1	8=1-12
AR-17-CD	48-3	6=1-9
AR-17-CDG	1-1	8=1-12
AR-17-CR	48-3	6=1-9
AR-17-CRG	1-1	8=1-12
AR-17-LG, AR-17-P	1-1	8=1-12
AR-17-RO	48-3	6=1-9
AR-17-ROG	1-1	8=1-12
AR-20-3DG, AR-20-CDG, AR-20-CRG, AR-20-TRG	1-1	8=1-12
AR-112X	48-3	6=10-16
AR-114A	48-3	6=1-9

AFFILIATED RETAILERS, INC. (Cont'd)

MODEL	PACK-FILE	PAGES
AR-163-CR	40-2	5=1-8
AR-216	40-2	5=1-8
AR-316, AR-316-3CM	40-2	5=1-8
AR-816	40-2	5=1-8
AR-816-3CM, AR-816-3CR	40-2	5=1-8
AR-819, AR-819-3CM	40-2	5=1-8 7=1
AR-919	40-2	5=1-8 7=1

AIMCEE WHOLESALE CORP. (AMC)

MODEL	PACK-FILE	PAGES
117C, 117CD, 117T	57-1	10=1-10

AIR KING PRODUCTS CO., INC.

MODEL	PACK-FILE	PAGES
12C1, Ch. 700	43-1	7=1-24
12T1, 12T2, Ch. 700	43-1	7=1-24
14T1, Ch. 700-30	43-1	7=1-24
16C1, Ch. 700-1, 700-10, 700-90	43-1	7=1-24
16C2, 16C3, Ch. 700-10	43-1	7=1-24
16C5, Ch. 700-10, 700-90	43-1	7=1-24
16K1, Ch. 700-2, 700-50, 700-92	43-1	7=1-24
16M1, Ch. 700-10, 700-90	43-1	7=1-24
16T1, Ch. 700-1, 700-10	43-1	7=1-24
16T1B, Ch. 700-1, 700-10, 700-90	43-1	7=1-24
19C1, Ch. 700-40, 700-91	43-1	7=1-24
20C1, 20C2, Ch. 700-93	43-1	7=1-24
20K1, Ch. 700-95	43-1	7=1-24
20M1, Ch. 700-90, 700-93	43-1	7=1-24
700, 700-1, 700-2, 700-5, Ch.	43-1	7=1-24
700-10, 700-20, 700-30, 700-40, 700-50, Ch.	43-1	7=1-24
700-90, 700-91, 700-92, 700-93, 700-95, Ch.	43-1	7=1-24

AIRLINE

See MONTGOMERY WARD

AIR MARSHAL CORP.

MODEL	PACK-FILE	PAGES
B-17-T	43-1	7=1-4

ALLIANCE MFG. CO.

MODEL	PACK-FILE	PAGES
AB, Booster	43-1	7=1

ALLIED PURCHASING CORP. (AMBASSADOR)

MODEL	PACK-FILE	PAGES
AM17C, AM17C1M, See STARRETT Ch. 12S1	75-1	10=1-8
AM17T, AM17T1M, See STARRETT Ch. 12S1	75-1	10=1-8
AM20C, AM20T, See STARRETT Ch. 12S1	75-1	10=1-8
C1720, C2020, C2420, CD2020, See TRAD T-20E Series	54-1	9=1-16
PL17C, PL17CB, PL17CG, See STARRETT Ch. 12S1	75-1	10=1-8
PL17TG, PL17TM, PL27CD, See STARRETT Ch. 12S1	75-1	10=1-8
T1720, T2020, See TRAD T-20E Series	54-1	9=1-16
20C23P, See STARRETT Ch. 12S1	75-1	10=1-8

ANCHOR RADIO CORP.

MODEL	PACK-FILE	PAGES
ARC-101-75, ARC-101-100	43-1	7=1-3

ANDREA RADIO CORP.

MODEL	PACK-FILE	PAGES
Brewster	43-1	9=1-4
Caronia, Fleetwood	43-1	6=1-10
Gotham	43-1	9=1-4

ANDREA RADIO CORP. (Cont'd)

MODEL	PACK-FILE	PAGES
Mayfield	43-1	6-1-10
Saybrook	43-1	6-1-10
Stratford	58-2	10-1-8
Sutton	43-1	6-1-10
Warwick	43-1	9-1-4
C-VL16, Ch. VL16, Sutton	43-1	6-1-10
C-VL17, Ch. VL17, Brewster	43-1	9-1-4
CO-VL16, Ch. VL16, Fleetwood	43-1	6-1-10
CO-VL19, Ch. VL19, Caronia	43-1	6-1-10
T-VL12, Ch. VL12, Saybrook	43-1	6-1-10
T-VL16, Ch. VL16, Mayfield	43-1	6-1-10
T-VL17, Ch. VL17, Gotham	43-1	9-1-4
VL12, VL16, Ch.	43-1	6-1-10
VL17, Ch.	43-1	9-1-4
VL19, Ch.	43-1	6-1-10
VL-20, Ch.	58-2	10-1-8
2C-VL17, Ch. VL17, Warwick	43-1	9-1-4
2C-VL20, Ch. VL-20, Stratford	58-2	10-1-8

ARTONE

See AFFILIATED RETAILERS, INC.
Also See MACY'S

ARVIN INDUSTRIES, INC.

MODEL	PACK-FILE	PAGES
TE272-1, TE272-2, Ch.	43-2	6-1-9
TE276, Ch.	43-2	6-1-9
TE282, Ch.	43-2	8-13-18
TE 286, Ch.	1-1	8-4-6
TE289, Ch.	43-2	8-10-12
TE-289-2, Ch.	1-1	8-1-3
TE289-3, Ch.	43-2	7-1-4
TE290, Ch.	43-2	7-5-8
TE300, Ch.	43-2	9-1-8
TE-302, Ch.	1-1	8-6-8
TE-302-1, Ch.	1-1	8-6
		8-9-10
TE315, TE315-1, TE315-2, Ch.	43-2	9-1-8
TE 331, Ch.	58-3	10-1-4
2120, 2121, Ch. TE289-3	43-2	7-1-4
2120CM, 2121TM, Ch. TE-289-2	1-1	8-1-3
2122TM, Ch. TE289	43-2	6-10-12
2123, Ch. TE289-3	43-2	7-1-4
2123TM, Ch. TE-289-2	1-1	8-1-3
2124, Ch. TE289-3	43-2	7-1-4
2124CCM, Ch. TE-289-2	1-1	8-1-3
2126, Ch. TE289-3	43-2	7-1-4
2126CM, Ch. TE-289-2	1-1	8-1-3
2160, 2161, 2162, 2164, Ch. TE290	43-2	7-5-8
3100TB, 3100TM, Ch. TE272-1	43-2	6-1-9
3101CM, Ch. TE272-1	43-2	8-1-9
3120CB, 3120CM, Ch. TE272-2	43-2	6-1-9
3121TM, Ch. TE272-2	43-2	6-1-9
3160CM, Ch. TE276	43-2	6-1-9
4080T, Ch. TE282	43-2	8-13-18
4162, Ch. TE 286	1-1	8-4-6
5170, Ch. TE-302	1-1	8-6-8
5170, Ch. TE-302-1	1-1	8-6
		8-9-10
5171, Ch. TE-302	1-1	8-6-8
5171, Ch. TE-302-1	1-1	8-6
		8-9-10
5172, Ch. TE-302	1-1	8-6-8
5172, 5173, Ch. TE-302-1	1-1	8-6
		8-9-10
5204, 5206, Ch. TE300	43-2	9-1-8
5210, 5211, 5212, Ch. TE315, TE315-1, TE315-2	43-2	9-1-8
6175TM, 6179TM, Ch. TE 331	58-3	10-1-4

ASTORIA

See MACY'S

AUTOMATIC RADIO MFG. CO., INC.

MODEL	PACK-FILE	PAGES
TV-5217, TV-5217T	58-1	10-1-6

BELMONT

See RAYTHEON TELEV. & RADIO CORP.

BENDIX RADIO DIV.

MODEL	PACK-FILE	PAGES
Belair, Guilford	48-2	7-1-9
C172, Belair	48-2	7-1-9
OAK3	58-3	10-1-12
*C182	48-2	7-1-9
C200, Guilford	48-2	7-1-9
T170	27-1	5-1-11
*T171	48-2	7-1-9
21K3, 21KD, 21T3, 21X3	58-3	10-1-12
2051	27-1	5-1-11
2060, 2070	27-1	5-1-11
3051	27-1	5-1-11
6001, 6003	27-1	5-1-11
6100	27-1	5-1-14
7001	27-1	5-1-11

BENRAY ELECTRONICS CORP. (SURREY)

MODEL	PACK-FILE	PAGES
17T31, 20T31, 24T31, See VIDEO PRODUCTS 630 Series	69-1	10-1-12
621-20, 621-16, See TRAD T-20E Series	54-1	9-1-16

CADILLAC ELECTRONICS CORP.

MODEL	PACK-FILE	PAGES
F-16	2-1	8-1-8

CBS-COLUMBIA INC.

Also See AIR KING PRODUCTS CO., INC.

MODEL	PACK-FILE	PAGES
17C18, 17M18, 17T18, Ch. 817	59-1	10-1-5
20M18, 20M28, 20T18, Ch. 820	59-1	10-1-5
817, 820, Ch.	59-1	10-1-5

CAPEHART-FARNSWORTH CORP.

MODEL	PACK-FILE	PAGES
C-278, C-279, Ch.	27-1	7-1-13
C-281, Ch.	27-1	5-1-12
CT-27, Ch. CX-33DX	27-1	9-1-4
CT-37, CT-38, CT-39, Ch. CX-33DX	27-1	9-1-4
CT-45, Ch. CX-33DX	27-1	9-1-4
CT52, CT57, CTR68, Ch., Prelim.	59-2	10-1-10
CX-32, Ch.	27-1	7-1-13
CX-33, Ch.	27-1	5-1-12
CX-33DX, Ch.	27-1	9-1-4
CX-36, Ch., Prelim.	59-2	10-1-10
1T172M, 2C172M, Ch. CT52, CX-36, Prelim.	59-2	10-1-10
3C212B, 3C212M, Ch. CT57, CX-38, Prelim.	59-2	10-1-10
4H212B, 4H212M, Ch. CT57, CX-36, Prelim.	59-2	10-1-10
5F212M, 6F212B, 7F212M, 8F212B, 9F212M, Ch. CT57, CX-36, Prelim.	59-2	10-1-10
10W212M, Ch. CTR68, CX-36, Prelim.	59-2	10-1-10
3005-M, Ch. C-279, CX-32	27-1	7-1-13
3008-M, Ch. C-278, CX-32	27-1	7-1-13
3011-B, 3011-M, Ch. C-281, CX-33	27-1	5-1-12
3012-B, 3012-M, Ch. C-281, CX-33	27-1	5-1-12

CONRAC, INC.

MODEL	PACK-FILE	PAGES
27-M-40, 27-W-40, Ch. 40, 44	2-1	8-1-3
28-B-40, 29-P-40, Ch. 40, 44	2-1	8-1-3
30-M-40, 30-W-40, Ch. 40, 44	2-1	8-1-3
31-P-40, Ch. 40, 44	2-1	8-1-3
40, 44, Ch.	2-1	8-1-3

* See HANDY.

CORONADO

See GAMBLE-SKOGMO, INC

COVIDEO, INC.

MODEL	PACK-FILE	PAGES
T-1400	2 1	8-1-4

CROSLEY DIV. AVCO MFG. CORP.

MODEL	PACK-FILE	PAGES
DU-17CDB, Ch. 356-1	2-1	8-13-17
DU-17CDB, Ch. 356-3, 356-4	59-5	10-1-4
DU-17CDM, Ch. 356-1	2-1	8-13-17
DU-17CDM, Ch. 356-3, 356-4	59-5	10-1-4
DU-17CHB, Ch. 356-3, 356-4	59-5	10-1-4
DU-17CHM, Ch. 356-1	2-1	8-13-17
DU-17CHM, Ch. 356-3, 356-4	59-5	10-1-4
DU-17CHN, Ch. 356-1	2-1	8-13-17
DU-17CHN, DU-17CHN1, Ch. 356-3, 356-4	59-5	10-1-4
DU-17COB, Ch. 356-1	2-1	8-13-17
DU-17COB, DU-17COL, DU-17COLa, Ch. 356-3, 356-4	59-5	10-1-4
DU-17COM, Ch. 356-1	2-1	8-13-17
DU-17COM, Ch. 356-3, 356-4	59-5	10-1-4
DU-17PDB, DU-17PDM, Ch. 359	17-3	9-5-10
Record Changer CROSLEY V-950	17-RC1	RCH 9-1-16
DU-17PHB, DU-17PHM, DU-17PHN, DU-17PHN1, Ch. 359	17-3	9-11-16
Record Changer CROSLEY V-950	17-RC1	RCH 9-1-16
DU-17TOB, Ch. 356-1	2-1	8-13-17
DU-17TOB, Ch. 356-3, 356-4	59-5	10-1-4
DU-17TOL, Ch. 356-1	2-1	8-13-17
DU-17TOL, DU-17TOL1, DU-17TOL2, Ch. 356-3, 356-4	59-5	10-1-4
DU-17TOM, Ch. 356-1	2-1	8-13-17
DU-17TOM, Ch. 356-3, 356-4	59-5	10-1-4
DU-20CDM, DU-20CHB, DU-20CHM, DU-20COB, DU-20COM, Ch. 357	17-3	9-1-4
DU-20PDM, Ch. 363	17-3	9-17-22
Record Changer CROSLEY V-950	17-RC1	RCH 9-1-16
DU-21CDM1, DU-21CDN, DU-21CHM1, Ch. 357-1	59-5	10-5-8
DU-21COB1, DU-21COL, DU-21COLB, DU-21COM1, Ch. 357-1	59-5	10-5-8
EU-17COL, EU-17COLB, Ch. 385	59-5	10-9-16
EU-17COM, Ch. 360	59-5	10-17-24
EU-17TOB, Ch. 380	59-5	10-17-24
EU-17TOLa, EU-17TOLB, Ch. 385	59-5	10-9-16
EU-17TOM, Ch. 380	59-5	10-17-24
EU-21CDB, EU-21CDM, EU-21CDN, Ch. 381	59-5	10-17-24
EU-21COBa, Ch. 381	59-5	10-17-24
EU-21COLd, Ch. 386	59-5	10-9-16
EU-21COLe, Ch. 387	59-5	10-9-16
EU-21COLBd, Ch. 386	59-5	10-9-16
EU-21COLBe, Ch. 387	59-5	10-9-16
EU-21COMa, Ch. 381	59-5	10-17-24
EU-21TOL, EU-21TOLB, Ch. 386	59-5	10-9-16
S11-442M1U, Ch. 331-4	2-1	8-18-23
S11-444MU, Ch. 331-4	2-1	8-18-23
Record Changer CROSLEY V-950	2-RC1	RCH 9-1-16
S11-447MU, Ch. 321-4	2-1	8-24-29
S11-453MU, Ch. 331-4	2-1	8-18-23
S11-459MU, Ch. 321-4	2-1	8-24-29
S11-472BU, Ch. 331-4	2-1	8-18-23
S11-474BU, Ch. 331-4	2-1	8-18-23
Record Changer CROSLEY V-950	2-RC1	RCH 9-1-16

CROSLEY DIV. (Cont'd)

MODEL	PACK-FILE	PAGES
S17-CDC1, S17-CDC3, S17-CDC4, Ch. 331-4	2-1	8-18-23
S17COC1, S17COC2, S17COC3, Ch. 331-4	2-1	8-18-23
S20-CDC1, S20-CDC2, S20-CDC3, Ch. 323-6	2-1	8-30-35
9-422M-LD	17-2	5-1-13
9-423M-LD	17-2	5-14-24
Record Changer CROSLEY 700F-33/45	17-RC2	RCH 9-17-24
10-401	17-2	5-25-36
10-404MU, 10-404M1U	18-4	6-1-4
10-412MU	18-4	6-1-4
10-414MU	17-2	5-37-41
10-416MU, 10-416M1U	17-2	5-37-41
10-418MU	18-4	6-1-4
10-419MU	17-2	5-42-46
10-421MU	18-4	6-5-9
10-428MU	18-4	6-10-14
10-429MU	17-2	5-37-41
11-441MU, Ch. 320	18-4	6-15-26
11-442M1U, Ch. 331	18-4	6-27-34
11-443MU, Ch. 323	18-4	6-35-40
11-444MU, Ch. 331	18-4	6-27-34
Record Changer CROSLEY V-950	18-RC1	RCH 9-1-16
11-453, Ch. 331	18-4	6-27-34
11-454MU, Ch. 323	18-4	6-35-40
11-458MU, Ch. 323	18-4	6-35-40
11-460MU, Ch. 331	18-4	6-27-34
11-461WU, Ch. 320	18-4	6-15-26
11-470BU, Ch. 331	18-4	6-27-34
11-471BU, Ch. 320	18-4	6-15-26
11-472B1U, Ch. 331	18-4	6-27-34
11-473BU, Ch. 323	18-4	6-35-40
11-474BU, Ch. 331	18-4	6-27-34
Record Changer CROSLEY V-950	18-RC1	RCH 9-1-16
11-476BU, Ch. 325, 325-1, 325-2	18-4	6-21-27
11-483BU, Ch. 331	18-4	6-27-34
11-484MU, Ch. 323	18-4	8-35-40
17CDC1, 17CDC2, 17CDC3, 17CDC4, Ch. 331, 331-1, 331-2	2-1	8-1-6
17COC1, 17COC2, 17COC3, Ch. 331, 331-1, 331-2	2-1	8-1-6
20CDC1, 20CDC2, 20CDC3, Ch. 323-3, 323-4	2-1	8-7-12
320, Ch.	18-4	6-15-26
321-4, Ch.	2-1	8-24-29
323, Ch.	18-4	6-35-40
323-3, 323-4, Ch.	2-1	8-7-12
323-6, Ch.	2-1	8-30-35
325, 325-1, 325-2, Ch.	18-4	6-21-27
331, Ch.	18-4	6-27-34
331, 331-1, 331-2, Ch.	2-1	8-1-6
331-4, Ch.	2-1	8-18-23
356-1, Ch.	2-1	8-13-17
356-3, 356-4, Ch.	59-5	10-1-4
357, Ch.	17-3	9-1-4
357-1, Ch.	59-5	10-5-8
359, Ch., DU-17PDB	17-3	9-5-10
359, Ch., DU-17PHB	17-3	9-11-16
363, Ch.	17-3	9-17-22
380, 381, Ch.	59-5	10-17-24
386, 387, Ch.	59-5	10-9-16

DE WALD RADIO MFG. CORP.

MODEL	PACK-FILE	PAGES
FT-200	59-1	10-1-6

ALLEN B. DUMONT LABORATORIES, INC.

MODEL	PACK-FILE	PAGES
Andover	18-1	7-1-9
Ardmore	33-3	6-1-26
Banbury	60-5	10-1-34
Beverly	60-5	10-35-42
Bradford	39-4	4-5-14
Brookville	33-3	6-1-26

ALLEN B. DUMONT LABORATORIES, INC. (Cont'd)

MODEL	PACK-FILE	PAGES
Burlingame	33-3	6=1-26
Canterbury	39-4	1=31-42
		3=1-4
		4=1-4
Carlton	18-1	7=1-9
Chatham	39-4	1=31-42
Clinton	60-5	10=35-42
Devon	60-5	10=1-34
Dynasty	60-5	10=1-34
Fairfield	39-4	1=31-42
		3=1-4
		4=1-4
Flanders	60-5	10=1-34
Guilford, Hanover	33-2	5=1-25
Hastings	39-4	1=31-42
		3=1-4
		4=1-4
Mansfield	39-4	4=5-14
Milford	60-5	10=35-42
Mt. Vernon	33-3	6=1-26
Newbury	60-5	10=1-34
Park Lane	18-1	7=1-9
Putnam	33-2	5=26-43
Revere	33-3	6=1-26
Ridgewood	60-5	10=35-42
Royal Sovereign	33-2	5=1-25
		8=1-12
Rumson	39-4	1=31-42
		3=1-4
		4=1-4
Savoy	39-4	1=31-42
Sheffield	39-4	1=31-42
		3=1-4
		4=1-4
Shelburne	60-5	10=35-42
Sherbrooke	33-2	5=1-25
Somerset	60-5	10=1-34
Strathmore, Sumter	18-1	7=1-9
Sussex	39-4	4=5-14
Tarrytown	33-3	6=1-26
Wakefield	60-5	10=35-42
Wellington	39-4	1=31-42
		3=1-4
		4=1-4
Westerly	33-3	6=1-26
The Westminster	39-4	9=1-24
Westwood	39-4	1=31-42
		3=1-4
		4=1-4
Whitehall II	60-5	10=1-34
Wickford	60-5	10=1-34
Wimbledon	60-5	10=1-34
Winslow	33-2	5=1-25
Winthrop	39-4	1=31-42
RA-103, Chatham, Savoy	39-4	1=31-42
RA-103C, Winthrop	39-4	1=31-42
RA-103-D, Canterbury, Rumson, Sheffield	39-4	1=31-42
		3=1-4
		4=1-4
RA-104-A, Hastings, Wellington	39-4	1=31-42
		3=1-4
		4=1-4
RA-105-B, Sussex	39-4	4=5-14
RA-108-A, Bradford, Mansfield	39-4	4=5-14
RA-110-A, Fairfield, Westwood	39-4	1=31-42
		3=1-4
		4=1-4
RA-109-A1, Winslow	33-2	5=1-25
RA-109-A2, Hanover	33-2	5=1-25
RA-109-A3, Sherbrooke	33-2	5=1-25
RA-109-A5, Winslow	33-2	5=1-25
RA-109-A6, Hanover	33-2	5=1-25
RA-109-A7, Sherbrooke	33-2	5=1-25
RA-111-A1, Putnam	33-2	5=26-43
RA-111-A2, Guilford	33-2	5=26-43
RA-111-A4, Putnam	33-2	5=26-43
RA-111-A5, Guilford	33-2	5=26-43

ALLEN B. DUMONT LABORATORIES, INC. (Cont'd)

MODEL	PACK-FILE	PAGES
RA-112-A1, Ardmore	33-3	6=1-26
RA-112-A2, Westerly	33-3	6=1-26
RA-112-A3, Mt. Vernon	33-3	6=1-26
RA-112-A4, Ardmore	33-3	6=1-26
RA-112-A5, Westerly	33-3	6=1-26
RA-112-A6, Mt. Vernon	33-3	6=1-6
RA-113-B1, RA-113-B2, Brookville	33-3	6=1-26
RA-113-B3, RA-113-B4, Revere	33-3	6=1-26
RA-113-B5, RA-113-B6, Burlingame	33-3	6=1-26
RA-113-B7, RA-113-B6, Tarrytown	33-3	6=1-26
RA-116A, The Westminster, Series II	39-4	9=1-24
Record Changer WEBSTER 100	39-RC1	RCH21=1-10
RA-117-A1, Sumter	18-1	7=1-9
RA-117-A3, Carlton	18-1	7=1-9
RA-117-A5, Strathmore	18-1	7=1-9
RA-117-A6, Andover	18-1	7=1-9
RA-117-A7, Park Lane	18-1	7=1-9
RA-119A, Royal Sovereign	33-2	5=1-25
		8=1-12
RA-160-A1, Devon	60-5	10=1-34
RA-162-B1, Wickford	60-5	10=1-34
RA-162-B4, Banbury	60-5	10=1-34
RA-162-B5, Flanders	60-5	10=1-34
RA-162-B6, Wimbledon	60-5	10=1-34
RA-162-B7, Whitehall II	60-5	10=1-34
RA-162-B10, Flanders	60-5	10=1-34
RA-162-B11, Newbury	60-5	10=1-34
RA-162-B12, Somerset	60-5	10=1-34
RA-162-B13, Banbury	60-5	10=1-34
RA-162-B14, Dynasty	60-5	10=1-34
RA-162-B21 -- RA-162-B26, Banbury	60-5	10=1-34
RA-164-A1, Clinton	60-5	10=35-42
RA-165-B1, Milford	60-5	10=35-42
RA-165-B2, Beverly	60-5	10=35-42
RA-165-B3, Wakefield	60-5	10=35-42
RA-165-B4, Ridgewood	60-5	10=35-42
RA-165-B5, Shelburne	60-5	10=35-42

ELECTRONIC APPLIANCES INC.

MODEL	PACK-FILE	PAGES
101, 102, 103, 104, 105, 107, 110, 111, Series, Lincoln, See VIDEO PRODUCTS 630-K3C	69-1	10=1-12

ELECTRO-TECHNICAL INDUSTRIES (TELEKIT)

MODEL	PACK-FILE	PAGES
19C	3-1	8=1-10

ELECTRO-VOICE INC.

MODEL	PACK-FILE	PAGES
3000, Booster	26-1	7=1-2

EMERSON RADIO & PHONO. CORP.

MODEL	PACK-FILE	PAGES
609, Ch. 120084-B	3-1	8=1-13
614D, Ch. 120095-B	26-2	6=1-4
637A, Ch. 120095-B	26-2	6=1-4
649A, Ch. 120094A	26-2	6=5-10
650B, Ch. 120118B	26-2	6=11-19
654B, Ch. 120118B	26-2	6=11-19
661B, Ch. 120134-B, 120134-G	26-3	7=1-10
662B, 663B, Ch. 120127-B, 120128-B	26-3	7=11-19
665B, Ch. 120131-B	26-3	7=20-27
666B, Ch. 120135-B	26-3	7=28-35
667B, 668B, Ch. 120134-B, 120134-G	26-3	7=1-10
669B, Ch. 120129-B	26-3	7=36-44
674B, Ch. 120134-G	26-3	7=1-10
675B, Ch. 120129-B	26-3	7=36-44

EMERSON RADIO & PHONO. CORP. (Cont'd)

MODEL	PACK-FILE	PAGES
676B, Ch. 120140-B, 120140-G, 120140-H	26-3	7=45-57
676D, Ch. 120144-B, 120144-G, 120144-H	3-1	8=16-30
*676F, Ch. 120143-B, 120143-H, similar to 681F, 686F, 687F, 696F	3-1	8=31-39
677B, 678B, Ch. 120134-B	26-3	7=1-10
680B, Ch. 120144-B, 120144-G, 120144-H	3-1	8=16-30
680D, 681B, Ch. 120140-B, 120140-G, 120140-H	26-3	7=45-57
681D, Ch. 120144-B, 120144-G, 120144-H	3-1	8=16-30
681F, Ch. 120143-B, 120143-H	3-1	8=31-39
683B, Ch. 120141-B	3-1	8=40-45
684B, 685B, Ch. 120134-B	26-3	7=1-10
686B, Ch. 120144-B, 120144-G, 120144-H	3-1	8=16-30
686D, Ch. 120140-B, 120140-G, 120140-H	26-3	7=45-57
686F, Ch. 120143-B, 120143-H	3-1	8=31-39
686L, Ch. 120142-B	3-1	8=46-55
687B, Ch. 120144-B, 120144-G, 120144-H	3-1	8=16-30
*687D, Ch. 120140B, similar to 680D, 686D	26-3	7=45-57
687F, Ch. 120143-B, 120143-H	3-1	8=31-39
687L, Ch. 120142-B	3-1	8=46-55
688B, 689B, 690B, Ch. 120129-B	26-3	7=36-44
*692B, 693B, 694B, Ch. 120129-D, similar to 688B, 689B, 690B, Ch. 120129-B	26-3	7=36-44
696F, Ch. 120143-B, 120143-H	3-1	8=31-39
696L, Ch. 120142-B	3-1	8=46-55
*697B, Ch. 120129-D, similar to 688B, 689B, 690B, Ch. 120129-B	26-3	7=36-44
699B, Ch. 120148-B	39-4	9=9-16
Record Changer VM-950	39-RC1	RCH22=1-16
699D, Ch. 120160-B	60-6	10=1-8
700B, Ch. 120153-B	39-4	9=1-8
Record Changer VM-950	39-RC1	RCH22=1-16
700D, Ch. 120158-B	50-5	9=17-24
700L, Ch. 120153-D	61-7	10=18-27
701B, Ch. 120153-B	39-4	9=1-8
Record Changer VM-950	39-RC1	RCH22=1-16
701D, Ch. 120158-B	50-5	9=17-24
709A, Ch. 120162-A	61-7	10=9-17
711B, 712B, Ch. 120164-B	61-7	10=28-39
714B, Ch. 120153-B	61-7	10=18-27
714D, 715D, Ch. 120153-D	61-7	10=18-27
720B, Ch. 120164-B	61-7	10=28-39
120084-B, Ch.	3-1	8=1-13
120094A, Ch.	26-2	6=5-10
120095-B, Ch.	26-2	6=1-4
120118B, Ch.	26-2	6=11-19
120127-B, 120128-B, Ch.	26-3	7=11-19
120129B, 120129D, Ch.	26-3	7=36-44
120131-B, Ch.	26-3	7=20-27
120134-B, 120134-G, Ch.	26-3	7=1-10
120135-B, Ch.	26-3	7=28-35
120140-B, 120140-G, 120140-H, Ch.	26-3	7=45-57
120141-B, Ch.	3-1	8=40-45
120142-B, Ch.	3-1	8=46-55
120143-B, 120143-H, Ch.	3-1	8=31-39
120144-B, 120144-G, 120144-H, Ch.	3-1	8=16-30
120148-B, Ch.	39-4	9=9-16
120153-B, Ch.	39-4	9=1-8
120153-B, Ch., Late	61-7	10=18-27
120153-D, Ch.	61-7	10=18-27
120158-B, Ch.	50-5	9=17-24
120160-B, Ch.	60-6	10=1-8
120162-A, Ch.	61-7	10=9-17

* See Emerson HANDY No. 16, Pack 26

EMERSON RADIO & PHONO. CORP. (Cont'd)

MODEL	PACK-FILE	PAGES
120164-B, Ch.	61-7	10=28-39
470651, Tuner	3-1	8=56-62
470662, Tuner	3-1	8=63-69

FADA RADIO & ELECTRIC CO., INC.

MODEL	PACK-FILE	PAGES
R7C15, R7C25	4-1	8=1-8
Tuner 42.51 for all 'R' Series	4-1	9=1-2
R-1025, R-1050	32-2	5=1-7
S6C55, S6C70, S6T65	32-2	7=1-12
S7C20, S7C30	32-2	7=1-14
S7C20, S7C30, Rev.	32-2	9=11-18
S7C70, S7T65	32-2	7=1-12
S-1015, S-1020, S-1030	32-2	5=8-12
S-1055	32-2	5=10-14
		7=1-12
S-1055X	32-2	7=1-12
S-1060, S-1065	32-2	5=10-14
		7=1-12
S20C10, S20T20	32-2	9=11-18
7C42, 7C52, 7T32	61-3	10=1-11
721, 775T	61-3	10=1-11
42.55, 42.64, Tuners used with 'S' Series	32-2	9=3-10

THE FIRESTONE TIRE & RUBBER CO.

MODEL	PACK-FILE	PAGES
13-G-44, 13-G-45	4-1	8=10-24
13-G-51, 13-G-52	4-1	8=25-39
13-G-53, 13-G-54, Ch. 700-90, 700-96	4-1	8=40-51
13-G-55, Ch. 700-93	4-1	8=40-51
13-G-56	4-1	8=52-59
13-G-57	4-1	8=1-9
Record Changer VM-950	4-RC1	RCH22=1-16
13-G-58, 13-G-59, 13-G-79, Ch. 700-96	4-1	8=60-70
13-G-110, Code 334-2-MS31C/A	61-2	10=1-10
13-G-115, 13-G-116, 13-G-119, 13-G-120, Code 334-2-MS31C/A	61-2	10=1-10
700-90, 700-93, Ch.	4-1	8=40-51
700-96, Ch., 13-G-53, 13-G-54	4-1	8=40-51
700-96, Ch., 13-G-58, -59, -79	4-1	8=60-70

FRANKLIN AIRLOOP CORP.

MODEL	PACK-FILE	PAGES
500-A-10, Tuner	4-1	8=1-2

FREED-EISEMANN

See FREED RADIO CORP.

FREED RADIO CORP. (FREED-EISEMANN)

MODEL	PACK-FILE	PAGES
54, 55, 56, 68, Ch. 1620C	32-1	5=1-7
101, 102, 103, 104, Ch. 1900	32-1	5=8-10
110, 111, 112, Ch. 700-120	50-2	9=1-8
121	50-2	9=9-14
700-120, Ch.	50-2	9=9-14
1620C, Ch.	32-1	5=1-7
1900, Ch.	32-1	5=8-10

GAMBLE-SKOGMO, INC. (CORONADO)

MODEL	PACK-FILE	PAGES
05RA4-43-8935A	31-2	6=1-6
05TV1-43-9014A, Ch. 16AY210	31-2	6=7-16
05TV2-43-8950A	31-2	6=17-26
05TV2-43-9010A	31-2	6=17-26
05TV6-43-8935A	31-2	6=1-6
15RA2-43-9105A, Ch. 16AY210	31-2	6=7-16
15TV1-43-8957A	5-1	8=1-8
15TV1-43-8958A	31-2	9=1-8
15TV1-43-9008A	5-1	8=9-18
15TV1-43-9015A, 15TV1-43-9016A	5-1	8=1-8
15TV1-43-9020A, 15TV1-43-9021A	31-2	9=1-8
15TV2-43-9101A, 15TV2-43-9102A	5-1	8=19-27
Record Changer VM-950	5-RC1	RCH22=1-16

INTERSTATE STORES BUYING CORP. (Cont'd)

MODEL	PACK-FILE	PAGES
AR-71, AR-71B	50-2	9-1-16
AR-73L	50-2	9-1-16
ARC-21, ARC-21B	50-2	9-1-16
ARC-71, ARC-71B	50-2	9-1-16
ARD-21M, ARD-22B	50-2	9-1-16
ARD-72, ARD-72B	50-2	9-1-16
250, 350	35-1	5-1-11
750	35-1	5-1-11
P1650T	35-1	7-1-8
P1652, P1653	35-1	7-1-8
P1751, P1752, P1753	35-1	7-1-8
P2052	35-1	7-1-8

JACKSON INDUSTRIES, INC.

MODEL	PACK-FILE	PAGES
114G, Ch.	6-1	8-1-8
114H, Ch.	65-2	10-10-17
116G, 117G, Ch.	6-1	8-1-8
117H, Ch.	65-2	10-10-17
120G, Ch.	6-1	8-1-8
120H, Ch.	65-2	10-10-17
217A, 217B, Ch.	65-2	10-1-9
220A, 220B, Ch.	65-2	10-1-9
221A, 221B, Ch.	65-2	10-1-9
1400T, Ch. 114G, 116G, 117G, 120G	6-1	8-1-8
1700C, 1700T, Ch. 114G, 116G, 117G, 120G	6-1	8-1-8
1700T, Ch. 117H	65-2	10-10-17
2000C, Ch. 114G, 116G, 117G, 120G	6-1	8-1-8
2000C, 2000CD, 2000CDB, Ch. 120H	65-2	10-10-17
3170C, Ch. 114G, 116G, 117G, 120G	6-1	8-1-8
Record Changer VM-950	6-RC1	RCH22-1-16
5120C, Ch. 114G, 116G, 117G, 120G	6-1	8-1-8
Record Changer VM-950	6-RC1	RCH22-1-16

KAYE-HALBERT CORP.

MODEL	PACK-FILE	PAGES
Cambridge, Hideaway	30-2	6-1-7
Normandy, Windsor	30-2	6-1-7
014, 024, Ch. 253	6-1	8-1-6
044, 045, 046, Ch. 253	6-1	8-1-6
074, 076, 077, Ch. 253	6-1	8-1-6
231, Ch.	30-2	6-1-7
231, 232, 233, Ch. 231, 242	30-2	6-1-7
234, Ch. 231, 242, Hideaway	30-2	6-1-7
235, Ch. 231, 242, Windsor	30-2	6-1-7
236, Ch. 231, 242, Normandy	30-2	6-1-7
237, Ch. 231, 242, Cambridge	30-2	6-1-7
238, Ch. 231, 242	30-2	6-1-7
239, Ch. 231, 242, Hideaway	30-2	6-1-7
240, Ch. 231, 242, Windsor	30-2	6-1-7
242, Ch.	30-2	6-1-7
253, Ch.	6-1	8-1-6
424, Ch. 253	6-1	8-1-6
714, 724, Ch. 253	6-1	8-1-6
731, 733, Ch. 231, 242	30-2	6-1-7
744, 745, Ch. 253	6-1	8-1-6
777, Ch. 253	6-1	8-1-6
914, Ch. 253	6-1	8-1-6

MACY ASSOCIATES
See MACY'S

MACY'S

MODEL	PACK-FILE	PAGES
AR14L, Ch. TVG, Artone, Hyde Park	7-1	9-21-30
AR-16 T-68, Artone	7-2	9-31-38
AR17L, Ch. TVG, Artone, Hyde Park	7-1	9-21-30
AR-23TV-1, Artone	7-2	9-31-38
HP-21B, HP-21M	47-3	9-57-72
HP-71B, HP-71M	47-3	9-57-72
HPC-21B, HPC-21M, HPC-22X	47-3	9-57-72
HPC-71B, HPC-71M	47-3	9-57-72

MACY'S (Cont'd)

MODEL	PACK-FILE	PAGES
HPD-21	47-3	9-57-72
MST12, Artone, Astoria, Hyde Park	7-2	9-45-52
Q-2617, Q-2617-1, Ch. 260-FM, 260-V, Macy Associates, Supremacy	7-2	9-53-56
Q-2619, Q-2619-1, Q-2620, Q-2620-1, Ch. 260-FM, 260-V, Macy Associates, Supremacy	7-2	9-53-56
S-20, Ch. 260-FM, 260-V, Macy Associates, Supremacy	7-2	9-53-56
S-210, S-211, S-212, S-213, Ch. 260-FM, 260-V, Macy Associates, Supremacy	7-2	9-53-56
TVG, Ch.	7-1	9-21-30
10C, 12X, Artone, Astoria, Hyde Park	7-2	9-45-52
16CD, Artone, Astoria, Hyde Park	7-1	9-1-8
16TR, Artone, Hyde Park	7-1	9-11-20
17CD, Ch. TVG, Artone, Hyde Park	7-1	9-21-30
17CR, Artone, Hyde Park	7-1	9-11-20
17CR, 17CRR, Ch. TVG, Artone, Hyde Park	7-1	9-21-30
17RDG, Ch. TVG, Artone, Hyde Park	7-1	9-21-30
17RO, Artone, Hyde Park	7-1	9-11-20
17ROR, Ch. TVG, Artone, Hyde Park	7-1	9-21-30
19CD, Artone, Hyde Park	7-1	9-1-9
19CX, Artone, Hyde Park	7-1	9-1-10
20CD, 20TR, Ch. TVG, Artone, Hyde Park	7-1	9-21-30
112, 112X, Artone, Astoria, Hyde Park	7-2	9-45-52
114, Artone, Hyde Park	7-1	9-11-20
203D, 204CAF, Ch. TVG, Artone, Hyde Park	7-1	9-21-30
260-FM, 260-V, Ch.	7-2	9-53-56
312, Artone, Astoria, Hyde Park	7-2	9-45-52
316, Astoria, Hyde Park	7-1	9-1-8
516, Artone, Hyde Park	7-1	9-11-20
816-3CR, Artone, Astoria, Hyde Park	7-1	9-1-8
819, Artone, Hyde Park	7-1	9-1-8 9-10
819, 819-3CM, 920, Ch. TVG, Artone, Hyde Park	7-1	9-21-30
1000, 1001, Ch. TVG, Artone, Hyde Park	7-1	9-21-30
1920, Ch. TVG, Artone, Hyde Park	7-1	9-21-30
2400, 4620, Ch. 260-FM, 260-V, Macy Associates, Supremacy	7-2	9-53-56

THE MAGNAVOX CO.

MODEL	PACK-FILE	PAGES
CT-232, CT-236, Ch.	30-1	6-1-14
CT-239, CT-240, Ch.	30-1	6-1-14
CT-244, CT-245, CT-246, Ch.	30-1	6-1-14
CT-247, CT-248, CT-249, Ch.	30-1	6-15-28
CT-250, CT-251, Ch.	30-1	6-1-14
CT-252, CT-253, CT-255, Ch.	30-1	6-15-28
CT-257, CT-258, CT-259, CT-260	30-1	7-1-13
CT-262, CT-263, CT-264, CT-265, CT-266, CT-267, CT-269, Series 103 Ch.	30-1	6-29-38
CT-270, CT-271, CT-272, CT-273, CT-274, CT-275, CT-276, CT-277, CT-278, CT-279, CT-280, CT-281, CT-282	30-1	7-14-28
CT-283, CT-284, CT-285, CT-286, CT-287, CT-288, CT-289, CT-290, CT-291, CT-293, CT-294, Series 103 Ch.	30-1	6-29-38

THE MAGNAVOX CO. (Cont'd)

MODEL	PACK-FILE	PAGES
CT-295, CT-296	30-1	7-1-13
CT-297, Series 103 Ch.	30-1	6-29-38
CT301, CT302, CT303, CT304, CT305, CT306, CT307, CT309, CT310, CT311, 104 Series	65-2	10-1-8
CT331, CT332, CT333, CT334, CT335, CT336, CT337, CT338, CT339, 105 Series	65-2	10-9-22
CT340, CT341, CT342, CT343, CT344, CT345, CT346, CT347, CT348, CT349, CT350, 105 Series	65-2	10-9-22

MAJESTIC RADIO & TELEVISION
DIV. OF WILCOX-GAY CORP.

MODEL	PACK-FILE	PAGES
A-70, Ch. 106A	6-1	8-1-7
A-712, Ch. 106A	6-1	8-1-7
7P1, 7P2, 7P3, Ch. 101A	30-2	7-1-16
7P10, 7P11, Ch. 101A	30-2	7-1-16
7PR12, 7PR13, Ch. 101C	30-2	7-1-16
9P4, 9P5, Ch. 103	30-2	7-1-16

MAJESTIC RADIO & TELEVISION (Cont'd)

MODEL	PACK-FILE	PAGES
9PR8, 9PR9, Ch. 103A	30-2	7-1-16
17DA, Ch. 101D	30-2	7-1-16
17FA, Ch. 106A	6-1	8-1-7
17GA, 17HA, Ch. 101D	30-2	7-1-16
17JA, 17K, Ch. 106A	6-1	8-1-7
20FP88, 20FP89, 109 Series	66-3	10-1-10
20K, Ch. 108C	6-1	8-1-7
20KA, 20LA, Ch. 108A	6-1	8-1-7
20UAT, Ch. 108B	6-1	8-1-7
20UC, 20UT, Ch. 108D	6-1	8-1-7
20X, Ch. 108B	6-1	8-1-7
70, 72, 73, Ch. 106	6-1	8-1-7
99, 100, 101, 101A, 101B, 101C, 101D, 102, 103, 103A, Ch.	30-2	7-1-16
105, Ch.	30-2	7-1-16
106, 106A, Ch.	6-1	8-1-7
108, 108A, 108B, 108C, 108D, Ch.	6-1	8-1-7
120, 121, 121B, Ch. 99	30-2	7-1-16
141, 141B, Ch. 100	30-2	7-1-16
141C, Ch. 101B	30-2	7-1-16
142, 142B, Ch. 100	30-2	7-1-16
143	30-2	7-1-16
160, 160B, Ch. 101	30-2	7-1-16
162, 163, Ch. 101	30-2	7-1-16
170, Ch. 101A	30-2	7-1-16
173	30-2	7-1-16
700, 701, Ch. 106	6-1	8-1-7
712, 715, 717, 718, 719, Ch. 106	6-1	8-1-7
800, 801, 802, 803, 804, Ch. 108	6-1	8-1-7
902, 903, Ch. 103	30-2	7-1-16
910, 911, Ch. 103	30-2	7-1-16
1400, 1400B, Ch. 100	30-2	7-1-16
1401, Ch. 105	30-2	7-1-16
1600, 1600B, Ch. 101	30-2	7-1-16
1605, 1605B, Ch. 102	30-2	7-1-16
1610, 1610B, Ch. 102	30-2	7-1-16
1700C, 1701C	30-2	7-1-16
1710, Ch. 101A	30-2	7-1-16
1720, 1721	30-2	7-1-16

JOHN MECK INDUSTRIES, INC.
DIV. OF SCOTT RADIO LABS., INC.
(MIRRORTONE)

MODEL	PACK-FILE	PAGES
JM-717C, JM-717T, Ch. 9021	7-1	8-1-11
JM-720C, JM-720T, Ch. 9023	7-1	8-1-11
MM-510T, MM-512C, MM-512T	45-2	6-1-5
MM-516C, MM-516T	45-2	6-1-5
MM-614C, MM-614T, Ch. 9018	45-2	7-1-11
MM-614TL, Ch. 9022, 9024	7-1	8-1-11
MM-616C, MM-616T, Ch. 9018	45-2	7-1-11
MM-617C, MM-617T, Ch. 9018	45-2	7-1-11
MM-617C, MM-617TL, Ch. 9022, 9024	7-1	8-1-11

JOHN MECK INDUSTRIES, INC.

MODEL	PACK-FILE	PAGES
MM-619C, Ch. 9018	45-2	7-1-11
XOB, XQA, XQR	45-2	6-1-5
XRA, XRPS, XRPT, XSA	45-2	6-1-5
XSB, XSC, XSD, Ch. 9018	45-2	7-1-11
XSPS, XSPT, XTA, XTR	45-2	6-1-5
17PCSB, 17PCW, 17PTE, Ch. 9033, 9034	66-3	10-1-13
20PCSB, 20PCW, Ch. 9033, 9034	66-3	10-1-13
20PTE, 20PTSB, 20PTW, Ch. 9033, 9034		
20TPRSB, 21PCS, Ch. 9033, 9034	66-3	10-1-13
21QDCS, 24QDCS, Ch. 9033, 9034	66-3	10-1-13
9018, Ch.	45-2	7-1-11
9021, 9022, 9023, 9024, Ch.	7-1	8-1-11
9033, 9034, Ch.	66-3	10-1-13

MIDWEST RADIO & TELEV. CORP.

MODEL	PACK-FILE	PAGES
BT-20, Ch.	7-1	8-1-6
CV-20, Ch.	7-1	8-7-11
DJ-19, Ch.	45-2	6-1-6
DM-16, DMA-16	45-2	7-1-7
DR-16, Ch.	45-2	6-1-6
DX-19, DXA-19, Ch.	45-2	7-1-7
K-19, KR-19, Ch. DJ-19	45-2	6-1-6
KX-19, Ch. DX-19	45-2	7-1-7
KXA-19, Ch. DXA-19	45-2	7-1-7
N-20, NC-20, Ch. BT-20	7-1	8-1-6
Record Changer VM-950	7-RC1	RCH22-1-16
NV-20, Ch. CV-20	7-1	8-7-11
P-16, PR-16, Ch. DR-16	45-2	6-1-6
PX-16, Ch. DM-16	45-2	7-1-7
PXA-16, Ch. DMA-16	45-2	7-1-7

MIRRORTONE
See JOHN MECK INDUSTRIES, INC.

MITCHELL MFG. CO.

MODEL	PACK-FILE	PAGES
T16-2KB, T16-2KM	45-2	6-1-4
T16-B, T16-M	45-2	6-1-4
T17-B, T17-M	7-1	8-1-4

MONTGOMERY WARD
(AIRLINE)

MODEL	PACK-FILE	PAGES
05BR-3034A, 05BR-3041A	8-1	8-1-10
05GCB-3019A	45-4	6-1-10
05WG-3038A	8-1	8-11-20
Record Changer VM-950	8-RC1	RCH22-1-16
05WG-3045A	8-1	8-21-30
Record Changer GENERAL INSTRUMENT 700F	8-RC1	RCH19-1-10
15BR-3035A	8-1	8-31-40
Record Changer VM-950	8-RC1	RCH22-1-16
15BR-3048A	51-5	9-1-8
15BR-3053A, 15BR-3053B	8-2	8-41-51
15BR-3054A	66-6	10-1-10
15GSE-3047A, 15GSE-3047B	8-2	8-52-62
15WG-3046A	8-3	8-63-70
15WG-3049A	51-5	9-9-16
15WG-3046B	8-3	8-63-73
15WG-3050A	8-3	8-74-83
Record Changer WEBSTER 100	8-RC1	RCH21-1-10
15WG-3050B	8-3	8-74-83
Record Changer VM-950	8-RC1	RCH22-1-16
15WG-3051A	8-3	8-63-70
15WG-3051B	8-3	8-63-73
16K1/63-3019	45-4	6-1-10
25BR-3048B	66-6	10-11-21
25GSE-3065A	66-6	10-22-29
94GCB-3023A, 94GCB-3023B, 94GCB-3023C	45-4	6-1-10
94WG-3008A	45-4	6-11-20
94WG-3106A, 94WG-3016B, 94WG-3016C	45-4	6-11-22
94WG-3028A	45-4	6-23-32

MOTOROLA INC.

MODEL	PACK-FILE	PAGES
TS-53, Ch.	36-3	8=1-15
TS-60, Ch.	47-4	7=1-16
TS-74, Ch.	36-3	6=51-64
TS-88, Ch.	36-3	6=29-41
TS-89, Ch.	47-4	7=17-34
TS-94, Ch.	47-4	7=17-34
TS-95, Ch.	47-4	7=17-34
TS-101, Ch.	47-5	7=57-65
TS-114, Ch.	36-3	6=42-50
TS-115, Ch.	36-3	6=16-28
TS-118, Ch.	47-5	7=35-45 7=66-68
TS-118A, TS-118B, Ch.	51-6	9=25-32
TS-119, TS-119A, TS-119B, TS-119C, Ch.	9-1	8=25-38
TS-119D, Ch.	67-7	10=51-58
TS-172, Ch.	47-5	7=46-56
TS-174, TS-174A, TS-175B, Ch.	9-1	8=1-15
TS-214, Ch.	51-6	9=33-40
TS-216, Ch.	9-2	9=1-8
TS-221, Ch.	9-1	8=16-24
TS-228, Ch.	70-8	10=1-12
TS-236, Ch.	9-2	9=9-16
TS-307, Ch.	70-8	10=42-50
TS-314, Ch.	51-6	9=17-24
TS-314A,Ch.	51-6	9=41-44
TS-315, Ch.	51-6	9=17-24
TS-315A, Ch.	51-6	9=41-44
TS-325, TS-325B, Ch.	70-8	10=13-41
TS-326, TS-326A, TS-326B, Ch.	70-8	10=13-41
TS-351, Ch.	70-8	10=13-41
TS-401, Ch.	67-7	10=59-68
12K1, 12K1B, Ch. TS-53	36-3	6=1-15
12K2, 12K2B, Ch. TS-53	36-3	6=1-15
12K3, 12K3B, Ch. TS-53	36-3	6=1-15
12T1, 12T1B, Ch. TS-53	36-3	6=1-15
12T2, 12T3, Ch. TS-53	36-3	6=1-15
14K1, 14K1B, Ch. TS-88	36-3	6=29-41
14K1BH, 14K1H, Ch. TS-115	36-3	6=16-28
14T1, 14T1B, Ch. TS-88	36-3	6=29-41
14T3, Ch. TS-114	36-3	6=42-50
14T4, 14T4B, Ch. TS-216	9-2	9=1-8
16F1, 16F1B, Ch. TS-60	47-4	7=1-16
16F1BH, 16F1H, Ch. TS-89	47-4	7=17-34
16K2, 16K2B, Ch. TS-74	36-3	6=51-64
16K2BH, 16K2H, Ch. TS-94	47-4	7=17-34
16T1, 16T1B, Ch. TS-60	47-4	7=1-16
16T1BH, 16T1H, Ch. TS-89	47-4	7=17-34
17F1, Ch. TS-118A, TS-118B	51-6	9=25-32
17F1, 17F1B, Ch. TS-118	47-5	7=35-45
17F1A, 17F1BA, Ch. TS-89	47-4	7=17-34
17F2W, Ch. TS-118	47-5	7=35-45
17F2W, Ch. TS-118A, TS-118B	51-6	9=25-32
17F2WA, Ch. TS-89	47-4	7=17-34
17F3B, Ch. TS-118	47-5	7=35-45
17F3B, Ch. TS-118A, TS-118B	51-6	9=25-32
17F3BA, Ch. TS-89	47-4	7=17-34
17F4, Ch. TS-118	47-5	7=35-45
17F4, Ch. TS-118A, TS-118B	51-6	9=25-32
17F4A, Ch. TS-89	47-4	7=17-34
17F5, Ch. TS-118	47-5	7=35-45
17F5, Ch. TS-118A, TS-118B	51-6	9=25-32
17F5A, Ch. TS-89	47-4	7=17-34
17F5B, Ch. TS-118	47-5	7=35-45
17F5BA, Ch. TS-89	47-4	7=17-34
17F6, Ch. TS-118	47-5	7=35-45
17F6, Ch. TS-118A, TS-118B	51-6	9=25-32
17F6B, Ch. TS-118	47-5	7=35-45 7=66-68
17F6BC, 17F6C, Ch. TS-174 TS-174A, TS-174B	9=1	8=1-15
Record Changer MOTOROLA RC-36A	9-RC1	RCH21=1-16
17F7, Ch. TS-118A, TS-118B	51-6	9=25-32
17F7B, Ch. TS-118	47-5	7=35-45 7=66-68
17F7B, Ch. TS-118A, TS-118B	51-6	9=25-32

MOTOROLA INC. (Cont'd)

MODEL	PACK-FILE	PAGES
17F7BC, Ch. TS-174, TS-174A, TS-174B	9-1	8=1-15
Record Changer MOTOROLA RC-36A	9-RC1	RCH21=1-16
17F8, Ch. TS-118	47-5	7=35-45
17F8, Ch. TS-118A, TS-118B	51-6	9=25-32
17F8C, Ch. TS-174, TS-174A, TS-174B	9-1	8=1-15
Record Changer MOTOROLA RC-36A	9-RC1	RCH21=1-16
17F9, Ch. TS-118A, TS-118B	51-6	9=25-32
17F9, 17F9B, Ch. TS-118	47-5	7=35-45 7=66-68
17F9BC, 17F9C, Ch. TS-174, TS-174A, TS-174B	9-1	8=1-15
Record Changer MOTOROLA RC-36A	9-RC1	RCH21=1-16
17F11, Ch. TS-228	70-8	10=1-12
17F12, Ch. TS-325	70-8	10=13-41
17F12A, Ch. TS-326	70-8	10=13-41
17F12B, Ch. TS-325	70-8	10=13-41
17F12BA, Ch. TS-326	70-8	10=13-41
17F12D, Ch. TS-401	67-7	10=59-68
17K1A, 17K1BA, Ch. TS-95	47-4	7=17-34
17K1BE, 17K1E, Ch. TS-172	47-5	7=46-56
17K2BE, 17K2E, Ch. TS-172	47-5	7=46-56
17K3, Ch. TS-118	47-5	7=35-45
17K3, Ch. TS-118A, TS-118B	51-6	9=25-32
17K3A, 17K3BA, Ch. TS-89	47-4	7=17-34
17K3B, Ch. TS-118	47-5	7=35-45
17K4A, Ch. TS-95	47-4	7=17-34
17K4E, Ch. TS-172	47-5	7=46-56
17K5, Ch. TS-118	47-5	7=35-45 7=66-68
17K5, Ch. TS-118A, TS-118B	51-6	9=25-32
17K5C, Ch. TS-174, TS-174A, TS-174B	9-1	8=1-15
17K5E, Ch. TS-221	9-1	8=16-24
17K6, Ch. TS-118	47-5	7=35-45 7=66-68
17K6, Ch. TS-118A, TS-118B	51-6	9=25-32
17K6C, Ch. TS-174, TS-174A, TS-174B	9=1	8=1-15
17K7, 17K7B, Ch. TS-118	47-5	7=35-45 7=66-68
17K7, Ch. TS-118A, TS-118B	51-6	9=25-32
17K7BC, 17K7C, Ch. TS-174, TS-174A, TS-174B	9-1	8=1-15
17K8, Ch. TS-236	9-2	9=9-16
17K8A, Ch. TS-228	70-8	10=1-12
17K8B, Ch. TS-236	9-2	9=9-16
17K8BA, Ch. TS-228	70-8	10=1-12
17K9A, 17K9BA, 17K10, Ch. TS-228	70-8	10=1-12
17K10E, Ch. TS-314	51-6	9=17-24
17K10E, Ch. TS-314A	51-6	9=41-44
17K10M, Ch. TS-228	70-8	10=1-12
17K11, Ch. TS-236	9-2	9=9-16
17K11A, Ch. TS-228	70-8	10=1-12
17K11B, Ch. TS-236	9-2	9=9-16
17K11BA, Ch. TS-228	70-8	10=1-12
17K11C, Ch. TS-236	9-2	9=9-16
17K12, Ch. TS-325	70-8	10=13-41
17K12A, Ch. TS-326	70-8	10=13-41
17K12B, Ch. TS-325	70-8	10=13-41
17K12BA, Ch. TS-326	70-8	10=13-41
17K12W, Ch. TS-325	70-8	10=13-41
17K12WA, Ch. TS-326	70-8	10=13-41
17K13A, Ch. TS-326A, TS-326B	70-8	10=13-41
17K13D, Ch. TS-401	67-7	10=59-68
17T1, 17T1B, Ch. TS-118	47-5	7=35-45
17T1A, 17T1BA, Ch. TS-89	47-4	7=17-34
17T2, Ch. TS-118A, TS-118B	51-6	9=25-32
17T2, 17T2B, Ch. TS-118	47-5	7=35-45
17T2A, 17T2BA, Ch. TS-89	47-4	7=17-34
17T3, Ch. TS-118	47-5	7=35-45
17T3, Ch. TS-118A, TS-118B	51-6	9=25-32

MOTOROLA INC. (Cont'd)

MODEL	PACK-FILE	PAGES
17T3A, Ch. TS-89	47-4	7=17-34
17T3G, Ch. TS-221	9-1	8=16-24
17T3X1, Ch. TS-118A, TS-118B	51-6	9=25-32
17T4, Ch. TS-118	47-5	7=35-45 7=66-68
17T4, Ch. TS-118A, TS-118B	51-6	9=25-32
17T4C, Ch. TS-174, TS-174A, TS-174B	9-1	8=1-15
17T4E, Ch. TS-221	9-1	8=16-24
17T5A, Ch. TS-214	51-6	9=33-40
17T5C, Ch. TS-228	70-8	10=1-12
17T5CA, Ch. TS-214	51-6	9=33-40
17T5D, Ch. TS-236	9-2	9=9-16
17T5E, Ch. TS-314	51-6	9=17-24
17T5E, Ch. TS-314A	51-6	9=41-44
17T5F, Ch. TS-315	51-6	9=17-24
17T5F, Ch. TS-315A	51-6	9=41-44
17T6BD, Ch. TS-236	9-2	9=9-16
17T6BF, Ch. TS-228	70-8	10=1-12
17T6C, 17T6D, Ch. TS-236	9-2	9=9-16
17T6F, Ch. TS-228	70-8	10=1-12
17T6G, Ch. TS-314A	51-6	9=41-44
17T7, Ch. TS-325	70-8	10=13-41
17T7A, Ch. TS-326	70-8	10=13-41
17T8, Ch. TS-325	70-8	10=13-41
17T8A, Ch. TS-326	70-8	10=13-41
17T8B, Ch. TS-325	70-8	10=13-41
17T8BA, Ch. TS-326	70-8	10=13-41
17T9, 17T9A, 17T9E, Ch. TS-326A, TS-326B	70-8	10=13-41
17T9EF, 17T9F, Ch. TS-401	67-7	10=59-68
17T10, Ch. TS-325B	70-8	10=13-41
17T10A, Ch. TS-326A, TS-326B	70-8	10=13-41
17T10D, Ch. TS-401	67-7	10=59-68
19K2, 19K2B, Ch. TS-101	47-5	7=57-65
19K2BE, 19K2E, Ch. TS-119, TS-119A	9-1	8=25-38
19K3, Ch. TS-101	47-5	7=57-65
19K4, 19K4B, Ch. TS-101	47-5	7=57-65
20F1, 20F1B, Ch. TS-119, TS-119A	9-1	8=25-38
Record Changer MOTOROLA RC-36A	9-RC1	RCH21=1-16
20F2, 20F2B, Ch. TS-119B, TS-119C	9-1	8=25-38
Record Changer MOTOROLA RC-36A	9-RC1	RCH21=1-16
20K1, 20K1B, 20K2, Ch. TS-119B, TS-119C	9-1	8=25-38
20K3, 20K3B, Ch. TS-119D	67-7	10=51-58
20K4, 20K4B, Ch. TS-119D	67-7	10=51-58
20K6, 20K6B, Ch. TS-307	70-8	10=42-50
20T1B, Ch. TS-119B, TS-119C	9-1	8=25-36
20T2, Ch. TS-119D	67-7	10=51-58
20T2A, Ch. TS-307	70-8	10=42-50
20T2B, Ch. TS-119D	67-7	10=51-58
20T2BA, Ch. TS-307	70-8	10=42-50
20T3, 20T3B, Ch. TS-307	70-8	10=42-50
21F1, 21F1B, Ch. TS-351	70-8	10=13-41
21K1, 21K1B, Ch. TS-351	70-8	10=13-41
21K2, 21K2B, Ch. TS-351	70-8	10=13-41
21K3, 21K3B, 21K3W, Ch. TS-351	70-8	10=13-41
21T1, 21T1B, Ch. TS-351	70-8	10=13-41
21T2, 21T2B, Ch. TS-351	70-8	10=13-41

M. P. TELEVISION

MODEL	PACK-FILE	PAGES
16T503, 17T504	9-1	8=1-4

MULTIPLE TELEV. MFG. CO.

MODEL	PACK-FILE	PAGES
EC20, Ch. 630K3B	9-1	8=1-2
HFD17, HFD20, Ch. 630K3B	9-1	8=1-2
LFD17, LFD20, Ch. 630K3B	9-1	8=1-2
OF17, OF20, OF20R, Ch. 630K3B	9-1	8=1-2
630K3B, Ch.	9-1	8=1-2

MUNTZ T-V, INC.

MODEL	PACK-FILE	PAGES
M31, Ch. TV17A2	36-1	6=1-12
M31R, Ch. TV17A3	36-1	6=1-12
M32, M32R, Ch. TV17A3	36-1	6=1-12
M33, M34, Ch. TV17A4	36-1	6=1-12
M41, M42, Ch. TV17A3A	36-1	6=1-12
M46, M49, Ch. TV17A7	36-1	6=1-12
TV17A2, Ch.	36-1	6=1-12
TV17A3, TV17A3A, Ch.	36-1	6=1-12
TV17A4, TV17A7, Ch.	36-1	6=1-12
WG2060	51-2	9=13-20
17B1, 17B2, 17B3, 17B4, Ch.	51-2	9=1-12
17B4, Carco, Ch.	67-3	10=1-10
17B5, 17B6, Ch.	51-2	9=1-12
17B6, Carco 17B6, Ch.	67-3	10=1-10
*1750, 1751, 1752, Ch. TV17A3A	36-1	6=1-12
*2053, 2054, 2055, 2056, Ch. TV17A7	36-1	6=1-12
2053-A, 2054-A, 2055-A, Ch. 17B1, 17B2	51-2	9=1-12
2055-B, Ch. 17B2	51-2	9=1-12
2056-A, Ch. 17B1, 17B2	51-2	9=1-12
2158-A, 2159-A, Ch. 17B5		
2158-A, 2159-A, Ch. 17B6, Carco 17B6, Late	67-3	10=1-10
2162-A, Ch. 17B5, 17B6	51-2	9=1-12
2162-A, Ch. 17B6, Carco 17B6, Late	67-3	10=1-10
2457-A, Ch. 17B3, 17B4	51-2	9=1-12
2457-A, 2461-A, Ch. Carco 17B4, Late	67-3	10=1-10

NATIONAL CO., INC.

MODEL	PACK-FILE	PAGES
TV1701	67-1	10=1-12

NORELCO

See NORTH AMERICAN PHILLIPS CO., INC.

NORTH AMERICAN PHILLIPS CO., INC. (NORELCO)

MODEL	PACK-FILE	PAGES
The Irvington	36-1	6=1-11
The Mt. Vernon	38-1	6=1-11
PT200, Ch.	36-1	6=1-11
PT200, Ch. PT200, The Irvington	36-1	6=1-11
PT300, Ch. PT200, The Mt. Vernon	38-1	6=1-11

OLYMPIC RADIO & TELEV. INC.

MODEL	PACK-FILE	PAGES
Broadmoor	44-1	6=1-12
Catalina	44-1	6=1-15
Challenger	44-1	6=1-12
Lancaster, Marlborough	44-1	7=1-8
Monte Carlo	44-1	6=1-12
Prince George	44-1	6=1-15
Riviera	44-1	6=1-12
Riviera Deluxe	44-1	7=1-8
Windsor	44-1	7=1-8
DX-214, DX-215, DX-216	44-1	4=1 5=1-6
DX-619, DX-620	44-1	5=1-7
DX-621	44-1	5=1-7 6=13-15
DX-622	44-1	5=1-7
DX-931, DX-932	44-1	5=1-7
DX-950	44-1	5=1-7
TG, Ch.	67-2	10=1-9
TH, Ch.	67-2	10=10-16
XL-210, XL-211	44-1	5=8-14
XL-612, XL-613	44-1	5=8-14
17C24, 17K31, 17K32, Ch. TG	67-2	10=1-9
17T20, 17T33, Ch. TG	67-2	10=1-9
21C28, 21D29, Ch. TH	67-2	10=10-16
21K26, 21T27, Ch. TH	67-2	10=10-16
752, Riviera	44-1	6=1-12

* See Muntz HANDY No. 8, Pack 36

PHILCO RCA — RCA RAYTHEON

PHILCO CORP. (Cont'd)

MODEL	PACK-FILE	PAGES
52-T2244, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2245, Ch. 44, D-4, Code 121	22-3	9=17-32
52-T2252, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2252, Ch. 71, G-1, Code 124	71-8	10=1-12
52-T2253, Ch. 44, D-4, Code 121	22-3	9=17-32
52-T2254, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2256, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2258, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2259, Ch. 41, D-1, Code 121	22-3	9=17-32
52-T2275, Ch. 35, F-2, Code 122	22-3	9=1-16
52-T2283, Ch. 44, D-4, Code 121	22-3	9=17-32
53-T1824, 53-T1825, 53-T1826, 53-T1852, Ch. 71, G-1, Code 124	71-8	10=1-12
53-T1853, 53-T1853L, Ch. 91, J-1, Code 126	68-7	10=35-44
53-T1883, 53-T1884, Ch. 44, G-4, Code 125	68-7	10=22-34
53-T1886, 53-T1886L, Ch. 44, G-4, Code 125	68-7	10=22-34
53-T2126, Ch. 42, G-2, Code 125	68-7	10=13-21
53-T2127, Ch. 91, J-1, Code 126	68-7	10=35-44
53-T2183, Ch. 44, G-4, Code 125	68-7	10=22-34
53-T2260, 53-T2262, 53-T2264, Ch. 42, G-2, Code 125	68-7	10=13-21
53-T2266, 53-T2268, Ch. 91, J-1, Code 126	68-7	10=35-44
53-T2269, 53-T2270, 53-T2271, Ch. 91, J-1, Code 126	68-7	10=35-44
53-T2273C, 53-T2273M, Ch. 91, J-1, Code 126	68-7	10=35-44
71, Ch.	71-8	10=1-12
76-4402, 76-5411, 76-5433, Series; Tuners	37-5	6=1-8
91, Ch.	68-7	10=35-44

PHILHARMONIC RADIO & TELEV. CORP.

MODEL	PACK-FILE	PAGES
C-6161, T-616	22-1	7=1-5
1116, 5816	22-1	7=1-5

PILOT RADIO CORP.

MODEL	PACK-FILE	PAGES
TV-125	20-1	5=1-12
TV-127	37-2	6=1-10
TV-161	20-1	5=1-12
TV-163	20-1	5=1-14
TV-164	37-2	6=1-10
TV-165	20-1	5=1-14
TV-167A	37-2	6=1-10
*TV-167B, TV-168	37-2	8=1-10
TV-191	37-2	6=1-10
*TV-191	37-2	6=1-10
TV-271, TV-273, TV-274	53-3	9=1-14
TV-293, TV-294	53-3	9=1-14

PLYMOUTH
See INTERSTATE STORES BUYING CORP.

PRECISION
See THE HERTNER ELECTRIC CO.

* See Pilot HANDY No. 1, Pack 37.

RADIO CORP. OF AMERICA

MODEL	PACK-FILE	PAGES
Ainsworth	72-12	10=64-72
Albury	72-12	10=55-63
Ashton	72-12	10=55-63
Belgrove	74-13	10=73-82
Bently	16-3	9=1-16
Brandon	74-13	10=73-82
Brett	72-12	10=64-72
Bristol	16-5	9=73-80
Bristol, Late	72-12	10=17-34
Brookfield	74-13	10=73-82
Caldwell	72-12	10=17-34
Calhoun	72-12	10=17-34
Clarendon	16-4	9=45-52
Colby	68-11	10=1-16
Covington	72-12	10=17-34
Crafton	68-11	10=1-16
Donley	16-4	9=45-52
Fairfield, Final	16-5	9=53-72
Glenside	68-11	10=1-16
Hadley	72-12	10=55-63
Hampton	16-5	9=73-80
Hampton, Late	72-12	10=17-34
Haywood	16-3	9=17-30
Highland, Final	16-5	9=53-72
Hillsdale	11-2	8=62-76
Hillsdale, Late	72-12	10=35-54
Kentwood	72-12	10=55-63
Lambert	74-13	10=73-82
Lansford	74-13	10=73-82
Lindale	74-13	10=73-82
Kendall	16-5	9=73-80
Kent, Modern, Newport; Final	16-5	9=53-72
Preston	16-5	9=73-80
Preston, Late	72-12	10=17-34
Provincial	11-2	8=62-76
Provincial, Final	16-5	9=53-72
Provincial	72-12	10=35-54
Regency, Final	16-5	9=53-72
Rockingham	16-4	9=45-52
Rutland	10-1	8=31-48
Shelley	72-12	10=55-63
Somerville	10-1	8=1-16
Suffolk	16-4	9=45-52
Talbot	16-4	9=31-44
Whitfield, Late	72-12	10=17-34
Winston, Final	16-5	9=53-72
York	11-2	8=62-76
York, Late	72-12	10=35-54
KCS31-1, Ch., S1000	20-6	5=48-64
KCS31-1, Ch., 9TW390	20-6	5=32-47
KCS34C, Ch.	34-7	5=80-110
KCS38, Ch.	34-7	5=65-79
KCS38C, Ch.	20-6	5=1-15
KCS40, KCS40A, Ch.	37-8	6=1-15
KCS40B, Ch.	46-10	7=50-64
KCS41-1, Ch.	20-6	5=16-31
KCS45, KCS45A, Ch.	46-9	7=1-16
KCS46, Ch.	46-9	7=17-32
KCS47, KCS47A, KCS47AT, Ch.	46-10	7=33-49
KCS47B, KCS47C, KCS47D, Ch.; Final	16-5	9=53-72
KCS47E, Ch.	16-4	9=31-44
KCS47F, KCS47G, Ch.; Final	16-5	9=53-72
KCS47GF-2, Ch.	16-3	9=17-30
KCS47T, Ch.	46-10	7=33-49
KCS48A, Ch.	10-1	8=31-48
KCS49B, Ch.	11-2	8=62-76
KCS49B, Ch., Late	72-12	10=35-54
KCS49BF, KCS49BF-2, Ch.	72-12	10=35-54
KCS49C, Ch.	11-2	8=62-76
KCS49C, Ch., Late	72-12	10=35-54
KCS49CF, KCS49CF-2, Ch.	72-12	10=35-54
KCS60A, Ch.	11-2	8=77-94
KCS61, Ch.	16-3	9=1-16
KCS62, Ch.	10-1	8=1-16
KCS66, Ch.	16-5	9=73-80
KCS66, Ch., Late	72-12	10=17-34
KCS66A, Ch.	16-5	9=73-80
KCS66A, Ch., Late	72-12	10=17-34
KCS66C, Ch.	68-11	10=1-16

RADIO CORP. OF AMERICA (Cont'd)

MODEL	PACK-FILE	PAGES
KCS66D, Ch.	72-12	10=17-34
KCS68C, Ch.	16-4	9=45-52
KCS72, Ch.	72-12	10=55-63
KCS72A, Ch.	74-13	10=73-82
KCS74, Ch.	72-12	10=64-72
S1000, Ch. KCS31-1	20-6	5=48-64
T100, Ch. KCS38	34-7	5=65-79
T120, Ch. KCS34C	34-7	5=80-94
T121, Ch. KCS34C	34-7	5=95-110
T164, Ch. KCS40	37-8	6=1-15
TC165, TC166, TC167, TC168, Ch. KCS40A	37-8	6=1-15
2T51, Ch. KCS45	46-9	7=1-16
2T60, Ch. KCS45A	46-9	7=1-16
2T81, Ch. KCS46	46-9	7=17-32
4T101, Ch. KCS61, Bently	16-3	9=1-16
4T141, Ch. KCS62, Somerville	10-1	8=1-16
Record Changer		
RCA 960282-4, 960282-5	10-RC2	RCH21=19-34
RCA RP-190-2	10-RC1	RCH21=1-12
6T53, 6T54, Ch. KCS47, KCS47T	46-10	7=33-49
6T64, 6T65, Ch. KCS47A, KCS47AT	46-10	7=33-49
6T71, Ch. KCS47A, KCS47AT	46-10	7=33-49
6T72, Ch. KCS40B	46-10	7=50-64
6T74, 6T75, 6T76, Ch. KCS47A, KCS47AT	46-10	7=33-49
7T103, Ch. KCS47B, Newport, Final	16-5	9=53-72
7T104, Ch. KCS47B, Kent, Final	16-5	9=53-72
7T104B, Ch. KCS47F, Final	16-5	9=53-72
7T111B, Ch. KCS47GF-2, Haywood	16-3	9=17-30
7T112, Ch. KCS47C, Highland, Final	16-5	9=53-72
7T112B, Ch. KCS47G, Final	16-5	9=53-72
7T122, Ch. KCS47C, Fairfield, Final	16-5	9=53-72
7T122B, Ch. KCS47G, Final	16-5	9=53-72
7T123, Ch. KCS47C, Regency, Final	16-5	9=53-72
7T123B, Ch. KCS47G, Final	16-5	9=53-72
7T124, Ch. KCS47C, Modern, Final	16-5	9=53-72
7T125B, Ch. KCS47G, Provincial, Final	16-5	9=53-72
7T132, Ch. KCS47D, Winston, Final	16-5	9=53-72
7T143, Ch. KCS48A, Rutland	10-1	8=31-48
Record Changer		
RCA 960284	10-RC3	RCH21=35-50
RCA RP-190	10-RC1	RCH21=1-12
9T105, Ch. KCS49B, York	11-2	8=62-76
9T105, Ch. KCS49B, KCS49BF, KCS49BF-2, York, Late	72-12	10=35-54
9T126, Ch. KCS49C, Hillsdale	11-2	8=62-76
9T126, Ch. KCS49C, KCS49CF, KCS49CF-2, Hillsdale, Late	72-12	10=35-54
9T128, Ch. KCS49C, Provincial	11-2	8=62-76
9T128, Ch. KCS49C, KCS49CF, KCS49CF-2, Provincial, Late	72-12	10=35-54
9T147, Ch. KCS60A	11-2	8=77-94
Record Changer		
RCA 960284	11-RC3	RCH21=35-50
RCA RP-190	11-RC1	RCH21=1-12
9T256, Ch. KCS38C	20-6	5=1-15
9TW309, Ch. KCS41-1	20-6	5=16-31
9TW390, Ch. KCS31-1	20-6	5=32-47
16T152, Ch. KCS47E, Talbot	16-4	9=31-44
17T150, Ch. KCS66C, Colby	68-11	10=1-16
17T151, Ch. KCS66C, Glenside	68-11	10=1-16
17T153, Ch. KCS66, Bristol	16-5	9=73-80
17T153, Ch. KCS66, Bristol, Late	72-12	10=17-34
17T154, Ch. KCS66, Whitfield, Late	72-12	10=17-34
17T155, Ch. KCS66, Preston	16-5	9=73-80
17T155, Ch. KCS66, Preston, Late	72-12	10=17-34

RADIO CORP. OF AMERICA (Cont'd)

MODEL	PACK-FILE	PAGES
17T160, Ch. KCS66, Hampton	16-5	9=73-80
17T160, Ch. KCS66, Hampton, Late	72-12	10=17-34
17T162, Ch. KCS66A, Caldwell, Late	72-12	10=17-34
17T163, Ch. KCS66C, Crafton	68-11	10=1-16
17T172, Ch. KCS66A, Covington, Late	72-12	10=17-34
17T172K, Ch. KCS66D	72-12	10=17-34
17T173, Ch. KCS66A, Calhoun, Late	72-12	10=17-34
17T173K, Ch. KCS66D	72-12	10=17-34
17T174, Ch. KCS66A, Kendall	16-5	9=73-80
17T174K, Ch. KCS66D	72-12	10=17-34
17T200, Ch. KCS72, Shelley	72-12	10=55-63
17T201, Ch. KCS72, Hadley	72-12	10=55-63
17T202, Ch. KCS72, Kentwood	72-12	10=55-63
17T211, Ch. KCS72, Ashton	72-12	10=55-63
17T220, Ch. KCS72, Albury	72-12	10=55-63
17T250DE, Ch. KCS74, Brett	72-12	10=64-72
17T261DE, Ch. KCS74, Ainsworth	72-12	10=64-72
21T176, Ch. KCS68C, Suffolk	16-4	9=45-52
21T177, Ch. KCS68C, Donley	16-4	9=45-52
21T178, Ch. KCS68C, Rockingham	16-4	9=45-52
21T179, Ch. KCS68C, Clarendon	16-4	9=45-52
21T208, Ch. KCS72A, Lambert	74-13	10=73-82
21T217, Ch. KCS72A, Brookfield	74-13	10=73-82
21T218, Ch. KCS72A, Lansford	74-13	10=73-82
21T227, Ch. KCS72A, Lindale	74-13	10=73-82
21T228, Ch. KCS72A, Brandon	74-13	10=73-82
21T229, Ch. KCS72A, Belgrove	74-13	10=73-82

RADIO CRAFTSMEN

MODEL	PACK-FILE	PAGES
RC101	15-1	8=1-5
RC100A	38-2	5=1-6
RC201	15-1	8=6-9
RC202	74-3	10=1-6

RAYTHEON TELEV. & RADIO CORP.

MODEL	PACK-FILE	PAGES
Adams	2-1	8=1-13
The Belmont	27-2	5=1-8
Catalina, Clayton	2-1	8=1-13
Commander	58-4	10=1-10
The Console	27-2	5=1-8
Constellation	2-1	8=1-13
The Evanston	48-3	7=1-16
Highland	58-4	10=11-20
Linden	58-4	10=1-10
The Marquis	48-3	7=1-16
The Mayfair, The Mozart	48-3	7=1-16
Raleigh	58-4	10=11-20
The Rancho, The Revere	48-3	7=1-16
The Rocket	48-3	7=1-16
Roseland	58-4	10=1-10
The Rover	27-2	5=1-8
The Savoy, The Santung	48-3	7=1-16
Sensation	58-4	10=11-20
The Starlight	2-1	8=14-25
The Suburban	27-2	5=1-8
Vogue	58-4	10=11-20
C-1104B, Ch. 12AX27, The Console	27-2	5=1-8
C-1401, Ch. 14AX21	27-2	5=9-18
C-1602, Ch. 16AX23, 16AX25, 16AX26	27-2	5=21-29
C-1602, Series C, Ch. 16AX29	27-2	5=21-29
C-1614A, Ch. 16AY211, The Marquis	48-3	7=1-16
C-1614B, Ch. 16AY28, The Marquis	48-3	7=1-16
C-1615A, Ch. 16AY211, The Mayfair	48-3	7=1-16
C-1615B, Ch. 16AY28, The Mayfair	48-3	7=1-16

RAYTHEON SEARS — SEARS SPARTON

RAYTHEON TELEV. & RADIO CORP. (Cont'd)

MODEL	PACK-FILE	PAGES
C-1616A, Ch. 16AY211, The Mozart	48-3	7=1-16
C-1616B, Ch. 16AY28, The Mozart	48-3	7=1-16
C-1714A, Ch. 17AY24, The Marquis	48-3	7=1-16
C-1714B, Ch. 17AY21, The Marquis	48-3	7=1-16
C-1715A, Ch. 17AY24, The Mayfair	48-3	7=1-16
C-1715B, Ch. 17AY21, The Mayfair	48-3	7=1-16
C-1716A, Ch. 17AY24, The Mozart	48-3	7=1-16
C-1716B, Ch. 17AY21, The Mozart	48-3	7=1-16
C-1724A, Ch. 17AY21, The Evanston	48-3	7=1-16
C-1729A, Ch. 17AY21A, Roseland	58-4	10=1-10
C-1731A, Ch. 17AY21A, Linden	58-4	10=1-10
C-2001A, Ch. 20AY21, Clayton	2-1	8=1-13
C-2002A, Ch. 20AY21, Catalina	2-1	8=1-13
C-2006A, Constellation	2-1	8=1-13
C-2103A, Ch. 21AY21, Raleigh	58-4	10=11-20
C-2105A, Ch. 21AY21, Highland	58-4	10=11-20
M-1105B, Ch. 12AX27, The Suburban	27-2	5=1-8
M-1106, Ch. 12AX27, The Rover	27-2	5=1-8
M-1107, Ch. 12AX27, The Belmont	27-2	5=1-8
M-1402, M-1403, M-1404, Ch. 14AX21	27-2	5=9-18
M-1601, Ch. 16AX23, 16AX25, 16AX26	27-2	5=21-29
M-1611A, Ch. 16AY211, The Rocket	48-3	7=1-16
M-1611B, Ch. 16AY28, The Rocket	48-3	7=1-16
M-1612A, Ch. 16AY211, The Rancho	48-3	7=1-16
M-1612B, Ch. 16AY28, The Revere	48-3	7=1-16
M-1613A, Ch. 16AY211, The Revere	48-3	7=1-16
M-1613B, Ch. 16AY28, The Revere	48-3	7=1-16
M-1711A, Ch. 17AY24, The Rocket	48-3	7=1-16
M-1711B, Ch. 17AY21, The Rocket	48-3	7=1-16
M-1712A, Ch. 17AY24, The Rancho	48-3	7=1-16
M-1712B, Ch. 17AY21, The Rancho	48-3	7=1-16
M-1713A, Ch. 17AY24, The Revere	48-3	7=1-16
M-1713B, Ch. 17AY21, The Revere	48-3	7=1-16
*M-1725A, Ch. 17AY21	48-3	7=1-16
M-1726A, Ch. 17AY21A, Commander	58-4	10=1-10
M-1728A, Ch. 17AY21A, Vogue	58-4	10=1-10
M-2101A, Ch. 21AY21, Sensation	58-4	10=11-20
P-301, Series B, Ch. 7DX22P	27-2	5=31-34
RC-1405, Ch. 14AX21	27-2	5=9-20
RC-1618A, Ch. 16AY211, The Savoy	48-3	7=1-16
RC-1618B, Ch. 16AY28, The Savoy	48-3	7=1-16
RC-1619A, Ch. 16AY211, The Santung	48-3	7=1-16

RAYTHEON TELEV. & RADIO CORP. (Cont'd)

MODEL	PACK-FILE	PAGES
RC-1619B, Ch. 16AY28, The Santung	48-3	7=1-16
RC-1718A, Ch. 17AY24, The Savoy	48-3	7=1-16
RC-1718B, Ch. 17AY21, The Savoy	48-3	7=1-16
RC-1719A, Ch. 17AY24, The Santung	48-3	7=1-16
RC-1719B, Ch. 17AY21, The Santung	48-3	7=1-16
RC-1720A, Ch. 17AY27, The Starlight	2-1	8=14-25
Record Changer VM-950	2-RC1	RCH22=1-16
RC-2005A, Ch. 20AY21, Adams	2-1	8=1-13
Record Changer VM-950	2-RC1	RCH22=1-16
6J6, 12AT7, Tuners	2-1	8=26-31
7DX22P, Ch.	27-2	5=31-34
12AX27, Ch.	27-2	5=1-8
14AX21, Ch.	27-2	5=9-20
16AX23, 16AX25, 16AX26, Ch.	27-2	5=21-29
16AX29, Ch.	27-2	5=21-29
16AY28, Ch.	48-3	7=1-16
16AY211, Ch.	48-3	7=1-16
17AY21, Ch.	48-3	7=1-16
17AY21A, Ch.	58-4	10=1-10
17AY24, Ch.	48-3	7=1-16
17AY27, Ch.	2-1	8=14-25
20AY21, Ch.	2-1	8=1-13
21AY21, Ch.	58-4	10=11-20

SCOTT RADIO LABS., INC.

MODEL	PACK-FILE	PAGES
Ashly, Chippendale, Cressy, Croydon, Ravenswood, Waverly, Wellington	54-1	9=1-16
AC-17, AT-17, Ch. 720, Ravenswood	54-1	9=1-16
Record Changer WEBSTER 100	54-RC1	RCH21=1-10
310, Ch. 720, Croydon	54-1	9=1-16
Record Changer MILWAUKEE 11600	54-RC1	RCH 9=1-4
320, Ch. 920, Croydon	54-1	9=1-16
Record Changer MILWAUKEE 11600	54-RC1	RCH 9=1-4
510, Ch. 720, Cressy	54-1	9=1-16
Record Changer WEBSTER 100	54-RC1	RCH21=1-10
520-TA, Ch. 920, Ashly	54-1	9=1-16
Record Changer WEBSTER 100	54-RC1	RCH21=1-10
720, Ch.	54-1	9=1-16
910, Ch. 920, Waverly	54-1	9=1-16
Record Changer WEBSTER 100	54-RC1	RCH21=1-10
920, Ch.	54-1	9=1-16
924, Ch. 924, Wellington	54-1	9=1-16
Record Changer WEBSTER 100	54-RC1	RCH21=1-10
924, Ch.	54-1	9=1-16
1000-TC, Ch. 924, Chippendale	54-1	9=1-16
Record Changer WEBSTER 100	54-RC1	RCH21=1-10

SEARS, ROEBUCK & CO. (SILVERTONE)

MODEL	PACK-FILE	PAGES
100.112, Ch.	11-1	8=1-14
100.120, Ch.	55-4	9=57-72
102-A, Ch. 549.100-7	55-4	9=49
110.111, Ch.	11-1	8=15-31
110.700, Ch.	74-5	10=1-30
110.700-1, 110.700-2, Ch.	74-5	10=1-30
110.700-10, 110.700-20, Ch.	74-5	10=1-30
110.700-40, 110.700-50, Ch.	74-5	10=1-30
110.700-90, 110.700-91, Ch.	74-5	10=1-30
110.700-92, 110.700-93, Ch.	74-5	10=1-30
110.700-96, 110.700-97, Ch.	74-5	10=1-30
111, 113, Ch. 110.700	74-5	10=1-30

SEARS, ROEBUCK & CO. (Cont'd)

MODEL	PACK-FILE	PAGES
116, Ch. 110.700-1, 110.700-10	74-5	10=1-30
116A, Ch. 110.700-1, 110.700-10, 110.700-90	74-5	10=1-30
127-12, Ch. 110.700	74-5	10=1-30
128-16, Ch. 478.337	55-3	9=13-20
131, Ch. 110.700-1, 110.700-10	74-5	10=1-30
131A, Ch. 110.700-1, 110.700-10, 110.700-90	74-5	10=1-30
132.014, Ch.	55-4	9=53-56
132.890, 132.890-1, 132.890-2, Ch.	12-2	8=53-66
134, Ch. 110.700-2, 110.700-20	74-5	10=1-30
139, 140, Ch. 110.700	74-5	10=1-30
143, Ch. 100.111	11-1	8=15-31
Record Changer SEARS 100.211-20	11-RC1	RCH 9=1-16
143A, Ch. 100.111	11-1	8=15-31
Record Changer VM-950	11-RC1	RCH22=1-16
150-14, Ch. 478.338	11-1	8=32-39
153-16, Ch. 478.341	55-3	9=9-12
161-16, Ch. 100.112	11-1	8=1-14
162-16, Ch. 110.700-10, 110.700-90	74-5	10=1-30
163-16, Ch. 478.319	55-3	9=1-8
165-16, Ch. 100.120	55-4	9=57-72
166-16, Ch. 478.339	55-3	9=21-36
166-17, Ch. 478.339-A	55-3	9=21-36
167-16, Ch. 549.101	11-1	8=40-52
167-16A, Ch. 549.101-1	11-1	8=40-52
168-16, Ch. 549.100-7	55-4	9=49
172-16, Ch. 549.101-4	74-5	10=31-40
173-16, Ch. 110.700-10, 110.700-90	74-5	10=1-30
175-16, 175-16A, Ch. 549.100-5, 549.100-8, 549.100-9	55-4	9=37-48
176-19, Ch. 549.100-6	55-4	9=50-52
177-19, Ch. 110.700-40, 110.700-91	74-5	10=1-30
179-16, 180-16, Ch. 132.890, 132.890-1, 132.890-2	12-2	8=53-66
185-16, Ch. 549.101-2	11-1	8=40-52
186-19, Ch. 549.101-3	11-1	8=40-52
187-16, 188-16, Ch. 110.700-10	74-5	10=1-30
189-16, Ch. 110.700-1, 110.700-10	74-5	10=1-30
191-16, Ch. 110.700-50, 110.700-92	74-5	10=1-30
192-16, Ch. 110.700-50	74-5	10=1-30
194-16, Ch. 132.890, 132.890-1, 132.890-2	12-2	8=53-66
195-16, Ch. 132.890, 132.890-1, 132.890-2	12-2	8=53-66
Record Changer VM-950	12-RC1	RCH22=1-16
478.319, Ch.	55-3	9=1-8
478.337, Ch.	55-3	9=13-20
478.338, Ch.	11-1	8=32-39
478.339, 478.339-A, 478.339-B, Ch.	55-3	9=21-36
478.341, Ch.	55-3	9=9-12
478.361, 478.361-A, Ch.	55-3	9=21-36
478.375, 478.376, Ch.	55-3	9=13-20
549.100-5, Ch.	55-4	9=37-48
549.100-6, Ch.	55-4	9=50-52
549.100-7, Ch.	55-4	9=49
549.100-8, 549.100-9, Ch.	55-4	9=37-48
549.101, 549.101-1, 549.101-2, 549.101-3, Ch.	11-1	8=40-52
549.101-4, Ch.	74-5	10=31-40
1116-16, Ch. 110.700-90	74-5	10=1-30
1117-17, 1130-17, Ch. 110.700-96	74-5	10=1-30
1132-17, Ch. 478.376	55-3	9=13-20
1135-17, Ch. 110.700-96	74-5	10=1-30
1141-20, Ch. 110.700-93	74-5	10=1-30
1146-20, Ch. 132.014	55-4	9=53-56
1150-14, Ch. 478.361, 478.361-A	55-3	9=21-36
1162-16, Ch. 110.700-90	74-5	10=1-30
1162-17, Ch. 110.700-96	74-5	10=1-30
1163-17, Ch. 478.375	55-3	9=13-20

SEARS, ROEBUCK & CO. (Cont'd)

MODEL	PACK-FILE	PAGES
1166-17, Ch. 478.339-B	55-3	9=21-36
1191-17, Ch. 110.700-97	74-5	10=1-30

SENTINEL RADIO CORP.

MODEL	PACK-FILE	PAGES
YA, YB, YC, Ch.	38-1	7=1-13 9=1-12
1U416	38-1	5=1-8
1U419, 1U420	38-1	5=9-16 6=1-8
1U424	38-1	6=1-8
1U425, 1U428, Ch. YA, YB, YC	38-1	7=1-13
1U432, Ch. YA, YB, YC	38-1	7=1-13
1U435, Ch. YB, YC	38-1	7=1-13
1U438, 1U439, 1U440, Ch. YA, YB, YC	38-1	9=1-12
1U441, 1U443, 1U444, Ch. YA, YB, YC	38-1	9=1-12
1U446, Series XD	38-1	9=1-12
1U-447-A, 1U-448-A, 1U-449-A	75-2	10=1-7
1U-450-A, 1U-451-A	75-2	10=1-7
416	38-1	5=1-8
419, 420	38-1	5=9-16
420B	38-1	6=1-8
423, 424	38-1	6=1-8
425, 428, Ch. YA, YB, YC	38-1	7=1-13
432, Ch. YA, YB, YC	38-1	7=1-13
435, Ch. YB, YC	38-1	7=1-13
438, 439, 440, Ch. YA, YB, YC	38-1	9=1-8
441, 443, 444, Ch. YA, YB, YC	38-1	9=1-8

SHERATON TELEV. CORP.

MODEL	PACK-FILE	PAGES
260-DX, 260-FM	54-1	9=1-6
260-S, 260-V	54-1	9=1-6

SILVERTONE

See SEARS, ROEBUCK & CO.

SKYRIDER

MODEL	PACK-FILE	PAGES
519, 520	12-1	8=1-7

SONORA RADIO & TELEV. CORP.

MODEL	PACK-FILE	PAGES
323, 324	54-1	9=1-4

SPARTON RADIO-TELEVISION DIV. OF THE SPARKS-WITHINGTON CO.

MODEL	PACK-FILE	PAGES
Berkeley	56-2	9=1-10
Del Mar	56-2	9=22-24
Gramercy	56-2	9=17-21
Hanover	56-2	9=11-16
Harrison	75-3	10=1-7
Hastings	75-3	10=1-7
Radmoor	75-3	10=1-7
Rochelle	56-2	9=22-24
Roxbury	75-3	10=1-7
Sheffield	56-2	9=22-24
The Sparcraft	24-1	7=3-10 8=1-6
The Westmont	24-1	7=3-10 8=1-6
Whitney	56-2	9=1-10 9=17-21
25RD190, Ch.	24-1	7=10 8=7-13
25SD201, Ch.	24-1	7=10 8=14-20
25SD201A, Ch.	56-2	9=11-16
26SD160, Ch.	24-1	7=3-12
26SD170, Ch.	24-1	7=3-10 8=1-6 8=21-25
26SD170, DeLuxe, Ch., 5078BB	24-1	7=3-10 8=6 8=31

SPARTON RADIO-TELEVISION (Cont'd)

MODEL	PACK-FILE	PAGES
26SD170, DeLuxe, Ch., 5079B	24-1	7=3-10 8=22 8=25-26
26SD170P, Ch.	24-1	7=3-10 8=2 8=21-25
26SD170X, 26SD170XP, Ch.	24-1	7=3-10 8=2 8=21-25
26SD171, Ch.	56-2	9=22-24
26SD172C, Ch.	75-3	10=1-7
26SS160, 26SS160B, 26SS160L, Ch.	24-1	7=3-12
26SS170, Ch.	24-1	7=3-10 8=23-24 8=27-31
26SS170D, 26SS170DD, Ch.	56-2	9=1-10
26SS170D, 26SS170DP, Ch.	24-1	7=5-10 8=23-24 8=27
26SS170P, Ch.	24-1	7=5-10 8=23-24 8=27
26SS171, 26SS171A, Ch.	56-2	9=17-21
5025, Ch. 26SS160	24-1	7=3-12
5025BA, Ch. 26SS170	24-1	7=3-10 8=28-31
5026, Ch. 26SS160	24-1	7=3-12
5029, 5030, Ch. 26SD160	24-1	7=3-12
5035, 5036, 5037, Ch. 26SS160L	24-1	7=3-12
5075BA, Ch. 26SS170	24-1	7=3-10 8=28-31
5078, Ch. 26SS160	24-1	7=3-12
5076BA, Ch. 26SS170	24-1	7=3-10 8=28-31
5076BB, Ch. 26SS160B	24-1	7=3-12
5077, Ch. 26SS160	24-1	7=3-12
5077B, Ch. 26SS160B	24-1	7=3-12
5077BA, Ch. 26SS170	24-1	7=3-10 8=28-31
5078BB, Ch. 26SD170, DeLuxe	24-1	7=3-10 8=6 8=31
5079, Ch. 26SD160	24-1	7=3-12
5079B, Ch. 26SD170, DeLuxe	24-1	7=3-10 8=22 8=25-26
5079BB, Ch. 26SD170, DeLuxe	24-1	7=3-10 8=6 8=31
5080, Ch. 26SD160	24-1	7=3-12
5080BB, Ch. 26SD170, DeLuxe	24-1	7=3-10 8=6 8=31
5082, 5083, Ch. 26SD170	24-1	7=3-10 8=1-6
5082, 5083, Ch. 26SD170X, 26SD170XP	24-1	7=3-10 8=2 8=21-25
5085, 5086, Ch. 25RD190	24-1	7=10 8=7-13
5088, Ch. 26SD170, The Westmont	24-1	7=3-10 8=1-6
5089, Ch. 26SD170	24-1	7=3-10 8=1-6
5090, Ch. 26SD170, The Sparcraft	24-1	7=3-10 8=1-6
5101, 5102, 5103, Ch. 26SS170, 26SS170P	24-1	7=5-10 8=23-24 8=27
5104, 5105, Ch. 26SS170D, 26SS170DP	24-1	7=5-10 8=23-24 8=27
5107X, Ch. 26SS170D, Whitney	56-2	9=1-10

SPARTON RADIO-TELEVISION (Cont'd)

MODEL	PACK-FILE	PAGES
5107X, Ch. 26SS171, Whitney	56-2	9=17-21
5108, Ch. 26SS170D, Whitney	56-2	9=1-10
5110, Ch. 26SS170DD, Berkeley	56-2	9=1-10
5125, Ch. 26SS170DD	56-2	9=1-10
5152, 5153, 5154, Ch. 26SS170, 26SS170P	24-1	7=5-10 8=23-24 8=27
5155, 5156, 5157, Ch. 26SD170X, 26SD170XP	24-1	7=3-10 8=2 8=21-25
5158, Ch. 26SD170, 26SD170P	24-1	7=3-10 8=2 8=21-25
5162X, 5163X, Ch. 26SS171A, Gramercy	56-2	9=17-21
5165X, 5166X, Ch. 26SD171, Sheffield	56-2	9=22-24
5170, 5171, Ch. 25SD201	24-1	7=10 8=14-20
5175X, Ch. 26SD171, Rochelle	56-2	9=22-24
5178X, Ch. 26SD171, Del Mar	56-2	9=22-24
5182, 5183, Ch. 26SD170, 26SD170P	24-1	7=3-10 8=2 8=21-25
5188, 5189, Ch. 26SD170, 26SD170P	24-1	7=3-10 8=2 8=21-25
5191, 5192, Ch. 25SD201A, Hanover	56-2	9=11-16
5220, Ch. 26SD172C, Harrison	75-3	10=1-7
5225, Ch. 26SD172C, Hastings	75-3	10=1-7
5226, Ch. 26SD172C	75-3	10=1-7
5270, Ch. 26SD172C, Roxbury	75-3	10=1-7
5271, Ch. 26SD172C	75-3	10=1-7
5272, 5273, Ch. 26SD172C, Radmoor	75-3	10=1-7

SPENCER-KENNEDY LABS., INC.

MODEL	PACK-FILE	PAGES
212TV, Booster	12-1	8=1-3

STANDARD COIL PRODUCTS CO. INC.

MODEL	PACK-FILE	PAGES
B-51, Booster	12-1	8=1

STARRETT TELEVISION CORP.

MODEL	PACK-FILE	PAGES
117H, Ch.	75-1	10=1-8
120H, Ch.	75-1	10=1-8
472.17XMC, 472.17XMT, Ch. 117H	75-1	10=1-8
472.20XMC, 472.20XMT, Ch. 120H	75-1	10=1-8
Eli Whitney	75-1	10=1-8
James Buchanan	75-1	10=1-8
James Madison	75-1	10=1-8
Patrick Henry	75-1	10=1-8
Peter Stuyvesant	75-1	10=1-8
The Riviera	75-1	10=1-8
12S1, Ch.	75-1	10=1-8
14S1, Ch.	75-1	10=1-8
15S1, Ch.	75-1	10=1-8
17BM1, Ch. 12S1, James Buchanan	75-1	10=1-8
20BM1, Ch. 15S1, Peter Stuyvesant	75-1	10=1-8
27BM1, Ch. 12S1, Patrick Henry	75-1	10=1-8
29AM1, Ch. 14S1, Peter Stuyvesant	75-1	10=1-8
30BM1, Ch. 15S1, James Madison	75-1	10=1-8
37BB1, Ch. 12S1, Eli Whitney	75-1	10=1-8
37BM1, Ch. 12S1, The Riviera	75-1	10=1-8
39AM1, Ch. 14S1, James Madison	75-1	10=1-8

STEWART-WARNER ELECTRIC DIV. OF STEWART-WARNER CORP.

MODEL	PACK-FILE	PAGES
9120-A, 9120-B, 9120-C, 9120-D, 9120-E, 9120-F	24-2	7=1-17
9121-A, 9121-B	24-2	7=18-36
9122-A	12-1	8=1-19
9125-A	56-4	9=19-36
Record Changer STEW.-WARNER VM-509032	56-RC1	RCH 9=1-16
9126-A, 9126-B	56-4	9=37-41
9127-A	56-4	9=42-46
9200-A, 9200-C, 9200-D, 9200-FA, 9200-G	12-1	8=20-36
9202-A, 9202-B	75-5	10=1-22
9202-C	12-1	8=37-53
9202-C, Late	75-5	10=1-22
9202-DA	12-1	8=37-53
9202-DA, Late	75-5	10=1-22
9202-DB	12-1	8=37-53
9202-DB, Late	75-5	10=1-22
9202-DD	12-1	8=37-53
9202-DD, Late, 9202-DDA	75-5	10=1-22
9202-E	12-1	8=37-53
9202-E, Late	75-5	10=1-22
9202-F	12-1	8=37-53
9202-F, Late, 9202-FA	75-5	10=1-22
9203-A	25-3	9=1-18
9204-A	75-5	10=1-22

STRAND TELEVISION CORP.

MODEL	PACK-FILE	PAGES
32-B The Vermont, 80, 2406-C Riverdale, 2412 The Commodore, 2415-C The Cosmopolitan, 2417-C The Van Courtland, 3203-C The Regal, 3214 The Aristocrat, 3217 The Provence, 3224 The Carolinian, 3255 The Danberry, 3353 The Madison, 3356 The Roosevelt, 3357 The Jackson, 3642 The Scarsdale, 3644L The Crestwood, 3645 The Yorktowne, 4000 The New Yorker, 4000 Ch. L, See VIDEO PRODUCTS 630-K3C, 630-DX, 630-FM	69-1	10=1-12

STROMBERG-CARLSON CO.

MODEL	PACK-FILE	PAGES
Brighton	76-3	10=1-7
Cavalier, Futura	23-2	9=1-8
Invader	76-3	10=8-18
Mandarin	76-3	10=1-7
Pan American	76-3	10=8-18
Panatomic	76-3	10=8-18
24C, 24CM, Ch. 112126	23-2	7=1-8
24RP, 24 Series, Ch. 112119	23-2	7=1-8
24RPM, 24 Series, Ch. 112119	23-2	7=1-8
Record Changer WEBSTER 100	23-RC1	RCH21=1-10
119CDM, 119CM, Ch. 112107	23-2	7=9-20
119M5A, 119M5D, 119M5G, 119M5I, 119M5M, 119M5R, Ch. 112114	23-2	7=9-20
119RPM, 119RPM2, Ch. 112114	23-2	7=9-20
317RPM, Ch. 112120	15-1	8=1-8
Record Changer VM-950	15-RC1	RCH22=1-16
317TM, Ch. 112121	15-1	8=1-8
321CD2M, 321CD2O, 321 Series, Ch. 112127, Futura	23-2	9=1-8
321CF, 321C2M, Ch. 112127, Cavalier	23-2	9=1-8
417C5M, 417C5O, 417 Series	76-3	10=1-7
417C5-Dec, 417 Series, Mandarin	76-3	10=1-7
417TX, 417 Series, Brighton	76-3	10=1-7
421CDM, 421 Series, Pan American	76-3	10=8-18
421CM, 421 Series, Invader	76-3	10=8-18
421TX, 421 Series, Panatomic	76-3	10=8-18

STROMBERG-CARLSON CO. (Cont'd)

MODEL	PACK-FILE	PAGES
112107, Ch.	23-2	7=9-20
112114, Ch.	23-2	7=9-20
112119, Ch.	23-2	7=1-8
112120, 112121, Ch.	15-1	8=1-8
112126, Ch.	23-2	7=1-8
112127, Ch.	23-2	9=1-8

SUPREMACY

See MACY'S

SURREY

See BENRAY ELECTRONICS CORP.

SYLVANIA ELECTRIC PRODUCTS INC.

MODEL	PACK-FILE	PAGES
1-197-2, Ch. 1-227	13-1	8=53-63
1-227, Ch.	13-1	8=53-63
1-231, Ch.	13-2	8=105-117
1-245-2, Ch. 1-227	13-1	8=53-63
1-247-1, Ch. 1-231	13-2	8=105-117
1-260, 1-261, Ch.	23-3	7=1-23
1-329, Ch.	13-1	8=64-82
1-356(CO5), Ch.	13-2	8=160-173
1-366, Ch.	23-3	7=1-23
1-366(CO8), Ch.	13-2	8=140-153
1-366-66, Ch.	23-3	7=1-23
1-381, Ch.	13-1	8=64-81
1-387, Ch.	13-1	8=83-98
1-387(CO7), Ch.	13-2	8=118-131
1-387-1, Ch., 22M-1	13-2	8=118-139
1-387-1, Ch., 25M	25-4	9=15-30
1-437, Ch.	23-3	7=24-37
1-437-1, Ch.	25-4	9=1-14 9=41-52
1-437-2, 1-437-3, Ch.	69-5	10=39-57
1-441, Ch.	23-3	7=1-23 8=99-104
1-441(CO2), Ch.	13-2	8=140-159
1-442, Ch.	23-3	7=24-37
1-502-1, Ch.	25-4	9=31-40
1-502-2, Ch.	76-6	10=1-21
1-502-3, Ch.	76-6	10=1-21
1-502-5, Ch.	76-6	10=1-21
1-507-1, Ch.	76-6	10=22-38
1-507-2, Ch.	76-6	10=22-38
22B-11, Ch. 1-507-1	76-6	10=22-38
22M, Ch. 1-387(CO7)	13-2	8=118-131
22M-1, Ch. 1-387-1	13-2	8=118-139
22M-11, Ch. 1-507-1	76-6	10=22-38
22M-11A, 22M-11B, Ch. 1-507-2	76-6	10=22-38
23B, Ch. 1-387-1	13-2	8=118-139
23B-11, Ch. 1-507-1	76-6	10=22-38
23M, Ch. 1-387-1	13-2	8=118-139
23M-11, Ch. 1-507-1	76-6	10=22-38
24M-1, Ch. 1-387-1	13-2	8=118-139
25M, Ch. 1-387-1	25-4	9=15-30
Record Changer VM-950	25-RC1	RCH22=1-16
71M, Ch. 1-441(CO2)	13-2	8=140-153
71M-1, 72B-1, Ch. 1-502-1	25-4	9=31-40
72B-11, Ch. 1-502-3	76-6	10=1-21
72M, Ch. 1-366	23-3	7=1-23
72M, Ch. 1-366(CO8)	13-2	8=140-153
72M-1, Ch. 1-502-1	25-4	9=31-40
72M-2, Ch. 1-437-3	69-5	10=39-57
72M-11, Ch. 1-502-3	76-6	10=1-21
72M-11A, 72M-11B, Ch. 1-502-5	76-6	10=1-21
73B, Ch. 1-366(CO8)	13-2	8=140-153
73B-5, Ch. 1-437-3	69-5	10=39-57
73B-11, Ch. 1-502-3	76-6	10=1-21
73M, Ch. 1-366	23-3	7=1-23
73M, Ch. 1-366(CO8)	13-2	8=140-153
73M-1, 73M-2, Ch. 1-502-2	76-6	10=1-21
73M-3, 73M-5, 73M-6, Ch. 1-437-3	69-5	10=39-57
73M-11, Ch. 1-502-3	76-6	10=1-21
74B-1, Ch. 1-437-1	25-4	9=41-52
74B-2, Ch. 1-437-2	69-5	10=39-57
74M, Ch. 1-356(CO5)	13-2	8=160-173
74M-1, Ch. 1-437-1	25-4	9=41-52
74M-2, 74M-3, Ch. 1-437-2	69-5	10=39-57

SYLVANIA ELECTRIC PRODUCTS INC. (Cont'd)

MODEL	PACK-FILE	PAGES
75B, 75M, Ch. 1-437-1	25-4	9=1-14
Record Changer VM-950	25-RC1	RCH22=1-16
1110X, Ch. 1-329	13-1	8=64-82
1210X, Ch. 1-381	13-1	8=64-81
2221M, Ch. 1-387	13-1	8=83-98
4120M, 4130B, Ch. 1-260, 1-261	23-3	7=1-23
4130E, Ch. 1-260	23-3	7=1-23
4130M, 4130W, Ch. 1-260, 1-261	23-3	7=1-23
6110X, Ch. 1-261	23-3	7=1-23
6120B, 6120M, 6120W, Ch. 1-260, 1-261	23-3	7=1-23
6130B, 6130M, 6130W, Ch. 1-260, 1-261	23-3	7=1-23
7110X, Ch. 1-366	23-3	7=1-23
7110XB, Ch. 1-441	23-3	7=1-23 8=99-104
7110XF, Ch. 1-366-66	23-3	7=1-23
7110XFA, Ch. 1-442	23-3	7=24-37
7111M, Ch. 1-441	23-3	7=1-23 8=99-104
7111MA, Ch. 1-366	23-3	7=1-23
7120B, 7120M, 7120W, Ch. 1-366	23-3	7=1-23
7120BF, 7120MF, Ch. 1-366-66	23-3	7=1-23
7120MFA, Ch. 1-442	23-3	7=24-37
7120WF, Ch. 1-366-66	23-3	7=1-23
7130, 7130M, 7130W, Ch. 1-366	23-3	7=1-23
7130BF, 7130MF, Ch. 1-366-66	23-3	7=1-23
7130MFA, Ch. 1-442	23-3	7=24-37
7130WF, Ch. 1-366-66	23-3	7=1-23
7140MA, 7140WA, Ch. 1-437	23-3	7=24-37

TECH-MASTER PRODUCTS CO. (VIDEOLA)

MODEL	PACK-FILE	PAGES
17U-A, Ch.	14-1	8=1-9
630D19, 630S10	69-2	10=1-15
1930 Final, 1930D	69-2	10=1-15
2430, 2431C, 2431P	69-2	10=1-15
5116, Ch. 17U-A	14-1	8=1-9

TELE KING CORP.

MODEL	PACK-FILE	PAGES
K-21, K-21B, K-22, Ch. TVJ	41-1	9=1-16
K-71, K-72, K-72B, Ch. TVJ	41-1	9=1-16
K-73L, K-74, Ch. TVJ	41-1	9=1-16
KC-21, KC-21B, Ch. TVJ	41-1	9=1-16
KC-71, KC-71B, Ch. TVJ	41-1	9=1-16
KD-21M, KD-22B, Ch. TVJ	41-1	9=1-16
KD-71, KD-72B, Ch. TVJ	41-1	9=1-16
TVG, Ch.	41-1	7=1-11
TVJ, Ch.	41-1	9=1-16
172LO, 172M, Ch. TVG	41-1	7=1-11
174LO, 174M, Ch. TVG	41-1	7=1-11
202LO, 202M, Ch. TVG	41-1	7=1-11
203, 205, Ch. TVG	41-1	7=1-11
916, 916CAF, Ch. TVG	41-1	7=1-11
919, 919CAF, Ch. TVG	41-1	7=1-11
1014, 1016, Ch. TVG	41-1	7=1-11

TELEKIT

See ELECTRO-TECHNICAL INDUSTRIES

TELEQUIP RADIO CO.

MODEL	PACK-FILE	PAGES
C517, C517B, Ch. 5050, 5050A	14-1	8=1-8
C617, C617B, Ch. 5050, 5050A	14-1	8=1-8
C720, C720B, Ch. 5050, 5050A	14-1	8=1-8
C820, C820B, Ch. 5050, 5050A	14-1	8=1-8
T417, T417B, T620, Ch. 5050, 5050A	14-1	8=1-8
12TR	41-2	6=1-8
14T, 14TR	41-2	6=1-8
16T, 16TR	41-2	6=1-8
19T, 19TR	41-2	6=1-8
5050, 5050A, Ch.	14-1	8=1-8

TELE-TONE RADIO CORP.

MODEL	PACK-FILE	PAGES
TAA, TAB, Ch.	41-2	6=9-17
TAG, Ch.	41-2	6=18-26 7=4-6
TAJ, Ch.	41-2	6=18-26
TAM, Ch.	41-2	7=7-12
TAO, Ch.	14-1	8=4-10
TAP-2, Ch.	41-2	7=1-12 8=1-3
TH, TJ, Rev., Ch.	41-2	6=1-8
TT, Ch.	41-2	6=1-8
TV-284, Ch. TT	41-2	6=1-8
TV-286, Ch. TH, TJ, Rev.	41-2	6=1-8
TV-287, TV-288, Ch. TT	41-2	6=1-8
TV300, TV301, Ch. TW, TX	41-2	6=9-14
TV304, TV305, Ch. TW, TX	41-2	6=9-14
TV306, Ch. TZ	41-2	6=18-26
TV307, Ch. TX	41-2	6=18-26
TV314, Ch. TAJ	41-2	8=18-26 7=1-3
TV315, Ch. TAA, TAB	41-2	6=9-17
TV316, Ch. TZ	41-2	6=18-26
TV317, Ch. TAG	41-2	6=18-26 7=4-6
TV318, Ch. TAM	41-2	7=7-12
TV322, TV323, Ch. TAM	41-2	7=7-12
TV324, TV325, TV326, Ch. TAP-2	41-2	7=1-12 8=1-3
TV328, TV329, Ch. TAP-2	41-2	7=1-12 8=1-3
TV330, TV331, TV332, TV333, Ch. TAO	14-1	8=4-10
TV335, TV336, Ch. TAP-2	41-2	7=1-12 8=1-3
TV340, TV345, Ch. TAP-2	41-2	7=1-12 8=1-3
TW, Ch.	41-2	6=9-14
TX, Ch.	41-2	6=9-14 6=18-26
TZ, Ch.	41-2	6=18-26

TELEVISION EQUIPMENT CORP.

MODEL	PACK-FILE	PAGES
S505, Booster	14-1	8=1

TRAD TELEVISION CORP.

MODEL	PACK-FILE	PAGES
C-2020, C-2420, CD-2020, Series T-20E	54-1	9=1-16
T-1720, Series T-20E	54-1	9=1-16

TRANS-VUE CORP.

MODEL	PACK-FILE	PAGES
1700C, 1700CD, 1700T	14-1	8=1-6

TRAV-LER RADIO CORP.

MODEL	PACK-FILE	PAGES
33A2, 34A2, 35B2, Ch.	69-1	10=1-10
217-10, 217-11, 217-12, 217-14, Ch. 33A2, 34A2, 35B2	69-1	10=1-10
220-9, 220-9B, Ch. 33A2, 34A2, 35B2	69-1	10=1-10

TRUETONE

See WESTERN AUTO SUPPLY CO.

VIDAIRE TELEVISION CO.

MODEL	PACK-FILE	PAGES
501	14-1	8=1-6

VIDEOLA

See TECH-MASTER PRODUCTS CO.

VIDEO PRODUCTS CORP.

MODEL	PACK-FILE	PAGES
630-DXC, 630-DX24, 630-K3C, 630-K24C	69-1	10=1-12
630-S, 630-SDX, 630-S24, 630-S24DX	69-1	10=1-12

JOHN WANAMAKER

MODEL	PACK-FILE	PAGES
C1720T, C1720T, See TRAD Ch. T-20E	54-1	9=1-16
T-1720, Series T-20E	54-1	9=1-16
C2020T, C2020V, See TRAD Ch. T-20E	54-1	9=1-16
C2420D, CD2020W, See TRAD Ch. T-20E	54-1	9=1-16

WESTERN AUTO SUPPLY CO. (TRUETONE)

MODEL	PACK-FILE	PAGES
2D1091, Ch. 12AX27	53-2	9=41-48
2D1092	53-2	9=37-40
2D1094A	14-1	8=1-9
Record Changer GENERAL INSTRUMENT 700F	14-RC1	RCH19=1-10
2D1095A, Ch. 16AX27	53-2	9=1-8
2D1185A	14-1	8=20-27
2D1190A	14-1	8=28-35
2D1190B	14-1	8=28-38
2D-1191A, Ch. 20AY22	73-3	10=9-20
2D1194A	14-1	8=10-19
Record Changer GENERAL INSTRUMENT 700F	14-RC1	RCH19=1-10
2D2043A, 2D2047B, Ch. 12AX27	53-2	9=41-48
2D2049A, Ch. 16AY210	53-2	9=9-20
2D2052A, 2D2052B, Ch. 16AY210	53-2	9=9-20
2D2052C, Ch. 17AY23	53-2	9=21-28
2D2052D, 2D2052E, Ch. 17AY28	53-2	9=29-36
2D2053	73-3	10=1-8
2D2149A, Ch. 17AY212	73-3	10=21-28
2D-2152A, Ch. 17AY26	73-3	10=20-40
12AX27, Ch.	53-2	9=41-48
16AY210, Ch.	53-2	9=9-20
16AX27, Ch.	53-2	9=1-8
17AY23, Ch.	53-2	9=21-28
17AY26, Ch.	73-3	10=20-40
17AY28, Ch.	53-2	9=29-36
17AY212, Ch.	73-3	10=21-28
20AY22, Ch.	73-3	10=9-20

WESTINGHOUSE ELECTRIC CORP.

MODEL	PACK-FILE	PAGES
Carlyle	54-4	9=17-24
H-606K12, H-607K12, Ch. V-2150-111	42-3	6=1-9
H-609T10, Ch. V-2150-94C	42-3	6=10-17
H-610T12, Ch. V-2150-136	42-3	6=18-24
H-611C12, Ch. V-2152-16	42-3	6=25-32
H-613K16, Ch. V-2150-146	42-3	6=33-40
H-614T12, Ch. V-2150-136	42-3	6=18-24
H-615C12, Ch. V-2152-16	42-3	6=25-32
H-617T12, Ch. V-2150-176	42-3	6=41-47
H-618T16, Ch. V-2150-186, V-2150-186A, V-2150-186C, V-2150-186CA	21-2	7=1-8
H-619T12, Ch. V-2150-176	42-3	6=41-47
H-619T12U, Ch. V-2150-176U, V-2150-177U	42-3	6=41-48
H-620K16, H-622K16, Ch. V-2150-186, V-2150-186A, V-2150-186C, V-2150-186CA	21-2	7=1-8
H-625T12, Ch. V-2150-197	21-2	7=9-15
H-626T16, Ch. V-2172	21-2	7=16-24
H-627K16, H-628K16, H-629K16, Ch. V-2171	21-2	7=16-24 7=34-35
H-630T14, Ch. V-2176	21-2	7=16-24
H-633C17, H-634C17, Ch. V-2173	15-1	8=4-13
H-636T17, Ch. V-2175	21-2	7=16-25 7=34-35
H-637T14, Ch. V-2177	21-2	7=16-26
H-638K20, Ch. V-2178	21-2	7=27-35
H-639T17, Ch. V-2192, V-2192-1	15-1	8=14-23
H-640T17, Ch. V-2175-3, V-2175-4	15-1	8=14-21 8=28-30

WESTINGHOUSE ELECTRIC CORP. (Cont'd)

MODEL	PACK-FILE	PAGES
H-640T17, Ch. V-2192, V-2192-1, V-2192-2, V-2192-3	15-1	8=14-26
H-640T17A, Ch. V-2192	15-1	8=14-24
H-641K17, Ch. V-2175-1, V-2175-5	15-1	8=14-21 8=28-30
H-641K17, Ch. V-2192, V-2192-1, V-2192-2, V-2192-3	15-1	8=14-26
H-641K17A, Ch. V-2192-1	15-1	8=14-24
H-642K20, Ch. V-2178-1, V-2178-3	15-1	8=32-39
H-642K20A, Ch. V-2194, V-2194-1	15-1	8=32-43
H-643K16, Ch. V-2179, V-2179-1	21-2	7=36-42
H-646K17, H-647K17, Ch. V-2175-3, V-2192	15-1	8=14-30
H-648T20, Ch. V-2201-1	21-2	9=9-16
H-649C17, Ch. V-2200-1	15-1	8=45-52
H-649T17, Ch. V-2192-4	15-1	8=14-27
H-650T17, Ch. V-2192-4	15-1	8=14-27
H-650T17, Ch. V-2200-1	15-1	8=45-52
H-651K17, Ch. V-2200-1, V-2204-1	15-1	8=45-52
H-652K20, Ch. V-2194-2, V-2194-3	15-1	8=32-44
H-652K20, Ch. V-2201-1	21-2	9=9-16
H-653K24, Ch. V-2202-2, V-2202-3, V-2210-1, Carlyle	54-4	9=17-24
H-654T17, Ch. V-2175-3, V-2175-4, V-2192, V-2192-1	15-1	8=14-31
H-655K17, H-656K17, H-657K17, Ch. V-2200-1	15-1	8=45-53
H-658T17, Ch. V-2192, V-2192-1	15-1	8=14-31
H-659T17, Ch. V-2204-1	15-1	8=45-54
H-660C17, H-661C17, Ch. V-2203-1	21-2	9=1-8
H-662K20, Ch. V-2201-1	21-2	9=9-16
H-663T17, Ch. V-2192, V-2192-2	15-1	8=14-26
H-664K17, Ch. V-2200-1	15-1	8=45-54
H-667T17, H-668T17, Ch. V-2216-1	77-6	10=11-29
H-673K21, H-676T21, Ch. V-2217-1	77-6	10=11-29
H-678K17, H-679K17, Ch. V-2216-1, V-2216-2	77-6	10=11-29
H-681T17, Ch. V-2215-1	77-6	10=11-29
H-689T16, Ch. V-2214-1	77-6	10=11-29
H-690K21, H-691K21, Ch. V-2217-1	77-6	10=11-29
H-692T21, H-695K21, Ch. V-2217-2	77-6	10=11-29
H-699K17, Ch. V-2216-2	77-6	10=11-29
H-700T17, H-701T17, Ch. V-2216-2	77-6	10=11-29
H-702K17, H-703K17, Ch. V-2216-2	77-6	10=11-29
H-704T17, H-705K17, Ch. V-2216-2	77-6	10=11-29
H-706T16, Ch. V-2207-1	73-5	10=1-10
H-708T20, Ch. V-2220-1	73-5	10=1-10
H-710T21, H-711T21, Ch. V-2217-2	77-6	10=11-29
H-713K21, H-714K21, H-715K21, Ch. V-2217-2	77-6	10=11-29
H-718K20, Ch. V-2220-2	73-5	10=1-10
H-720K21, H-721K21, H-722K21, Ch. V-2217-2	77-6	10=11-29
H-724T20, H-725T20, Ch. V-2220-2	73-5	10=1-10
H-730C21, Ch. V-2218-1	77-6	10=30-40
H-732C21, H-733C21, Ch. V-2218-1	77-6	10=30-40
V-2150-94C, Ch.	42-3	6=10-17
V-2150-111, Ch.	42-3	6=1-9

WESTINGHOUSE ELECTRIC CORP. (Cont'd)

ZENITH RADIO CORP.

ZENITH RADIO CORP. (Cont'd)

ZENITH

ZENITH RADIO CORP. (Cont'd)

ZENITH RADIO CORP. (Cont'd)

Replacement Parts

(Continued from page 10)

related changes which develop during operation.

NPO Ratings. In contrast to the capacitor which changes in value with changes in operating temperature, some circuits require that the capacitance (whatever it may be) remain constant with changing temperature. These capacitors are in the temperature compensating group except that they have a zero temperature coefficient. They neither increase nor decrease in capacitance with changes in temperature. Another identification for these units is NPO. Because of the high order of stability of NPO units they are excellent replacements for silver micas, assuming that all other requirements are satisfied.

In summarizing the temperature compensating variety of capacitors, it might be well to comment that they are in the main ceramic dielectric capacitors. Also that television receivers make use of a variety of negative temperature coefficient ratings — all the way from N030 (−.00003) to N4200 (−.0042) in many different nominal values of capacitance, and in from 500 to 1,500 volts d-c working voltage ratings, and even higher.

GP or General Purpose Types. Another interesting point in connection with ceramic capacitors and which involves the temperature coefficient, as well as having a bearing on the matter of replacement, is the meaning of the words General Purpose. The words are self explanatory relative to application, but what is not generally known is that these units embrace a variety of temperature coefficients from P100 to N750 indiscriminately. A general purpose unit may therefore have any temperature characteristic within this range because they are used in circuits where capacitance changes with changing operating temperature are not too important. Accordingly a capacitor with any specific coefficient within this range may be used as a replacement for a general purpose capacitor, provided that nominal capacitance, capacitance tolerance, and operating voltage requirements are satisfied.

The reverse however is not true; the general purpose capacitor is not a replacement for a temperature compensating capacitor with a particular temperature coefficient, unless it is known that the temperature coefficient of the particular GP component is exactly the same as the unit to be replaced.

SL Types. There is still another variety of temperature compensating capacitor in the ceramic group. These are the units which are identified as SL, or with an N330 (+ and − 500) temperature coefficient. In effect it is a general purpose unit, and any temperature compensating capacitor whose nominal temperature coefficient

(Continued on page 32)

ADDITIONS and CORRECTIONS RIDER'S TV MANUAL 10

Here are more data that will keep your RIDER'S DEPENDABLE REPLACEMENT PARTS LISTING published in TV Volume 10 up to date.

FIXED CAPACITORS

Set Mfr.	Set Mfr.'s Original Part No.	
Trav-Ler	TV-EC-16	Add FP238 to Mallory column
"	"	Add AFM2-87 to Aerovox column
"	TV-EC-17	Add 3N537-MS1 to Mallory column
"	"	Add PRS450V/40-40 to Aerovox column
"	TV-EC-23	Add PRS450V/40-40 plus PRS25V/100 to Aerovox column
"	"	Add 3N537-MS1 to Mallory column

VARIABLE RESISTANCE CONTROLS

Andrea	GRV-830	Change AG-00-2 to AG-00-Z in Clarostat column
"	GR-830	Delete GR-830 from Part No. column.
"	GRV-831	Transpose UF26L from Mallory Kit No. column to Panel Elem. column.
"	"	Transpose UR54L from Mallory Panel Elem. column to Rear Elem. column.
Belmont	10A-18441-1	Change P200 to P1200 in IRC Outer Shaft column.
"	"	Change RTV-128 to RTV-218 in Clarostat Cat. No. column
Du Mont	01044411	Change RL-200 to R6-206 in IRC Inner Shaft column
Firestone	78X13	Change B13-137 to B13-137X in IRC Rear Elem. column
General Electric	RRC-161	Change R2730 to R2-230 in IRC Inner Shaft column
"	RRC-166	Change P1-0 to B13-133 in IRC Rear Elem. column
Hallicrafters	25B886	Change R2-126 to R2-216 in IRC Inner Shaft column
"	"	Change RTV-239 to RTV-237 in Clarostat Cat. No. column
Montgomery Ward	10A-18841-1	Change P200 to P1-200 in IRC Outer Shaft column
"	"	Change RTV-128 to RTV-218 in Clarostat Cat. No. column
Motorola	18A790166	Change B-137X to B13-137X in IRC Rear Elem. column
"	18AK702864	Change B17-111A to B17-111X in IRC Panel Elem. column
RCA	76974	Change R1-126 to R1-216 in IRC Inner Shaft column
Western Auto	10A-18441-1	Change P200 to P1-200 in IRC Outer Shaft column
"	10A-18441	Change RTV-128 to RTV-218 in Clarostat Cat. No. column
Westinghouse	V-9877-3	Change B18-133 to B18-133X in IRC Rear Elem. column
Zenith	63-2825	Change Q1-359 to QJ-359 in IRC Stock No. column

AUDIO TRANSFORMERS

Motorola	25K703068	Add A-3020 to Merit column
Packard-Bell	89427A	Add A-2932 to Merit column
Philco	32-8242-11	Add A-3823 to Stancor column
"	32-8532	Add A-3825* to Stancor column and
		Add *Drill new mtg. hole to Remarks column
RCA	76156	Add A-2931 to Merit column
"	76982	Add A-2931 to Merit column
Techmaster	T114 (Symbol No.)	Add A-2932 to Merit column

POWER AND FILAMENT TRANSFORMERS

Packard-Bell	89043B	Add P-3070 to Merit column
Trav-Ler	TV-TR-9	Add R-38A to Triad column

SWEEP TRANSFORMERS

Admiral	79A18-4	Change 2.5:1 to 1:4.2 in Remarks column
Gamble-Skogmo	51X156	Transpose A-8141 from Stancor column to Ram column
Packard-Bell	89031	Add A-3003 to Merit column
RCA	74114	Add A-4003 to Merit column
Radio Craftsmen	183801	Add A-3003 to Merit column
Sylvania	241-0004	Change 1:1 to 11:1 in Remarks column
Techmaster	8T2	Add A-3000 to Merit column
Trav-Ler	TV-TR-3	Add A-8122 to Stancor column
"	"	Add A-8TY to Triad column
"	TV-TR-8	Add A-8123 to Stancor column
Western Auto	C201-1999	Change C201-1999 to C201-19999 in Part No. column

FILTER CHOKES

Packard-Bell	27005	Add C-2996 to Merit column
RCA	76498	Add C-2996* to Merit column and
		Add *Drill new mtg. hole to Remarks column
Trav-Ler	TV-FC-1	Add C-2325* to Stancor column and
		Add *Drill one mtg. hole to Remarks column
"	"	Add C-2974 to Merit column
"	"	Add C-31X to Triad column

SWEEP SECTION COILS

Majestic	C-8.234-4	Add MF-3 to Merit column
Packard-Bell	29527	Add TV-163 to Merit column
Sylvania	133-0001	Change L-.2mh-.3mh to L-.2mh-.8mh in Remarks column
Western-Auto	201-20186	Add 201R5 to Ram column

YOKES

Motorola	94K703240	Add MDF-70* to Merit column and
		Add *If ringing occurs, add circuit elements as per schematic to Remarks column
Packard-Bell	29537	Add MDF-30 to Merit column
Western Auto	201-19947	Add Y70F08 to Ram column
"	"	Add DY-8 to Stancor column

SPEAKERS

General Electric	852707	Change 852707 to 8527D7 in Part No. column
Philco	36-1626-9	Add P8-U ST-118 to Jensen column
"	36-1646-6	Add 10J11* to Jensen column and
		Add *Viking to Remarks column

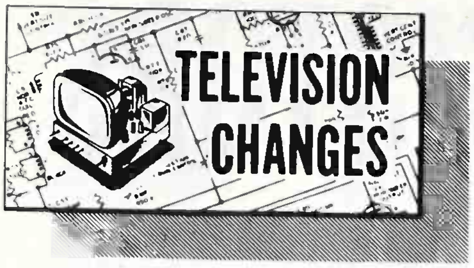
RIDER Books May Now Be Purchased With TEK-FILE Coupons!

You can now buy Rider books from your favorite parts distributor and pay him with TEK-FILE binder coupons.

The TEK-FILE binder coupon, included with each TEK-FILE pack you buy, has a purchase value of five cents when you purchase Rider books.

Of course, you can still use the coupons to get TEK-FILE binders, but you now have the alternative of applying them toward your purchase of Rider books. This special offer does not apply to Rider Manuals or TEK-FILE.

Do you want to own a copy of the TV TROUBLE-SHOOTING AND REPAIR GUIDE BOOK, ENCYCLOPEDIA ON CATHODE-RAY OSCILLOSCOPES AND THEIR USES, etc? Start saving your TEK-FILE binder coupons today. They're redeemable at all TEK-FILE distributors.



In compliance with the many requests we have received from our readers, this and future issues of SUCCESSFUL SERVICING will again contain the feature, TV PRODUCTION CHANGES.

The Rider Manual pages and TEK-FILE pack which include the original data and shematics to which the following production changes apply, appear in the index on page 32 of this issue.

HOFFMAN

MODEL 610
CHASSIS 140

Hoffman Model 610 is a 24 tube table model with a 6 inch speaker and an audio power output of 3.0 watts. A 10 inch picture tube is used. Its major components are:

Chassis – 140
Speaker – 6″ PM (Part No. 9062 voice coil, 3.2 ohms at 400 cps.)
Cabinet – Part No. 7532
Escutcheon Frame – Part No. 2250
Filter Plate Glass – Part No. 733
Picture Tube – 10BP4, 10FP4

●

MAGNAVOX

CHASSIS CT-270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282 (the 102 series)
for Chassis with A, B and C suffix

Video i-f Alignment Chart
Modulated Generator Frequency
22.75 Mc
23.4 Mc
25.2 Mc
25.3 Mc
Adjust for Maximum
Converter coil (on r-f tuner, front end.)
1st I-F T-102
2nd I-F T-103
3rd I-F T-104

●

MAGNAVOX

MODELS CT-270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282 (the 102 series)
For Chassis with D suffix

Video i-f Alignment Chart
Modulated Generator Frequency
23.1 Mc
25.3 Mc
23.6 Mc
25.5 Mc
Adjust for Maximum
Converter coil (on r-f tuner)
1st I-F T-102
2nd I-F T-103
3rd I-F T-104

RCA

MODELS T100, T120, T121
CHASSIS KCS34C, KCS38

Deflection Yoke (Circuit Changes)

Two different types of deflection yokes are used on these chassis. The older type, with an iron wire-wrap core, has a cardboard outer housing. The newer type, with a powdered-iron core, has a moulded bakelite housing. The two types are not directly interchangeable.

While the iron wire-wrap yoke will work in all receivers, the powdered-iron yoke will not work in the earlier receivers unless certain circuit changes, made in production, are incorporated. These changes are noted below:

1. Locate resistor R-181, in the grid circuit of the horizontal output tube (pin 5 of V-112, 6BG6). R-181 is directly connected to one end of the 47 ohm resistor, R-183, the other end of which goes directly to pin 5. R-181 was 1 meg, and must be changed to 470k to allow for the use of either yoke.
2. To avoid vertical non-linearity in T120 receivers when the powdered yoke replaces the wire-wrap type, it is also necessary to modify the deflection circuits in accordance with the accompanying diagram.

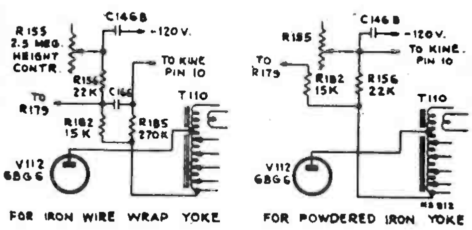


Fig. 1. B Filter Connections.

3. When installing a new wire-wrap yoke (201D3 yoke), check the schematic for the following: the 56μμf capacitor which appears across one portion of the horizontal winding should appear across terminals 1 and 2 in some receivers, but across terminals 2 and 3 in others. In the latter case, the capacitor must be reconnected, since the yoke is wired with the capacitor between terminals 1 and 2. Incorrect placement of the capacitor may result in excessive raster ringing.

NOTE: Later production chassis incorporate these revisions.

●

SYLVANIA

MODEL 1110X
CHASSIS 1-329

Horizontal Deflection (Capacitor Change)

Capacitor C-211, connected to the Horizontal Size Control, is changed from .00047μf, 1kv to .00075μf, 1.6kv, paper capacitor, Service Part 162-16375.

NOTE: Chassis coded C01 and later incorporate this change.

MITCHELL

MODELS T16-2KB, T16-2KM, T16-B, T16-M

Circuit Changes (General)

1. Decrease the value of C-23, located between the junction of R-3 and L-5 (i-f coil) and ground, from .005 μf to .0015 μf (minimum value).

NOTE: C-23 is now connected to terminal #3 of the tuner instead of terminal #7.

2. Increase the value of C-96, located between one side of the horizontal yoke and one side of the secondary of h-v transformer (T8), from .25μf to .5μf, 200v.
3. Connect a .005μf capacitor from the cathode of the audio output stage (pin 8, 6V6) to chassis.

NOTE: Late production chassis incorporate these changes.

Rider Offers Test Record with Hi-Fi Book

A completely unique arrangement between John F. Rider Publisher, Inc., and Columbia Records, Inc., permits the publisher to make an exclusive record offer to purchasers of its book HIGH FIDELITY SIMPLIFIED.

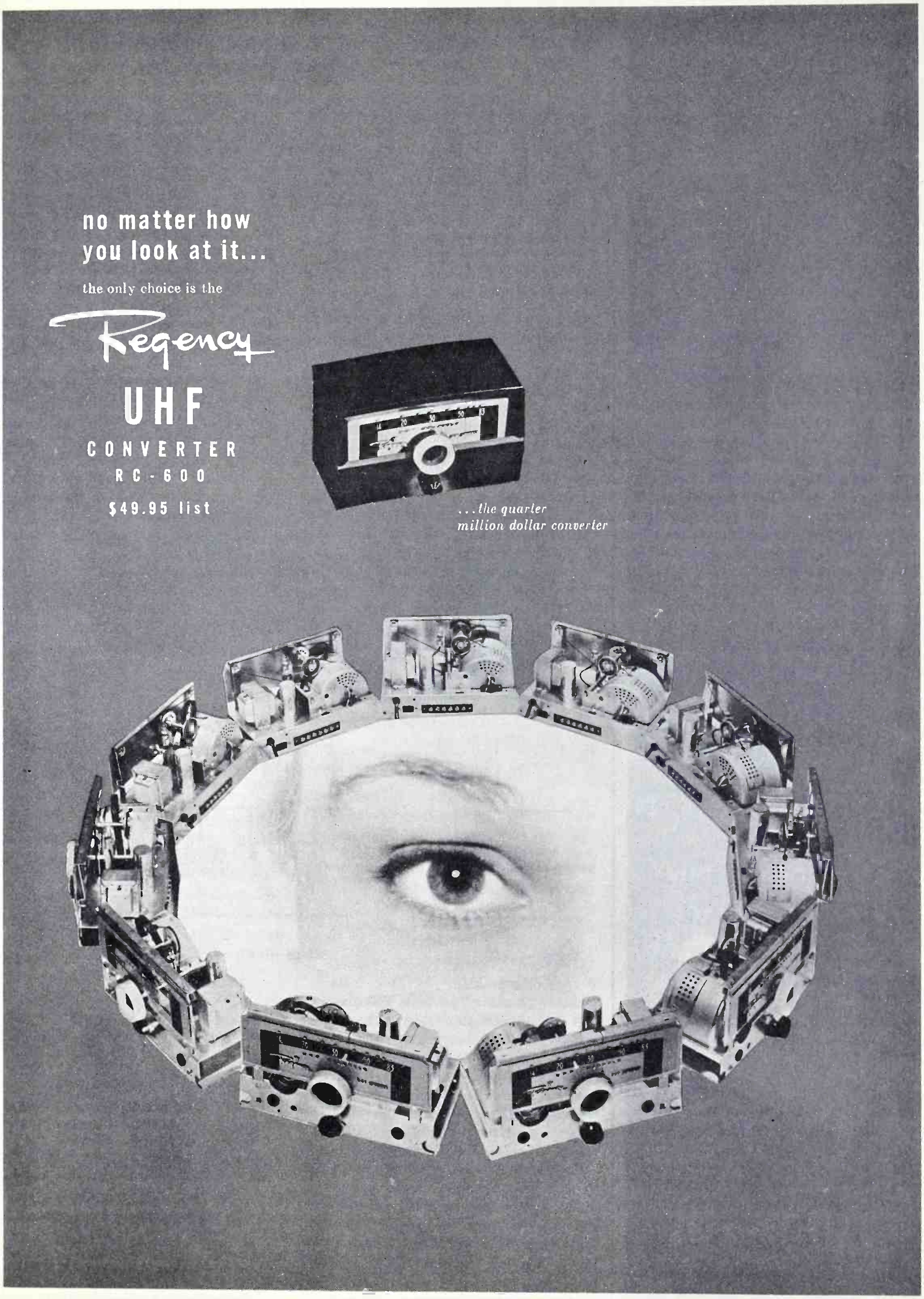
Now in its third big printing, HIGH FIDELITY SIMPLIFIED, by Harold D. Weiler, has proved there is substantial public interest in this fast-growing home activity.

Starting immediately, buyers of the book will be able to obtain a Columbia 7-inch long-playing high fidelity test record. A special coupon included with the new printing of HIGH FIDELITY SIMPLIFIED, accompanied by twenty-five cents entitles the sender to the record.

Available through no other sources, this specially recorded record enables the individual to make definitive performance tests of the audio equipment he owns. A section of HIGH FIDELITY SIMPLIFIED tells the reader what to listen for when making the tests.

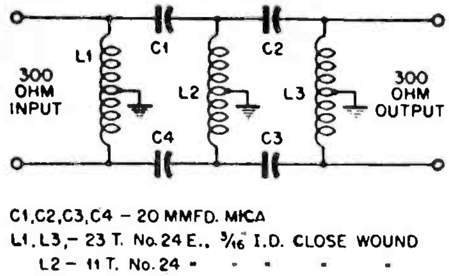
The test record is recorded on two sides and includes excerpts from selections of the Philadelphia Orchestra conducted by Eugene Ormandy, the Orchestra of the Metropolitan Opera Association conducted by Fausto Cleva, and Andre Kostelanetz and his orchestra. In addition, excerpts from selections performed by the following prominent soloists are included: Michael Rabin (violin), Leonard Rose (cello), Georgy Sandor (piano) and E. Power Biggs (organ).

This special offer expires September 1, 1953. HIGH FIDELITY SIMPLIFIED may be purchased from electronics parts distributors and bookstores.


no matter how
you look at it...
the only choice is the
Regency
UHF
CONVERTER
RC-600
$49.95 list
...the quarter
million dollar converter

TV Interference and Its Remedies

(Continued from page 1)



Courtesy Aerovox

Fig. 4. High-pass filter in 300-ohm line for eliminating signals lower than 53 mc.

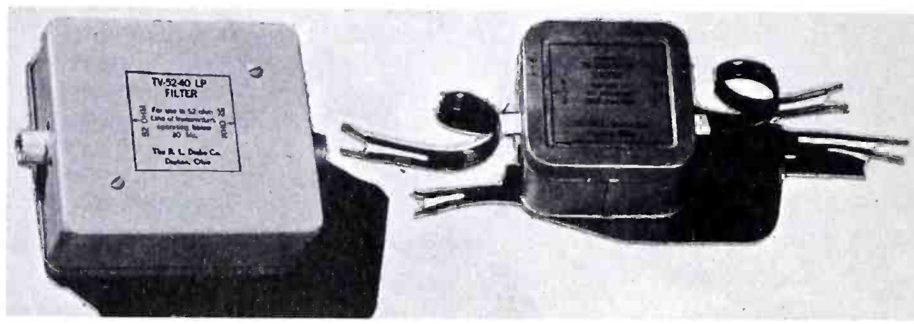
the lowest TV frequency, that is below 54 mc. Design values for two typical filters are shown in Figs. 3 and 4. The filter shown in Fig. 3 is designed to attenuate signals 45 mc and below. The one shown in Fig. 4 attenuates signals below 53 mc.

resonant circuit, its impedance at that frequency is a minimum, therefore short-circuiting any signal components at this frequency. At frequencies other than resonance, its impedance becomes high, so that it does not affect these frequencies.

In Fig. 6 (B) we will illustrate a series trap, which consists of a parallel resonant circuit tuned to the unwanted frequency. A parallel resonant circuit offers a high impedance to its resonant frequency and a relatively low impedance to other frequencies. A commercial product designed to attenuate signals between 20 and 26 mc is shown in Fig. 7.

In addition to using lumped capacitance and inductance components, tuned stubs made of 300-ohm twinlead and coaxial cable may be employed. Referring to the theory of tuned stubs, a quarter-wave open

(Continued on page 30)



Courtesy R. L. Drake Co.

Fig. 5. Right: High-pass filter used in TV receivers which cuts off all signals below 50 mc. Left: Low-pass filter in transmitter which cuts off all signals above 40 mc.

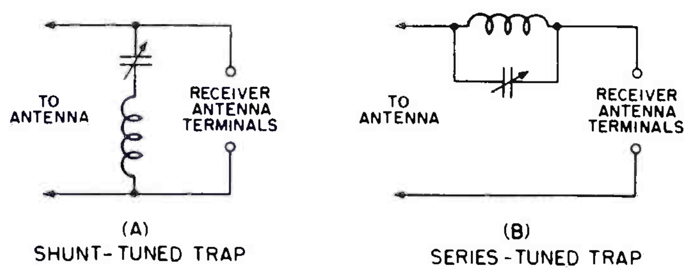
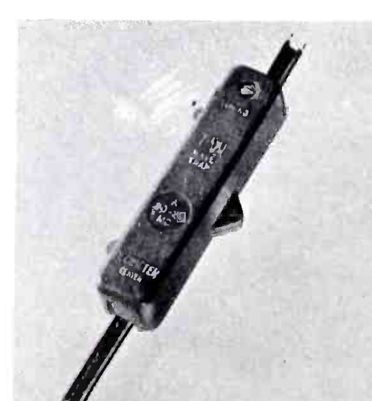


Fig. 6. Resonant wave-traps used in TV receivers.

Typical commercial products are shown in Fig. 5. The filter illustrated at the right is a high-pass unit designed to attenuate all signals from zero to 50 mc. The filter at the left, which is a low-pass r-f filter, is used in transmitters, and is designed to attenuate all signals above 40 mc. This insures against the transmission of harmonics which fall within the TV band.

Resonant filters are used as wave traps for such offending frequencies as might be transmitted by f.m., a.m., and other services. Two types of traps are generally employed. These are illustrated diagrammatically in Fig. 6. The one shown in Fig. 6 (A) is a shunt type trap, and is designed to resonate at the undesired frequency. As a series



Courtesy Decimeter

Fig. 7. Commercial tuned-resonant traps for eliminating TVI in the 20-26 mc band.

Causes and Cures of TV Interference

The following tables were excerpted from the TVI paper presented by P. S. Rand (W1DBM) at a meeting of the "Wireless Association of Ontario" in Toronto, Canada, and are supplied through the courtesy of Mr. Rand and the Laboratory of Advanced Research, Remington Rand Inc.

A. COMMON TYPES OF TV INTERFERENCE

1. Diathermy.
2. Receiver radiation.
3. Co-channel interference.
4. Spark-plug interference.
5. Multiple images caused by reflections off buildings.
6. Airplane flutter.
7. Germicidal lamps.
8. Super-regenerative receivers operating radio controlled garage doors.
9. Oscillator radiation from f-m receivers and other short-wave receivers.
10. F-m broadcast transmitters.
11. Image response of receivers, etc.
12. Amateur TVI.
13. Harmonics of tv i-f amplifier falling in a tv channel.
14. Sound bars from tv sound channel; faulty trap adjustment or tuning of tv set.

B. TV INTERFERENCE RELATED TO TV RECEIVER DESIGN

1. Direct i-f feedthrough.
2. Image interference, arising from a combination of local oscillator frequency plus i.f.
3. Signal image interference, resulting from local oscillator frequency plus signal frequency.
4. Interference occurring at twice the oscillator frequency plus or minus the i.f.
5. Direct reception of the oscillator signal from a nearby television receiver.
6. Direct reception of the third harmonic of the tv receiver's i-f amplifier on channel 5.

C. AMATEUR INTERFERENCE RELATED TO TV RECEIVER DESIGN

1. Front-end overloading with generation of harmonics in tv set.
2. Cross-talk.
3. I-f feedthrough.
4. I-f pickup.
5. Video pickup.
6. Spurious responses, such as various harmonics of the local oscillator beating with amateur station fundamental, etc.
7. Variation in line voltage, upsetting the picture when amateur transmitter is switched on and off or when keyed.
8. Rectification of amateur signal by a corroded tv antenna connection.
9. Weak tv signal due to a painted or improperly installed 300-ohm ribbon or an indoor antenna.
10. Rectification of amateur signal in first audio stage of tv receiver and resulting audio interference.

D. TV INTERFERENCE FROM TRANSMITTER MAY BE DUE TO:

1. Self-oscillation in the final amplifier or one of the buffer stages due to lack of neutralization.
2. Parasitics in one of the r-f stages.
3. Key clicks in the case of a c-w (code) transmitter.
4. Surging line voltage when the transmitter is turned on or off or keyed.
5. Harmonics generated by one or more of the stages.
6. Side-band splatter in case of a phone transmitter.
7. Parasitics in the modulator.
8. Blanketing type of broadcast interference due to unbalanced feed lines.

Many or all of the above types of interference to a television picture can be radiated:

1. Directly from the antenna.
2. From the antenna feeders.
3. From the r-f tank circuit in question.
4. From the wiring or inter-connecting cables in the transmitter.
5. From the house wiring.
6. From the supposedly shielded relay rack.

E. SUGGESTED CIRCUIT CHANGES IN TRANSMITTERS

1. Return all grounds with short, heavy low inductance leads directly to the cathode of the tube.
2. Bypass all leads directly to the cathode, preferably with some of the new "through-type" or ceramic disc type capacitors.
3. Use shielded wire for all inter-connections under the chassis, omitting, of course, those leads that are supposed to be hot with r-f. Shield all inter-connecting cables between chassis preferably with a cable made up of individually shielded wires.
4. Use adequate filtering in all leads that leave the chassis.
5. Use high-C circuits.
6. Use pentodes wherever possible in place of triodes.
7. Use some type of capacitors, either tubular or vacuum, directly from plate to cathode on each tube.
8. Use harmonic plate traps, if necessary.
9. Use adequate shielding.
10. Operate the final amplifier as a class-B rather than class-C amplifier.
11. Use as low grid current and grid drive as is practical.
12. Use link coupling between stages with coaxial cable and coaxial fittings.
13. Use double-tuned tank circuits in the final amplifier (antenna coupler).
14. Use an antenna that will not radiate harmonics.
15. Use a low-pass filter between the final amplifier and antenna; never couple the antenna directly to the final tank.
16. Do frequency multiplying in low-power stages that are well filtered and well shielded.
17. Use narrow-band f.m. to eliminate last traces of modulation bars in picture.
18. Install RG 8-U to the transmitting antenna and adjust for a low standing-wave ratio.

F. WHAT TO TRY ON RECEIVER

1. Install a high-pass filter or wave traps in the antenna lead-in.
2. Try an r-f filter in the a-c line.
3. Try wave traps on the i-f amplifier to trap out the fundamental interfering frequency.
4. Try wave traps on the r-f amplifier ahead of the television receiver.
5. Try a bottom pan on the chassis.
6. Try substituting a coaxial feeder for the 300-ohm ribbon.
7. Check the tv set for correct alignment.
8. Try a good tv booster amplifier ahead of the tv receiver.

EDITOR'S NOTE: *Since the foregoing information was originally directed to an audience of radio amateurs, most of the emphasis has been placed on causes and cures of television interference resulting from amateur transmitters. This is not to imply that this source of interference is any more or less important or widespread than the other 13 types listed under A above. As a matter of fact, radio amateurs, as a group, have done much to cooperate in the elimination of tv interference.*

TV Service Training Course

(Continued from page 9)

Russ Hansen — Contracts Manager
Motorola, Inc., Chicago, Ill.

Dr. George R. Town — Assoc. Director, Engineering Experiment Station, Iowa State College
Ames, Iowa

Students, drawn mainly from Iowa, Illinois, Missouri and Nebraska, were lodged and quartered on the campus for the course. These students were divided into two classes which ran concurrently. The classes began at eight o'clock in the morning and terminated at ten o'clock in the evening so that individual instruction and consultation could be undertaken during the evening sessions. Both students and instructors lived, ate, and slept television during the two intensive weeks of training. A large quantity of demonstration equipment and service instruments were used both during the formal daytime sessions and during the informal evening classes. All were in agreement that both students and instructors benefited greatly from the 2-week course.

RCAI Alumni News

At the RCA Institute's alumni meeting in February, Mr. Robert Hurd, Commercial Service Representative of RCA Service Company, gave a lecture-demonstration on UHF and the RCA Service Clinic. After explaining the reasons for the "freeze" on VHF allocations and why it was lifted, he continued his talk on UHF and the new problems and opportunities it presents to the television industry. RCAI members were then shown a film on the experimental UHF station KC2XAK at Bridgeport, Conn. and compared VHF and UHF transmission and reception.

The March meeting of the RCAI alumni will be held on March 26th at the RCA Institute. At that time Mr. Whitney Baston, Chief Audio Engineer of NBC will give a speech and demonstration (using an NBC field truck) on Audio Field and Studio Broadcasting Techniques.

Sylvan A. Wolin Forms New Advertising Agency

Sylvan A. Wolin, closely associated with the electronic parts field for twenty years, has just announced the establishment of his own advertising agency. The new corporation, Sylvan A. Wolin & Associates, has its offices at 15 West Palisade Avenue, Englewood, New Jersey.

Specializing in accounts relating to the electronics field, his new corporation will offer complete advertising, public relations and sales-promotional merchandising of clients' products. Mr. Wolin believes that his long experience in advertising and sales activities, on the manufacturer's side of the fence, can be of benefit to his accounts.

TV Interference, etc.

(Continued from page 28)

line is equivalent to a series resonant circuit, and a quarter-wave shorted line equivalent to a parallel resonant circuit.

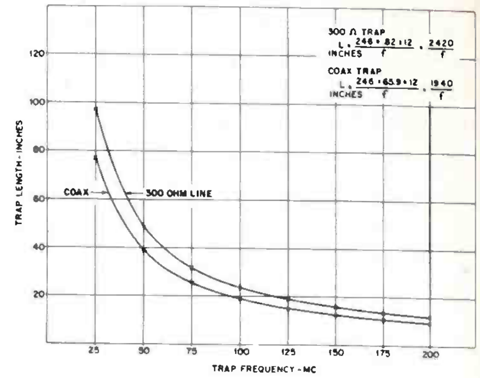


Fig. 8. Graph indicating length of transmission line wavetraps for various frequencies.

In all calculations involving the design of traps of this type, the velocity of propagation in the material used must be taken into account. For ordinary twinlead this value is about 0.82, and for coaxial cable about 65.9. Thus, for an interfering f-m station operating at a frequency of 100 mc, the length of a 300-ohm stub required becomes:

$$Length = \frac{246 \times .82}{f} = 2.02\ ft.$$

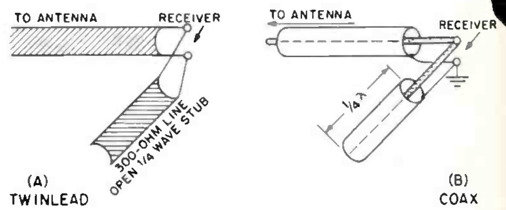


Fig. 9. Methods of connecting twin-lead or coax cable as ¼-λ wavetraps.

A graph giving the size of quarter-wave traps for a range of frequencies from 20 to 200 mc is shown in Fig. 8. Notice that coaxial-cable traps, because of their lower velocity of propagation are somewhat shorter than 300-ohm twinlead stubs. The manner in which open stubs may be connected in the antenna line is shown in Fig. 9.

A monthly summary of product developments and price changes supplied by RADIO'S MASTER, the Industry's Official Buying Guide, available through local parts distributors.

COMMENT: Tube, antenna sound and audio manufacturers again dominate the "change activity" scene, with special emphasis being placed on the introduction of new products. As noted for the past 3 months, tube manufacturers are continuing their tendency of increasing prices, while other product groups show no apparent trend.

New Items

AMERICAN TELEVISION & RADIO—Added a number of ATR inverter replacement vibrators.
AMPEREX ELECTRONIC—Added a new series of germanium diodes. Also added special purpose tube EC80 at $7.50 dealer net.
BARKER & WILLIAMSON—Added Model 600-A, coil set at $4.64 net and Model 600-AB, blank coil at $.75 net.
CENTRALAB—Added No. PA2049, miniature rotary switch at $3.45 dealer net.
CLAROSTAT — Added TV replacement controls RTV391 to RTV393 inclusive.
CLEAR BEAM—Introduced new Yagi series YSD 8 element and YSD-2 8 element antennas.
CREST LABS.—Added Model 51, cathode-ray tube rejuvenator at $2.40 dealer net.
FAIRCHILD RECORDING EQUIP. — Added Model 650-C, preamplifier at $47.50 dealer net . . . Model 651-B, power supply at $51.00 dealer net and Model 652-C, preamplifier at $47.50 dealer net.
FLEXO INTERNATIONAL—Added Model 4303, bench lamp at $18.95 list and Model 4324, portable desk lamp at $25.00 list.
FRETCO—Added Four Stack at $7.59 dealer net to their series of Mi Tee Ray UHF antennas and Model SA300 at $1.11 dealer net to their Nu Design Mount line. Also added 8 element Yagi antenna series QTV8-2 to QTV8-12 inclusive and 10 element Yagi antenna series QTV10-2 to QTV10-13 inclusive.
GENERAL ELECTRIC—Added germanium diodes 1N81 at $4.35 list and G7G at $2.00 list . . . receiving tube 12AY7 at $3.00 list and to their test equipment series, Model ST-13A (single freq.) at $250.00 dealer net . . . Model ST-13A (dual freq.) at $275.00 dealer net . . . external anaenna mounting for ST-13A at $8.30 dealer net and cable (BNC to UHF—six feet long) at $7.95 dealer net.
GON-SET—Added Model 3026, "communicator" at $189.50 dealer net to their new 2 meter transmitter-receiver series.
GREAT EASTERN MFG.—Added Stray-X filament choke at $.95 dealer net.
HICKOK ELECTRICAL INSTR. — Added Model 533DM, special tube merchandiser at $179.50 dealer net and Model 605, combination tube tester and set analyzer at $184.50 dealer net.
HYTRON—Added special purpose tube 6V6GTY at $1.08 dealer net and TV picture tubes 21XP4 . . . 21YP4 and 21ZP4A.
JAMES VIBRAPOWR CO.—Added Model 12J7, interrupter type vibrator at $2.88 dealer net.
KRYLON—Added No. 1601, black spray at $1.95 list.
LOUIS BROS.—Model 718, corner reflector antenna at $12.45 dealer net and Model 2-82-WR, VHF-UHF rhombic antenna with reflector at $8.31 dealer net have been added to their line.
LOWELL MANUFACTURING CO.—Added No. SS 24 at $1.11 dealer net and No. SS 48 at $1.59 dealer net, steel support channels for suspended ceilings. Also added "The Richmond", series of wall type speaker baffles.
MALLORY & CO., P.R.—Added a new line of UE controls. Also added Model 4548, vibrator of the communications type at $4.62 dealer net.
MARKEL ELECTRIC PRODUCTS — Added Model A 7165, metal clad crystal element cartridge complete with 2 osmium tip stylus for microgroove records at $7.20 dealer net and Model A 7166, metal clad crystal element cartridge complete with 2 osmium tip stylus for standard groove records at $7.20 dealer net.
MASTER MOBILE MOUNTS—Added all band Civil Air Patrol Antennas, Models 2374KC, 4507.5 and 4585 all at $9.95 net. Also added extra coils, Models M2374, M4507.5 and M4585 all at $3.60 net.
NUCLEAR INSTRUMENT & CHEMICAL — Added Model 1413, "cloudmaster" geiger counter at $59.00 dealer net.
RADELCO MFG.—Added UHF antennas US-102A at $3.75 dealer net and US-104 at $7.05 dealer net.
RADIO MERCHANDISE SALES—Added a number of new UHF antennas.
RAM ELECTRONIC—Added a number of vertical output transformers, V301 to V312 inclusive and also vertical blocking transformers V401 to V405 inclusive.
RAYTHEON—Added germanium junction transistors CK721 at $12.50 dealer net and CK722 at $7.60 dealer net. Also added special purpose tubes CK5670 at $7.00 dealer net . . . CK5750 at $3.25 dealer net . . . CK6212 at $7.50 dealer net and CK6247 at $14.65 dealer net.
RIDER, JOHN F.—Added No. 143, TV Manufacturers' Receiver Trouble Cures, Vol 1 at $1.80 dealer net.
SCHOTT CO., WALTER L.—Added UHF antennas No. 4150, trombone at $11.10 dealer net . . . Model 4152, trombone at $23.97 dealer net and Model 4153, trombone at $32.97 dealer net.
SYLVANIA—Added special purpose tubes 6BF7W at $4.45 dealer net and 6X4W at $2.00 dealer net . . . radio receiving tubes 6BQ7A at $3.20 list . . . 6BK5 at $2.45 list and 12B4 at $2.00 list and TV picture tube 21ZP4A at $4.00 dealer net.
TECHNICAL APPLIANCE CORP. — Added a number of one and two bay, 5-element, 2 diameter Yagi antennas.
TELEMATIC—Added TV receiver coupler, Model AM-44 at $2.50 dealer net and CRT booster, Model CR-64 at $1.26 dealer net.
TELREX—Added a number of new UHF antennas. Also added Model DY6x1, dual channel "fishbone jr", cut for channel 4 and 5 at $11.81 dealer net.
THOMAS ELECTRONICS — Added cathode ray tubes, 19BP4A at $45.10 dealer net . . . 21WP4 at $38.35 dealer net . . . 21YP4 at $38.35 dealer net and 21ZP4 at $39.80 dealer net.
UTAH RADIO PRODUCTS—Model C-1272, filter choke at $1.20 dealer net . . . Model P-1061, power transformer at $17.10 dealer net and Model VB-1170, vertical blocking oscillator at $1.35 dealer net have been added to their line.

Discontinued Items

GERRARD SALES—Discontinued Model 201/B5, multi-speed transcription turntable.
RADELCO MFG.—Discontinued Model 43, dual band dipole and mast kit and Model RS-531, dual band television array.
RADIO CITY PRODUCTS—Discontinued Model 447BPK, multitester kit and Model 449A, pocket multitester.
RCA — Discontinued No. 201B1, television component and No. 37158, crystal pickup.
SYLVANIA — Discontinued sub-miniature tubes 6BF7 and 6BG7.
TELREX—Discontinued their bi-channel 5 element series and their metro series.
VIDAIRE ELECTRONICS — Model PA-150, phono amplifier has been discontinued.
WEBSTER ELECTRIC — Discontinued Model 84-25, public address amplifier.

Price Decreases

BARKER & WILLIAMSON—Decreased price on Model 600, dipmeter to $39.75 net and Model 3975, balum coils to $3.75 net.
CHATHAM ELECTRONICS — Model 1Z2, high voltage vacuum rectifier decreased to $4.25 dealer net.
CREST TABS—Decreased price on cathode ray tube rejuvenators Model B to $2.25 dealer net . . . Model C to $2.10 dealer net and Model D to $2.25 dealer net.
FAIRCHILD RECORDING EQUIP. — Decreased price on Model 620-CL, power amplifier to $190.00 dealer net.
FRETCO—Decreased price on fretaray to $23.97 dealer net and fretaray junior to $11.97 dealer net.
LOWELL MANUFACTURING CO. — Decreased price on Model H-24, hi-fidelity decorative grille to $10.50 dealer net.
MERIT TRANSFORMER — Decreased price on deflection yokes Model MDF-30, Model MDF-70 and Model MDF-71 all to $6.00 dealer net. Also decreased Model HVO-8, horizontal output and hi-voltage transformer to $3.90 dealer net.
PENTRON CORP. — Decreased price on Model 9-T3M, duo-speed portable tape recorder to $59.75 net.
PRECISION ELECTRONICS — Decreased price on Model 100-BA, basic amplifier to $41.25 dealer net and Model 215-BA, high fidelity triode amplifier to $99.50 dealer net.
RADELCO MFG.—Decreased price on Model RT-51, high band television array to $1.32 dealer net.
RAYTHEON—Decreased price on special purpose tube CK6146 to $4.15 dealer net and rectifilters Model RFR-1027B to $44.00 user price and Model RFR-1027BR to $48.00 user price.
SYLVANIA — Radio receiving tube 12J5GT decreased to $1.55 list.

(Continued on page 32)

Radio's Master Reports

(Continued from page 31)

Price Increases

CANNON ELECTRIC—Increased price on No. XK-3-11, straight cord plug (with socket insert) to $3.30 dealer net.

ELECTRO-VOICE—Increased price on Model 6-HD, diffraction horn to $15.00 dealer net.

FRETCO—Increased price on fretline series, Model BC to $38.40 dealer net and Model E to $54.60 dealer net.

RCA—Increased—price on Model 269S1, electronic component speaker (PM type) to $6.24 dealer net.

SCHOTT CO., WALTER L.—Increased price on antenna kits; No. 4066, V-King, U-Install to 9.45 dealer net . . . No. 4096, Signal King to $9.45 dealer net and No. 4106, Double-Vee, U-Install to $8.40 dealer net.

SIMPSON MFG.—Increased price on their No. 52 series of tape recorders.

SYLVANIA—Increased price on germanium crystal diodes 1N60 to $.75 dealer net and 1N105 to $.75 dealer net.

TECHNICAL APPLIANCE CORP. — Increased price on a number of one bay and two bay silver-streak antennas.

WEBSTER ELECTRIC—Increased price on replacement cartridge No. V1Q3 to $7.50 dealer net.

Replacement Parts

(Continued from page 23)

falls within the limits of P100 and N750 is suitable for use where the SL or the other is specified, provided that the other related constants also are satisfied.

It is conceivable that replacement of micas, ceramics and paper dielectric capacitors may become a matter of concern because the units with the desired temperature characteristics and capacitance values may not be available. Where temperature compensation is a factor, replacement is fairly well limited to the specific general type of capacitor used as original equipment. An exception is the replacement of a temperature compensating mica with a temperature compensating ceramic. This need will not be encountered too frequently because virtually all temperature compensating capacitors used in television equipment are ceramic dielectric components.

When it is necessary to replace a general purpose or an SL variety of ceramic or a general purpose mica and the particular capacitance is not available, an NPO type of proper capacitance tolerance and working voltage rating is a good replacement. The reverse is not true; an NPO unit must be replaced with another NPO capacitor.

INDEX OF CHANGES

Model No.	*Manual Page From*	*To*	*Tek-File Pack*
Hoffman 610 Ch. 140	5-8	5-16	35
Magnavox CT-270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282 (102 series)	7-14	7-28	30
Mitchell T16-2KB, T16-2KM, T16B, T16-M	6-1	6-4	45
RCA T100, T120, T121, Ch. KCS34C, KCS38	5-65	5-110	34
Sylvania 1110X Ch. 1-329	8-64	8-82	13

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SUCCESSFUL Servicing

APRIL 1953

I-F Trap Circuits in TV Receivers

by Sid Deutsch

Television receiver trap circuits are one of the few items that may be radically different from one manufacturer to the next. Some receivers have as many as six trap circuits, while others have only one. This may explain why the serviceman often neglects the trap circuits of a faulty receiver. Improperly aligned or missing trap circuits can give rise to important difficulties.

The Need for Traps

Trap circuits are placed in the intermediate-frequency and video sections of the receiver, and are named from the fact that they are used to "trap" certain undesired signals. To illustrate the need for trap circuits, let us assume that the receiver is being used in a locality where the signals of channels 2, 3, and 4 are present. (In general, this can occur midway between two large cities, such as between New York and Philadelphia.) Let us further assume that the receiver is tuned to channel 3, and that the new 44-mc i-f range is employed. The local-oscillator frequency will then be 107 mc. The local oscillator will hetrodyne with the picture and the sound carriers of channels 2, 3, and 4 to give the intermediate frequencies shown in Fig. 1. Notice that the local oscillator causes the frequencies to invert, so that channel 4 appears a a lower intermediate frequency than channel 3.

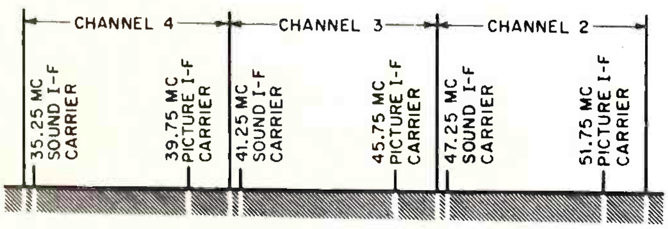

Fig. 1. Intermediate frequencies that may be present when receiving channel 3 in the 44 mc i-f range.

The i-f response curve of a receiver is relatively wide. In the absence of trap circuits, certain of the frequencies of Fig. 1 will reach the second detector and give rise to spurious effects. The response curves of Fig. 2 have been drawn to illustrate these effects. The dotted curve is the response curve of a receiver without i-f trap circuits, while the solid curve is the correct overall i-f response curve of a receiver. In the example chosen, improper trapping will result in the following effects.

1. The adjacent picture i-f carrier, 39.75 mc, will introduce the channel-4 picture at the same time that channel 3 is being received. The interfering picture will usually appear dimly in the background, but out of synchronization with the desired picture.

2. The 47.25-mc adjacent sound i-f carrier, if allowed to reach the second detector, will place horizontal sound bars of the channel-2 sound upon the channel-3 picture. Even more serious, however, is the fact that this signal will hetrodyne with the 45-75-mc picture i-f carrier to produce a 1.5-mc beat signal. This will appear as an annoying vertical-line interference in the picture.

3. The associated sound i-f carrier, 41.25 mc, is the most important signal to be acted upon by trap circuits. Excessive amplitude of this signal at the second detector will result in horizontal sound bar interference in the picture. It is also possible for the 41.25-mc sound i-f carrier to hetrodyne with the 45.75-mc picture i-f carrier. This will result in a 4.5-mc signal that can appear as interference in the television picture.

In non-intercarrier receivers, it is desirable to trap out as much of the associated sound i-f carrier as possible. In intercarrier receivers, on the other hand, the amplitude of this carrier at the second detector should be approximately at the 3 percent level, as shown in Fig. 2. The 4-5-mc signal mentioned in the previous paragraph is used, in intercarrier receivers, as the sound intermediate frequency. If the 41.25-mc amplitude in Fig. 2 is much below 3 percent, the sound output of an intercarrier receiver will be unnecessarily reduced. If the amplitude is much above 3 percent, the sound output may contain the annoying 60-cycle buzz that often plagues intercarrier receivers. (The 60-cycle buzz is the way a picture signal "sounds" in a loudspeaker. It seems peculiar, therefore, that excessive 41.25-mc sound i-f carrier amplitude can result in a buzz. When two signals hetrodyne together, however, the amplitude of the beat signal is controlled by the amplitude of the weaker of the two original signals. Thus, a weak 41.25-mc sound i-f carrier hetrodyning with a strong 45.75-mc picture i-f carrier will result in a clean 4.5-mc sound i-f signal.

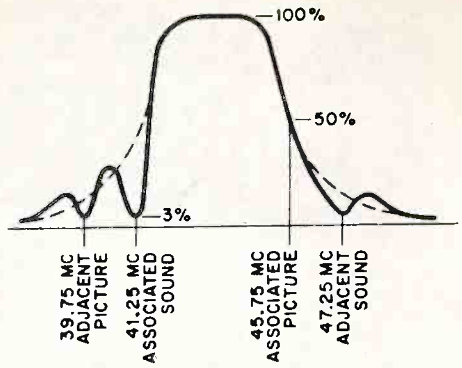

Fig. 2. The 44 mc i-f response curve of a TV receiver. Dotted curve - without traps. Solid curve - with a complete set of traps.

The 35.25-mc and 51.75-mc signals of Fig. 1 are relatively weak in a properly aligned receiver, and will not cause interference effects.

In general, as shown in Fig. 2, each of the undesired i-f carriers should have an amplitude of 3 percent or less, while the desired picture i-f carrier of 45.75-mc should have an amplitude of 50 percent.

Almost all receivers employ associated sound traps. Some receivers have an additional 4.5-mc trap in the video section to eliminate the 41-25-mc—45.75-mc beat note. All intercarrier receivers use such a 4.5-mc trap for the purpose of developing the sound i-f signal. Some receivers have adjacent picture and sound traps in addition to associated sound traps.

Types of Trap Circuits

Figure 3 illustrates the four main types of trap circuit. All of these traps have one thing in common—very high Q's. The trap coils, for example, consist of a few turns of relatively heavy wire, since a low-Q trap circuit

(Continued on page 10)

SUCCESSFUL Servicing

APRIL 1953

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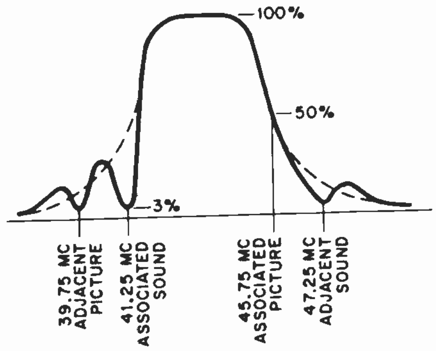

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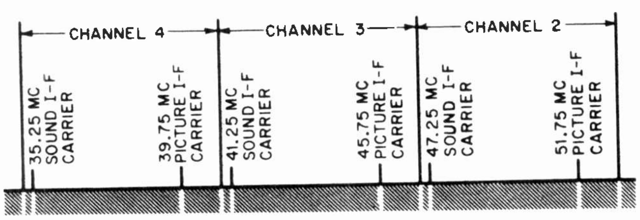

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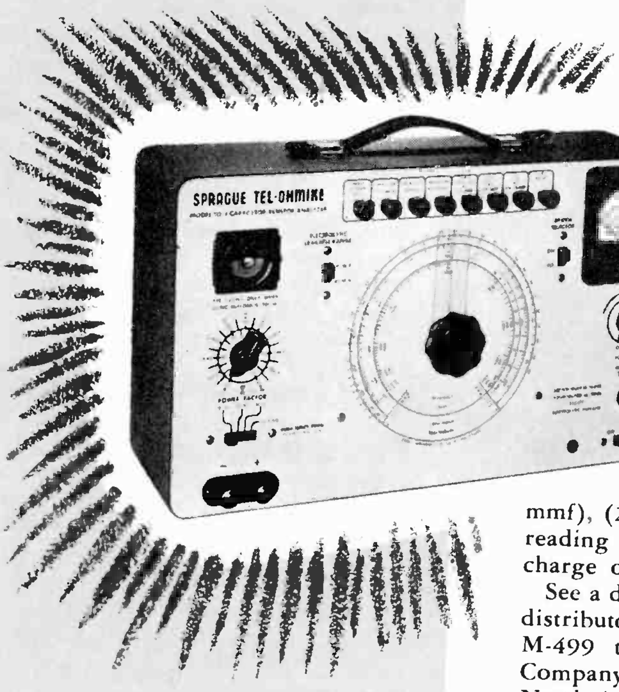

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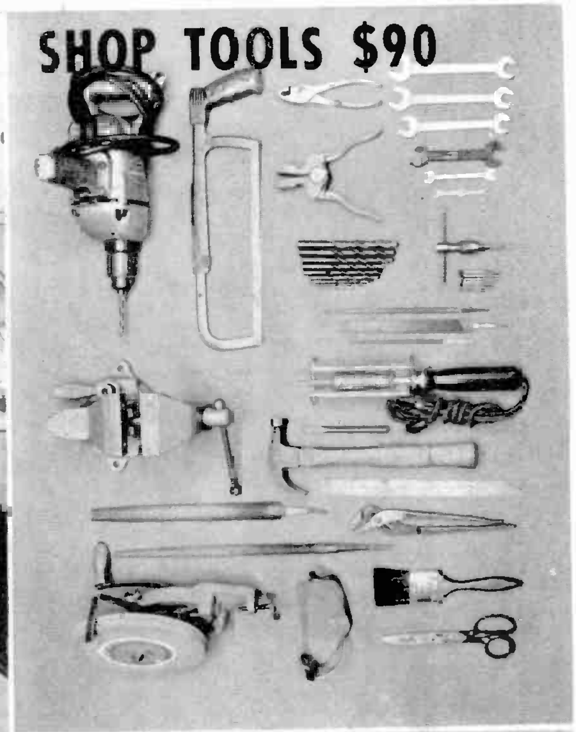

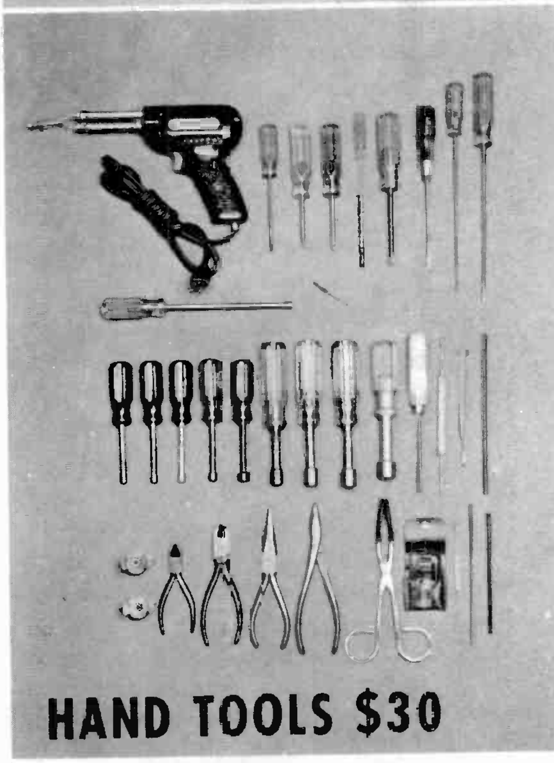

Setting Up for TV Service

Because of the opening of new market areas and an awakening realization in old ones of the values of store-operated service, many dealers are asking: What does it take, in dollars and equipment, to set up for TV service? Herewith, from several experts, the answers.

by Ted Weber

The following article and its illustrations are reprinted through the courtesy of ELECTRICAL MERCHADISING and the McGraw-Hill Publishing Co., Inc. who acknowledge the cooperation of experts from Emerson Radio & Phonograph Corp., Allen D. DuMont Laboratories, Inc., and RCA Service Co. in providing data for this article.

Reckoned in dollars and cents, setting up a television service operation is an expensive undertaking.

But figured in terms of customer good will, a good service operation is a profitable investment.

There's no paradox here — it does take money to equip a service department to handle TV. But, once equipped, a well-managed service operation can hold old friends and make new ones.

Not every dealer wants to handle his own TV servicing. Some may find it more economical or more efficient to let a distributor or an independent service agency handle the work. Many others, however, will feel that it will pay them to set up their own service shop. Taving made that decision, the retailer is faced with a number of other questions—boiled down they ask the how, what and where of setting up a TV service department.

For the answers, Electrical Merchandising asked a group of TV set makers for their recommendations. On this, and the following pages, their suggestions for shop layouts, test equipment, hand tools, installation tools and materials and parts inventories are summarized for the dealer interested in handling his own service.

Planning the Shop

Space limitations may prevent the dealer from choosing the "ideal" location or dimensions for a service shop. But good planning can turn a less than ideal space into an

If possible, service benches should be placed end to end and flush against the wall to facilitate supervision. Storage area for incoming and outgoing work should be as near to the benches as possible; if it is any great distance away some sort of wheeled "dolly" should be provided for moving chassis from the storage area to the benches.

If a one-man shop is planned, test equipment can be permanently fixed in a panel. However, in shops employing more than a single technician, flexibility must be considered and the solution would appear to be a shelf (12 to 24 inches high) mounted at the rear of the bench. An adequate number of AC outlets should be provided along the length of the shelf. Test equipment can then be moved from place to place on the shelf.

Generally speaking, the bench surface should be large enough to allow one receiver to be set aside for a heat run while the technician is working on a second set. The bench should be at least six feet long, four feet deep and be from 36 to 38 inches high. Placement of drawers, AC outlets and the selection of a bench top are largely matters of personal preference. Generally, a single drawer will be sufficient for the storage of hand tools; too many drawers will lead service men to regard them as a last resting place for parts and junk. There are arguments for and against metal top benches. One firm suggested the use of either copper or tempered masonite bench tops, terming the decision a matter of personal preference. But a second manufacturer's service manager said that the use of a metal top "is not recommended."

Sufficient AC outlets must be provided not only for the shelf holding test equipment but for the service bench itself. One service

(*Continued on page* 25)

Successful SERVICING

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The Itinerant TV Service Technician

A Detroit TV Service Association publication has commented on our editorial on the itinerant service technician which appeared in the January, 1953 issue of SUCCESSFUL SERVICING. The contention is that we have changed our minds concerning the disadvantages of doing service work in the home; that is, we expressed contrary opinions some time ago and now seem to be in favor of it.

The fact of the matter is that we spoke about what seems to be the trend, and fairly definite at that. Moreover it is not unusual to change one's opinion with changing times. Trends do appear and while all individuals and concerns having an interest in it may not agree, only time tells which is proven right or wrong.

There is no question about the advantages of doing service work in the shop and the disadvantages of working in the home. But the public has learned that service work can be done in the home. Perhaps it has been mainly tube changing in the past, but in the eyes of the public it has been service—and they like the idea of not having the chassis removed from the home. Admittedly they accepted the idea of chassis pulling and removal to the service shop, but by and large they were unhappy about it and prefer service in the home. Add to this the fact that more than just a random few service facilities in different parts of the country are making an effort to render service in the home, and others are talking about it more and more, and there you have your trend. The likelihood of it growing is very great, if for no other reason that the public likes it.

The statement was made that a complete repair cannot be made in the home. Isn't it determined by the type of fault present in the receiver and what is involved in the repair? We agree that a good job should be done, that certain tests should be made on a receiver, but it is not inconceivable that many complete repairs and tests can be made in the home. It all depends on the nature of the trouble; the availability of the proper types of test equipment for diagnosis in the home, the availability of parts—the competency of the service technician and his sales ability, etc. These are problems but their solutions are not impossible.

The cardinal item is the public reaction to a servicing approach which has been set by TV servicing facilities. In the past it has been tube changing by many; but others have changed yokes, focus coils, variable resistance controls, tuner coil strips, electrolytic capacitors, peaking coils, fixed capacitors, width and linearity coils and numerous small inductor type components in the home. Defects associated with these components are not necessarily complicated—although they may be so, if the fault found is multiple. In that event the chassis is removed to the service shop. Major repairs like overall alignment, power transformer and horizontal output trans-former changes are shop jobs. It is interesting to note that one receiver manufacturer has unitized chassis for sectional replacement in the home; another has introduced horizontal-output transformers with phone tip connectors.

There are no laws which dictate that service work must be done in the home, but isn't it somewhat unwise to shut one's eyes to a trend? Picture if you will the possibilities of having a removable bottom to every table model cabinet . . . access to the bottom of the chassis without pulling it!—One manufacturer already has a screen at the bottom of the table model cabinet. Now it is there for ventilation purposes, but if it were made removable, consider the convenience for home servicing.

Manufacturrs are adding tests points available at the top of the chassis as a convenience for trouble diagnosis. Naturally it is a convenience in shop servicing, but it also aids in the evaluation of the type of fault possibly present in the receiver when diagnosis is carried on in the home.

One of the points raised against home service is that the family watches the repair operations and becomes a time keeper. Another contention is that if a schematic is used, the receiver owner suspects incompetency. A third is the matter of bickering over price. All of the conditions described happen, but the question is are they valid reasons for not performing home service—or should the visiting technician also be a salesman who will educate the public to undertand each of the points being raised? Perhaps the final result will be understanding from only 90 percent of the television receiver owners, *but* it is a step in the right direction. The public does not know—and some do not want to learn—but by and large, the majority can be sold. It all depends on the approach . . . It may be a long drawn out affair, but it is the problem of the servicing industry and all those who cater to it, to try to find the answer for better public relations and more profitable operation.

Maybe it will take years for the home servicing trend to develop . . . Maybe it will grow for a year or so, and then change because of some other situation. Maybe the arrival of color television (in about two years) may nullify the trend; then again maybe the reverse will happen—receiver manufacturers may so design their equipments that substantial amount of service can be done in the home. We're not fortune tellers—but neither do we fail to note the appeal which home TV service has to the public. Nor can we shut our eyes to the fact that more than just a few service facilities operating in different parts of the nation are doing more than just tube changing TV service in the home.

When we examine public reaction, we must be objective. Consider the expansion of department stores. Traffic problems make it difficult for suburbanites to come into town—so, many large stores open branches in the suburbs. This is a trend which is developing around all large cities. All stores don't comply, but many do—the idea being to meet the desires of the public—who in the final analysis foots the bills.

Ask any design engineer active in the electronic field about printed circuits . . . It's a trend, and little by little it is growing. Can tube manufacturers ward off the semi-conductor (transistor) trend? Of course not! How will the transistor and printed circuits affect other component manufacturers in time? The impact is a relatively long time off, but the trend is there.

The point is raised that adequate numbers of competent personnel may not be available for good home service . . . Perhaps this is true and it may limit the extent of the activity . . . Perhaps the shortage may be so great as to actually prevent the realization of the trend . . . But does this mean that we should not see the trend? . . . As we said before, all organizations may not welcome a change of this kind. It is their privelege to try to ward it off, but how is it possible to ward off something if we don't see it looming in the distance?

We repeat that if the trend takes hold, it will be necessary for competitive organizations to follow suit. Isn't this normal in competitive activities which render a service? The prices need not be the same but the modus operandi for satisfying the public's wishes cannot differ too greatly.

John F. Rider

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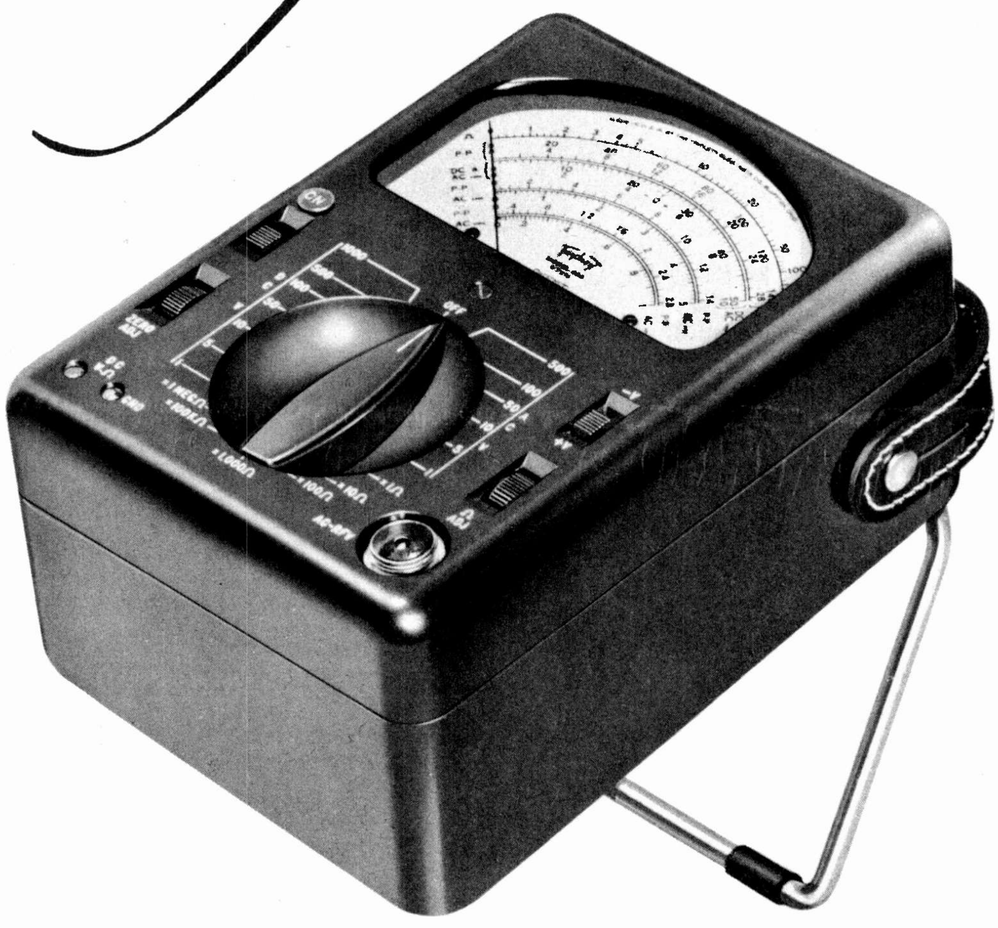

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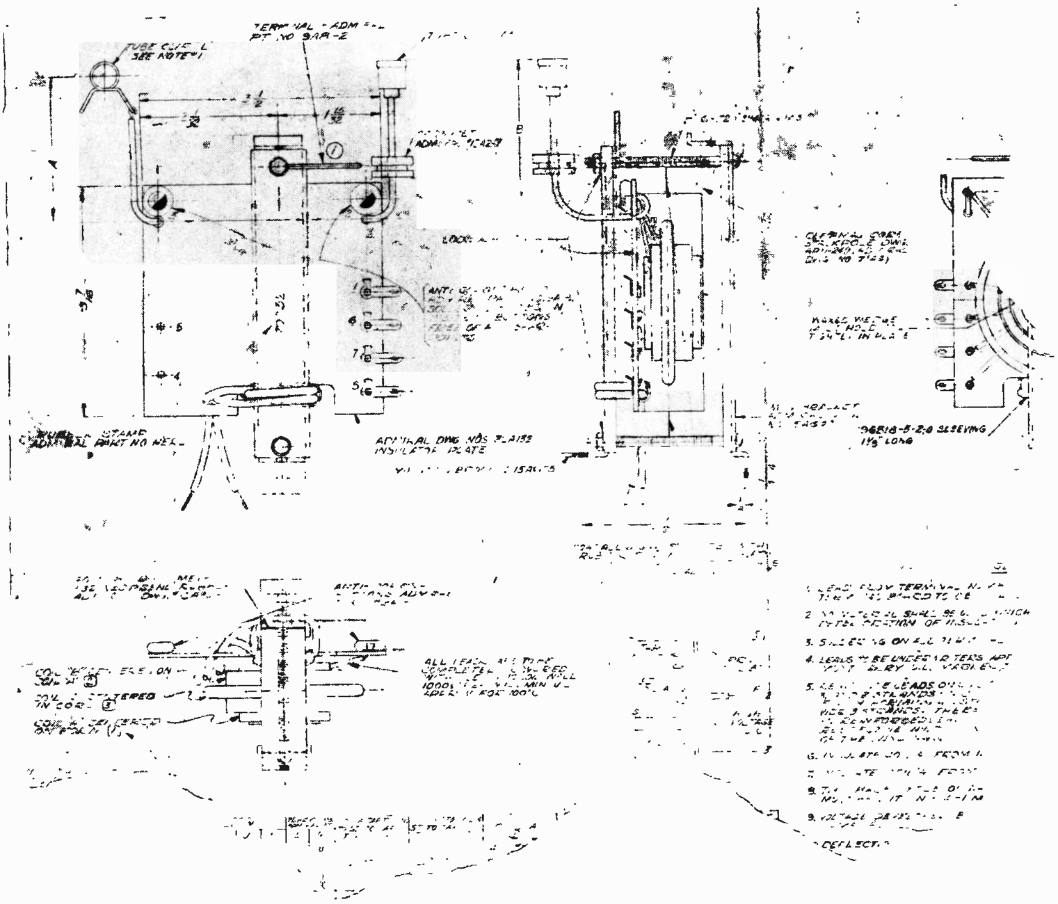


Fig. 1. Sample of the set manufacturer's blueprint used for reference, describing all electrical mechanical and physical details of the original parts.

Some Questions & Answers About Rider's Dependable Replacement Parts Listings

We have received numerous letters asking questions concerning the Replacement Parts Listings which appeared for the first time in Rider's TV Manual 10 and in the Tek-Files beginning with pack 57. We feel that these questions can best be answered by listing the query and explaining the answer.

Q—Why are there vacant spaces in the parts manufacturers' columns?

A—The vacant spaces under the various parts manufacturers' listings indicate that, at the time of preparation of the list for inclusion in the Rider Manual or Tek-File, the parts manufacturer did not have a replacement which, upon analysis, was considered suitable as a replacement for the original part used by the set manufacturer.

Q—It it important to adhere to the tolerance specifications given in the tolerance column in the fixed capacitor listing?

A—The answer is yes. The tolerance listed in the tolerance column relates to the original capacitor used in the receiver. Numerous circuits in TV receivers are critical. Unless it was necessary, the receiver manufacturer would not pay a premium price to the parts supplier for capacitors which are closer to the nominal value than the industry standard of plus or minus 20%. It is always best servicing practice to use replacements which conform with stated tolerance ratings, also those which are expressed in terms of micro micro farads. It is conceivable that under certain conditions a capacitor rated at a higher tolerance may function satisfactorily in a circuit, wherein a more rigid tolerance is specified, but this does not indicate that it will happen in many cases. On occasion a 20% capacitor may display a capacitance which is within 1% of the normal rating. This is just a fortunate circumstance. Unless the set manufacturer's engineers felt that they needed a 5 or 10% capacitor, they would not so specify on the blueprint and pay the extra money for the higher accuracy.

Q—How is the suitability of a replacement part decided?

A—The replacement parts listed are selected by *comparing* the electrical, physical and test specifications on those parts with the corresponding specifications of the original parts used in the receiver. If the specifications for the suggested replacement match the specifications for the original parts, the replacement is listed. The receiver manufacturers furnish us with blueprints of the various components which we embrace in the Replacement Part Program. An example of one of the blue prints is shown here. It is for a horizontal output transformer. Although the Rider Dependable Replacement Parts Program is only about eight months old, we already on hand, for reference purposes, blueprints covering more than 20,000 components such as transformers, capacitors, variable resistor controls and speakers, used in television receivers. Many are received each day. Using blueprints of the original components is the most reliable means of determining the constants of the parts used in all of the production runs of television receivers produced by manufacturers.

Q—How do you take care of the different kinds of speakers which are used in the different models?

A—The information we receive from receiver manufacturers indicates to us the variety of speakers which are used in the table models, consoles, and consolette Models of television receivers. The new replacemnt parts listing which will accompany Rider's TV Manual 11, and shown herein, will in many instances, disclose from 3 to 10 different versions of loud speakers which are used for the chassis listed. Competitive parts listing services that are incomplete frequenly show just one speaker as being applicable for perhaps 10 to 20, or more, receiver models.

Q—Are the parts listed as replacements in Rider listings subject to much fabrication?

A—No. The need for extensive fabrication is one of the reasons for disqualifying a suggested replacement part. The blueprints covering original components received from the receiver manufacturers, stipulate the mechanical requirements. Only such replacement parts as fit within these mechanical limitations, with minor variations, are listed. This means that when a service technician purchases one of the parts shown in our listing, fabrication or alteration by him is unnecessary, or at least is kept to the absolute minimum.

Q—What does "compliance with test specifications mean?"

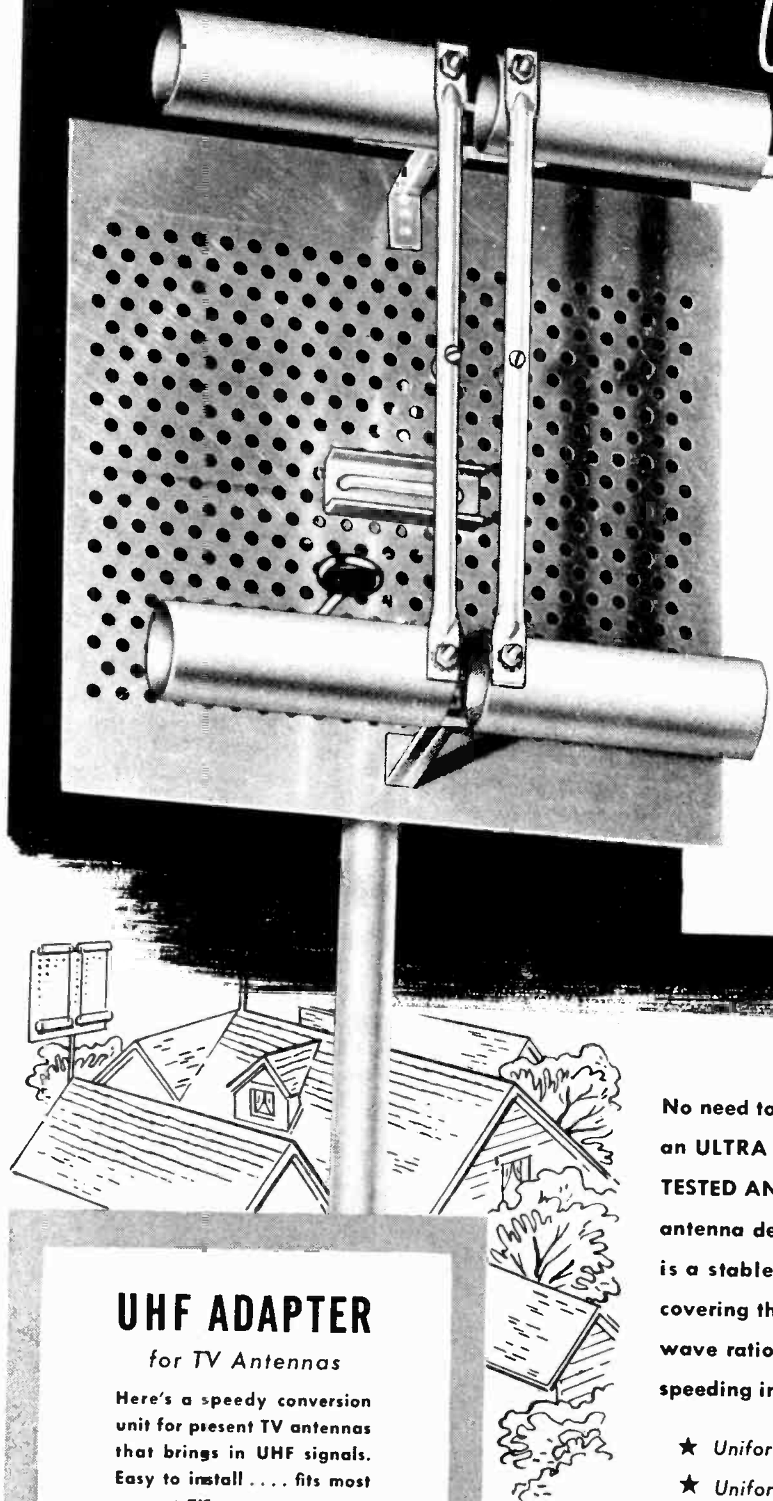
A—One of the requirements set by us for listing a replacement part, is that its test specifications conform with those which cover the original part in the receiver. In other words, if the set manufacturer stipulates that the original part must withstand the application of 2,500 volts rms between the winding and the coil of a transformer, the replacement part must do likewise in order that it be considered acceptable for listing. This is a safeguard for the service technician and is one of the many reasons why the Rider listings are the most dependable.

Q—Do you ever check parts in receivers?

A—Yes, many times. This is why we consider the matter of tolerance on inductive and capacitive components to be such a serious matter. Time and again we establish that as little as 10% difference in the inductance of a horizontal deflection winding from that of the original part can be very troublesome; that as little as 10% difference in the turns-ratio of a vertical output transformer from the rating of the original part can cause substantial non-linearity and correction would

(*Continued on page 32*)

why guess?



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A Note on TV in England

Observations made by one of our servicemen-authors who has been trying his hand at TV Servicing in a shop in England while "vacationing" abroad.

by John D. Burke

One of my biggest problems since starting to work in a London TV repair shop two months ago, has been in reading the diagrams provided for our use.

First of all — there is a considerable difference just in terminology, between the two countries — even though we both speak the "same" language.

Here are some of the translations:

American	British
B Plus	High Tension (H.T.)
Power Line	Extra High Tension
High Voltage	(E.H.T.)
Tube	Valve (except for a CRT—which is a "tube")
Antenna	Aerial
Ground	Earth
Shielding	Screening
Chassis	(Sometimes called "the deck")
Globar Resistor	Brimistor Resistor
Vertical	Frame
Horizontal	Line
Micromicrofarad	Pica Farad
Yoke	Scan Coils
Broadcast Band	Medium Wave
Mixer	Frequency Changer
By-Pass	Decoupling
Socket	Valve Holder
Plate	Anode
Phonograph	Gramophone
Damper	Efficiency Diode
B Plus Plus	Boosted H.T.
Sweep Circuits	Time Bases
"Open"	O/C
Short	S/C
Unsoldered Connection	Dry Joint
Filter Capacitor	Smoothing Capacitor
Input Capacitor	Reservoir Capacitor
VTVM	Valve Voltmeter

May I hasten to add the fact that there are many more words which are the same in both countries — we can read one another's technical literature. For example, such words as *focus, definition, radio frequency, alignment, synchronization* — mean the same.

It was just the fact that these strange words had to be understood by me, quickly, and while I was struggling with other problems of a foreign country's TV system.

The shop in which I work employs four bench mechanics — called "service engineers". We have a rather good supply of service information. Good, that is, in that it covers most of the sets we are likely to see; and good in comparison with the service information a smaller shop might have been able to acquire. This word "acquire" is used advisedly. For, service information in not offered to the whole trade. Some manufacturers will only supply such information to those dealers who are franchised to sell and service their brand of sets.

Other manufacturers have released diagrams for publication — but there are limitations. A book has just been published giving a great deal of information about quite a few sets. But the price is very high. Also, the diagrams are so small I cannot read them without a magnifying glass!

There are two magazines with restricted circulation which publish one TV and one radio schematic each month. One of these magazines goes only to full-time profesisonal repairman. The other *only* to dealers. The information they give is very welcome, and I have been working with such forms of technical guidance for two months.

However, I find a number of great shortcomings in practically all British radio and TV service sheets:

Size — generally much smaller print than can be read comfortably.

Values of resistors and capacitors — not given on the diagrams. Sometimes they are, but usually one has to hunt up the parts lists, with a great loss of time, and much annoyance.

Tubes not designated by type — that is, the diagram only bears V1, V2, V3, etc. Again, time is spent looking for the list of tubes (valves).

Pin numbers not given — a few English diagrams do show the pin connections but most do not. Sometimes they will have a basing chart printed near the schematic. Other times, one must hunt for it.

Chassis layout charts also have the same defect — they show you where V6 is, but they do not say what type of tube it is, nor what function it has in the set.

Voltage readings are not given on the schematic. Usually this is given on a separate chart.

Ohms readings on coils are also given separately, if given at all.

Of course, my criticisms of English schematics are prompted mostly by my having worked with those used by our trade in the U.S. My shopmates are accustomed to using what they have, and manage to get along quite well in spite of the handicap.

In time I will be able to do the same. But I hope for an improvement. Perhaps it will come as Britain gets more flooded with TV sets. They now have about 2,000,000 in use.

It must be added, in their favor, that the sets are quite good, and compare favorably with American sets.

There are many varieties of chassis — with some 20 to 30 manufacturers — less than in the States, but quite enough to satisfy my wish to always have new and interesting problems to solve each day.

I brought along with me some technical literature, including some copies of Rider's Tek-Files. Looking through several as I write this, let me assure you that the English TV repairman quite often has only about 10% of the information furnished to him that you are getting.

English shops do not promise quick-as-a-wink service. And most repair jobs go into the shop. The average job in my shop takes two to three days from pick-up 'til delivery.

Also the sets are simpler, and the problems of 405 line television, and one-channel television, are much less. However, that will provide material for other articles.

Our author - John D. Burke

ATTENTION AUTHORS:

We are soliciting articles concerning radio, television, and allied electronic maintenance. All aspects are of interest. Articles of 1,000 to 2,000 words are desired. Preference is given to subject matter which reflects practical work rather than theory. The presentation should be direct, to the point, and amply illustrated. Finished art work will be prepared by us from the roughs submitted. Photographs are welcome. The rate of payment is on a word basis — and, needless to say, good writing rates good pay!

Submit all articles and inquiries to Editor, *Successful Servicing*.

I-F Trap Circuits in TV Receivers

(Continued from page 1)

is useless. Trap circuit capacitors must be of a low-loss type in order to obtain high Q's. For convenience, we will assume that each of the diagrams of Fig. 3 represents an associated sound traps, although trap circuits do not depend upon the frequency to which the trap is tuned.

The coil of an inductively-coupled trap, as in Fig. 3(A), is placed near the i-f interstage coil with which it is to work. If a 41.25-mc associated sound signal is present in the i-f interstage coil, it will induce a signal in the trap circuit. This will result in a relatively large circulating current in the trap because of its high Q. The circulating current produces a magnetic field that acts to oppose the 41.25-mc signal in the i-f interstage coil, thereby considerably reducing the strength of the associated sound signal. (The amplitude of this signal cannot be reduced to zero, of course, because then there will be no magnetic field in the trap circuit).

A second type of circuit, the capacitively-coupled trap, is shown in Fig. 3(B). Although the operation of this circuit is different than that of the inductively-coupled trap, the end result is the same. At 41.25 mc, for example, coupling capacitor C_C in combination with L and C, will produce a low-impedance series-resonant path to ground. This will "short-circuit" the 41.25-mc signal that is present in the i-f interstage coil. The capacitively-coupled trap also produces a peak to the left of 41.25 mc, but in this case it is caused by a high-impedance parallel-resonant condition between the i-f interstage coil and the trap circuit.

The effectiveness of the capacitively-coupled trap is partly determined by the size of the C_c. If this capacitor is too large, the trapping action will remove some of the picture signals, while an undersized coupling capacitor will result in insufficient trapping action. A typical value for C_c is 1.5 $\mu\mu f$.

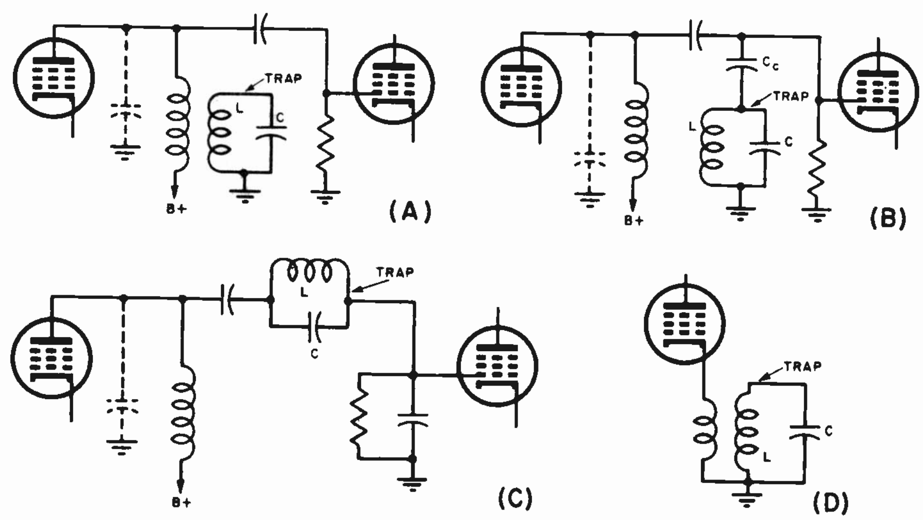


Fig. 3. Various trap circuits. (A) Inductively-coupled trap. (B) Capacitively-coupled trap. (C) Series-coupled trap. (D) Cathode trap.

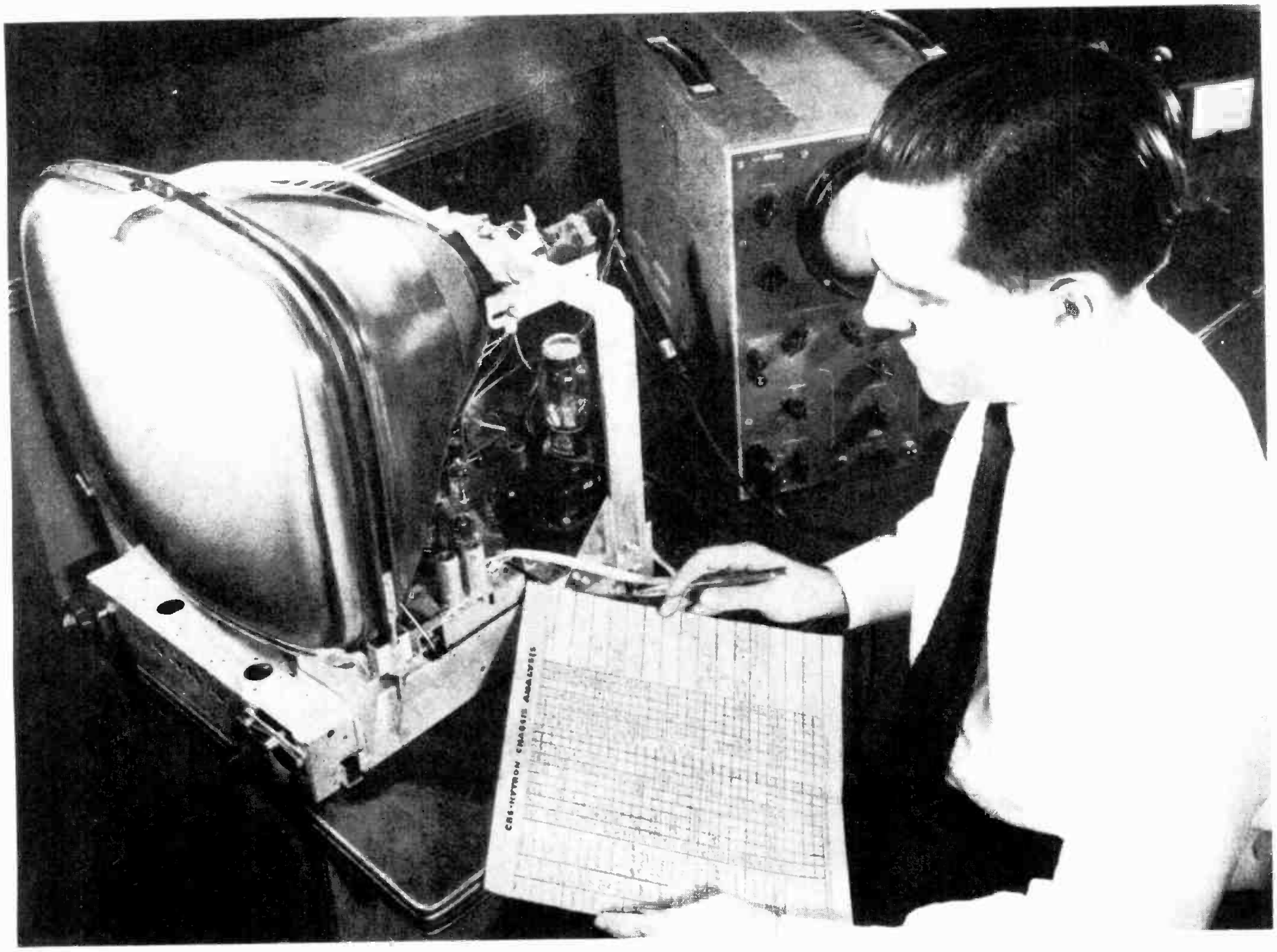
As the solid line of Fig. 2 shows, the 41.25-mc trap produces a response-curve peak slightly to the left of 41.25-mc. If a 40.5-mc signal is present in the i-f interstage coil, for example, it will also produce some circulating current in the trap circuit. The magnetic field that is produced in this case, however, will aid the 40.5-mc signal because of phase differences between the 40.5-mc and 41.25-mc operation. Fortunately, there is little likelihood of a signal at 40.5 mc, and the peak at this point should cause no trouble. Similar peaks may be created to the left of 39.75 mc and to the right of 47.25 mc.

If the inductively-coupled trap coil is too near the i-f interstage coil, the trapping effect becomes broadened out until some of the picture signals are trapped out in addition to 41.25 mc. If the trap coil is too far from the i-f interstage coil it will have insufficient effect.

The series-coupled trap of Fig. 3(C) acts by introducing a high-impedance parallel-resonant circuit in series with the signal path. This trap is also characterized by a peak to the left of 41.25 mc. The action of the trap is controlled by the size of C. When C is too small, the picture frequencies will be affected. When C is too large, the size of L becomes correspondingly small and it becomes difficult to build a high-Q trap coil. C is generally over 100$\mu\mu f$ in value.

The fourth circuit, the cathode trap, is shown in Fig. 3(D). The action of this trap is based upon the reduced gain that results when an impedance is introduced into the cathode circuit of a tube. At 41.25 mc the trap coil reflects a high impedance into the cathode circuit, while at other frequencies it has very little effect. The cathode coil by itself is a small inductance, and does not

(Continued on page 18)



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Replacement Parts in TV Receivers

(Part 1-Capacitors con'td)

by John F. Rider

This is the sixth in a series of articles on "Replacement Parts in TV Receivers." "Transformers" will be discussed next month.

Maximum Operating Temperature

We have already referred to the item of operating temperature. In a sense, the maximum operating temperature is a constant for a capacitor although it might, perhaps, be better viewed as a rating. By and large the general run of capacitors intended for use in television receivers are designd for operation at either maximum temperatures of 65°C or 85°C. In either case, whatever are supposed to be the other constants of the unit are assumed to be true only if the capacitor is used within the maximum operating temperature rating.

An attempt towards standardizing maximum operating temperature ratings of paper dielectric capacitors used in TV receivers at 85°C is under way. However, 65°C capacitors are still commonplace. Operating a capacitor above its maximum operating temperature rating generally results in a reduction in the insulation resistance of the capacitor and in an increase in the power factor, that is, in the electrical losses in the unit.

Receiver manufacturers have displayed during the past few years, a trend towards the use of 85°C capacitors in place of the 65°C capacitors which they used in the past. Unfortunately, the specific capacitor used in a receiver does not bear a label which indicates its maximum operating temperature rating. Hence, when replacement is the issue it is a matter of either replacing with a component which is similar to that used in the receiver, which may be a 65°C unit or buying a 85°C and using it. In this respect, reference to the catalogues made by the capacitor manufacturers will disclose the maximum operating temperature ratings of their components. It is pretty much standard today that molded capacitors are 85°C rated. As a matter of fact, the replacements shown in the Rider Dependable Replacement Parts Lists for tubular capacitors are the molded variety even when the original part was a paper tubular. Summarizing the entire matter, the use of molded case paper dielectric tubulars with the various synthetic impregnants as replacements for tubular capacitors used in TV receivers will satisfy the maximum operating temperature ratings set by the receiver manufacturers with very rare exceptions.

Insulation Resistance

The insulation resistance is a rating associated with paper dielectric tubulars, mica dielectric and ceramic dielectric fixed capacitors. It expresses the d-c resistance of the capacitor at rated temperatures. It is an important item when capacitors are used as blocking devices to prevent the application of d-c voltage present at one point, at another point. The blocking capacitor, also known as the coupling capacitor in many amplifier circuits is the example of such an application.

The usual way in which the insulation resistance of paper dielectric capacitors is mentioned, is megohms times microfarads. On the average, the insulation resistance of paper dielectric tubular capacitors at the temperatures from 20 to 25°C runs around 2,000 megohms per microfarad for values above .1 mfd. On occasion the rating is 1,000 megohms per microfarad. This means that if the capacitance is .5 microfarad the insulation resistance may vary from 500 to perhaps 1,000 megohms. If the capacitance is less than .1 mfd the insulation resistance usually is specified at a fixed amount, as for example, 5,000 megohms for the unit. As to the change in insulation resistance with temperature, it may decrease to as low as 1/70th of its base value at 20°C, when the temperature rises 40 to 50°C.

In the case of ceramic and mica capacitors which are generally available in the lower values, the insulation resistance is generally expressed as a fixed quantity as for example 5,000 megohms, or more or less. The receiver manufacturers generally specify the insulation resistance when they order capacitors and their requirements extend from 5,000 to 7,500 megohms. Replacement units of this kind of capacitor generally display similar values of insulation resistance.

The lower the insulation resistance of a capacitor, the greater is the possible leakage of the d-c voltage applied to the plate of a tube, through the capacitor, to the grid of the next tube, assuming that the capacitor is the d-c blocking device between these two tube electrodes. On the face of it, it may seem as though 1,000 megohms insulation resistance is a tremendously high ohmic value, yet receiver manufacturers frequently require that paper, ceramic and mica capacitors in certain capacitance ranges display insulation resistance of from 6,000 megohms to 7,500 megohms minimum, when measured at 100 volts dc at from 20 to 25°C. For example, if the insulation resistance is 1,000 megohms and the voltage is 250 volts, a current of .25 microampere will flow through the capacitor. If this amount of current is allowed to flow through, a 10 megohm grid leak and a 2½ volt drop will develop across the resistor and by virtue of the polarity, can very materially and adversly affect the existing grid bias. This accounts for the requirement of 5,000 to 10,000 megohms insulation resistance for capacitors less than .1 mf used in this manner. Frequently, in order to maintain the high insulation resistance present between the terminals of mica capacitors for example, they are waxed dipped.

Although we have not mentioned this point earlier, it is always advisable before wiring in a replacement capacitor to check its capacitance and its insulation resistance. On more than one occasion, we found that this brief test saved a great deal of time, because in some cases the capacitor was wrongly labeled and in other cases its insulation resistance had for some unknown reason, fallen from far below its normal value. This does not happen too frequently, but the few moments necessary to make these tests will be worthwhile in the long run.

Relative to insulation resistance it is well to take note of another very important consideration, namely the voltage at which the capacitor is tested. The ordinary ohmmeter test is not satisfactory because the voltage applied is too low. Whenever possible, the insulation resistance test should be made with at least 100 volt dc applied, preferably several hundred volts.

Quite frequently the insulation test made with an ordinary ohmmeter shows a tremendously high resistance, but when the applied voltage is increased from 100 volts dc to perhaps 300 volts dc, the insulation resistance falls to a value which indicates excessive leakage through the capacitor and its unsuitability for use in the circuit.

Power Factor

Power factor is a constant for all capacitors. It is an expression which denotes the

(Continued on page 28)

HINT FOR FINDING TV CHANNEL FREQUENCIES

The following hint, which appeared originally in "The Relay" (published by the Fred C. Harrison Co., Elmira, N. Y.) is based on an idea submitted by John Mulligan.

1. To find the frequencies corresponding to any uhf channel (channels 14 to 83) proceed as follows. Multiply the channel number by 6, then add 389 mc. This will give the center frequency of the channel. The frequency of the picture carrier is 1.75 mc below the center frequency, and the frequency of the sound carrier is 2.75 mc above the center frequency.

2. To find the frequencies corresponding to a channel in the high vhf band (channels 7 to 13) proceed as follows: Multiply the channel number by 6, then add 135 mc. This will give the center frequency of the channel. The picture-carrier frequency is 1.75 mc below the center frequency, and the sound-carrier frequency is 2.75 mc above the center frequency.

3. To find the frequencies corresponding to a channel in the low vhf band (channels 2 to 6) proceed as follows: Multiply the channel number by 6, then add 49 mc for channels 5 or 6 or add 45 mc for channels 2, 3, or 4. This will give the center frequency of the channel. The picture-carrier frequency is 1.75 mc below and the sound-carrier frequency is 2.75 mc above the center frequency.

As an example, assume you are interested in knowing the frequencies coresponding to uhf channel 44. The center frequency is 44 times 6 plus 389 mc, or 653 mc. The picture-carrier frequency is 1.75 mc lower, or 651.25 mc while the sound-carrier frequency is 2.75 mc higher, or 655.75 mc.

As a second example, assume you are interested in knowing the frequencies of vhf channel 11. The center frequency is 11 times 6 plus 135 mc, or 201 mc. The picture-carrier frequency (1.75 mc lower) is 199.25 mc, while the sound-carrier frequency (2.75 mc higher) is 203.75 mc.

Maintenance and Repair

(*Continued from page* 15)

be glad to pay the extra charge when he sees the improvement made on performance.

In conclusion, we might say that you only get out of the radio-TV service business what you put into it. If you put your full time into doing the best possible work on your customer's sets, using all of the helps available, you will be more than repaid in the increased service business, especially in the repeat business that high-quality work will always bring in.

TV SUPPLEMENTARY SHEET NO. 2

MODEL & CHASSIS	PART #	CATALOG #	FUNCTION	DESCRIPTION	LIST PRICE
ARVIN					
6175TM 6179TM	E22464-20	RTV-259	Vert. Lin./ Height	3000/2.5 Meg. 2W-W.W./carbon Conc. Dual	$3.10
	E22464-27	RTV-352	Contrast Vol./Sw.	1500/250 Ω Conc. Dual carbon--SPST	$3.70
	E22464-34	AG-49-S KSS-3	Bright.	100K Ω carbon	$1.25
CHASSIS TE-331 TE-331-2	E22464-36	AG-83-S KSS-3	Vert. Hold	1.5 Meg. Ω carbon	$1.25
	E22464-38	AG-[illegible] KSS-[illegible]	Hor. Hold	25K Ω carbon	$1.25
BELMONT-RAYTHEON					
C-1729A C-1731A M-1726A M-1726A	A10A-18[illegible]	RTV-218	Contrast/ Vol./Sw.	5000/1Meg. Tap 100K Ω Conc. Dual carbon DPST	$4.50
	A10B-17275	AG-49-S KSS-3	Vert. Hold	100K Ω carbon	$1.25
	A10B-17764	AG-44-S KSS-3	Bright.	50K Ω carbon	$1.25
	A10B-19218	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	A10B-19220	AG-61-S FKS-1/4	Height	750K Ω carbon	$1.25
	A10B-19542	AG-63-Z KSS-3	Tone	1 Meg. Ω carbon	$1.25
BENDIX					
0AK3 21K3 21KD 21T3 21X3	CH262022-4	AG-42-S FS-3	Hor. Hold	30K Ω carbon	$1.25
	CH262024-15	AG-27-S FKS-1/4	Noise Inverter	10K Ω carbon	$1.25
	RV4C10 CH262025-4 CH262025-14	AG-83-S FKS-1/4	Vert. Hold	2 Meg. Ω carbon	$1.25
	RV4C07 CH262025-7	AG-85-S FKS-1/4	Height	3 Meg. Ω carbon	$1.25
	RV4C07 CH262025-7 CH262025-12	AG-85-S FKS-1/4	Focus	3 Meg. Ω carbon	$1.25
	RV4C11 CH262025-10 CH262025-13	AG-58-S FKS-1/4	Vert. Lin.	600K Ω carbon	$1.25
	CH262041-2	AT-90 FS-3/SWA	Vol./Sw.	500K Ω carbon--SPST	$1.25
	LH262045-1	RTV-373	Bright./ Contrast	100K/1200 Ω Conc. Dual carbon	$3.10
CROSLEY					
DU-20CDM, CHB, CHM, COB, COM,	B-148952	AG-83-S RS-2	Vert. Hold	1.5 Meg. Ω carbon	$1.25
DU-21CDM1, CDN, CHM, COB, COL, COLB, COM	B-148953	AG-44-S RS-2	Hor. Hold	50K Ω carbon	$1.25
	B-148966	AG-43-S RS-2	Bright.	40K Ω carbon	$1.25
	B-149893	A10-1500 KSS-3	Focus	1500 Ω 4W-W.W.	$1.85
	B-151634	AG-15-S RS-2	Vert. Lin.	3000 Ω carbon	$1.25
CHASSIS 357 357-1	B-152129	AG-83-S RS-2	Height	1.5 Meg. Ω carbon	$1.25
	C-151111	RTV-327	Contrast/ Vol./Sw.	1500/1Meg. Tap 250K Ω Conc. Dual carbon SPST	$4.30

MODEL & CHASSIS	PART #	CATALOG #	FUNCTION	DESCRIPTION	LIST PRICE
	W-148861	Order From MFR.	AGC	1000 Ω 1W-W.W.	
EMERSON					
711B 712B 720B	390156	AG-61-S KSS-5	Vert. Hold	1 Meg. Ω carbon	$1.25
	390181	AG-52-S KSS-5	Bright.	200K Ω carbon	$1.25
	390183	AG-44-S KSS-5	Hor. Hold	50K Ω carbon	$1.25
	390196	AG-83-S FKS-1/4	Height	2 Meg. Ω carbon	$1.25
CHASSIS 120164B	390196	AG-83-S FKS-1/4	Focus	2 Meg. Ω carbon	$1.25
	390197	A43-5000 FKS-1/4	Vert. Lin.	5000 Ω 2W-W.W.	$1.25
	390201	RTV-296	Contrast Vol./Sw.	1500/1 Meg. Conc. Dual carbon--SPST	$3.70
	390202	AG-83-S FKS-1/4/SWB	Fringe Com- pensator	2 Meg. Ω carbon--SPST	$1.25 .60
FADA					
7C42 7C52	* D220076G20	A43-5000 FKS-1/4	Vert. Lin.	5000 Ω 2W-W.W.	$1.25
	52.24	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	52.64	RTV-109	Contrast/ Vol./Sw.	750 Tap 500/500K Ω 2W-W.W./carbon Conc. Dual--SPST	$4.50
	52.66	RTV-110	Vert./ Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	$3.10
	52.69	AG-44-S FS-3	Bright.	50K Ω carbon	$1.25
	52.74	AG-84-S FKS-1/4	Focus	2.5 Meg. Ω carbon	$1.25
	* Some Models Use Part # 52.68				
7T32, 77T32, 721	52.24	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	* 52.24	AG-84-S FKS-1/4	Focus	2.5 Meg. Ω carbon	$1.25
	52.64	RTV-109	Contrast Vol./Sw.	750 Tap 500/500K Ω 2W-W.W./carbon Conc. Dual--SPST	$4.50
	52.66	RTV-110	Vert/ Hor. Hold	1 Meg/50K Ω Conc. Dual carbon	$3.10
	52.68	A43-5000 FKS-1/4	Vert. Lin.	5000 Ω 2W-W.W.	$1.25
	52.69	AG-44-S FS-3	Bright.	50K Ω carbon	$1.25
	* Some Models Use Alternate Part # 52.74				
20C22 20T12 24T10	52.24	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	52.64	RTV-109	Contrast/ Vol./Sw.	750 Tap 500/500K Ω 2W-W.W./carbon Conc. Dual--SPST	$4.50
	52.66	RTV-110	Vert./Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	$3.10
	52.68	A43-5000 FKS-1/4	Vert. Lin.	5000 Ω 2W-W.W.	$1.25
	52.69	AG-44-S FS-3	Bright.	50K Ω carbon	$1.25

Form No. 751836010-5M-11/52

Mismatched TV Components

Numerous comments concerning the effects of improperly matched TV components have appeared in SUCCESSFUL SERVICING in the past. These have led to numerous telephone calls from service technicians asking that we publish information concerning the effects of such conditions. These articles will appear in this magazine beginning with the May, 1953 issue.

The Editor

CORRECTION TO:

Rider's Dependable Replacement Parts Listing published in TV Volume 10.

SWEEP TRANSFORMERS

Set Mfr.	Set Mfr's Original Part No.
Gamble-Skogmo	51X156

Correction: Transpose A-8141 from Ram column to Stancor column.

RCA	74114

Correction: Change Part No. 74114 to 74144 in Part No. column.

I-F Trap Circuits etc.

(*Continued from page 10*)

cause much degeneration. A transformer arrangement is used to obtain a high-Q trap circuit. The coupling between primary and secondary determines the effectiveness of the trap.

The cathode trap generally does not produce a peak to the left of 41.25 mc. However, the trap loses its effectiveness if the transconductance of the associated tube is low. This tube should operate, therefore, with a constant bias. If agc bias is applied to the tube, the trap will become useless when strong station signals are being received.

Any of the four arangements shown in Fig. 3 may be used to trap out a 4.5-mc signal in the video section of the receiver.

Tuning of Traps

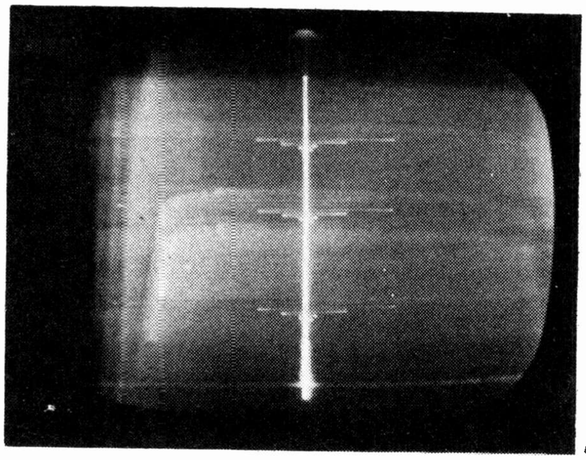
In non-intercarrier receivers, the sound i-f signal is removed from one of the 41.25-mc traps, while in intercarrier receivers the sound signal is obtained from a 4.5-mc trap. The question arises, when tuning these traps, as to whether to tune for maximum sound output or minimum picture-signal output. The answer is that i-f traps should always be adjusted for minimum second-detector output, so as to obtain the solid-line response curve of Fig. 2. Similarly, 4.5-mc traps should be adjusted for minimum 4-5-mc signal at the cathode-ray tube. A properly designed receiver will have sufficient sound output when the traps are adjusted in this manner, and it is more important to optimize the picure presentation. Receiver schematics usually specify the frequency at which each trap is intended to operate. In most cases, the trap circuits are slug tuned.

Conclusion and Summary

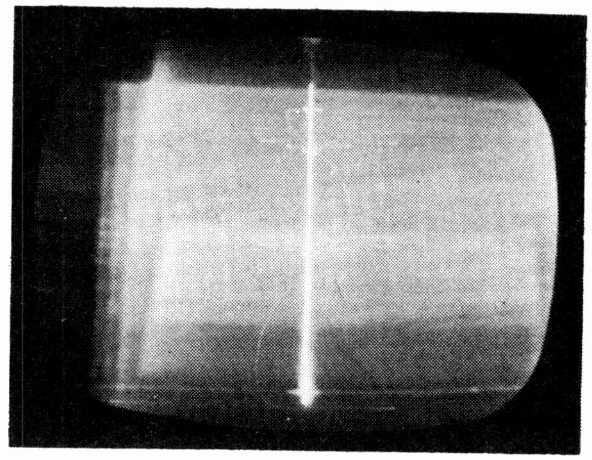
From the foregoing discussion, one may conclude that many television receiver faults may be traced to improperly aligned traps, or to traps that have been omitted in the design of the receiver. In all cases, improperly aligned traps may trap out picture signals rather than the signals they were intended for. This may be checked by examining the overall i-f and video response curves of the receiver. Summarizing, we may note that:

1. Improperly aligned or missing associated sound traps may result in sound-bar and 4.5-mc interference in the picture, and buzz in intercarrier receivers;
2. An improperly aligned or missing adjacent sound trap may result in sound-bar and 1.5-mc interference in the picture;
3. An improperly aligned or missing adjacent picture trap may result in adjacent-picture interference in the desired picture;
4. An improperly aligned or missing 4.5-mc trap may results in 4.5-mc interference in the picture, and weak sound in intercarrier receivers.

BRIGHT VERTICAL LINE



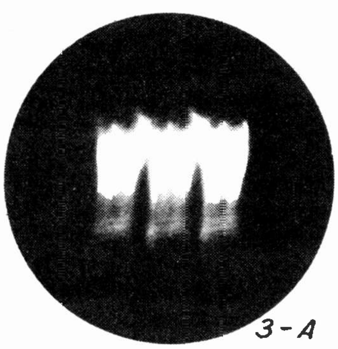
1



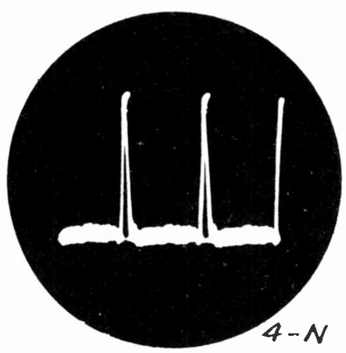
2

(NOTE: Refer to CIRCUIT GUIDE IV-9(A) for identification of components.)

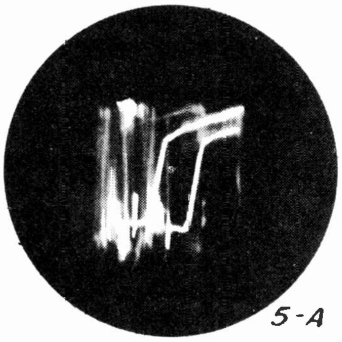
The unstable picture-tube pattern evident while the receiver was defective is shown, as photographed at different instants, in Figs. 1 and 2. The raster was shrunken in size and jumped erratically over the face of the picture tube at a rapid but visible rate, giving the appearance of a flickering raster. Neither vertical nor horizontal sync could be restored by adjustment of the hold controls. The bright vertical line, marked by intermittent horizontal streaks, was conspicuous at all times. While audio-output level was normal, a steady oscillation of undetermined frequency accompanied the sound.



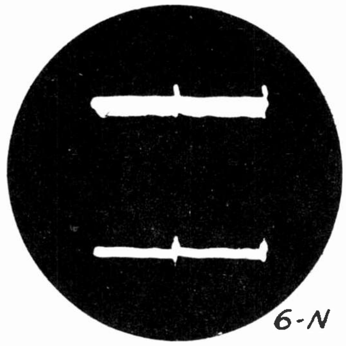
3-A



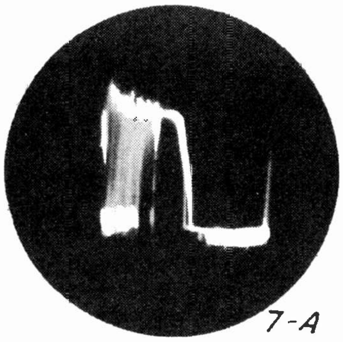
4-N



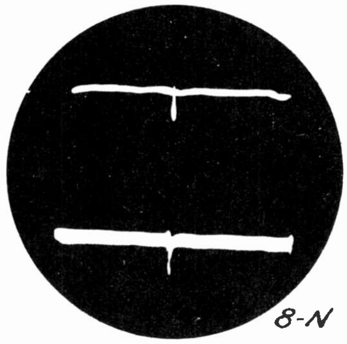
5-A



6-N



7-A



8-N

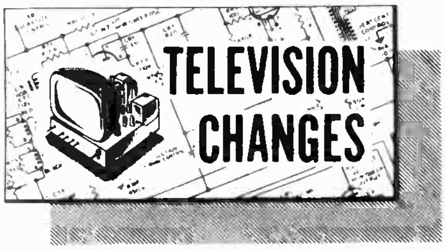
Since symptoms of faulty operation appeared to involve both vertical and horizontal synchronization and the high-voltage section, which depends on the horizontal-sweep circuit, operation of the common sync strip was checked. The sync separator and clipper (*V1* and *V2*) appeared to be operating normally. However, at the grid of the sync splitter (*V3*), the unstable, distorted waveform of Fig. 3 was obtained, with an isolating probe, at H/3. Normally, the well-defined steady pulse of Fig. 4 is present. A similar condition existed at the vertical-scanning frequency.

Output from this stage was then investigated. Waveforms at the plate were badly distorted in shape. For example, at V/2 through the low-capacitance probe, the pattern of Fig. 5 was noted. This stage, when functioning properly, produces a plate waveform like that shown in Fig. 6 at the frequency mentioned.

The cathode-output waveform (obtained at the junction of *R9* with *R10*) was similar to but out of phase with the plate output, as expected (see Fig. 7). However, it was much lower in amplitude. Cathode and plate output waveforms are normally of the same amplitude. The normal output waveforms of Figs. 6 and 8, for example, are similar in shape, opposite in polarity, and of the same P-P height. The positive d-c voltage at the junction of *R9* and *R10*, however, was considerably larger than the normal low value.

A check of the output side of capacitor *C6*, feeding from the cathode, revealed the expected display, already shown in Fig. 7; but the d-c voltage, normally negative, was identical to the positive reading found at the previously mentioned junction of *R9* and *R10*. In addition, resistance readings on either side of capacitor *C6* were the same.

Normal operation of this receiver was restored by replacing a defective component in the cathode-output circuit of the phase splitter, V3. Coupling capacitor C6 was found to be shorted.



The Rider Manual pages and TEK-FILE pack which include the original data and shematics to which the following production changes apply, appear in the index on page 29 of this issue.

GAMBLE-SKOGMO (CORONADO)
MODELS 05TV1-43-9014A, 15RA2-43-9105A
CHASSIS 16AY210

Circuit Changes, Audio

A 6T8 tube (triode-triple diode) replaces the audio amp. 6AV6 (V12) and the audio det. 6AL5 (V21), performing the same functions as these two tubes.

In the audio strip assembly, 72 (Part No. B-13M-19257, the ratio detector coil) is replaced by Part No. B-13M-17273.

NOTE: Chassis stamped with RMA date code number 124031 or higher incorporate these changes.

•

MAGNAVOX
CHASSIS CT-275, 276, 277, 278, 279, 280, 281, 282

R-F Unit

These chassis use either r-f unit 700349 or 700354.

SYLVANIA
MODEL 1110X
CHASSIS 1-329

Sound I-F Limiter (Circuit Change)

1. Dual ceramic capacitor C-103 and C-104 (.004µf, 450v), connected to pins 6 and 7 of the Sound I-F Limiter (V-9, 6AU6), is removed from the circuit.
2. Resistor R-105 (330 ohms, ½w), connected to pin 7 of V-9, is removed from the circuit.
3. The cathode of V-9 (pin 7) is connected directly to ground.
4. New capacitor C-103 (.005µf, 500v, ceramic, Service Part 166-500D) is added to the circuit as screen grid bypass for V-9 (pin No. 6 to ground).

NOTE: Chassis coded C02 and later incorporate this change.

•

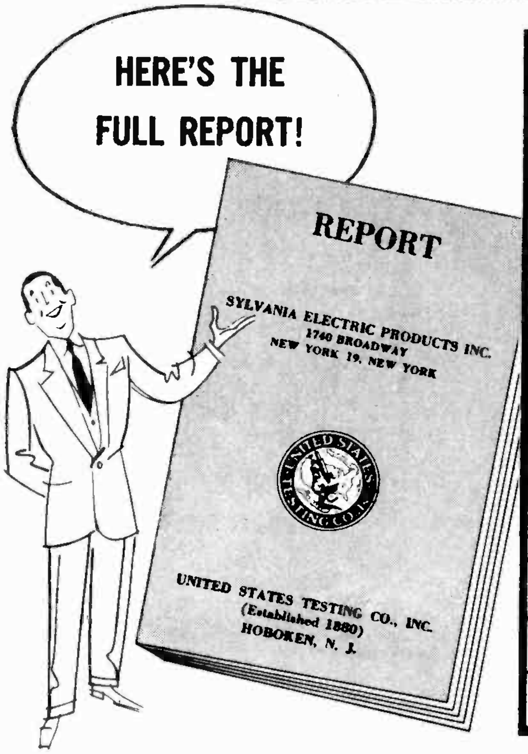
SYLVANIA
MODELS 71M, 72M, 73B, 73M
CHASSIS 1-366(C08), 1-441(C02)

Sound I-F Limiter (Circuit Change)

1. Resistor R-105 (330 ohms) and capacitor C-103 (.004µf) are removed from the cathode (pin 7) of the Sound I-F Limiter (V-10, 6AU6).
2. The cathode is connected directly to ground.
3. Capacitor C-103 (pin 6 of V-10, 6AU6) is changed from .004µf, 500v to .005µf, 500v (Service Part 166-5000D).

NOTE: Chassis 1-366 coded C09 and chassis 1-441 coded C03 incorporate this change.

SUPERIOR PERFORMANCE OF SYLVANIA PICTURE TUBES NOW PROVED BEYOND ALL DOUBT



LIFE TEST MAGNETIC TUBES
United States Testing Company
Hoboken, N. J.

Test No. E-5526
Date 10-11-52
Engineer A.S.M.

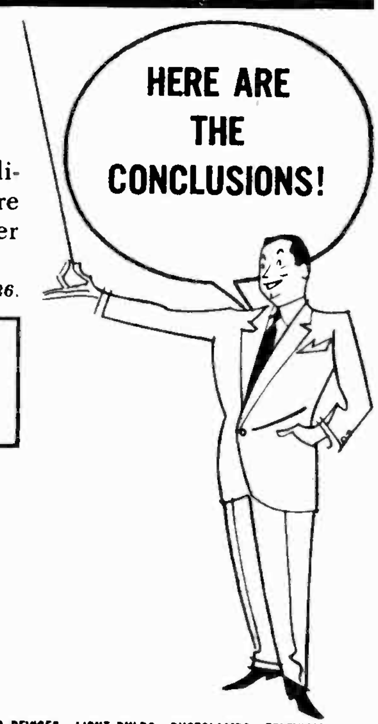
Mfr.	Tubes Tested	Tubes Failed	Point Quality
A	8	3	76
B	8	4	79
C	8	6	62
D	8	4	74
E	8	4	67
F	8	5	42
G	8	4	52
H	8	5	30
SYLVANIA	8	0	93

Exhaustive tests by United States Testing Company prove Sylvania Picture Tubes out-last, out-perform all others tested!

● Hour after hour for over 1,400 consecutive hours, Sylvania Picture tubes were tested side by side with tubes of 8 other manufacturers. The chart at right tells the remarkable performance record. Note that only Sylvania Picture tubes showed no failures. Here's the conclusion of the U. S. Testing Company Report: "On the basis of an ultimate Life Test Evaluation of the eight tubes of each brand tested, it can be concluded that the averaged overall qualities measured on the Sylvania Tubes were superior to the averages of the other brands tested."*

*United States Testing Company, Inc., Test No. E-5526.

We'll be glad to send you full details of this report. Send your request to Sylvania Electric Products Inc., Department 3R-1804, 1740 Broadway, New York 19, N. Y.



SYLVANIA

RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT LAMPS, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

What Is The Fastest Way To Trouble-Shoot A TV Set?

This material originally appeared in A.G. RADIO NEWS, published by the AG Radio Parts Co.

Every service technician has his own little private system of trouble shooting because it is developed from day to day experiences in dealing with an endless variety of problems.

In beginning to trouble shoot a chassis brought into the shop, some prefer to check prominent B voltage points first; others choose to test suspected groups of tubes first; some rely on observation of the end result of both picture and sound for the prime indication of a defect and still others turn directly to signal tracing or signal injection methods.

Each of these approaches has it own definite advantages and because of this, furnishes grounds for argument, which incidentally, is not the concern of this review.

Regardless of the system of trouble shooting which you may employ, it may be wise to stop and analyze it occasionally to find if you are competitive in today's modern service market.

How does your system of trouble shooting measure up to the following questions?

(1) Is it fast enough to be competitive even when severe problems are encountered?

(2) Is it a sure-fire direct approach to the source of a defect right down to the very component at fault?

(3) Does it furnish positive proof of correction enabling you to gain control over the cause of trouble so you can repeat bad or good operation at will?

When the going gets tough and extraordinary demands are placed on any particular system, it may soon be found to be limited to the extent where tests methods of another system must be reverted to in order to reach a conclusion. On may suppose then, that a combination of the above listed systems might be best, but this hardly seems practical.

From another aspect, trouble shooting practice can be relegated to two broader classifications:

(a) The "case history" or "experience" method and

(b) progressive testing.

Many technicians depend on their experience with one set to guide them in repairing another one like it. When an unfamiliar problem arises, someone else's experience is sought, either through conversation or by resorting to technical files.

The popularity of direct solutions to characteristic problems is responsible for the introduction of many technical data sheets hints and kinks, and other printed helps. Therein other peoples' experience are described so the technician can avoid the costly process of working them out for himself. The limitation to this "case history" method, however, lies in the extensive filing job necessary to organize sufficient data and to constantly amend it for all makes of sets. Filing could conceivably take more time than trouble shooting!

Where specialization on a single line of receivers alone is practiced, the "case history" method with its repeatedly used short-cut experiences, becomes highly practical. This is a point in favor of having exclusively franchised dealers or large specializing contractors.

Progressive testing should appeal more to the independent technician who services all makes of receivers. His pet system of trouble shooting, plus schematics, voltage charts, and other pertinent basic information will enable him to rush through most problems.

When his routine practice is completed, the employment of his extended knowledge of various systems of trouble shooting, quickly leads to conclusive .results.

This "general practitioner", therefore, must rely more on his ability to think of a test that will solve his unusual problems than to rely solely on finding a case history that will match any problem which he may encounter.

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IMPS ARE REALLY RUGGED!

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IMPS ARE MOISTURE-PROOF!

No moisture can get through the varnished plastic case, or even through the lead anchor points.

IMP LEADS CAN BEND AND BEND!

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PYRAMID ELECTRIC COMPANY

1444 HUDSON BOULEVARD · NORTH BERGEN, NEW JERSEY

Setting Up for TV Service

(*Continued from page* 3)

manager specified seven outlets served through a circuit braker and isolation transformer. A switch pilot light should also be incorporated.

Two sets of antenna leads should be available at the bench. Provisions for the mounting of a test CRT should also be provided.

As far as storage space is concerned, the shop should have adequate space to heat run repaired chassis for at least four hours, preferably in their cabinets.

Generally speaking, lighting should be such that the service man does not cast shadows on his work. Recommendations as to fluorescent and incandescent lamps vary. If the former is used, it must be properly installed to minimize interference. Overhead lighting should be supplemented by gooseneck or floating-arm lights.

There is some tendency to locate service shops in basements or other poorly ventilated spots. In any shop, efficiency can be stepped up by giving some attention to good ventilation. Actual sound-proofing of the shop is usually impractical but a little attention to layout and some inexpensive soundproofing measures are often sufficient. In addition, the shop noise level can often be reduced by care on the part of service personnel.

A regard for efficiency alone will dictate the minimums as regards shop layout, lighting and ventilation. Dividends in the form of better employee morale and a better impression on the public can be realized by going one step further in providing a neat, well-laid out shop. An operation of this type can be well publicized, rather than being relegated to obscurity.

Test Equipment

Many of the service managers contributing advice to Electrical Merchandising in preparing this article emphasized that purchase of inferior test equipment was no economy.

Said one, summarizing the problem: "A big headache to manufacturers is the type of equipment offered by test suppliers, since there is a good chance that test equipment will not perform as advertised. We have spent considerable time in analyzing test equipment offered to the trade and have found some of it almost worthless. . . . . Generally speaking, a serviceman gets what he pays for. . . . Much of the equipment offered to the serviceman two years ago is not acceptable for use on TV receivers today because of the increased sensitivity built into sets since that time."

What test equipment does the dealer need for his service shop? Four manufacturers provided answers, varying in detail.

A spokesman for Admiral Corp. suggested that the minimum would include an oscilloscope, a vacuum tube voltmeter with high voltage test leads and RF probe, a sweep generator and calibrator.

CHART I—TEST EQUIPMENT (Du Mont Recommendations)

The Minimum

1. Oscillograph with horizontal probe (from $150 to $330).
2. Vacuum tube voltmeter ($55 to $125).
3. Sweep generator ($220 to $550).
4. Peak to peak scope calibrator ($40).
5. Isolation transformer ($25).

Useful Additions

Tube tester with CRT test adaptor ($100 to $165). Capacitor checker ($70). Cross hatch generator ($175). Field strength meter ($85). High frequency and high voltage probes for VTTM.

How Much Equipment

Each bench should have an oscillograph and VTTM.

A de luxe shop would have one sweep generator setup for every two benches and a Scope P-P Calibrator for every bench. At a minimum, however, one of each of these pieces of equipment would be adequate.

What To Look For In Buying This Equipment

1. Oscillograph
   Sensitivity—minimum 30 mv/in. R.M.S.
   Vertical amplifier response—Flat from a few cycles per second to a minimum of 100KC (at 10% point).
   Shielding—CRT, and input terminals must be fully shielded.
   Screen Size—Preferably 5".
2. Vacuum tube voltmeter
   Input impedance—At least 10 megohms.
   Voltage ranges—Minimum low range—3v. Minimum high range—600v.
   Polarity switching—Should incorporate provisions for switching between positive and negative voltage.
   Zero center scale—Should provide one for simplified FM alignment.
3. Sweep generator
   Flatness—Output should be flat within .2db.
   Shielding—Unit must be fully shielded to minimize extraneous pickup.
   Sensitivity—Should have at least a maximum 0.1v output.
   Sweep width—Minimum 10mc.
   Center Freq.—Minimum 4mc to 216 mc.
4. Marker
   Sensitivity—At least a maximum 0.1v output.
   Accuracy—Within ± 0.5%.
   Modulation—Should provide frequency for internal modulation of cw marker.
   Horizontal check—Incorporates horizontal oscillator for accuracy tests.
5. Scope P — P Calibrator
   Range—Preferably .01v to 100v in direct readings.
   Physically—Should be mounted on scope to provide instantaneous p — p measurement by simply turning a knob on the calibrator.

In describing the test equipment needed by a servicing dealer, DuMont and Emerson experts went into considerable detail, not only as to the equipment but also as to the features and performance characteristics which should be found in such equipment. For these opinions, see Charts I and II.

RCA, whose subsidiary, RCA Service Co., is the largest servicing organization in the field, suggested these guides for purchasing test equipment. (The large shop shown in the table employs from 16 to 20 technicians, the small has only three or four.)

Item	*Large Shop*	*Small Shop*
Audio amplifiers	1	1
Antenna rotor kits	8	2
Dual turntable racks	1	1
High voltage test probe	1	1
Oscilloscope	1	1
Circuit tester	27	5
Sweep generator	1	1
Crystal calibrator	1	1
Signal generator	1	1
Monitor TV set	1	1
RF unit test jig	1	1
Junior Voltohmyst	2	1
Sound power phone (hand)	7	2
Sound power phone (chest)	7	2
Telescopic survey truck	1	1
Tube tester	1	0
Survey receiver	1	0
Record player	3	3
Capacitor analyzer	1	0
16" test jig	2	1
17" test jig	2	1
21" test jig	2	1

Tools: Hand, Shop, and Installation

Chart III gives a good idea of the variety of tools required for servicing a set and for installation work. Generally speaking one set of hand tools is required for each bench. A single set of shop tools, however, should be sufficient for the entire shop.

Installation Supplies

A crew handling installations must carry a wide variety of supplies; these can be broken down roughly into antennas (and masts) and mounting accessories. An ample supply of accessories should be maintained on the truck at all times. The antennas and masts can be drawn from stock each morning to cover that day's jobs. Each truck should carry about 1,000 feet of antenna lead-in wire.

In determining his stock levels on installation supplies, the dealer must take into consideration the number of trucks being used and the number of installations handled on an average day. Generally speaking, a two-

CHART II —TEST EQUIPMENT (Emerson Recommendations)

The Equipment

1. Oscilloscope (from $175 to $300).
2. Vacuum Tube Voltmeter ($50 to $65).
3. Sweep and marker generators ($175 to $500).
4. AM-FM Signal Generator ($75 to $200).
5. Tube Tester ($150).

How Much Equipment

1. Usually only one alignment set (scope, sweep and marker generators) is necessary for the entire shop.
2. Each man should have a VTTM and oscilloscope.

What To Look For In Buying This Equipment

1. Oscilloscope
   An oscilloscope should have at least .05 volts per inch vertical deflection sensitivity and have a good frequency response to at least 150KC. Be certain that the input resistance is in the order of 35 mmf. or less and at least 1 meg ohm, and that it has provision for at least a 20KC sweep sync rate. Be certain that the scanning line has enough intensity and can be focused on high intensity settings. A good sync is also desirable.
   A more elaborate scope has provisions for peak to peak voltage readings, frequency response to over 300KC and a very bright and well focused scanning beam. The vertical sensitivity is usually in the order of .01 volts per inch deflection with high horizontal gain for expanding wave pattern. This type of scope sells for about $300.
   The above two pieces of equipment are requieed for service work. The following equipment is needed for alignment work which sometimes is the cause of many service headaches.
2. Vacuum tube voltmetee
   a) Make sure it has a high D.C. input impedance about 11 megohms for minimum loading of circuits.
   b) Low voltage scale of at least 5v.
   c) Zero center scale for alignment of Disr. is good but not necessary.
   d) Should also read A.C. volts and ohms. (x 1 meg).
   A more elaborate V.T.V.M. should also have a high input impedance on A.C. and be relatively flat for a wide range of audio frequencies, so that it can be used as an output meter and test probe. The cost for such a V.T.V.M. is about $65.
3. Sweep and marker generators
   a) Sweep 20 and 40 mc I.F. ranges. Plus F.M.
   b) Sweep entire T.V. R.F. spectrum.
   c) Linearity of sweep to be constant with output setting. (Voltage output should not change with frequency over sweep range).
   d) At least .1 volt output.
   e) Marker should be accurate to at least 1% preferably crystal controlled and relatively free of drift after warm up.
   f) Marker should have at least .1 volts output.
   g) Each unit should be free of Harmonic output (well shielded) especially the sweep generator.
   h) Provision for calibrating dial, especially for marker.
   There is more of a variation in price for the above items than practically any other. Better units have separate markers and sweeps and operate strictly on fundamentals. Cheaper units usually do not contain R.F. markers, so that the stations must be used to align the local oscillator. Such equipment cannot be used too well for the alignment or repair of tuners. Cheaper units which do a fair job cost about $175 while better units cost anywhere upwards of $500 for sweep and marker.
   In any event, the most important factors are sufficient output and good linearity, especially with a change in attenuator setting (output voltage).
4. AM-FM Signal Generator
   a) Cover frequeneies of feom about 100KC to 120 mc.
   b) Sufficient output at least .1 volt.
   c) Good stability after warm up and at least 3% accuracy.
   d) Amplitude modulated by about 400 cycles at approximately 30% modulation.
   Cheaper units operate mainly on harmonics, have low output, poor stability and tracking accuracy, about $50.
   Better units operate on fundamentals, have approximately 1% accuracy, have provisions for varying percent modulation and frequency of modulation, and also can frequency modulate the R.F. carrier. These units are approximately $200.
5. Tube Tester
   A tube tester is necessary for counter use, (testing customers tubes). It should be of the dynamic mutual conductance type and take all different type tubes including miniatures. It should have provisions for testing shorts and noise with an internal replaceable tube chart roll.

(*Continued on page* 26)

Setting Up for TV Service

(*Continued from page* 25)

CHART III—TOOLS . . . Hand, Shop and Installation

A. HAND TOOLS

Suggested by Du Mont

Screw driver set (regular and Phillips head)	$ 3.00
Set of spintights	5.00
Long nose pliers	2.00
Diagonal cutters	2.00
Set, alignment and adjustment tools	4.00
Soldering gun	12.00
Tube puller	.75
Pin straighteners (7 and 9 pin base)	.75
Hex and spline wrench set	1.25

Suggestions by Admiral

- Screw driver set (⅛" to ¼" blade)
- Set, spin type wrenches, 3/32" to ⅜"
- Diagonal pliers
- Long nose pliers
- Soldering gun/iron
- Alignment wrenches

Suggestions by RCA Service Co.

- Diagonal pliers 6"
- Slip joint pliers—6"
- Screw driver, cap tip 8"
- Screw drivers, set of 4
- Ratchet—¼"
- Socket set 11 pieces
- Soldering gun
- Needle-nose pliers—6"
- Crescent wrench—6"
- Phillips screw driver ¼"
- Allen wrenches
- Mirror, 4 x 5 inches

Suggestions by Emerson

200 watt soldering gun	$13.00
Long nose pliers	2.25
Diagonal cutters	2.25
Set, spintights	4.25
Screw drivers (2)	1.00
Phillips head screw drivers (2)	1.50
Kit, alignment tools	1.00

B. SHOP TOOLS

Du Mont

Vise	$15.00
200 watt soldering iron	6.50
½" electric hand drill and set of drills	40.00
Wire stripper	4.00
Adjustable hack saw	1.75
Center punch	.75
Tool steel reamers	2.00
Set of files	4.00
Hammer	1.50
Set, open-end wrenches	3.00
Mirrors, stand	5.00
Electric grinder	15.00

Admiral

- Electric drill
- Vise
- Socket punches
- Drill set—1/16" to at least ¼"

RCA Service Co. (shop and installation tools)

- Extension cord, 100 feet
- Soldering iron
- Hammer, double face, 3 lbs.
- Wood lever, 12"
- Files (2), 8" med.
- Keyhole saw; hack saw
- Screw driver, 6" blade
- Screw driver, Phillips
- Pliers, side cut, 7"
- Cold chisel, ½"; wood chisel, ½"
- Center punch, ⅜" dia.
- Ratchet wrench box type (½ x 9/16")
- Ratchet wrench box type (⅜" x 7/16")
- Flashlight, right angle
- Channel lock pliers
- Tri-plug
- Bit brace
- Claw hammer, 16 oz.
- Screw driver std. tip, 3" blade
- Cab. tip and screw
- Diagonal pliers, 7"
- Pliers, needle-nose, 7"
- Paint brush, 1"; putty knife
- End wrench, 8"
- Steel tape, 6 ft.
- Pliers, slip joint

Emerson

- Use 200 watt soldering iron instead of gun
- Each technician is furnished more expensive set of alignment tools than specified under hand tools
- Shop tools such as vise, electric drill, etc.

C. INSTALLATION TOOLS

Du Mont

- Adjustable 50 ft ladders
- Pipe wrenches
- Rope (100 ft)
- Extension cord (200 feet with multiple outlets)
- Set masonry drills
- Hammer heavy construction type
- Set chisels
- Pair of phones—sound powered
- Heavy duty electric drill
- COST: About $120 per truck

Emerson

Hack saw	$1.25
Pipe wrench	5.00
Vice grip wrench	1.00
Set, box wrenches	3.00
Assorted size star drills	1.00
Medium size hammer	2.50
Large screw driver	.70
Lacquer (for corrosion proofing)	

man crew should be able to handle four installations per day.

For some idea of what's required in the way of supplies for installations, see Chart IV.

CHART IV—INSTALLATION SUPPLIES

- Antennas, Masts and Mast extensions, Mast connectors
- 300 ohm antenna wire
- Coaxial cable (72 or 75 ohm. Should be used only for special applications: electrically noisy areas, damp salty areas where 300 ohm line would deteriorate rapidly).
- Gonset low loss open wire line (to be used only in extreme fringe areas where minimum line loss is necessary).
- Lightning arrestor, aluminum ground wire, ground clamps and ground rods
- Mounts: chimney, wall, adjustable wall (for clearing obstructions) and base mounts
- Guy Wire (6 strand steel wire), turnbuckles and guy rings
- Anchor bolts for mounting brackets to masonry
- Lead plugs for securing stand-offs to masonry
- Stand offs for: twin lead in wire, coaxial antenna wire
- Single and double mast stand-offs for securing antenna wire to mast
- Insulated tacks, black friction tape
- Spring-wing toggle bolts for mounting brackets against hollow wall
- Rotors and boosters

Parts

A good service operation is no stronger than its weakest link—and the most elaborate service set-up will be rendered ineffective if the dealer fails to stock an adequate supply of parts and tubes.

What constitutes an adequate stock of these items is a question which is best determined with reference to past experience. Some general rules can be set up as a preliminary guide. They may have to be adjusted or supplemented when a dealer has put them into effect and determined whether they suit the conditions he is meeting.

One manufacturer tells his dealers: maintain two replacement parts unless you find that you need more. Have at least 10 tubes of each type on hand and for the more popular types, keep 50 on hand.

RCA Service Co. carries a two-month supply of parts available within 30 days and keeps an additional month's supply on order.

Maintenance of a parts inventory system is strongly recommended, both as a control measure and as a means of determining satisfactory inventory levels. These records can be maintained in a variety of forms. Dealers should remember that the more information required by the system, the more valuable it will be to management. The following items, listed in order of their importance, could be included:

1. Record of purchases by description, purchase order number and date and quantity ordered.
2. Record of receipts by quantity and date.
3. Cost of item to dealer and list price.
4. Usage and balance on hand.
5. Minimum and maximum stock quantities.
6. Location of items.

According to Harold Schulman, manager of the Du Mont teleset service control department, the information provided in items (1) and (2) above automatically provide the dealer with:

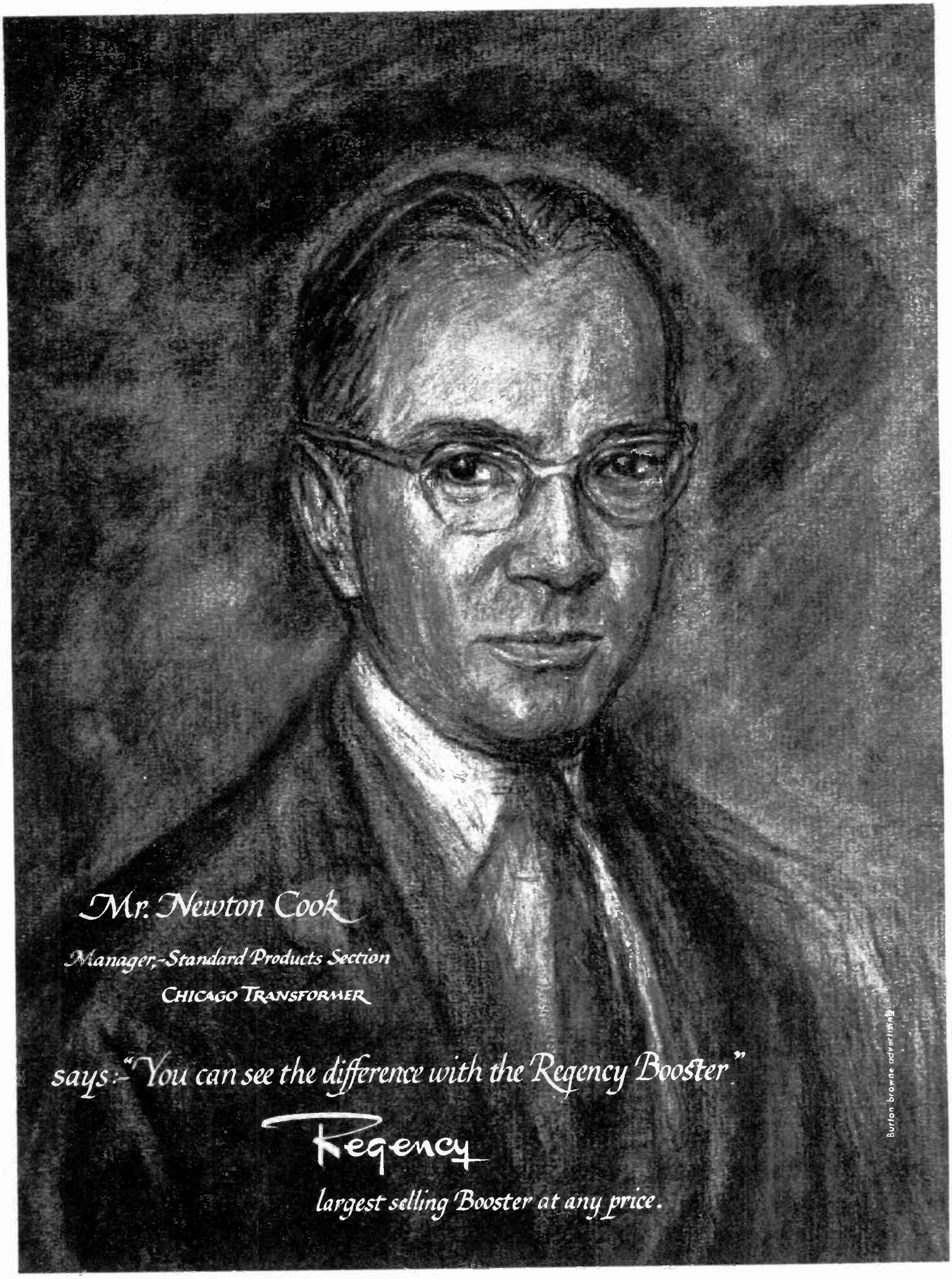
a. The approximate rate of usage. Quantity to be purchased can then be judged according to the frequency and quantities of past orders.

b. A safeguard against reordering parts already on order—a major cause of overstocking.

c. A steady reference file for giving approximate dates of delivery and timing of purchases.

This system has one drawback, Schulman warns: it provides no usage report. The dan-

(*Continued on page* 31)


Mr. Newton Cook
Manager,-Standard Products Section
CHICAGO TRANSFORMER
says:-"You can see the difference with the Regency Booster."
Regency
largest selling Booster at any price.
Burton browne advertising

REPLACEMENT PARTS, Etc.

(*Continued from page* 13)

magnitude of electrical losses. It is expressed in terms of percentage. The range of power factor for paper dielectric tubulars at base temperatures of 20 to 25°C is from perhaps .25 to 1%. As a general rule, power factor increases with both decrease and increase in operating temperature relative to the rated base temperature, so that an increase of from 3 to perhaps 5% for a temperature rise of 40—60°C is not unusual. Generally, the power factor increases very rapidly when a capacitor is used at temperatures beyond its rated operating temperature.

In the case of mica capacitors and ceramic capacitors, the power factor figures are substantially lower than for the paper dielectric type of unit. Assuming these types of capacitors are being used within their rated operating temperatures, the power factor of mica capacitors generally is substantially below 0.2%, especially the silver mica variety. Ceramics are in the same category, generally even better, frequently displaying power factor values as low as .02%, if not less.

The general order of paper dielectric tubular, mica dielectric and ceramic dielectric offered for replacement are within the general ratings set by the receiver manufacturers for the original components used in their receivers.

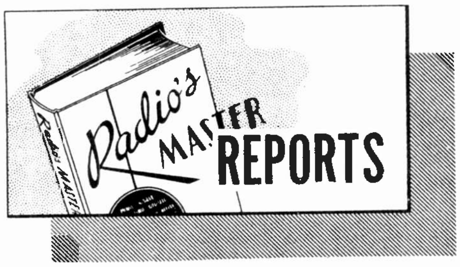
Summary

We realize that all possible items relating to capacitors have not been treated in this series. As it is, and even with these omissions the articles have extended over six issues of SUCCESSFUL SERVICING. We have much more to go in covering the other components used in television receivers.

The facts given herein, when supplemented with information contained in the capacitor manufacturers' catalogues, and when complemented with the information given in the Rider Replacement Part Listings, should be of material aid in the problem of understanding TV receiver capacitor components and replacements.

The statements made in these series of articles represent highlights of the factors which are important relative to this component. We say this to fend off possible misconceptions which may result from the occasional hap-hazard selection and use of a replacement capacitor in a television receiver without noting any undesirable effects. This may lead one to believe that the important points raised here are simply efforts to fill space. This is not so. Many service technicians have been greatly confused by the peculiar behavior of receivers after a capacitor replacement which, to all intents and purposes, should have worked properly because the capacitor was electrically perfect.

We might emphasize to the servicing industry that, as time passes, closer and closer attention will have to be paid to capacitance tolerance and temperature coefficients and that when a service technician takes in a stock of fixed capacitors he will require 10% units as well as 20% units, and in some few instances even 5% units. Fortunately this is not a problem, because an examination of the Rider Replacement Part Listings found in Rider Manuals, discloses the fact that some specific values of capacitors more than others, are of the 10% capacitance tolerance rating. Incidentally, this might be of interest also to the capacitor manufacturers who sell to the parts jobbers, and to the parts jobbers who in turn sell to the servicing industry.



A monthly summary of product developments and price changes supplied by RADIO'S MASTER, the Industry's Official Buying Guide, available through local parts distributors.

COMMENT: Over-all product activity continues to be heavy, with more manufacturers reporting changes for this period. As noted last month, tube, antenna and sound manufacturers continue their dominance of the "change activity" scene, while the steady increase in tube prices noted over the last three months has slackened off slightly.

New Items

AMERICAN MICROPHONE — Added Model RCS, crystal microphone with slide switch at $8.10 dealer net.

AMERICAN PHENOLIC — Added new bo-ty and reflector antenna package No. 114-065 at $4.65 dealer net, containing No. 114-053, bo-ty and No. 114-560, bo-ty reflector, with stacking bar included.

CLEVELAND ELECTRONICS — Added Model 88, UHF TV antenna at $5.97 dealer net.

CORNELL-DUBILIER — Added auto radio replacement vibrators; Model 6326 at $2.76 dealer net . . . Model 6330 at $2.76 dealer net . . . Model 6370 at $2.52 dealer net and Model 5370 at $2.52 dealer net, which supercedes Model 5520-4.

CREST LABS. — Added a number of Universal Variable Inductance Kits. Also added a new series of receiver replacement output transformers.

FRETCO — Added Bo-Ti UHF antennas; Model Bo-Ti at $2.70 dealer net . . . Model Bo-Ti reflector at $4.35 dealer net and Model Bo-Ti corner reflector at $8.97 dealer net.

GENERAL ELECTRIC — Added GL-6130, a hydrogen thyroton especially designed for pulsing applications which require a tube that will give dependable operation at high altitudes under stringent operating conditions at $18.00 dealer net and TV picture tube 21ZP4A at $38.50 dealer net.

HARVEY-WELLS ELECTRONICS — Added Bandmaster VFO at $47.50 dealer net.

HYTRON — Added point-contact transistors No. PT-2A at $17.40 dealer net and No. PT-2S at $17.40 dealer net. Also added receiving tubes 12X4 at $1.55 list . . . 12AQ5 at $2.00 list . . . 12V6GT at $2.00 list and germanium diode 1N133 at $1.20 dealer net.

ILLINOIS RESEARCH LABS. — Added Silencer, gallon size at $24.00 dealer net and Sta-Clear, quart size at $4.50 dealer net.

MALLORY & CO., P. R. — Added new 12 volt replacement vibrator, Model G-874 at $3.30 dealer net. Also added Model 6SAC4, battery charger with selenium rectifier at $10.00 dealer net . . . Model 12SAC5, battery charger with selenium rectifier at $24.00 dealer net . . . Model R-670, output cable at $1.30 dealer net and Model 675, output cable at $1.49 dealer net.

MARKEL ELECTRIC PRODUCTS — Added No. A-7180 at $9.98 dealer net and No. A-7181 at $9.98 dealer net, both sapphire tipped Pfan-Tone Cartridges. (These models replace metal tipped Pfan-Tone cartridges No. A-7157 and No. A-7158.)

NATIONAL ELECTRONICS — Added full-wave rectifier, Model NL-606 at $16.63 dealer net and ignitron, Model NL-1005 at $80.50 dealer net.

PERMOFLUX — Added outdoor theater speakers Model 4C-DI at $2.73 dealer net and Model 52C-DI at $2.91 dealer net.

PREMAX PRODUCTS — Aluminum ground wire No. AW-810 at $1.62 dealer net . . . No. AW-825 at $3.60 dealer net and No. AW-850 at $7.20 dealer net have been added to their line.

QUAM-NICHOLS — Added Model QF-3, focalizer unit at $3.57 dealer net and Model IT-4, ion trap at $.60 dealer net.

RCA — Added No. 76323, sapphire at $.90 dealer net. Also added Volume VII to their Service Data series at $5.00 dealer net.

RADIO RECEPTOR CO. — Added a number of new germanium diodes.

REEVES SOUNDCRAFT — Added a number of new tape recording accessories.

RIDER, JOHN F. — Added No. 143-2, TV Manufacturers' Receiver Trouble Cures, Volume 2 at $1.80 dealer net . . . No. 145, TV Sweep Alignment Techniques at $2.10 dealer net and No. 2011, Rider Television Manual, Volume 11 at $24.00 dealer net (available in April).

SCALA RADIO — Introduced Model BZ-4, voltage doubler probe at $10.75 dealer net.

SCOTT INC., HERMAN — Added Model 214-AB at $196.75 dealer net and Model 214-X8 at $29.95 dealer net, both remote control amplifiers and Model 120-AB, equalizer pre-amplifier at $79.25 dealer net.

SPRAGUE PRODUCTS — Added a number of twist-lok electrolytic capacitors.

STANCOR — Added new ultra-miniature transistor transformers; No. UM-110, interstage at $7.35 dealer net . . . No. UM-111, output or matching at $9.00 dealer net . . . No. UM-112, high imp. mic. input at $8.25 dealer net . . . No. UM-113, interstage at $6.60 dealer net and No. UM-114, output or matching at $9.00 dealer net.

SYLVANIA — Added 21" TV picture tubes; 21-WP4 at $39.00 dealer net . . . 21XP4 at $40.50 dealer net . . . 21YP4 at $41.50 dealer net and 21ZP4 at $40.00 dealer net. Also radio receiving tube 6CS6 at $1.90 list.

TRIPLETT ELECTRICAL CO. — Added Model 420, volume unit meter at $16.50 dealer net and Model 420 (illuminated) at $18.00 dealer net.

TURNER CO. — Added Model 9R, microphone at $14.10 dealer net . . . Model SR9R, microphone at $16.80 dealer net and Model C-4, stand at $3.45 dealer net.

WHARFEDALE SPEAKERS — Added Model HS/CR/3, 3 way crossover network at $31.00 net.

Discontinued Items

ASTATIC CORP. — Discontinued Models AT-1B, BT-1 and BT-2 all TV and FM radio boosters.

ELECTRONIC MEASUREMENT — Discontinued Model 300, vacuum tube volt-ohm-capacity meter and Model 300P, same meter with portable case and cover.

GENERAL ELECTRIC — Discontinued Model RPX-051, triple play variable reluctance cartridge . . . Model RPX-042, single variable reluctance cartridge and Model SPX-001, phono preamplifier.

INTERNATIONAL RESISTANCE — Discontinued replacement control QJ-375.

RAYTHEON — Discontinued TV picture tubes 3KP4 and 12LP4.

SIMPSON MFG. CO. — Discontinued a number of items including driver pre-amplifiers; Models DR-5, DR-5M, DR-5MP and DR-5P.

SYLVANIA — Discontinued radio receiving tubes 1S6 . . . 1W5 and IX2.

TRIPLETT ELECTRICAL CO. — Discontinued Model 466, electrodynamometer.

VIBRALOC — Discontinued their "W" series containing sloping wall type baffle . . . grill plate and reducers.

WIRT PRODUCTS — Model S-924, auto radio iginition suppressor, snap-on plug type, discontinued.

Price Decreases

CLEVELAND ELECTRONICS — Decreased price on Model T-WA, lightning arrester to $.90 dealer net.

CONTINENTAL CARBON — Model NF-½, metal film resistor, decreased to $.48 dealer net.

CORNELL-DUBILIER — Decreased price on a number of auto generator capacitors.

DUMONT LABS. — Decreased price on teletron tube 16K/RP4 to $28.00 dealer net.

GENERAL ELECTRIC — Decreased price on industrial and transmitting type tubes GL-5670 to $5.25 dealer net and GL-5844 to $2.25 dealer net. Also decreased TV picture tube 21ZP4A to $38.50 dealer net.

GONSET — Decreased price on rocket antennas; Model 1511 to $18.27 dealer net and Model 1510 to $8.55 dealer net.

RCA — Decreased price on batteries; No. VS216 to $2.30 dealer net and VS236 to $.21 dealer net.

SYLVANIA — Sub-miniature tube 5719 decreased to $9.80 dealer net.

Price Increases

ALPHA WIRE — Increased prices on numbers 286, 289, 292, 295 and 296, tinned copper bus-bar wire.

GENERAL ELECTRIC — Increased price on TV picture tube 17CP4 to $26.15 dealer net. Also increased price on Model RKP-009, replacement parts kit for triple play cartridges (less stylus assemblies) to $.19 dealer net.

GONSET — Model 3026, 2 meter transmitter receiver increased to $199.50 dealer net. Also increased price on Model 1508, rocket antenna to $5.67 dealer net and Model 1512, rocket antenna to $5.07 dealer net.

HYTRON — Increased price on radio receiving tubes 12A4 to $2.40 list . . . 12B4 to $2.40 list . . . 6BY5G to $2.90 list and germanium diode 1N51 to $.54 dealer net.

Correction

GONSET — Only the 1521 model radarray has been discontinued—not the complete series as was published in error.

INDEX OF CHANGES

Model No.	Manual Page From	To	Tek-File Pack
Gamble-Skogmo 05TV1-43-9014A, 15RA2-43-9105A, Ch. 16AY210	6-1	6-16	3
Magnavox	7-14	7-28	30
Ch. CT-275, -276, -277, -278, -279, -280, -281, -282			30
Sylvania 1110X, Ch. 1-329	8-64	8-82	13
Sylvania 71M, 72M, 73B, 73M, Ch. 1-366(C08), 1-441(C02)	8-140	8-153	13

Presenting *Federal's* TV-1185

..."PIPELINE" of the air!

with the all-weather "silver" pigmentation that lets you

INSTALL IT and FORGET IT!

FEDERAL'S TV-1185—newest sensation of the top-quality twin-leads – is virtually a *"pipeline"* for better-than-ever TV reception . . . VHF or UHF!

Insulated with the revolutionary Federal-developed "silver" polyethylene, TV-1185 is amazingly *tough* and *efficient.* It repels sunlight...fights heat... resists moisture and salt spray and other destructive deposits. Dirt and dust *tumble* off its fine, smooth, tubular surface!

TV-1185 keeps the energy field inside the weather-proof "silver" polyethylene sheath . . . providing *low loss . . . more constant impedance . . .* a better TV picture regardless of area or length of lead!

There's nothing finer for VHF or UHF than Federal's "pipeline" twin-lead . . . *because nothing but the finest has gone into its design and production!*

For complete details see your Federal distributor or write to Dept. D-5101.

Federal

Telephone and Radio Corporation

SELENIUM-INTELIN DIVISION, 100 KINGSLAND ROAD, CLIFTON, NEW JERSEY

In Canada: Federal Electric Manufacturing Company, Ltd., Montreal, P.Q.
Export Distributors: International Standard Electric Corp., 67 Broad St., N. Y.

OUTSTANDING FEATURES OF FEDERAL'S TV-1185

- Exceptionally low loss
- Holds impedance values
- Copperweld conductors—7/#28
- Leads in Weatherometer tests
- Flexible in low temperatures
- Rejects ultra-violet rays at higher temperature levels
- Top performer in any area
- Attenuation- db/100 ft.

10 mc—	0.50	400 mc—	2.6
50 " —	0.95	500 " —	3.0
100 " —	1.11	1000 " —	4.6
200 " —	1.7		

- SO EASY TO INSTALL:

Expose required length of wire by stripping off polyethylene. To tight-seal, heat end of tube with match or other flame and crimp together with pliers. Sealing assures quality performance under all atmospheric conditions.

Setting Up For TV Service

(*Continued from page* 26)

ger of running out of an item before it can be ordered can be minimized by keeping a "want book". Anyone drawing parts should be required to note in this book if the stock of that particular item is low. This, of course, poses a problem of what is "low stock". Although it is possible to rely on the judgment of the parts clerk, a more desirable solution is to establish a minimum quantity. This can be posted on the bin or drawer where the part is stored. On small parts, the minimum quantity can be placed in a sealed envelope; when it becomes necessary to open the envelope, parts should be reordered.

What Does it Cost

Determining what maintenance of a good service shop and an adequate parts inventory will cost a dealer in dollars and cents investment is difficult to determine. Most servicemen feel that the dollars and cents figure is relatively unimportant when measured in terms of the return the dealer can expect from his service operation.

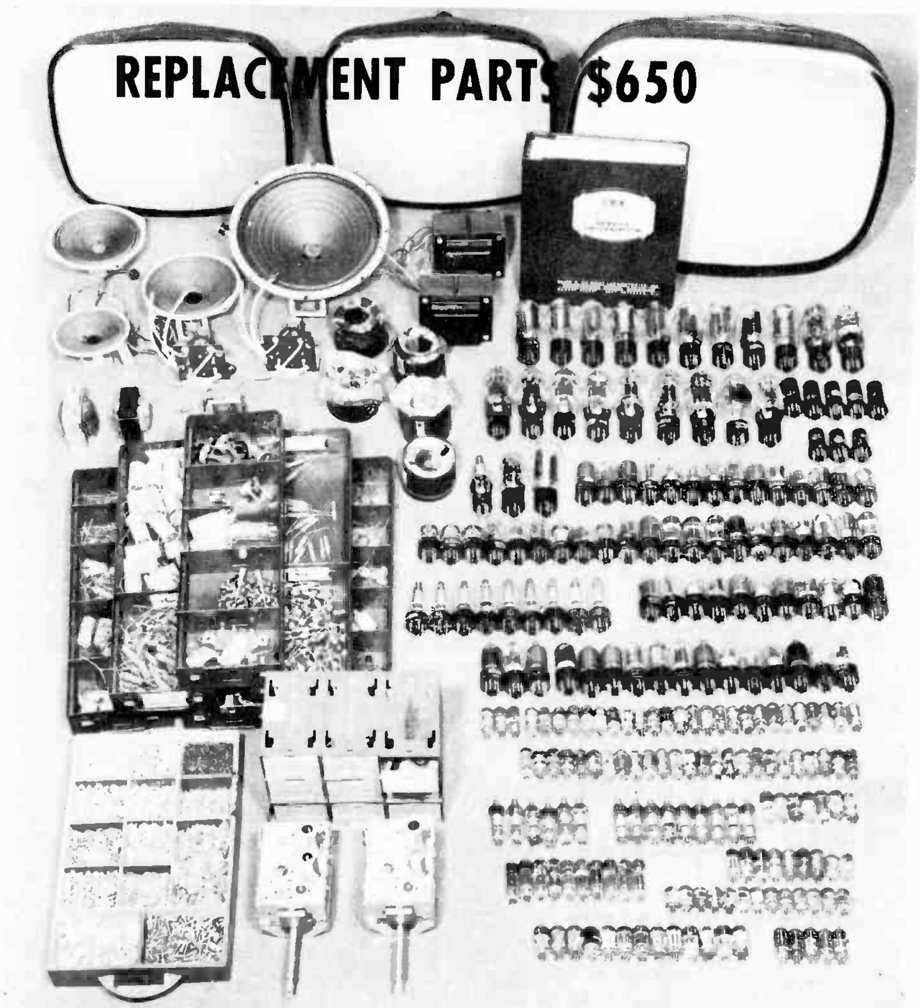
In addition, the investment varies with the dealer's location, the size of his shop and the volume of business he handles. Even with all these variables, one must consider also that dealers in the same area with the same business volume may differ in the amount of money they invest. One may feel that the "minimum" investment in equipment and parts is the wisest decision; the second may decide to spend considerably more in setting up his shop.

Du Mont's Schulman estimates the cost of a service shop in these terms (truck not included):

a. deluxe operation — about $2500 (including $1000 in parts)
b. average operation — about $1500 (in cluding $600 parts)
c. minimum operation — about $1000 (including $300 in parts).

Harold Bernstein, service manager for Emerson, uses a different basis in coming up with his estimate. For a one man operation, he says, equipment, tubes, fixtures and basic parts would require about $2500. For each additional man add about $125 more for extra tools, meters, tubes and so forth.

No matter whose estimate you accept, establishing a service shop is an expensive move in terms of dollars and cents alone. A decision as to whether the investment will pay off—both tangibly in the form of dollar income from service work and intangibly in the form of a good service reputation which builds additional set sales for the dealers—is one that must be made with reference to the dealer's own circumstances.



Some Questions and Answers, etc.

(*Continued from page 7*)

require substantial differences in the constants of the vertical output tube, or that the use of a 20% capacitance tolerance capacitor where a 5% unit is required results in instability and unsatisfactory receiver performance. We do not feel that a service technician should make changes in circuit constants in order to compensate for a replacement part that is not within the required tolerance ratings of the original component. Because we adhere to this philosophy in the listing of replacement parts, the service technician can have the greatest faith in the replacement parts which are shown in Rider Lists. It explains why our listings of suitable replacement parts show fewer parts than other listings.

Q—If you exercise care when selecting replacement parts for listing, why do you have to publish change notices?

A—For several reasons. Regardless of the extreme care which is used in checking, typographical errors in parts number listings occur. Remember that we are listing thousands upon thousands of numbers, and transpositions are possible. We try to keep the errors to the absolute minimum, but they occur.

A second reason is the changes which are made in receivers at the manufacturing point. If one part was a replacement and a change was made calling for a new replacement part, it is foolish to continue reprinting the original replacement part number—the new one with the changed part is the correct one.

We publish additions to the list because some of the replacement data arrives too late for inclusion in the printed list, and because the parts manufacturers we work with are adding new replacement parts to their line.

Q—Your replacement parts lists show only the set manufacturers' parts numbers, but not the receiver chassis in which they are used. Why?

A—This was so only in the Rider TV 10 Manual listing. In the new replacement parts listings for TV 11, which will be cumulative for TV 10 and TV 11, the parts numbers are related to the chassis in which they are used. A section of the replacement parts list for Emerson is shown herein as an example of our new listing format.

Q—Why don't you have replacement parts listing for Rider's TV 9 and earlier manuals?

A—Because we started the replacement part listing program with TV 10. However, we now are in the process of preparing data on TV 9 and earlier Rider TV Manual contents. The task of preparing the data is prodigious; we must prepare information specification sheets for the parts manufacturers, and before we do this it is necessary to correlate the contents of the receivers made during all the production runs. It will take time to do this, but it will be done. Such replacement parts guides will be available to service technicians sometime in the near future.

Fig. 2. Below: Type of spec. sheet on which the part's manufacturer lists his replacement suggestion.

This is your file copy.

JOHN F. RIDER PUBLISHER, INC.
480 CANAL ST., N. Y. 13, N. Y.

This information prepared by JOHN F. RIDER LABS. INC 480 CANAL ST., N. Y. 13, N. Y. for

Information requested below is required within 10 working days from date shown

DATE
RECEIVER Sylvania MFR. same
MODEL NO.
CHASSIS NO. 1-502-3
SERIAL NO.
CIRCUIT SYMBOL NO.
PART FUNCTION
REC. MFR. PART NO. 141-0022
~~COMPONENT MFR. & PART NO.~~ DWG #55-77358

POWER TRANSFORMERS

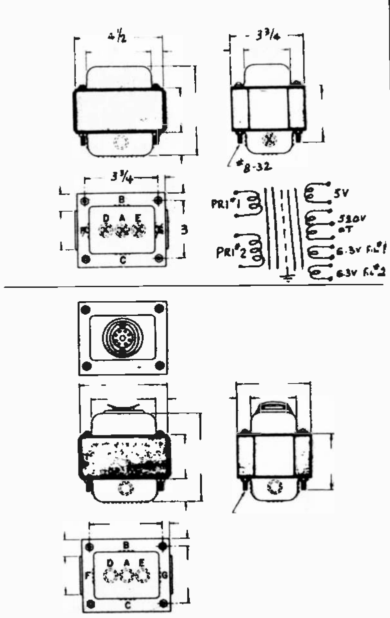
Windings	Lead Position	Lead Color	Minimum Lead Length	D C Resistance	Volts Cps	Amps
Primary #1	B	BLK. BLK-RD	7½ 7¾		117V* 60~	
~~Secondary~~ PRIMARY #2	B	WHITE BLK-YEL	5½ 6½		117V* 60~	
Secondary #1 CT	B	RD RD-YEL	7⅞ 3¼		@ 315 ma DC 260V-0-260V	
Secondary #2 CT	B	YEL	6		5V	6A
Secondary #3	B FIL #1	GRN ORANGE	5⅜ 5⅜		6 3V	6.3A
Secondary #4	B FIL #2	BRWN BLUE	6⅝ 5⅞		6.3V	6.3A
Secondary #6						

Insulation Test Between FIL #1 and GROUND 2500 Volts RMS
Between and Volts — Temp. Rise 55 C MAX.
Between and Volts
Ripple Input To Filter — Volts Peak-to-Peak — Ripple Output From Filter — Volts Peak-to-Peak
Potting Compound — Clearance — Faraday Shield (Yes) No
Remarks: For 117V operation, Connect PRI #1 + #2 in parallel; for 234V in Series

SUGGESTED REPLACEMENTS

Manufacturer	Number	Remarks	Signature

JOHN F. RIDER PUBLISHER, INC., 480 Canal Street, N. Y. 13, N. Y.



VARIABLE RESISTANCE CONTROLS

NOTE: For single controls the identification may appear under the Cat. No. or Stock No. columns. If a special shaft number is shown for a single control, it appears under Inner Shaft column.

RECEIVER MANUFACTURER: EMERSON

COMPONENT TYPE and PART NUMBER	MODELS & CHASSIS: 120153-B	120153-D	120160-B	120162-A	120163-D	120164-B	120166-D	120168-D	120171-B	REPLACEMENTS: CLAROSTAT Cat. No.	CLAROSTAT Inner Shaft	CLAROSTAT Switch No.	IRC Stock No.	IRC Kit. No.	IRC Panel Elem.	IRC Rear Elem.	IRC Outer Shaft	IRC Inner Shaft	IRC Switch No.	MALLORY Stock No.	MALLORY Kit. No.	MALLORY Panel Elem.	MALLORY Rear Elem.	MALLORY Outer Shaft	MALLORY Inner Shaft	MALLORY Switch No.
390142	X	X	X	X						AG-83-S	FKS-1/4		Q11-139							SU56						
390143	X	X	X	X						A43-5000	FKS-1/4		W-5000							R5000L						
390156					X	X		X		AG-61-S	KSS-5		Q11-137							U-54					DS-36	
390163	X	X	X	X						AG-61-S	KSS-3		Q11-137							U-54						
390164	X	X	X	X						AG-44-S	KSS-3		Q11-123							U-35						
390181					X	X		X		AG-52-S	KSS-5		Q11-129							U-43					DS-36	
390183					X	X		X		AG-44-S	KSS-3		Q11-123							U-35					DS-36	
390184	X	X		X						RTV-296			QJ-313	K-2	B17-110	B13-137	P1-224	R1-308	76-1			UF152R	UR16A			US-26
390187			X							RTV-362			QJ-237	K-2	B17-110	B13-137X	P1-224	R1-308	76-1			UF152L	UR16T25			
390191	X	X	X	X						AG-52-S	RS-2		Q11-129							U-43						
390196					X	X	X	X	X	AG-83-S	FKS-1/4		Q11-139							SU56						
390197					X	X	X	X	X	A43-5000	FKS-1/4		W-5000							SU14						
390201					X	X		X		RTV-296			QJ-313	K-2	B17-110	B13-137	P1-224	R1-308	76-1			UF152L	UR16A			US-26
390202				X	X	X	X	X	X	AG-83-S	FKS-1/4	SWB	Q11-139						76-1	U-56						US-26
390207							X		X	RTV-378			QJ-410	K-2	B17-109	B13-137	P2-116	R1-202	76-1			UF152L	UR16A			US-26
390208							X		X	AG-52-S	KSS-3		Q11-129							U-43						
390209							X		X	AG-44-S	KSS-3		Q11-123							U-35						
390211							X		X	AG-61-S	KSS-3		Q11-137							U-54						
390219							X	X	X	AG-52-S	FKS-1/4		Q11-129							U-43						

Fig. 3. A greatly reduced example of how variable resistors are shown in Rider's Replacement Parts Listings.

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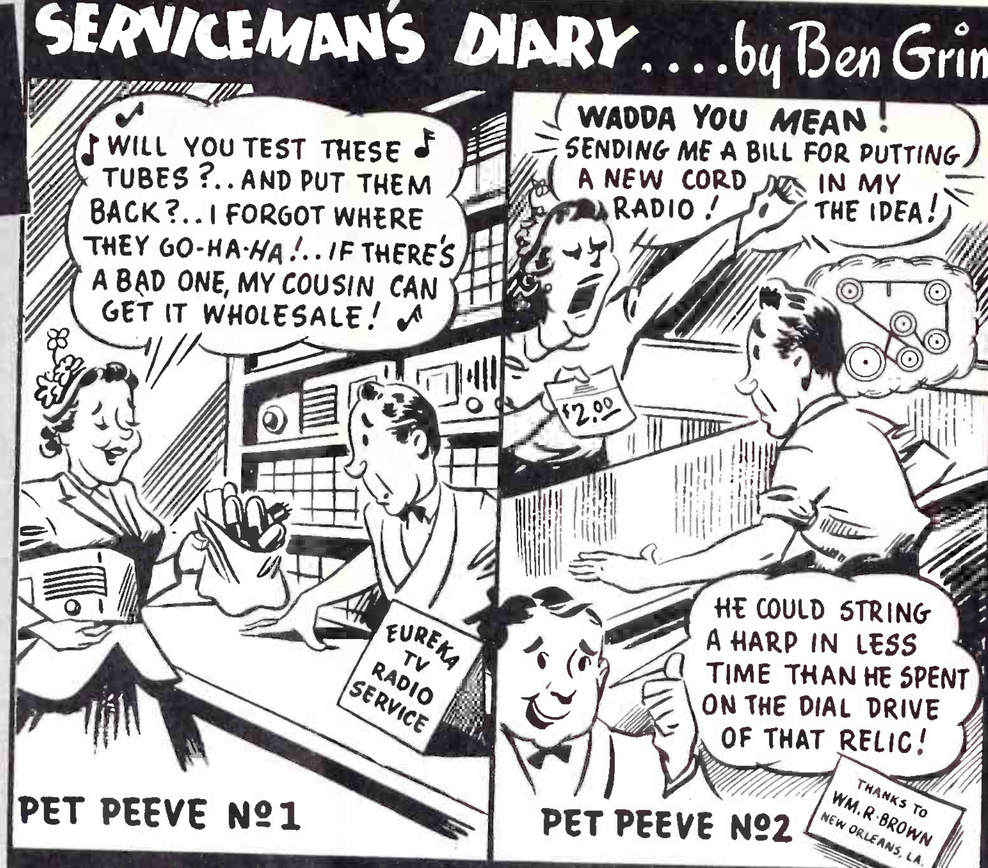

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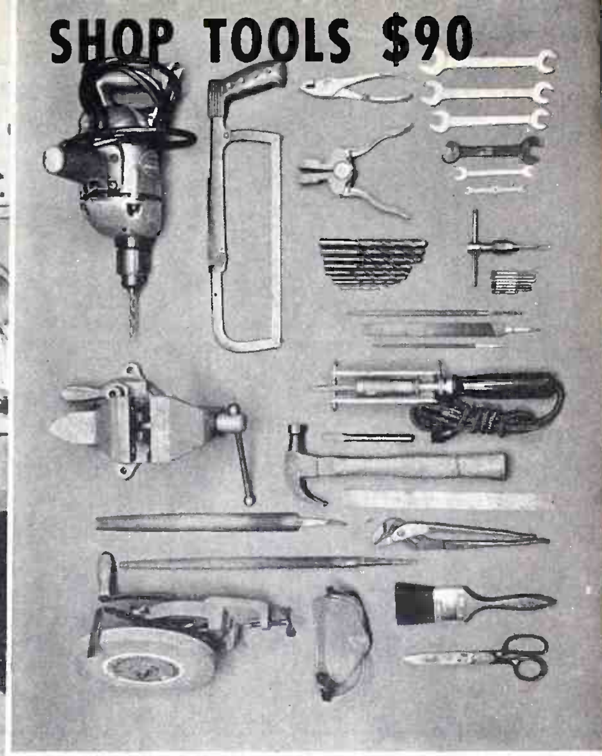

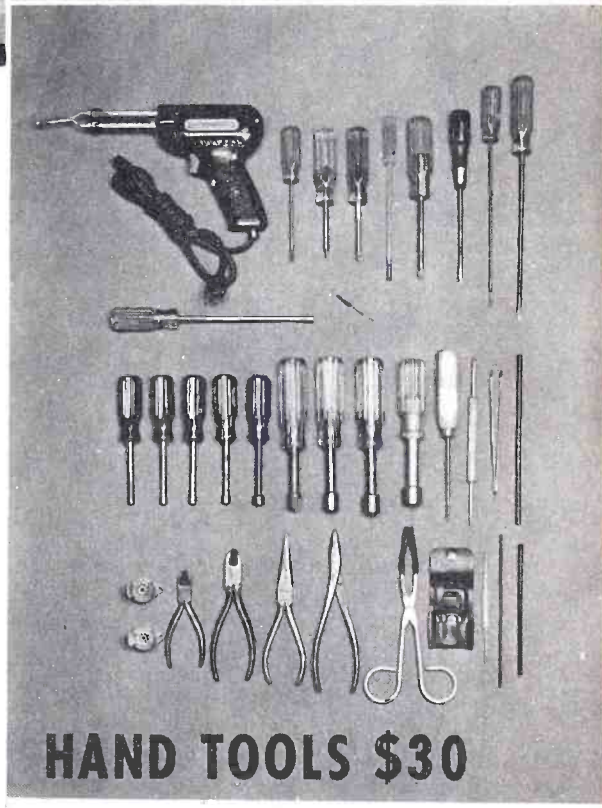

Setting Up for TV Service

Because of the opening of new market areas and an awakening realization in old ones of the values of store-operated service, many dealers are asking: What does it take, in dollars and equipment, to set up for TV service? Herewith, from several experts, the answers.

by Ted Weber

The following article and its illustrations are reprinted through the courtesy of ELECTRICAL MERCHADISING and the McGraw-Hill Publishing Co., Inc. who acknowledge the cooperation of experts from Emerson Radio & Phonograph Corp., Allen D. DuMont Laboratories, Inc., and RCA Service Co. in providing data for this article.

Reckoned in dollars and cents, setting up a television service operation is an expensive undertaking.

But figured in terms of customer good will, a good service operation is a profitable investment.

There's no paradox here — it does take money to equip a service department to handle TV. But, once equipped, a well-managed service operation can hold old friends and make new ones.

Not every dealer wants to handle his own TV servicing. Some may find it more economical or more efficient to let a distributor or an independent service agency handle the work. Many others, however, will feel that it will pay them to set up their own service shop. Taving made that decision, the retailer is faced with a number of other questions—boiled down they ask the how, what and where of setting up a TV service department.

For the answers, Electrical Merchandising asked a group of TV set makers for their recommendations. On this, and the following pages, their suggestions for shop layouts, test equipment, hand tools, installation tools and materials and parts inventories are summarized for the dealer interested in handling his own service.

Planning the Shop

Space limitations may prevent the dealer from choosing the "ideal" location or dimensions for a service shop. But good planning can turn a less than ideal space into an

If possible, service benches should be placed end to end and flush against the wall to facilitate supervision. Storage area for incoming and outgoing work should be as near to the benches as possible; if it is any great distance away some sort of wheeled "dolly" should be provided for moving chassis from the storage area to the benches.

If a one-man shop is planned, test equipment can be permanently fixed in a panel. However, in shops employing more than a single technician, flexibility must be considered and the solution would appear to be a shelf (12 to 24 inches high) mounted at the rear of the bench. An adequate number of AC outlets should be provided along the length of the shelf. Test equipment can then be moved from place to place on the shelf.

Generally speaking, the bench surface should be large enough to allow one receiver to be set aside for a heat run while the technician is working on a second set. The bench should be at least six feet long, four feet deep and be from 36 to 38 inches high. Placement of drawers, AC outlets and the selection of a bench top are largely matters of personal preference. Generally, a single drawer will be sufficient for the storage of hand tools; too many drawers will lead service men to regard them as a last resting place for parts and junk. There are arguments for and against metal top benches. One firm suggested the use of either copper or tempered masonite bench tops, terming the decision a matter of personal preference. But a second manufacturer's service manager said that the use of a metal top "is not recommended."

Sufficient AC outlets must be provided not only for the shelf holding test equipment but for the service bench itself. One service

(*Continued on page 25*)

Successful SERVICING

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MEMBER

Curtain Time

The Itinerant TV Service Technician

A Detroit TV Service Association publication has commented on our editorial on the itinerant service technician which appeared in the January, 1953 issue of SUCCESSFUL SERVICING. The contention is that we have changed our minds concerning the disadvantages of doing service work in the home; that is, we expressed contrary opinions some time ago and now seem to be in favor of it.

The fact of the matter is that we spoke about what seems to be the trend, and fairly definite at that. Moreover it is not unusual to change one's opinion with changing times. Trends do appear and while all individuals and concerns having an interest in it may not agree, only time tells which is proven right or wrong.

There is no question about the advantages of doing service work in the shop and the disadvantages of working in the home. But the public has learned that service work can be done in the home. Perhaps it has been mainly tube changing in the past, but in the eyes of the public it has been service—and they like the idea of not having the chassis removed from the home. Admittedly they accepted the idea of chassis pulling and removal to the service shop, but by and large they were unhappy about it and prefer service in the home. Add to this the fact that more than just a random few service facilities in different parts of the country are making an effort to render service in the home, and others are talking about it more and more, and there you have your trend. The likelihood of it growing is very great, if for no other reason that the public likes it.

The statement was made that a complete repair cannot be made in the home. Isn't it determined by the type of fault present in the receiver and what is involved in the repair? We agree that a good job should be done, that certain tests should be made on a receiver, but it is not inconceivable that many complete repairs and tests can be made in the home. It all depends on the nature of the trouble; the availability of the proper types of test equipment for diagnosis in the home, the availability of parts—the competency of the service technician and his sales ability, etc. These are problems but their solutions are not impossible.

The cardinal item is the public reaction to a servicing approach which has been set by TV servicing facilities. In the past it has been tube changing by many; but others have changed yokes, focus coils, variable resistance controls, tuner coil strips, electrolytic capacitors, peaking coils, fixed capacitors, width and linearity coils and numerous small inductor type components in the home. Defects associated with these components are not necessarily complicated—although they may be so, if the fault found is multiple. In that event the chassis is removed to the service shop. Major repairs like overall alignment, power transformer and horizontal output trans-former changes are shop jobs. It is interesting to note that one receiver manufacturer has unitized chassis for sectional replacement in the home; another has introduced horizontal-output transformers with phone tip connectors.

There are no laws which dictate that service work must be done in the home, but isn't it somewhat unwise to shut one's eyes to a trend? Picture if you will the possibilities of having a removable bottom to every table model cabinet . . . access to the bottom of the chassis without pulling it!—One manufacturer already has a screen at the bottom of the table model cabinet. Now it is there for ventilation purposes, but if it were made removable, consider the convenience for home servicing.

Manufacturrs are adding tests points available at the top of the chassis as a convenience for trouble diagnosis. Naturally it is a convenience in shop servicing, but it also aids in the evaluation of the type of fault possibly present in the receiver when diagnosis is carried on in the home.

One of the points raised against home service is that the family watches the repair operations and becomes a time keeper. Another contention is that if a schematic is used, the receiver owner suspects incompetency. A third is the matter of bickering over price. All of the conditions described happen, but the question is are they valid reasons for not performing home service—or should the visiting technician also be a salesman who will educate the public to undertand each of the points being raised? Perhaps the final result will be understanding from only 90 percent of the television receiver owners, *but* it is a step in the right direction. The public does not know—and some do not want to learn—but by and large, the majority can be sold. It all depends on the approach . . . It may be a long drawn out affair, but it is the problem of the servicing industry and all those who cater to it, to try to find the answer for better public relations and more profitable operation.

Maybe it will take years for the home servicing trend to develop . . . Maybe it will grow for a year or so, and then change because of some other situation. Maybe the arrival of color television (in about two years) may nullify the trend; then again maybe the reverse will happen—receiver manufacturers may so design their equipments that substantial amount of service can be done in the home. We're not fortune tellers—but neither do we fail to note the appeal which home TV service has to the public. Nor can we shut our eyes to the fact that more than just a few service facilities operating in different parts of the nation are doing more than just tube changing TV service in the home.

When we examine public reaction, we must be objective. Consider the expansion of department stores. Traffic problems make it difficult for suburbanites to come into town—so, many large stores open branches in the suburbs. This is a trend which is developing around all large cities. All stores don't comply, but many do—the idea being to meet the desires of the public—who in the final analysis foots the bills.

Ask any design engineer active in the electronic field about printed circuits . . . It's a trend, and little by little it is growing. Can tube manufacturers ward off the semi-conductor (transistor) trend? Of course not! How will the transistor and printed circuits affect other component manufacturers in time? The impact is a relatively long time off, but the trend is there.

The point is raised that adequate numbers of competent personnel may not be available for good home service . . . Perhaps this is true and it may limit the extent of the activity . . . Perhaps the shortage may be so great as to actually prevent the realization of the trend . . . But does this mean that we should not see the trend? . . . As we said before, all organizations may not welcome a change of this kind. It is their privelege to try to ward it off, but how is it possible to ward off something if we don't see it looming in the distance?

We repeat that if the trend takes hold, it will be necessary for competitive organizations to follow suit. Isn't this normal in competitive activities which render a service? The prices need not be the same but the modus operandi for satisfying the public's wishes cannot differ too greatly.

John F. Rider

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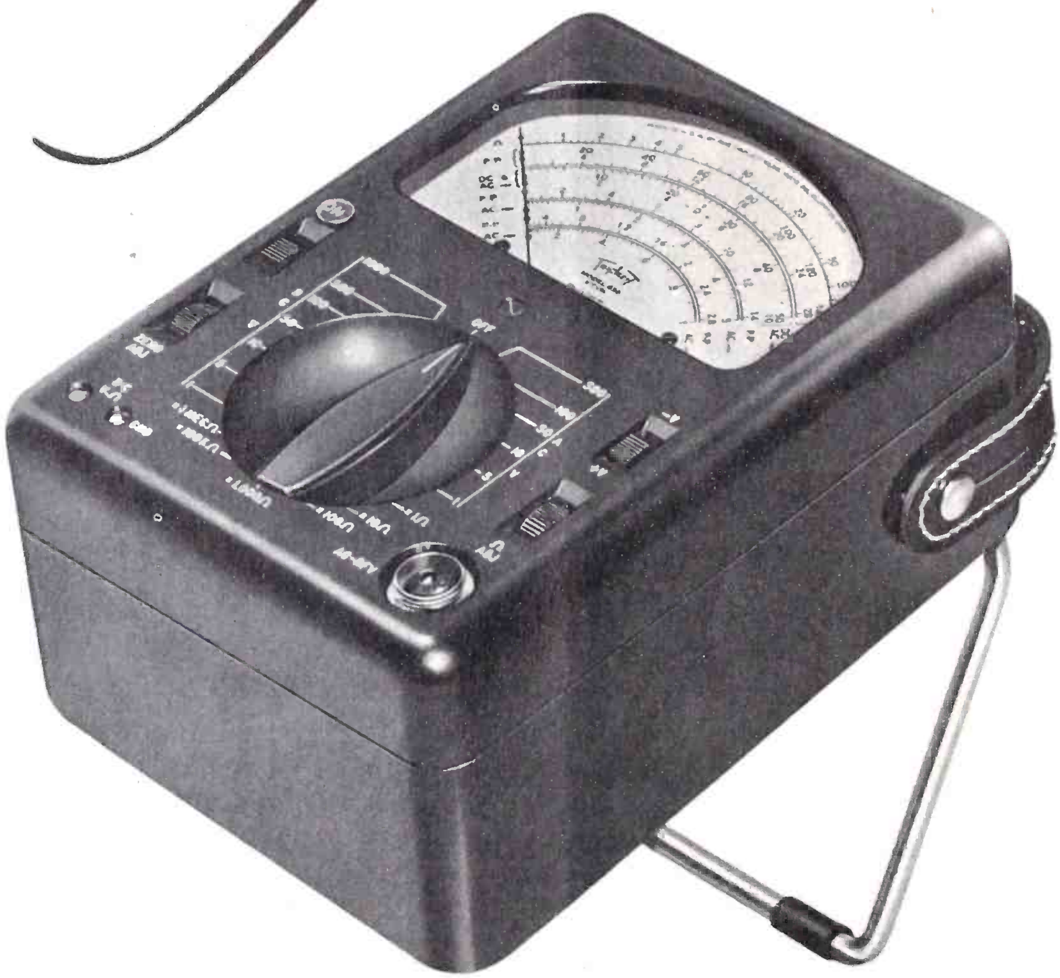

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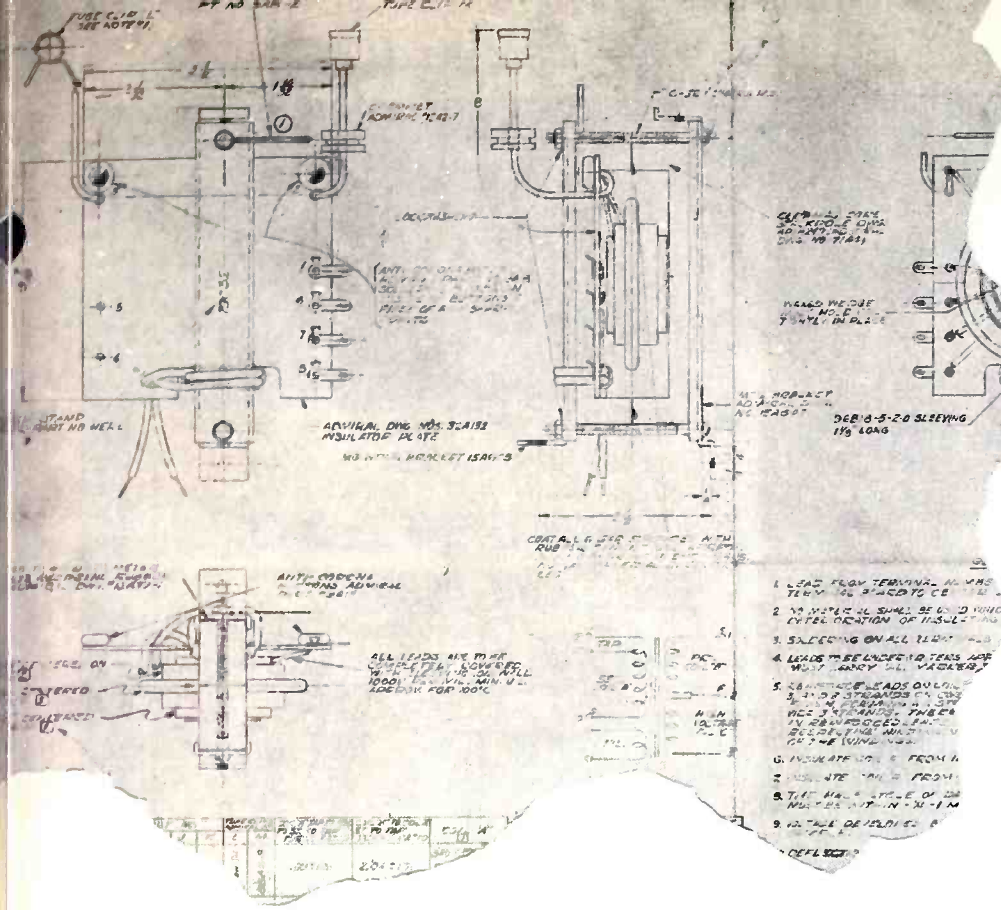

Fig. 1. *Sample of the set manufacturer's blueprint used for reference, describing all electrical mechanical and physical details of the original parts.*

Some Questions & Answers About Rider's Dependable Replacement Parts Listings

We have received numerous letters asking questions concerning the Replacement Parts Listings which appeared for the first time in Rider's TV Manual 10 and in the Tek-Files beginning with pack 57. We feel that these questions can best be answered by listing the query and explaining the answer.

Q—Why are there vacant spaces in the parts manufacturers' columns?

A—The vacant spaces under the various parts manufacturers' listings indicate that, at the time of preparation of the list for inclusion in the Rider Manual or Tek-File, the parts manufacturer did not have a replacement which, upon analysis, was considered suitable as a replacement for the original part used by the set manufacturer.

Q—It it important to adhere to the tolerance specifications given in the tolerance column in the fixed capacitor listing?

A—The answer is yes. The tolerance listed in the tolerance column relates to the original capacitor used in the receiver. Numerous circuits in TV receivers are critical. Unless it was necessary, the receiver manufacturer would not pay a premium price to the parts supplier for capacitors which are closer to the nominal value than the industry standard of plus or minus 20%. It is always best servicing practice to use replacements which conform with stated tolerance ratings, also those which are expressed in terms of micro micro farads. It is conceivable that under certain conditions a capacitor rated at a higher tolerance may function satisfactorily in a circuit, wherein a more rigid tolerance is specified, but this does not indicate that it will happen in many cases. On occasion a 20% capacitor may display a capacitance which is within 1% of the normal rating. This is just a fortunate circumstance. Unless the set manufacturer's engineers felt that they needed a 5 or 10% capacitor, they would not so specify on the blueprint and pay the extra money for the higher accuracy.

Q—How is the suitability of a replacement part decided?

A—The replacement parts listed are selected by *comparing* the electrical, physical and test specifications on those parts with the corresponding specifications of the original parts used in the receiver. If the specifications for the suggested replacement match the specifications for the original parts, the replacement is listed. The receiver manufacturers furnish us with blueprints of the various components which we embrace in the Replacement Part Program. An example of one of the blue prints is shown here. It is for a horizontal output transformer. Although the Rider Dependable Replacement Parts Program is only about eight months old, we already on hand, for reference purposes, blueprints covering more than 20,000 components such as transformers, capacitors, variable resistor controls and speakers, used in television receivers. Many are received each day. Using blueprints of the original components is the most reliable means of determining the constants of the parts used in all of the production runs of television receivers produced by manufacturers.

Q—How do you take care of the different kinds of speakers which are used in the different models?

A—The information we receive from receiver manufacturers indicates to us the variety of speakers which are used in the table models, consoles, and consolette Models of television receivers. The new replacemnt parts listing which will accompany Rider's TV Manual 11, and shown herein, will in many instances, disclose from 3 to 10 different versions of loud speakers which are used for the chassis listed. Competitive parts listing services that are incomplete frequenly show just one speaker as being applicable for perhaps 10 to 20, or more, receiver models.

Q—Are the parts listed as replacements in Rider listings subject to much fabrication?

A—No. The need for extensive fabrication is one of the reasons for disqualifying a suggested replacement part. The blueprints covering original components received from the receiver manufacturers, stipulate the mechanical requirements. Only such replacement parts as fit within these mechanical limitations, with minor variations, are listed. This means that when a service technician purchases one of the parts shown in our listing, fabrication or alteration by him is unnecessary, or at least is kept to the absolute minimum.

Q—What does "compliance with test specifications mean? "

A—One of the requirements set by us for listing a replacement part, is that its test specifications conform with those which cover the original part in the receiver. In other words, if the set manufacturer stipulates that the original part must withstand the application of 2,500 volts rms between the winding and the coil of a transformer, the replacement part must do likewise in order that it be considered acceptable for listing. This is a safeguard for the service technician and is one of the many reasons why the Rider listings are the most dependable.

Q—Do you ever check parts in receivers?

A—Yes, many times. This is why we consider the matter of tolerance on inductive and capacitive components to be such a serious matter. Time and again we establish that as little as 10% difference in the inductance of a horizontal deflection winding from that of the original part can be very troublesome; that as little as 10% difference in the turns-ratio of a vertical output transformer from the rating of the original part can cause substantial non-linearity and correction would

(*Continued on page* 32)


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A Note on TV in England

Observations made by one of our servicemen-authors who has been trying his hand at TV Servicing in a shop in England while "vacationing" abroad.

by John D. Burke

One of my biggest problems since starting to work in a London TV repair shop two months ago, has been in reading the diagrams provided for our use.

First of all — there is a considerable difference just in terminology, between the two countries — even though we both speak the "same" language.

Here are some of the translations:

American	British
B Plus	High Tension (H.T.)
Power Line	Extra High Tension
High Voltage	(E.H.T.)
Tube	Valve (except for a CRT—which is a "tube")
Antenna	Aerial
Ground	Earth
Shielding	Screening
Chassis	(Sometimes called "the deck")
Globar Resistor	Brimistor Resistor
Vertical	Frame
Horizontal	Line
Micromicrofarad	Pica Farad
Yoke	Scan Coils
Broadcast Band	Medium Wave
Mixer	Frequency Changer
By-Pass	Decoupling
Socket	Valve Holder
Plate	Anode
Phonograph	Gramophone
Damper	Efficiency Diode
B Plus Plus	Boosted H.T.
Sweep Circuits	Time Bases
"Open"	O/C
Short	S/C
Unsoldered Connection	Dry Joint
Filter Capacitor	Smoothing Capacitor
Input Capacitor	Reservoir Capacitor
VTVM	Valve Voltmeter

May I hasten to add the fact that there are many more words which are the same in both countries — we can read one another's technical literature. For example, such words as *focus, definition, radio frequency, alignment, synchronization* — mean the same.

It was just the fact that these strange words had to be understood by me, quickly, and while I was struggling with other problems of a foreign country's TV system.

The shop in which I work employs four bench mechanics — called "service engineers". We have a rather good supply of service information. Good, that is, in that it covers most of the sets we are likely to see; and good in comparison with the service information a smaller shop might have been able to acquire. This word "acquire" is used advisedly. For, service information in not offered to the whole trade. Some manufacturers will only supply such information to those dealers who are franchised to sell and service their brand of sets.

Other manufacturers have released diagrams for publication — but there are limitations. A book has just been published giving a great deal of information about quite a few sets. But the price is very high. Also, the diagrams are so small I cannot read them without a magnifying glass!

There are two magazines with restricted circulation which publish one TV and one radio schematic each month. One of these magazines goes only to full-time profesisonal repairman. The other *only* to dealers. The information they give is very welcome, and I have been working with such forms of technical guidance for two months.

However, I find a number of great shortcomings in practically all British radio and TV service sheets:

Size — generally much smaller print than can be read comfortably.

Values of resistors and capacitors — not given on the diagrams. Sometimes they are, but usually one has to hunt up the parts lists, with a great loss of time, and much annoyance.

Tubes not designated by type — that is, the diagram only bears V1, V2, V3, etc. Again, time is spent looking for the list of tubes (valves).

Pin numbers not given — a few English diagrams do show the pin connections but most do not. Sometimes they will have a basing chart printed near the schematic. Other times, one must hunt for it.

Chassis layout charts also have the same defect — they show you where V6 is, but they do not say what type of tube it is, nor what function it has in the set.

Voltage readings are not given on the schematic. Usually this is given on a separate chart.

Ohms readings on coils are also given separately, if given at all.

Of course, my criticisms of English schematics are prompted mostly by my having worked with those used by our trade in the U.S. My shopmates are accustomed to using what they have, and manage to get along quite well in spite of the handicap.

In time I will be able to do the same. But I hope for an improvement. Perhaps it will come as Britain gets more flooded with TV sets. They now have about 2,000,000 in use.

It must be added, in their favor, that the sets are quite good, and compare favorably with American sets.

There are many varieties of chassis — with some 20 to 30 manufacturers — less than in the States, but quite enough to satisfy my wish to always have new and interesting problems to solve each day.

I brought along with me some technical literature, including some copies of Rider's Tek-Files. Looking through several as I write this, let me assure you that the English TV repairman quite often has only about 10% of the information furnished to him that you are getting.

English shops do not promise quick-as-a-wink service. And most repair jobs go into the shop. The average job in my shop takes two to three days from pick-up 'til delivery.

Also the sets are simpler, and the problems of 405 line television, and one-channel television, are much less. However, that will provide material for other articles.

Our author - John D. Burke

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I-F Trap Circuits in TV Receivers

(Continued from page 1)

is useless. Trap circuit capacitors must be of a low-loss type in order to obtain high Q's. For convenience, we will assume that each of the diagrams of Fig. 3 represents an associated sound traps, although trap circuits do not depend upon the frequency to which the trap is tuned.

The coil of an inductively-coupled trap, as in Fig. 3(A), is placed near the i-f interstage coil with which it is to work. If a 41.25-mc associated sound signal is present in the i-f interstage coil, it will induce a signal in the trap circuit. This will result in a relatively large circulating current in the trap because of its high Q. The circulating current produces a magnetic field that acts to oppose the 41.25-mc signal in the i-f interstage coil, thereby considerably reducing the strength of the associated sound signal. (The amplitude of this signal cannot be reduced to zero, of course, because then there will be no magnetic field in the trap circuit).

A second type of circuit, the capacitively-coupled trap, is shown in Fig. 3(B). Although the operation of this circuit is different than that of the inductively-coupled trap, the end result is the same. At 41.25 mc, for example, coupling capacitor C_C in combination with L and C, will produce a low-impedance series-resonant path to ground. This will "short-circuit" the 41.25-mc signal that is present in the i-f interstage coil. The capacitively-coupled trap also produces a peak to the left of 41.25 mc, but in this case it is caused by a high-impedance parallel-resonant condition between the i-f interstage coil and the trap circuit.

The effectiveness of the capacitively-coupled trap is partly determined by the size of the C_c. If this capacitor is too large, the trapping action will remove some of the picture signals, while an undersized coupling capacitor will result in insufficient trapping action. A typical value for C_c is 1.5 μμf.

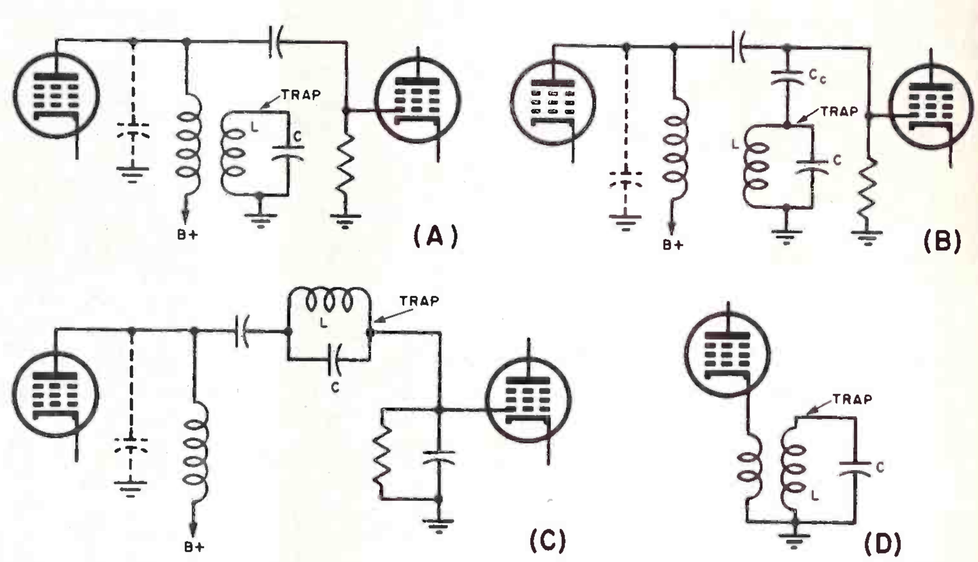


Fig. 3. Various trap circuits. (A) Inductively-coupled trap. (B) Capacitively-coupled trap. (C) Series-coupled trap. (D) Cathode trap.

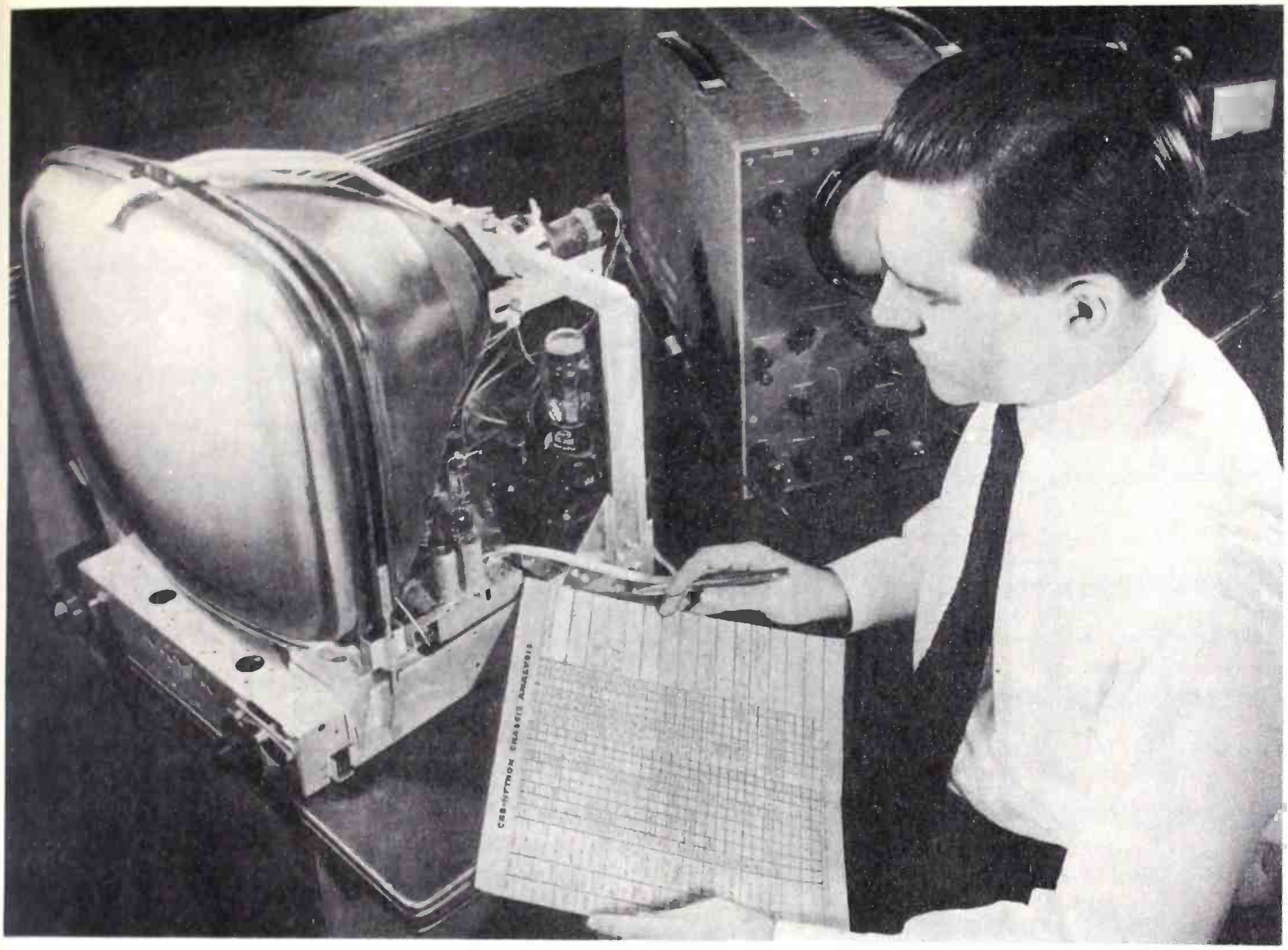
As the solid line of Fig. 2 shows, the 41.25-mc trap produces a response-curve peak slightly to the left of 41.25-mc. If a 40.5-mc signal is present in the i-f interstage coil, for example, it will also produce some circulating current in the trap circuit. The magnetic field that is produced in this case, however, will aid the 40.5-mc signal because of phase differences between the 40.5-mc and 41.25-mc operation. Fortunately, there is little likelihood of a signal at 40.5 mc, and the peak at this point should cause no trouble. Similar peaks may be created to the left of 39.75 mc and to the right of 47.25 mc.

If the inductively-coupled trap coil is too near the i-f interstage coil, the trapping effect becomes broadened out until some of the picture signals are trapped out in addition to 41.25 mc. If the trap coil is too far from the i-f interstage coil it will have insufficient effect.

The series-coupled trap of Fig. 3(C) acts by introducing a high-impedance parallel-resonant circuit in series with the signal path. This trap is also characterized by a peak to the left of 41.25 mc. The action of the trap is controlled by the size of C. When C is too small, the picture frequencies will be affected. When C is too large, the size of L becomes correspondingly small and it becomes difficult to build a high-Q trap coil. C is generally over 100μμf in value.

The fourth circuit, the cathode trap, is shown in Fig. 3(D). The action of this trap is based upon the reduced gain that results when an impedance is introduced into the cathode circuit of a tube. At 41.25 mc the trap coil reflects a high impedance into the cathode circuit, while at other frequencies it has very little effect. The cathode coil by itself is a small inductance, and does not

(Continued on page 18)



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Replacement Parts in TV Receivers

(Part 1-Capacitors con'td)

by John F. Rider

This is the sixth in a series of articles on "Replacement Parts in TV Receivers." "Transformers" will be discussed next month.

Maximum Operating Temperature

We have already referred to the item of operating temperature. In a sense, the maximum operating temperature is a constant for a capacitor although it might, perhaps, be better viewed as a rating. By and large the general run of capacitors intended for use in television receivers are designd for operation at either maximum temperatures of 65°C or 85°C. In either case, whatever are supposed to be the other constants of the unit are assumed to be true only if the capacitor is used within the maximum operating temperature rating.

An attempt towards standardizing maximum operating temperature ratings of paper dielectric capacitors used in TV receivers at 85°C is under way. However, 65°C capacitors are still commonplace. Operating a capacitor above its maximum operating temperature rating generally results in a reduction in the insulation resistance of the capacitor and in an increase in the power factor, that is, in the electrical losses in the unit.

Receiver manufacturers have displayed during the past few years, a trend towards the use of 85°C capacitors in place of the 65°C capacitors which they used in the past. Unfortunately, the specific capacitor used in a receiver does not bear a label which indicates its maximum operating temperature rating. Hence, when replacement is the issue it is a matter of either replacing with a component which is similar to that used in the receiver, which may be a 65°C unit or buying a 85°C and using it. In this respect, reference to the catalogues made by the capacitor manufacturers will disclose the maximum operating temperature ratings of their components. It is pretty much standard today that molded capacitors are 85°C rated. As a matter of fact, the replacements shown in the Rider Dependable Replacement Parts Lists for tubular capacitors are the molded variety even when the original part was a paper tubular. Summarizing the entire matter, the use of molded case paper dielectric tubulars with the various synthetic impregnants as replacements for tubular capacitors used in TV receivers will satisfy the maximum operating temperature ratings set by the receiver manufacturers with very rare exceptions.

Insulation Resistance

The insulation resistance is a rating associated with paper dielectric tubulars, mica dielectric and ceramic dielectric fixed capacitors. It expresses the d-c resistance of the capacitor at rated temperatures. It is an important item when capacitors are used as blocking devices to prevent the application of d-c voltage present at one point, at another point. The blocking capacitor, also known as the coupling capacitor in many amplifier circuits is the example of such an application.

The usual way in which the insulation resistance of paper dielectric capacitors is mentioned, is megohms times microfarads. On the average, the insulation resistance of paper dielectric tubular capacitors at the temperatures from 20 to 25°C runs around 2,000 megohms per microfarad for values above .1 mfd. On occasion the rating is 1,000 megohms per microfarad. This means that if the capacitance is .5 microfarad the insulation resistance may vary from 500 to perhaps 1,000 megohms. If the capacitance is less than .1 mfd the insulation resistance usually is specified at a fixed amount, as for example, 5,000 megohms for the unit. As to the change in insulation resistance with temperature, it may decrease to as low as 1/70th of its base value at 20°C, when the temperature rises 40 to 50°C.

In the case of ceramic and mica capacitors which are generally available in the lower values, the insulation resistance is generally expressed as a fixed quantity as for example 5,000 megohms, or more or less. The receiver manufacturers generally specify the insulation resistance when they order capacitors and their requirements extend from 5,000 to 7,500 megohms. Replacement units of this kind of capacitor generally display similar values of insulation resistance.

The lower the insulation resistance of a capacitor, the greater is the possible leakage of the d-c voltage applied to the plate of a tube, through the capacitor, to the grid of the next tube, assuming that the capacitor is the d-c blocking device between these two tube electrodes. On the face of it, it may seem as though 1,000 megohms insulation resistance is a tremendously high ohmic value, yet receiver manufacturers frequently require that paper, ceramic and mica capacitors in certain capacitance ranges display insulation resistance of from 6,000 megohms to 7,500 megohms minimum, when measured at 100 volts dc at from 20 to 25°C. For example, if the insulation resistance is 1,000 megohms and the voltage is 250 volts, a current of .25 microampere will flow through the capacitor. If this amount of current is allowed to flow through, a 10 megohm grid leak and a 2½ volt drop will develop across the resistor and by virtue of the polarity, can very materially and adversly affect the existing grid bias. This accounts for the requirement of 5,000 to 10,000 megohms insulation resistance for capacitors less than .1 mf used in this manner. Frequently, in order to maintain the high insulation resistance present between the terminals of mica capacitors for example, they are waxed dipped.

Although we have not mentioned this point earlier, it is always advisable before wiring in a replacement capacitor to check its capacitance and its insulation resistance. On more than one occasion, we found that this brief test saved a great deal of time, because in some cases the capacitor was wrongly labeled and in other cases its insulation resistance had for some unknown reason, fallen from far below its normal value. This does not happen too frequently, but the few moments necessary to make these tests will be worthwhile in the long run.

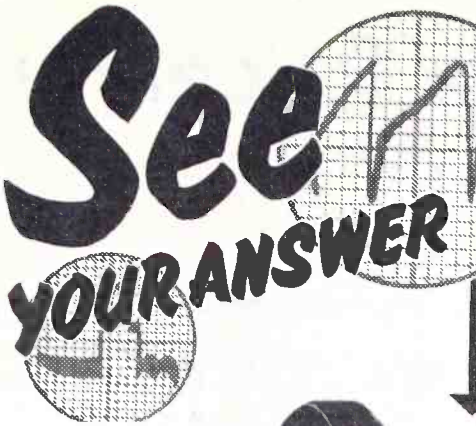
Relative to insulation resistance it is well to take note of another very important consideration, namely the voltage at which the capacitor is tested. The ordinary ohmmeter test is not satisfactory because the voltage applied is too low. Whenever possible, the insulation resistance test should be made with at least 100 volt dc applied, preferably several hundred volts.

Quite frequently the insulation test made with an ordinary ohmmeter shows a tremendously high resistance, but when the applied voltage is increased from 100 volts dc to perhaps 300 volts dc, the insulation resistance falls to a value which indicates excessive leakage through the capacitor and its unsuitability for use in the circuit.

Power Factor

Power factor is a constant for all capacitors. It is an expression which denotes the

(*Continued on page 28*)



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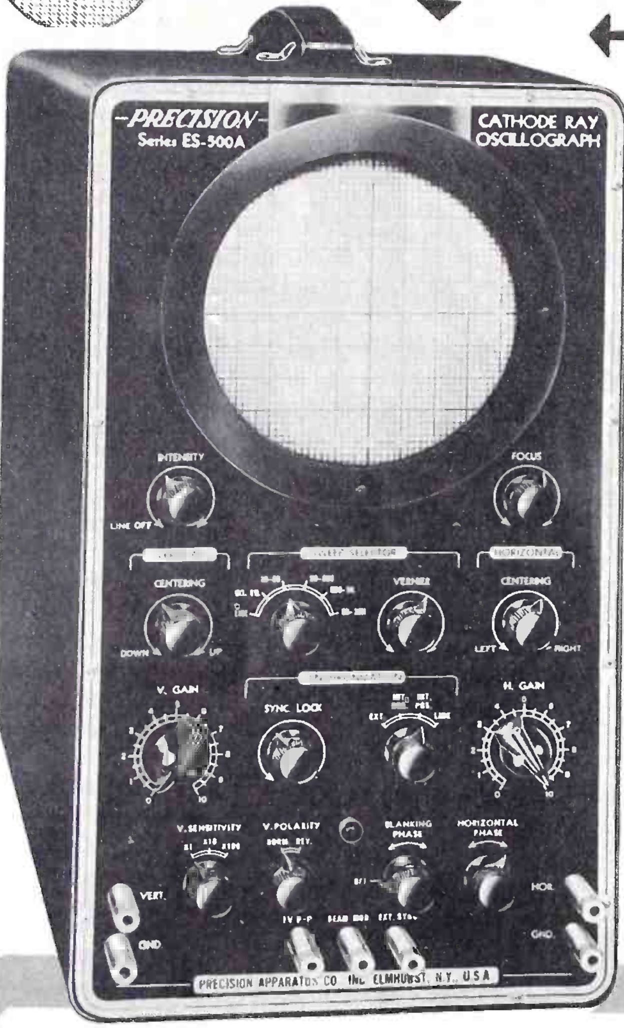

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Maintenance and Repair

by Jack Darr

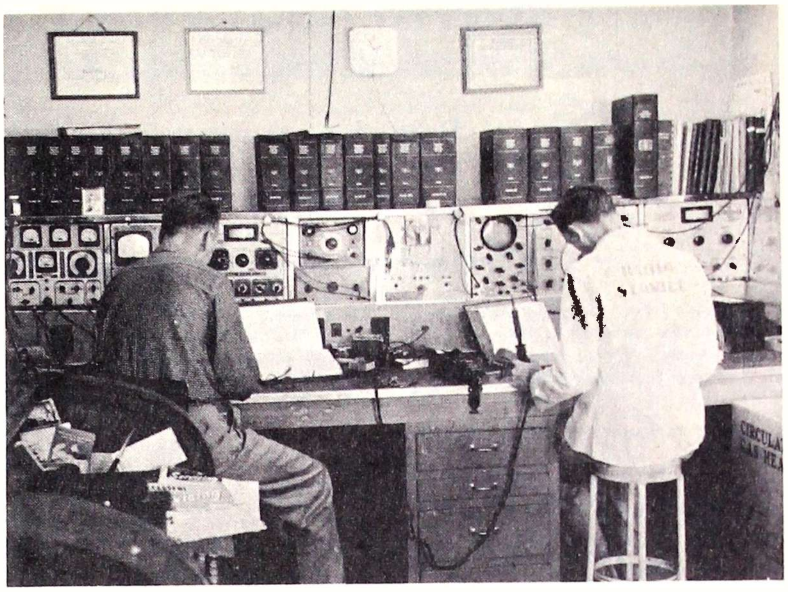
Repair:

To remedy damage or harm.

Maintenance:

To keep in a specified state — keep supplied, equipped: To keep in operating condition.

(New Century Dictionary, Appleton-Century-Crofts, Inc.)



Photograph showing the workbench of Ouachita Radio Service, Mena, Arkansas. Jack Darr is at the left and his helper, Delmer Lott, is at the right.

A recent editorial in a trade magazine brought out the desirability of having men trained in *maintenance* work on radio and television, rather than in *repair*. Although this may seem to be a simple play upon words, the difference here is in the meaning: "maintenance" being used in the sense of performing such work upon the equipment so that it will *remain* in operating condition all the time, as opposed to waiting until some breakdown has occurred, and then repairing just that trouble.

This principle can very easily be applied by the working radio-TV serviceman, so that he becomes a true "maintenanceman" rather than a "repairman". Of course, it is impossible to make periodic checks upon all the radio or tv sets used by his customers, but he can and should perform each individual service job as if he were doing *maintenance* work instead of merely *repair*.

This implies a thorough knowledge of the characteristics and circuitry of the equipment he is working on. He must not only have the ability to remedy the fault which caused the unit to be brought into the shop, but also to foresee imminent troubles and remedy them in advance. The natural rejoinder to this statement will be, "Yes, but how are you going to forecast all of the possible trouble that will develop in any given set for any protracted period of time?" The obvious answer to this is of course that you aren't. Inasmuch as no test-equipment manufacturer has been able to develop a useful crystal ball, you will not be able to prevent all of the future troubles, but by careful checking of all possible trouble sources, whenever any unit is brought in for service, you will be able to eliminate a large majority of them.

Methods and Equipment

This kind of work obviously cannot be performed with a voltmeter and a screwdriver. It will require the intelligent use of every piece of test equipment in the shop, together with a thorough familiarity with the unit under repair. Inasmuch as it is quite impossible for any one man to carry all the necessary information in his head, this also implies the possession of a complete set of service information, covering all possible sets. This must also provide the very latest information on any changes or modifications made by the manufacturer of the unit, either to prevent failures or to improve performance.

For simplicity's sake, let us assume a service job on an fm-am table model receiver of the ac-dc type. By questioning the customer, we learn that the set has not been in a shop for at least a year. We ask about the sensitivity, selectivity, fading, and other details of the set's performance in the period before the failure occurred. From this information, we can learn where to look for other possible troubles. Testing discloses the rectifier tube open. This is replaced; the other tubes are tested, and the power tube and i-f amplifier tube are found to be weak. After replacing the weak tubes and testing the filter and line bypass capacitors for leakage or shorts, we turn the set on. Voltage measurements show the plate voltage to be about 20 volts low. From the service manual, we learn that this set uses a 30 to 50 μf filter capacitor rated at 150 volts, and the filter resistor is 1,700 ohms. This resistor is discolored so that the color code is unreadable, but the ohmmeter shows it to be about 2,400 ohms. The surge resistor is also burned and unreadable, but the schematic shows 33 ohms as the correct value. This resistor is also found to measure high. Therefore, the two resistors are replaced with the correct values. The capacitor-tester shows the filter capacitors to be within their capacitance rating and to have a good power factor. The line bypass capacitor is also checked, for both capacitance and voltage breakdown. If sufficient leakage is found in this important capacitor, it is replaced.

The set is turned on and the voltage returns to normal, although to the uninitiated ear, there is not too much difference. Experience has shown, however, that such changes in value denote the distinct possibility of a continuing change, ending in a failure. Voltage measurements are now made for the rest of the set, paying particular attention to such points as the power-tube grid (to check for coupling capacitor leakage), the oscillator grid (to check the oscillator tube and circuit), and the first audio amplifier plate and screen, if any. Any deviation from the norm here must be checked and remedied. Although little trouble is found in avc resistors and bypass capacitors in present-day sets, it will still pay to test them carefully.

Although the example given has been a small radio set, the same methods and principles will apply equally well to other units that come into the shop. We have occasion to deal with electronic organs, especially those used in churches. These are apt to go for long periods of time without attention, ending in a failure. We recently serviced an old Minshall-Estey for the local church here. The immediate cause of failure was a dead tube, but we took the main amplifier and generator unit to the shop on suspicion. This suspicion was well repaid. With the schematic and an ohmmeter, we found nine defective resistors, including phase-inverter plate loads, grid resistors, filter resistors, and practically all the tremolo—circuit resistors. Later, we pulled the "stops" unit, and in this, replaced the astonishing total of seventeen defective resistors! This restored the organ to its original fine performance, and the choir director was extremely grateful.

The above procedure sounds like a long, time-consuming job. It is not: the whole series of tests outlined can be made by a competent man, using proper equipment and the accurate service information necessary, in a short time. The results obtained will certainly justify the extra time. The customer will

(Continued on page 16)

HINT FOR FINDING TV CHANNEL FREQUENCIES

The following hint, which appeared originally in "The Relay" (published by the Fred C. Harrison Co., Elmira, N. Y.) is based on an idea submitted by John Mulligan.

1. To find the frequencies corresponding to any uhf channel (channels 14 to 83) proceed as follows. Multiply the channel number by 6, then add 389 mc. This will give the center frequency of the channel. The frequency of the picture carrier is 1.75 mc below the center frequency, and the frequency of the sound carrier is 2.75 mc above the center frequency.

2. To find the frequencies corresponding to a channel in the high vhf band (channels 7 to 13) proceed as follows: Multiply the channel number by 6, then add 135 mc. This will give the center frequency of the channel. The picture-carrier frequency is 1.75 mc below the center frequency, and the sound-carrier frequency is 2.75 mc above the center frequency.

3. To find the frequencies corresponding to a channel in the low vhf band (channels 2 to 6) proceed as follows: Multiply the channel number by 6, then add 49 mc for channels 5 or 6 or add 45 mc for channels 2, 3, or 4. This will give the center frequency of the channel. The picture-carrier frequency is 1.75 mc below and the sound-carrier frequency is 2.75 mc above the center frequency.

As an example, assume you are interested in knowing the frequencies coresponding to uhf channel 44. The center frequency is 44 times 6 plus 389 mc, or 653 mc. The picture-carrier frequency is 1.75 mc lower, or 651.25 mc while the sound-carrier frequency is 2.75 mc higher, or 655.75 mc.

As a second example, assume you are interested in knowing the frequencies of vhf channel 11. The center frequency is 11 times 6 plus 135 mc, or 201 mc. The picture-carrier frequency (1.75 mc lower) is 199.25 mc, while the sound-carrier frequency (2.75 mc higher) is 203.75 mc.

Maintenance and Repair

(Continued from page 15)

be glad to pay the extra charge when he sees the improvement made on performance.

In conclusion, we might say that you only get out of the radio-TV service business what you put into it. If you put your full time into doing the best possible work on your customer's sets, using all of the helps available, you will be more than repaid in the increased service business, especially in the repeat business that high-quality work will always bring in.

TV SUPPLEMENTARY SHEET NO. 2

MODEL & CHASSIS	PART #	CATALOG #	FUNCTION	DESCRIPTION	LIST PRICE
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6175TM 6179TM	E22464-20	RTV-259	Vert. Lin./ Height	3000/2.5 Meg. 2W-W.W./carbon Conc. Dual	$3.10
	E22464-27	RTV-352	Contrast Vol./Sw.	1500/250 Ω Conc. Dual carbon--SPST	$3.70
	E22464-34	AG-49-S KSS-3	Bright.	100K Ω carbon	$1.25
CHASSIS TE-331 TE-331-2	E22464-36	AG-83-S KSS-3	Vert. Hold	1.5 Meg. Ω carbon	$1.25
	E22464-38	AG-40-S KSS-3	Hor. Hold	25K Ω carbon	$1.25
BELMONT-RAYTHEON					
C-1729A C-1731A M-1726A M-1728A	A10A-18441	RTV-218	Contrast/ Vol./Sw.	5000/1Meg. Tap 100K Ω Conc. Dual carbon DPST	$4.50
	A10B-17275	AG-49-S KSS-3	Vert. Hold	100K Ω carbon	$1.25
	A10B-17764	AG-44-S KSS-3	Bright.	50K Ω carbon	$1.25
	A10B-19218	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	A10B-19220	AG-61-S FKS-1/4	Height	750K Ω carbon	$1.25
	A10B-19542	AG-63-Z KSS-3	Tone	1 Meg. Ω carbon	$1.25
BENDIX					
0AK3 21K3 21KD 21T3 21X3	CH262022-4	AG-42-S FS-3	Hor. Hold	30K Ω carbon	$1.25
	CH262024-15	AG-27-S FKS-1/4	Noise Inverter	10K Ω carbon	$1.25
	RV4C10 CH262025-4 CH262025-14	AG-83-S FKS-1/4	Vert. Hold	2 Meg. Ω carbon	$1.25
	RV4C07 CH262025-7	AG-85-S FKS-1/4	Height	3 Meg. Ω carbon	$1.25
	RV4C07 CH262025-7 CH262025-12	AG-85-S FKS-1/4	Focus	3 Meg. Ω carbon	$1.25
	RV4C11 CH262025-10 CH262025-13	AG-58-S FKS-1/4	Vert. Lin.	600K Ω carbon	$1.25
	CH262041-2	AT-90 FS-3/SWA	Vol./Sw.	500K Ω carbon--SPST	$1.25
	LH262045-1	RTV-373	Bright./ Contrast	100K/1200 Ω Conc. Dual carbon	$3.10
CROSLEY					
DU-20CDM, CHB, CHM, COB, COM,	B-148952	AG-83-S RS-2	Vert. Hold	1.5 Meg. Ω carbon	$1.25
DU-21CDMI, CDN, CHM, COB, COL, COLB, COM	B-148953	AG-44-S RS-2	Hor. Hold	50K Ω carbon	$1.25
	B-148966	AG-43-S RS-2	Bright.	40K Ω carbon	$1.25
	B-149893	A10-1500 KSS-3	Focus	1500 Ω 4W-W.W.	$1.85
	B-151634	AG-15-S RS-2	Vert. Lin.	3000 Ω carbon	$1.25
CHASSIS 357 357-1	B-152129	AG-83-S RS-2	Height	1.5 Meg. Ω carbon	$1.25
	C-151111	RTV-327	Contrast/ Vol./Sw.	1500/1Meg. Tap 250K Ω Conc. Dual carbon SPST	$4.30

MODEL & CHASSIS	PART #	CATALOG #	FUNCTION	DESCRIPTION	LIST PRICE
	W-148861	Order From MFR.	AGC	1000 Ω 1W-W.W.	
EMERSON					
711B 712B 720B	390156	AG-61-S KSS-5	Vert. Hold	1 Meg. Ω carbon	$1.25
	390181	AG-52-S KSS-5	Bright.	200K Ω carbon	$1.25
	390183	AG-44-S KSS-5	Hor. Hold	50K Ω carbon	$1.25
	390196	AG-83-S FKS-1/4	Height	2 Meg. Ω carbon	$1.25
CHASSIS 120164B	390196	AG-83-S FKS-1/4	Focus	2 Meg. Ω carbon	$1.25
	390197	A43-5000 FKS-1/4	Vert. Lin.	5000 Ω 2W-W.W.	$1.25
	390201	RTV-296	Contrast Vol./Sw.	1500/1 Meg. Conc. Dual carbon--SPST	$3.70
	390202	AG-83-S FKS-1/4/SWB	Fringe Compensator	2 Meg. Ω carbon--SPST	$1.25 .60
FADA					
7C42 7C52	* D220076G20	A43-5000 FKS-1/4	Vert. Lin.	5000 Ω 2W-W.W.	$1.25
	52.24	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	52.64	RTV-109	Contrast/ Vol./Sw.	750 Tap 500/500K Ω 2W-W.W./carbon Conc. Dual--SPST	$4.50
	52.66	RTV-110	Vert./ Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	$3.10
	52.69	AG-44-S FS-3	Bright.	50K Ω carbon	$1.25
	52.74	AG-84-S FKS-1/4	Focus	2.5 Meg. Ω carbon	$1.25
	* Some Models Use Part # 52.68				
7T32, 77T32, 721	52.24	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	* 52.24	AG-84-S FKS-1/4	Focus	2.5 Meg. Ω carbon	$1.25
	52.64	RTV-109	Contrast Vol./Sw.	750 Tap 500/500K Ω 2W-W.W./carbon Conc. Dual--SPST	$4.50
	52.66	RTV-110	Vert/ Hor. Hold	1 Meg/50K Ω Conc. Dual carbon	$3.10
	52.68	A43-5000 FKS-1/4	Vert. Lin.	5000 Ω 2W-W.W.	$1.25
	52.69	AG-44-S FS-3	Bright.	50K Ω carbon	$1.25
	* Some Models Use Alternate Part # 52.74				
20C22 20T12 24T10	52.24	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	52.64	RTV-109	Contrast/ Vol./Sw.	750 Tap 500/500K Ω 2W-W.W./carbon Conc. Dual--SPST	$4.50
	52.66	RTV-110	Vert./Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	$3.10
	52.68	A43-5000 FKS-1/4	Vert. Lin.	5000 Ω 2W-W.W.	$1.25
	52.69	AG-44-S FS-3	Bright.	50K Ω carbon	$1.25

Form No. 751836010-5M-11/52

CLAROSTAT

This supplementary sheet is for use as an up-to-the-minute addition to your Clarostat RTV Manual. Manuals are available through your distributor or directly from Clarostat. Price $1.00.

CLAROSTAT MFG. CO., INC.
DOVER, NEW HAMPSHIRE

Mismatched TV Components

Numerous comments concerning the effects of improperly matched TV components have appeared in SUCCESSFUL SERVICING in the past. These have led to numerous telephone calls from service technicians asking that we publish information concerning the effects of such conditions. These articles will appear in this magazine beginning with the May, 1953 issue.

The Editor

CORRECTION TO:

Rider's Dependable Replacement Parts Listing published in TV Volume 10.

SWEEP TRANSFORMERS

Set Mfr.	Set Mfr's Original Part No.
Gamble-Skogmo	51X156

Correction: Transpose A-8141 from Ram column to Stancor column.

Set Mfr.	Set Mfr's Original Part No.
RCA	74114

Correction: Change Part No. 74114 to 74144 in Part No. column.

I-F Trap Circuits etc.

(*Continued from page* 10)

cause much degeneration. A transformer arrangement is used to obtain a high-Q trap circuit. The coupling between primary and secondary determines the effectiveness of the trap.

The cathode trap generally does not produce a peak to the left of 41.25 mc. However, the trap loses its effectiveness if the transconductance of the associated tube is low. This tube should operate, therefore, with a constant bias. If agc bias is applied to the tube, the trap will become useless when strong station signals are being received.

Any of the four arangements shown in Fig. 3 may be used to trap out a 4.5-mc signal in the video section of the receiver.

Tuning of Traps

In non-intercarrier receivers, the sound i-f signal is removed from one of the 41.25-mc traps, while in intercarrier receivers the sound signal is obtained from a 4.5-mc trap. The question arises, when tuning these traps, as to whether to tune for maximum sound output or minimum picture-signal output. The answer is that i-f traps should always be adjusted for minimum second-detector output, so as to obtain the solid-line response curve of Fig. 2. Similarly, 4.5-mc traps should be adjusted for minimum 4-5-mc signal at the cathode-ray tube. A properly designed receiver will have sufficient sound output when the traps are adjusted in this manner, and it is more important to optimize the picure presentation. Receiver schematics usually specify the frequency at which each trap is intended to operate. In most cases, the trap circuits are slug tuned.

Conclusion and Summary

From the foregoing discussion, one may conclude that many television receiver faults may be traced to improperly aligned traps, or to traps that have been omitted in the design of the receiver. In all cases, improperly aligned traps may trap out picture signals rather than the signals they were intended for. This may be checked by examining the overall i-f and video response curves of the receiver. Summarizing, we may note that:

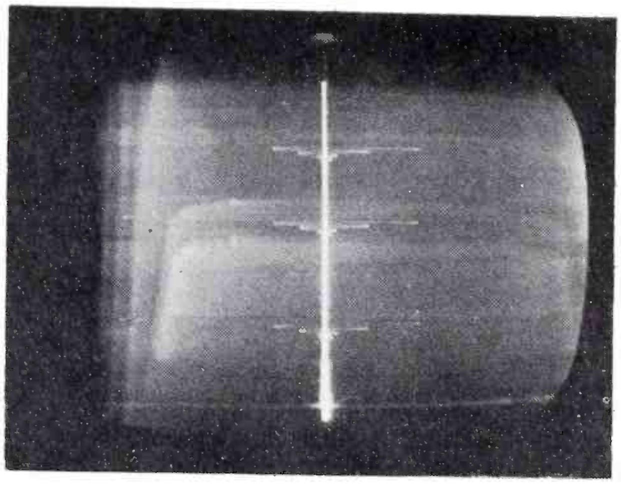
1. Improperly aligned or missing associated sound traps may result in sound-bar and 4.5-mc interference in the picture, and buzz in intercarrier receivers;

2. An improperly aligned or missing adjacent sound trap may result in sound-bar and 1.5-mc interference in the picture;

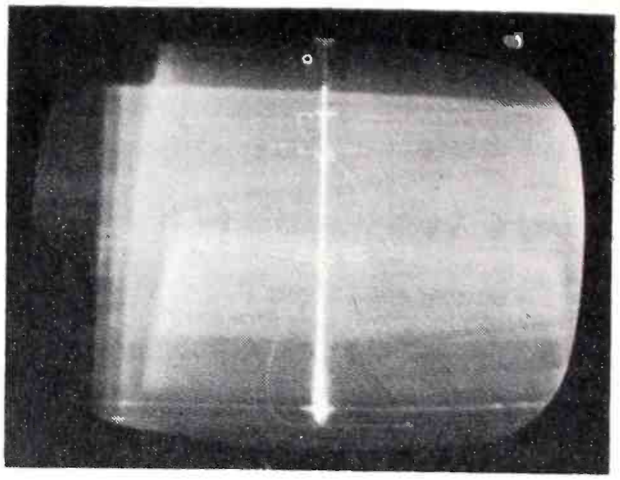
3. An improperly aligned or missing adjacent picture trap may result in adjacent-picture interference in the desired picture;

4. An improperly aligned or missing 4.5-mc trap may results in 4.5-mc interference in the picture, and weak sound in intercarrier receivers.

BRIGHT VERTICAL LINE



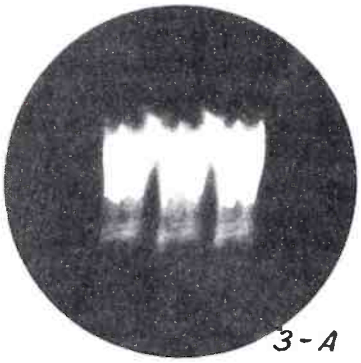
1



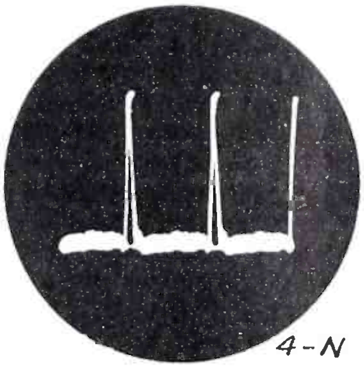
2

(NOTE: Refer to CIRCUIT GUIDE IV-9(A) for identification of components.)

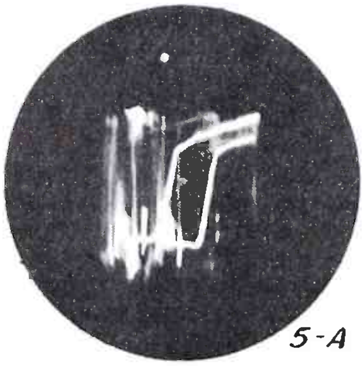
The unstable picture-tube pattern evident while the receiver was defective is shown, as photographed at different instants, in Figs. 1 and 2. The raster was shrunken in size and jumped erratically over the face of the picture tube at a rapid but visible rate, giving the appearance of a flickering raster. Neither vertical nor horizontal sync could be restored by adjustment of the hold controls. The bright vertical line, marked by intermittent horizontal streaks, was conspicuous at all times. While audio-output level was normal, a steady oscillation of undetermined frequency accompanied the sound.



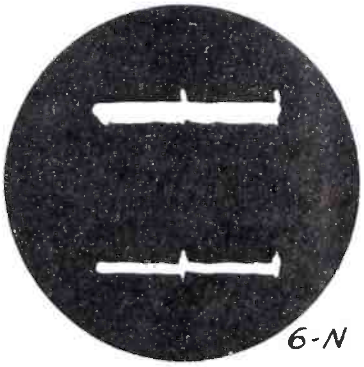
3-A



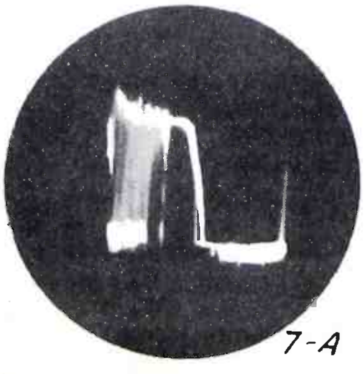
4-N



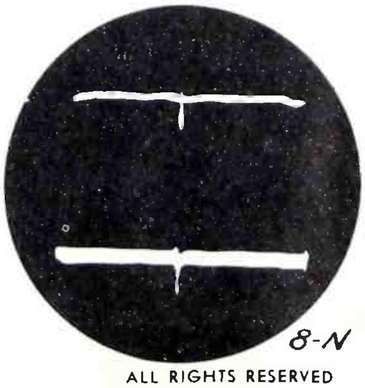
5-A



6-N



7-A



8-N

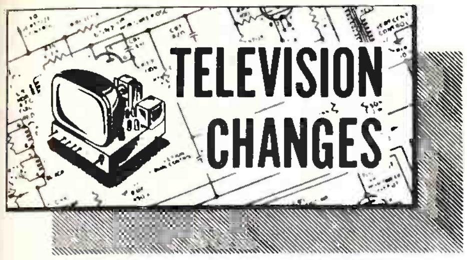
Since symptoms of faulty operation appeared to involve both vertical and horizontal synchronization and the high-voltage section, which depends on the horizontal-sweep circuit, operation of the common sync strip was checked. The sync separator and clipper (*V1* and *V2*) appeared to be operating normally. However, at the grid of the sync splitter (*V3*), the unstable, distorted waveform of Fig. 3 was obtained, with an isolating probe, at H/3. Normally, the well-defined steady pulse of Fig. 4 is present. A similar condition existed at the vertical-scanning frequency.

Output from this stage was then investigated. Waveforms at the plate were badly distorted in shape. For example, at V/2 through the low-capacitance probe, the pattern of Fig. 5 was noted. This stage, when functioning properly, produces a plate waveform like that shown in Fig. 6 at the frequency mentioned.

The cathode-output waveform (obtained at the junction of *R9* with *R10*) was similar to but out of phase with the plate output, as expected (see Fig. 7). However, it was much lower in amplitude. Cathode and plate output waveforms are normally of the same amplitude. The normal output waveforms of Figs. 6 and 8, for example, are similar in shape, opposite in polarity, and of the same P-P height. The positive d-c voltage at the junction of *R9* and *R10*, however, was considerably larger than the normal low value.

A check of the output side of capacitor *C6*, feeding from the cathode, revealed the expected display, already shown in Fig. 7; but the d-c voltage, normally negative, was identical to the positive reading found at the previously mentioned junction of *R9* and *R10*. In addition, resistance readings on either side of capacitor *C6* were the same.

Normal operation of this receiver was restored by replacing a defective component in the cathode-output circuit of the phase splitter, V3. Coupling capacitor C6 was found to be shorted.



The Rider Manual pages and TEK-FILE pack which include the original data and shematics to which the following production changes apply, appear in the index on page 29 of this issue.

GAMBLE-SKOGMO (CORONADO)
MODELS 05TV1-43-9014A, 15RA2-43-9105A
CHASSIS 16AY210

Circuit Changes, Audio

A 6T8 tube (triode-triple diode) replaces the audio amp. 6AV6 (V12) and the audio det. 6AL5 (V21), performing the same functions as these two tubes.

In the audio strip assembly, 72 (Part No. B-13M-19257, the ratio detector coil) is replaced by Part No. B-13M-17273.

NOTE: Chassis stamped with RMA date code number 124031 or higher incorporate these changes.

●

MAGNAVOX
CHASSIS CT-275, 276, 277, 278, 279, 280, 281, 282

R-F Unit

These chassis use either r-f unit 700349 or 700354.

SYLVANIA
MODEL 1110X
CHASSIS 1-329

Sound I-F Limiter (Circuit Change)

1. Dual ceramic capacitor C-103 and C-104 (.004µf, 450v), connected to pins 6 and 7 of the Sound I-F Limiter (V-9, 6AU6), is removed from the circuit.
2. Resistor R-105 (330 ohms, ½w), connected to pin 7 of V-9, is removed from the circuit.
3. The cathode of V-9 (pin 7) is connected directly to ground.
4. New capacitor C-103 (.005µf, 500v, ceramic, Service Part 166-500D) is added to the circuit as screen grid bypass for V-9 (pin No. 6 to ground).

NOTE: Chassis coded C02 and later incorporate this change.

●

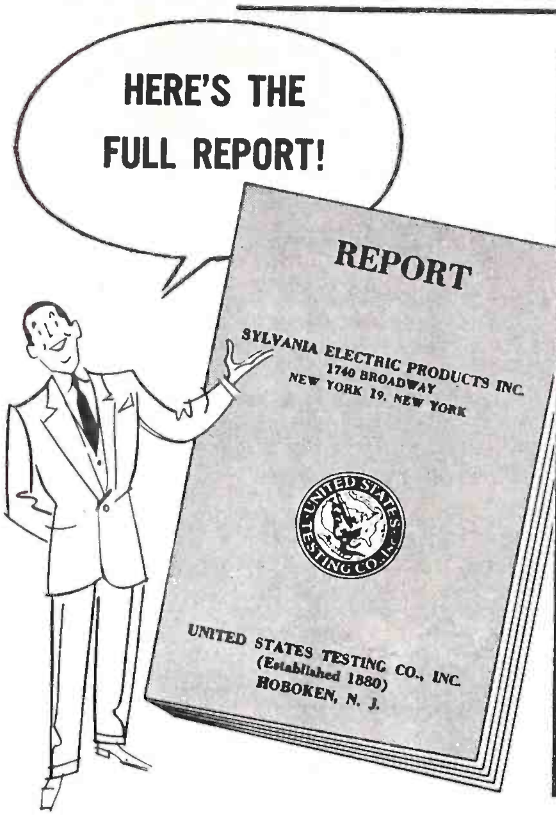
SYLVANIA
MODELS 71M, 72M, 73B, 73M
CHASSIS 1-366(C08), 1-441(C02)

Sound I-F Limiter (Circuit Change)

1. Resistor R-105 (330 ohms) and capacitor C-103 (.004µf) are removed from the cathode (pin 7) of the Sound I-F Limiter (V-10, 6AU6).
2. The cathode is connected directly to ground.
3. Capacitor C-103 (pin 6 of V-10, 6AU6) is changed from .004µf, 500v to .005µf, 500v (Service Part 166-5000D).

NOTE: Chassis 1-366 coded C09 and chassis 1-441 coded C03 incorporate this change.

SUPERIOR PERFORMANCE OF SYLVANIA PICTURE TUBES NOW PROVED BEYOND ALL DOUBT

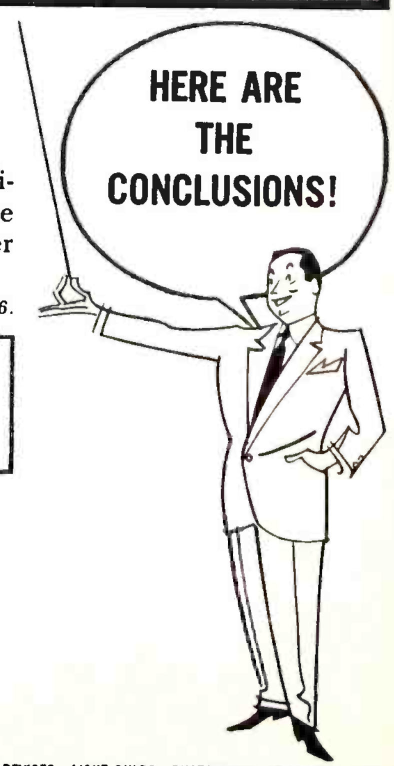


LIFE TEST MAGNETIC TUBES
United States Testing Company
Hoboken, N. J.

Test No. E-5526
Date 10-11-52
Engineer A.S.M.

Mfr.	Tubes Tested	Tubes Failed	Point Quality
A	8	3	76
B	8	4	79
C	8	6	62
D	8	4	74
E	8	4	67
F	8	5	42
G	8	4	52
H	8	5	30
SYLVANIA	8	0	93

Exhaustive tests by United States Testing Company prove Sylvania Picture Tubes out-last, out-perform all others tested!



• Hour after hour for over 1,400 consecutive hours, Sylvania Picture tubes were tested side by side with tubes of 8 other manufacturers. The chart at right tells the remarkable performance record. Note that only Sylvania Picture tubes showed no failures. Here's the conclusion of the U. S. Testing Company Report: "On the basis of an ultimate Life Test Evaluation of the eight tubes of each brand tested, it can be concluded that the averaged overall qualities measured on the Sylvania Tubes were superior to the averages of the other brands tested."*

**United States Testing Company, Inc., Test No. E-5526.*

We'll be glad to send you full details of this report. Send your request to Sylvania Electric Products Inc., Department 3R-1804, 1740 Broadway, New York 19, N. Y.

SYLVANIA

RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT LAMPS, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

What Is The Fastest Way To Trouble-Shoot A TV Set?

This material originally appeared in A.G. RADIO NEWS, published by the AG Radio Parts Co.

Every service technician has his own little private system of trouble shooting because it is developed from day to day experiences in dealing with an endless variety of problems.

In beginning to trouble shoot a chassis brought into the shop, some prefer to check prominent B voltage points first; others choose to test suspected groups of tubes first; some rely on observation of the end result of both picture and sound for the prime indication of a defect and still others turn directly to signal tracing or signal injection methods.

Each of these approaches has it own definite advantages and because of this, furnishes grounds for argument, which incidentally, is not the concern of this review.

Regardless of the system of trouble shooting which you may employ, it may be wise to stop and analyze it occasionally to find if you are competitive in today's modern service market.

How does your system of trouble shooting measure up to the following questions?

(1) Is it fast enough to be competitive even when severe problems are encountered?

(2) Is it a sure-fire direct approach to the source of a defect right down to the very component at fault?

(3) Does it furnish positive proof of correction enabling you to gain control over the cause of trouble so you can repeat bad or good operation at will?

When the going gets tough and extraordinary demands are placed on any particular system, it may soon be found to be limited to the extent where tests methods of another system must be reverted to in order to reach a conclusion. On may suppose then, that a combination of the above listed systems might be best, but this hardly seems practical.

From another aspect, trouble shooting practice can be relegated to two broader classifications:

(a) The "case history" or "experience" method and

(b) progressive testing.

Many technicians depend on their experience with one set to guide them in repairing another one like it. When an unfamiliar problem arises, someone else's experience is sought, either through conversation or by resorting to technical files.

The popularity of direct solutions to characteristic problems is responsible for the introduction of many technical data sheets hints and kinks, and other printed helps. Therein other peoples' experience are described so the technician can avoid the costly process of working them out for himself. The limitation to this "case history" method, however, lies in the extensive filing job necessary to organize sufficient data and to constantly amend it for all makes of sets. Filing could conceivably take more time than trouble shooting!

Where specialization on a single line of receivers alone is practiced, the "case history" method with its repeatedly used short-cut experiences, becomes highly practical. This is a point in favor of having exclusively franchised dealers or large specializing contractors.

Progressive testing should appeal more to the independent technician who services all makes of receivers. His pet system of trouble shooting, plus schematics, voltage charts, and other pertinent basic information will enable him to rush through most problems.

When his routine practice is completed, the employment of his extended knowledge of various systems of trouble shooting, quickly leads to conclusive results.

This "general practitioner", therefore, must rely more on his ability to think of a test that will solve his unusual problems than to rely solely on finding a case history that will match any problem which he may encounter.

Setting Up for TV Service

(Continued from page 3)

manager specified seven outlets served through a circuit braker and isolation transformer. A switch pilot light should also be incorporated.

Two sets of antenna leads should be available at the bench. Provisions for the mounting of a test CRT should also be provided.

As far as storage space is concerned, the shop should have adequate space to heat run repaired chassis for at least four hours, preferably in their cabinets.

Generally speaking, lighting should be such that the service man does not cast shadows on his work. Recommendations as to fluorescent and incandescent lamps vary. If the former is used, it must be properly installed to minimize interference. Overhead lighting should be supplemented by goose-neck or floating-arm lights.

There is some tendency to locate service shops in basements or other poorly ventilated spots. In any shop, efficiency can be stepped up by giving some attention to good ventilation. Actual sound-proofing of the shop is usually impractical but a little attention to layout and some inexpensive soundproofing measures are often sufficient. In addition, the shop noise level can often be reduced by care on the part of service personnel.

A regard for efficiency alone will dictate the minimums as regards shop layout, lighting and ventilation. Dividends in the form of better employee morale and a better impression on the public can be realized by going one step further in providing a neat, well-laid out shop. An operation of this type can be well publicized, rather than being relegated to obscurity.

Test Equipment

Many of the service managers contributing advice to Electrical Merchandising in preparing this article emphasized that purchase of inferior test equipment was no economy.

Said one, summarizing the problem: "A big headache to manufacturers is the type of equipment offered by test suppliers, since there is a good chance that test equipment will not perform as advertised. We have spent considerable time in analyzing test equipment offered to the trade and have found some of it almost worthless. . . . . Generally speaking, a serviceman gets what he pays for. . . . Much of the equipment offered to the serviceman two years ago is not acceptable for use on TV receivers today because of the increased sensitivity built into sets since that time."

What test equipment does the dealer need for his service shop? Four manufacturers provided answers, varying in detail.

A spokesman for Admiral Corp. suggested that the minimum would include an oscilloscope, a vacuum tube voltmeter with high voltage test leads and RF probe, a sweep generator and calibrator.

CHART I—TEST EQUIPMENT (Du Mont Recommendations)

The Minimum

1. Oscillograph with horizontal probe (from $150 to $330).
2. Vacuum tube voltmeter ($55 to $125).
3. Sweep generator ($220 to $550).
4. Peak to peak scope calibrator ($40).
5. Isolation transformer ($25).

Useful Additions

Tube tester with CRT test adaptor ($100 to $165). Capacitor checker ($70). Cross hatch generator ($175). Field strength meter ($85). High frequency and high voltage probes for VTTM.

How Much Equipment

Each bench should have an oscillograph and VTTM.

A de luxe shop would have one sweep generator setup for every two benches and a Scope P-P Calibrator for every bench. As a minimum, however, one of each of these pieces of equipment would be adequate.

What To Look For In Buying This Equipment

1. Oscillograph
   Sensitivity—minimum 30 mv/in. R.M.S.
   Vertical amplifier response—Flat from a few cycles per second to a minimum of 100KC (at 10% point).
   Shielding—CRT, and input terminals must be fully shielded.
   Screen Size—Preferably 5".
2. Vacuum tube voltmeter
   Input impedance—At least 10 megohms.
   Voltage ranges Minimum low range—3v. Minimum high range—600v.
   Polarity switching—Should incorporate provisions for switching between positive and negative voltage.
   Zero center scale—Should provide one for simplified FM alignment.
3. Sweep generator
   Flatness—Output should be flat within .2db.
   Shielding—Unit must be fully shielded to minimize extraneous pickup.
   Sensitivity—Should have at least a maximum 0.1v output.
   Sweep width—Minimum 10mc.
   Center Freq.—Minimum 4mc to 216 mc.
4. Marker
   Sensitivity—At least a maximum 0.1v output.
   Accuracy—Within ± 0.5%.
   Modulation—Should provide frequency for internal modulation of cw marker.
   Horizontal check—Incorporates horizontal oscillator for accuracy tests.
5. Scope P — P Calibrator
   Range—Preferably .01v to 100v in direct readings.
   Physically—Should be mounted on scope to provide instantaneous p — p measurement by simply turning a knob on the calibrator.

In describing the test equipment needed by a servicing dealer, DuMont and Emerson experts went into considerable detail, not only as to the equipment but also as to the features and performance characteristics which should be found in such equipment. For these opinions, see Charts I and II.

RCA, whose subsidiary, RCA Service Co., is the largest servicing organization in the field, suggested these guides for purchasing test equipment. (The large shop shown in the table employs from 16 to 20 technicians, the small has only three or four.)

Item	Large Shop	Small Shop
Audio amplifiers	1	1
Antenna rotor kits	8	2
Dual turntable racks	1	1
High voltage test probe	1	1
Oscilloscope	1	1
Circuit tester	27	5
Sweep generator	1	1
Crystal calibrator	1	1
Signal generator	1	1
Monitor TV set	1	1
RF unit test jig	1	1
Junior Voltohmyst	2	1
Sound power phone (hand)	7	2
Sound power phone (chest)	7	2
Telescopic survey truck	1	1
Tube tester	1	0
Survey receiver	1	0
Record player	3	3
Capacitor analyzer	1	0
16" test jig	2	1
17" test jig	2	1
21" test jig	2	1

Tools: Hand, Shop, and Installation

Chart III gives a good idea of the variety of tools required for servicing a set and for installation work. Generally speaking one set of hand tools is required for each bench. A single set of shop tools, however, should be sufficient for the entire shop.

Installation Supplies

A crew handling installations must carry a wide variety of supplies; these can be broken down roughly into antennas (and masts) and mounting accessories. An ample supply of accessories should be maintained on the truck at all times. The antennas and masts can be drawn from stock each morning to cover that day's jobs. Each truck should carry about 1,000 feet of antenna lead-in wire.

In determining his stock levels on installation supplies, the dealer must take into consideration the number of trucks being used and the number of installations handled on an average day. Generally speaking, a two-

CHART II —TEST EQUIPMENT (Emerson Recommendations)

The Equipment

1. Oscilloscope (from $175 to $300).
2. Vacuum Tube Voltmeter ($50 to $65).
3. Sweep and marker generators ($175 to $500).
4. AM-FM Signal Generator ($75 to $200).
5. Tube Tester ($150).

How Much Equipment

1. Usually only one alignment set (scope, sweep and marker generators) is necessary for the entire shop.
2. Each man should have a VTTM and oscilloscope.

What To Look For In Buying This Equipment

1. Oscilloscope
   An oscilloscope should have at least .05 volts per inch vertical deflection sensitivity and have a good frequency response to at least 150KC. Be certain that the input resistance is in the order of 35 mmf. or less and at least 1 meg ohm, and that it has provision for at least a 20KC sweep sync rate. Be certain that the scanning line has enough intensity and can be focused on high intensity settings. A good sync is also desirable.
   A more elaborate scope has provisions for peak to peak voltage readings, frequency response to over 300KC and a very bright and well focused scanning beam. The vertical sensitivity is usually in the order of .01 volts per inch deflection with high horizontal gain for expanding wave pattern. This type of scope sells for about $300.
   The above two pieces of equipment are required for service work. The following equipment is needed for alignment work which sometimes is the cause of many service headaches.
2. Vacuum tube voltmeter
   a) Make sure it has a high D.C. input impedance about 11 megohms for minimum loading of circuits.
   b) Low voltage scale of at least 5v.
   c) Zero center scale for alignment of Disc. is good but not necessary.
   d) Should also read A.C. volts and ohms. (x 1 meg).
   A more elaborate V.T.V.M. should also have a high input impedance on A.C. and be relatively flat for a wide range of audio frequencies, so that it can be used as an output meter and test probe. The cost for such a V.T.V.M. is about $65.
3. Sweep and marker generators
   a) Sweep 20 and 40 mc I.F. ranges. Plus F.M.
   b) Sweep entire T.V. R.F. spectrum.
   c) Linearity of sweep to be constant with output setting. (Voltage output should not change with frequency over sweep range).
   d) At least .1 volt output.
   e) Marker should be accurate to at least 1% preferably crystal controlled and relatively free of drift after warm up.
   f) Marker should have at least .1 volts output.
   g) Each unit should be free of Harmonic output (well shielded) especially the sweep generator.
   h) Provision for calibrating dial, especially for marker.
   There is more of a variation in price for the above items than practically any other. Better units have separate markers and sweeps and operate strictly on fundamentals. Cheaper units usually do not contain R.F. markers, so that the stations must be used to align the local oscillator. Such equipment cannot be used too well for the alignment or repair of tuners. Cheaper units which do a fair job cost about $175 while better units cost anywhere upwards of $500 for sweep and marker.
   In any event, the most important factors are sufficient output and good linearity, especially with a change in attenuator setting (output voltage).
4. AM-FM Signal Generator
   a) Cover frequencies of from about 100KC to 120 mc.
   b) Sufficient output at least .1 volt.
   c) Good stability after warm up and at least 3% accuracy.
   d) Amplitude modulated by about 400 cycles at approximately 30% modulation.
   Cheaper units operate mainly on harmonics, have low output, poor stability and tracking accuracy, about $50.
   Better units operate on fundamentals, have approximately 1% accuracy, have provisions for varying percent modulation and frequency of modulation, and also can frequency modulate the R.F. carrier. These units are approximately $200.
5. Tube Tester
   A tube tester is necessary for counter use, (testing customers tubes). It should be of the dynamic mutual conductance type and take all different type tubes including miniatures. It should have provisions for testing shorts and noise with an internal replaceable tube chart roll.

(Continued on page 26)


IMPS are TOPS!
IMPS WON'T FREEZE OR MELT!
They'll operate faithfully in temperatures ranging from −40°C. to +100°C. (212°F.)—and that's the boiling point of water!
IMPS ARE REALLY RUGGED!
The tough thermo-setting plastic will take an astounding amount of abuse—yet IMPS will still look and perform like new!
PYRAMID imp .1 MFD 600 DCVW
IMPS ARE MOISTURE-PROOF!
No moisture can get through the varnished plastic case, or even through the lead anchor points.
IMP
IMP LEADS CAN BEND AND BEND!
Tinned leads that are *really* securely anchored—you'll be amazed at how much punishment they'll take without breaking!
All over the country service-engineers are praising the newest and finest molded tubular paper capacitor—the Pyramid IMP!
IMPS are available in all popular ratings in 200, 400 and 600 volt ranges.
If you haven't tried the new IMP, send for your free sample today—
PYRAMID ELECTRIC COMPANY
1444 HUDSON BOULEVARD · NORTH BERGEN, NEW JERSEY

Setting Up for TV Service

(Continued from page 3)

manager specified seven outlets served through a circuit braker and isolation transformer. A switch pilot light should also be incorporated.

Two sets of antenna leads should be available at the bench. Provisions for the mounting of a test CRT should also be provided.

As far as storage space is concerned, the shop should have adequate space to heat run repaired chassis for at least four hours, preferably in their cabinets.

Generally speaking, lighting should be such that the service man does not cast shadows on his work. Recommendations as to fluorescent and incandescent lamps vary. If the former is used, it must be properly installed to minimize interference. Overhead lighting should be supplemented by goose-neck or floating-arm lights.

There is some tendency to locate service shops in basements or other poorly ventilated spots. In any shop, efficiency can be stepped up by giving some attention to good ventilation. Actual sound-proofing of the shop is usually impractical but a little attention to layout and some inexpensive soundproofing measures are often sufficient. In addition, the shop noise level can often be reduced by care on the part of service personnel.

A regard for efficiency alone will dictate the minimums as regards shop layout, lighting and ventilation. Dividends in the form of better employee morale and a better impression on the public can be realized by going one step further in providing a neat, well-laid out shop. An operation of this type can be well publicized, rather than being relegated to obscurity.

Test Equipment

Many of the service managers contributing advice to Electrical Merchandising in preparing this article emphasized that purchase of inferior test equipment was no economy.

Said one, summarizing the problem: "A big headache to manufacturers is the type of equipment offered by test suppliers, since there is a good chance that test equipment will not perform as advertised. We have spent considerable time in analyzing test equipment offered to the trade and have found some of it almost worthless. . . . . Generally speaking, a serviceman gets what he pays for. . . . Much of the equipment offered to the serviceman two years ago is not acceptable for use on TV receivers today because of the increased sensitivity built into sets since that time."

What test equipment does the dealer need for his service shop? Four manufacturers provided answers, varying in detail.

A spokesman for Admiral Corp. suggested that the minimum would include an oscilloscope, a vacuum tube voltmeter with high voltage test leads and RF probe, a sweep generator and calibrator.

CHART I—TEST EQUIPMENT (Du Mont Recommendations)

The Minimum

1. Oscillograph with horizontal probe (from $150 to $330).
2. Vacuum tube voltmeter ($55 to $125).
3. Sweep generator ($220 to $550).
4. Peak to peak scope calibrator ($40).
5. Isolation transformer ($25).

Useful Additions

Tube tester with CRT test adaptor ($100 to $165). Capacitor checker ($70). Cross hatch generator ($175). Field strength meter ($85). High frequency and high voltage probes for VTTM.

How Much Equipment

Each bench should have an oscillograph and VTTM.

A de luxe shop would have one sweep generator setup for every two benches and a Scope P-P Calibrator for every bench. As a minimum, however, one of each of these pieces of equipment would be adequate.

What To Look For In Buying This Equipment

1. Oscillograph
   Sensitivity—minimum 30 mv/in. R.M.S.
   Vertical amplifier response—Flat from a few cycles per second to a minimum of 100KC (at 10% point).
   Shielding—CRT, and input terminals must be fully shielded.
   Screen Size—Preferably 5".
2. Vacuum tube voltmeter
   Input impedance—At least 10 megohms.
   Voltage ranges Minimum low range—3v. Minimum high range—600v.
   Polarity switching—Should incorporate provisions for switching between positive and negative voltage.
   Zero center scale—Should provide one for simplified FM alignment.
3. Sweep generator
   Flatness—Output should be flat within .2db.
   Shielding—Unit must be fully shielded to minimize extraneous pickup.
   Sensitivity—Should have at least a maximum 0.1v output.
   Sweep width—Minimum 10mc.
   Center Freq.—Minimum 4mc to 216 mc.
4. Marker
   Sensitivity—At least a maximum 0.1v output.
   Accuracy—Within ± 0.5%.
   Modulation—Should provide frequency for internal modulation of cw marker.
   Horizontal check—Incorporates horizontal oscillator for accuracy tests.
5. Scope P — P Calibrator
   Range—Preferably .01v to 100v in direct readings.
   Physically—Should be mounted on scope to provide instantaneous p — p measurement by simply turning a knob on the calibrator.

In describing the test equipment needed by a servicing dealer, DuMont and Emerson experts went into considerable detail, not only as to the equipment but also as to the features and performance characteristics which should be found in such equipment. For these opinions, see Charts I and II.

RCA, whose subsidiary, RCA Service Co., is the largest servicing organization in the field, suggested these guides for purchasing test equipment. (The large shop shown in the table employs from 16 to 20 technicians, the small has only three or four.)

Item	Large Shop	Small Shop
Audio amplifiers	1	1
Antenna rotor kits	8	2
Dual turntable racks	1	1
High voltage test probe	1	1
Oscilloscope	1	1
Circuit tester	27	5
Sweep generator	1	1
Crystal calibrator	1	1
Signal generator	1	1
Monitor TV set	1	1
RF unit test jig	1	1
Junior Voltohmyst	2	1
Sound power phone (hand)	7	2
Sound power phone (chest)	7	2
Telescopic survey truck	1	1
Tube tester	1	0
Survey receiver	1	0
Record player	3	3
Capacitor analyzer	1	0
16" test jig	2	1
17" test jig	2	1
21" test jig	2	1

Tools: Hand, Shop, and Installation

Chart III gives a good idea of the variety of tools required for servicing a set and for installation work. Generally speaking one set of hand tools is required for each bench. A single set of shop tools, however, should be sufficient for the entire shop.

Installation Supplies

A crew handling installations must carry a wide variety of supplies; these can be broken down roughly into antennas (and masts) and mounting accessories. An ample supply of accessories should be maintained on the truck at all times. The antennas and masts can be drawn from stock each morning to cover that day's jobs. Each truck should carry about 1,000 feet of antenna lead-in wire.

In determining his stock levels on installation supplies, the dealer must take into consideration the number of trucks being used and the number of installations handled on an average day. Generally speaking, a two-

CHART II —TEST EQUIPMENT (Emerson Recommendations)

The Equipment

1. Oscilloscope (from $175 to $300).
2. Vacuum Tube Voltmeter ($50 to $65).
3. Sweep and marker generators ($175 to $500).
4. AM-FM Signal Generator ($75 to $200).
5. Tube Tester ($150).

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What To Look For In Buying This Equipment

1. Oscilloscope
   An oscilloscope should have at least .05 volts per inch vertical deflection sensitivity and have a good frequency response to at least 150KC. Be certain that the input resistance is in the order of 35 mmf. or less and at least 1 meg ohm, and that it has provision for at least a 20KC sweep sync rate. Be certain that the scanning line has enough intensity and can be focused on high intensity settings. A good sync is also desirable.
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(Continued on page 26)

Setting Up for TV Service

(*Continued from page 25*)

CHART III—TOOLS . . . Hand, Shop and Installation

A. HAND TOOLS

Suggested by Du Mont

Screw driver set (regular and Phillips head)	$ 3.00
Set of spintights	5.00
Long nose pliers	2.00
Diagonal cutters	2.00
Set, alignment and adjustment tools	4.00
Soldering gun	12.00
Tube puller	.75
Pin straighteners (7 and 9 pin base)	.75
Hex and spline wrench set	1.25

Suggestions by Admiral

- Screw driver set (⅛" to ¼" blade)
- Set, spin type wrenches, 3/32" to ⅜"
- Diagonal pliers
- Long nose pliers
- Soldering gun/iron
- Alignment wrenches

Suggestions by RCA Service Co.

- Diagonal pliers—6"
- Slip joint pliers—6"
- Screw driver, cap tip 8"
- Screw drivers, set of 4
- Ratchet—¼"
- Socket set—11 pieces
- Soldering gun
- Needle-nose pliers—6"
- Crescent wrench—6"
- Phillips screw driver—¼"
- Allen wrenches
- Mirror, 4 x 5 inches

Suggestions by Emerson

200 watt soldering gun	$13.00
Long nose pliers	2.25
Diagonal cutters	2.25
Set, spintights	4.25
Screw drivers (2)	1.00
Phillips head screw drivers (2)	1.50
Kit, alignment tools	1.00

B. SHOP TOOLS

Du Mont

Vise	$15.00
200 watt soldering iron	6.50
½" electric hand drill and set of drills	40.00
Wire stripper	4.00
Adjustable back saw	1.75
Center punch	.75
Tool steel reamers	2.00
Set of files	4.00
Hammer	1.50
Set, open-end wrenches	3.00
Mirrors, stand	5.00
Electric grinder	15.00

Admiral

- Electric drill
- Vise
- Socket punches
- Drill set—1/16" to at least ¼"

RCA Service Co. [list bracketed for Shop and Installation Tools]

- Extension cord, 100 feet
- Soldering iron
- Hammer, double face, 3 lbs.
- Wood lever, 12"
- Files (2), 8" med.
- Keyhole saw; back saw
- Screw driver, 6" blade
- Screw driver, Phillips
- Pliers, side cut, 7"
- Cold chisel, ½"; wood chisel, ½"
- Center punch, ⅜" dia.
- Ratchet wrench box type (½ x 9/16")
- Ratchet wrench box type (⅜" x 7/16")
- Flashlight, right angle
- Channel lock pliers
- Tri-plug
- Bit brace
- Claw hammer, 16 oz.
- Screw driver std. tip, 3" blade
- Cab. tip and screw
- Diagonal pliers, 7"
- Pliers, needle-nose, 7"
- Paint brush, 1"; putty knife
- End wrench, 8"
- Steel tape, 6 ft.
- Pliers, slip joint

Emerson

- Use 200 watt soldering iron instead of gun
- Each technician is furnished more expensive set of alignment tools than specified under hand tools
- Shop tools such as vise, electric drill, etc.

C. INSTALLATION TOOLS

Du Mont

- Adjustable 50 ft ladders
- Pipe wrenches
- Rope (100 ft)
- Extension cord (200 feet with multiple outlets)
- Set masonry drills
- Hammer—heavy construction type
- Set chisels
- Pair of phones—sound powered
- Heavy duty electric drill
- COST: About $120 per truck

Emerson

Hack saw	$1.25
Pipe wrench	5.00
Vice grip wrench	3.00
Set, box wrenches	3.00
Assorted size star drills	1.00
Medium size hammer	2.50
Large screw driver	.70
Lacquer (for corrosion proofing)	

man crew should be able to handle four installations per day.

For some idea of what's required in the way of supplies for installations, see Chart IV.

CHART IV—INSTALLATION SUPPLIES

- Antennas, Masts and Mast extensions, Mast connectors
- 300 ohm antenna wire
- Coaxial cable (73 or 75 ohm. Should be used only for special applications: electrically noisy areas, damp salty areas where 300 ohm line would deteriorate rapidly).
- Gonset low loss open wire line (to be used only in extreme fringe areas where minimum line loss is necessary).
- Lightning arrestor, aluminum ground wire, ground clamps and ground rods
- Mounts: chimney, wall, adjustable wall (for clearing obstructions) and base mounts
- Guy Wire (6 strand steel wire), turnbuckles and guy rings
- Anchor bolts for mounting brackets to masonry
- Lead plugs for securing stand-offs to masonry
- Stand offs for: twin lead in wire, coaxial antenna wire
- Single and double mast stand-offs for securing antenna wire to mast
- Insulated tacks, black friction tape
- Spring-wing toggle bolts for mounting brackets against hollow wall
- Rotors and boosters

Parts

A good service operation is no stronger than its weakest link—and the most elaborate service set-up will be rendered ineffective if the dealer fails to stock an adequate supply of parts and tubes.

What constitutes an adequate stock of these items is a question which is best determined with reference to past experience. Some general rules can be set up as a preliminary guide. They may have to be adjusted or supplemented when a dealer has put them into effect and determined whether they suit the conditions he is meeting.

One manufacturer tells his dealers: maintain two replacement parts unless you find that you need more. Have at least 10 tubes of each type on hand and for the more popular types, keep 50 on hand.

RCA Service Co. carries a two-month supply of parts available within 30 days and keeps an additional month's supply on order.

Maintenance of a parts inventory system is strongly recommended, both as a control measure and as a means of determining satisfactory inventory levels. These records can be maintained in a variety of forms. Dealers should remember that the more information required by the system, the more valuable it will be to management. The following items, listed in order of their importance, could be included:

1. Record of purchases by description, purchase order number and date and quantity ordered.
2. Record of receipts by quantity and date.
3. Cost of item to dealer and list price.
4. Usage and balance on hand.
5. Minimum and maximum stock quantities.
6. Location of items.

According to Harold Schulman, manager of the Du Mont teleset service control department, the information provided in items (1) and (2) above automatically provide the dealer with:

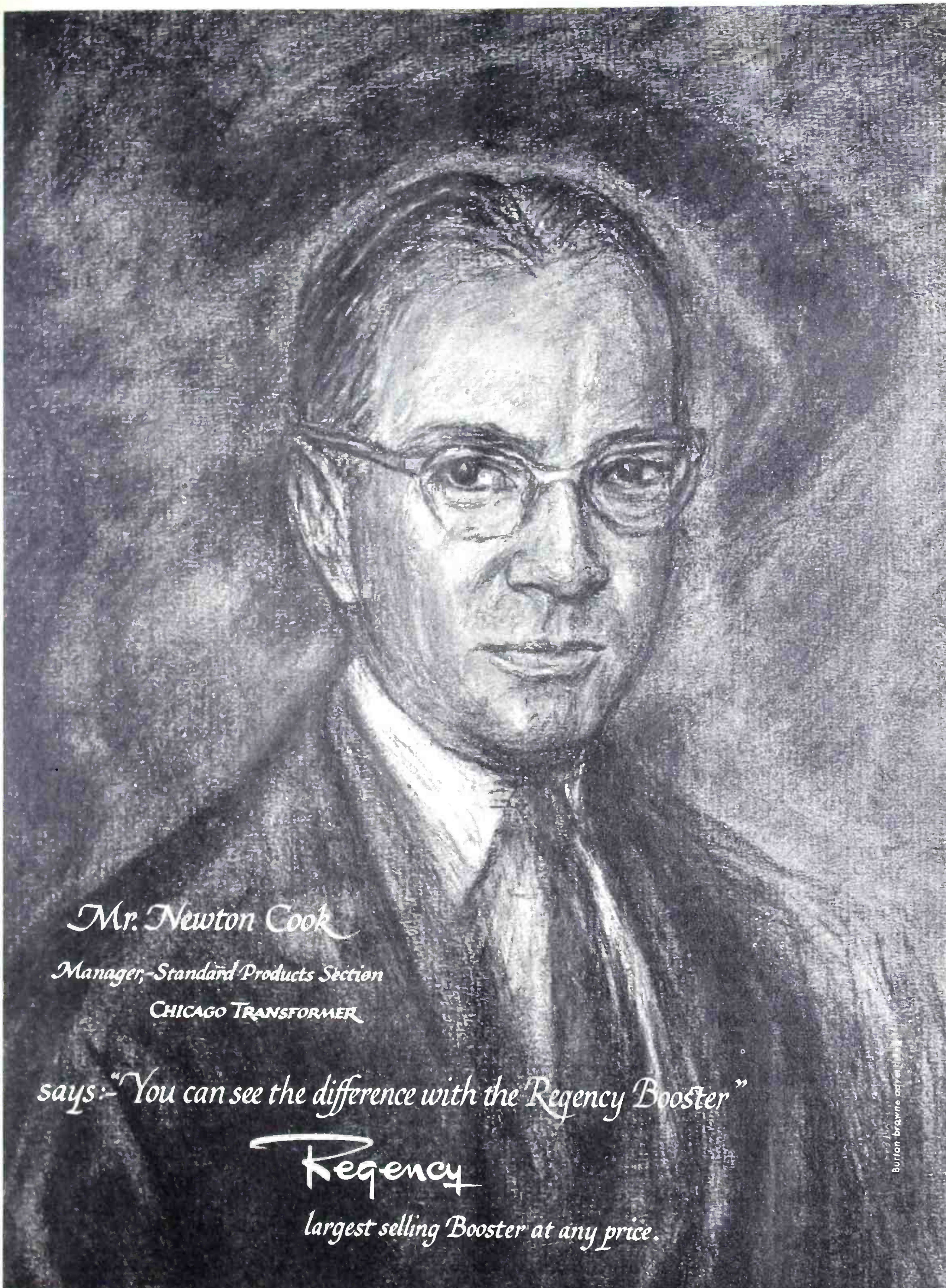
a. The approximate rate of usage. Quantity to be purchased can then be judged according to the frequency and quantities of past orders.

b. A safeguard against reordering parts already on order—a major cause of overstocking.

c. A steady reference file for giving approximate dates of delivery and timing of purchases.

This system has one drawback, Schulman warns: it provides no usage report. The dan-

(*Continued on page 31*)


Mr. Newton Cook
Manager, Standard Products Section
CHICAGO TRANSFORMER
says:—"You can see the difference with the Regency Booster"
Regency
largest selling Booster at any price.
Burton browne

REPLACEMENT PARTS, Etc.

(Continued from page 13)

magnitude of electrical losses. It is expressed in terms of percentage. The range of power factor for paper dielectric tubulars at base temperatures of 20 to 25°C is from perhaps .25 to 1%. As a general rule, power factor increases with both decrease and increase in operating temperature relative to the rated base temperature, so that an increase of from 3 to perhaps 5% for a temperature rise of 40—60°C is not unusual. Generally, the power factor increases very rapidly when a capacitor is used at temperatures beyond its rated operating temperature.

In the case of mica capacitors and ceramic capacitors, the power factor figures are substantially lower than for the paper dielectric type of unit. Assuming these types of capacitors are being used within their rated operating temperatures, the power factor of mica capacitors generally is substantially below 0.2%, especially the silver mica variety. Ceramics are in the same category, generally even better, frequently displaying power factor values as low as .02%, if not less.

The general order of paper dielectric tubular, mica dielectric and ceramic dielectric offered for replacement are within the general ratings set by the receiver manufacturers for the original components used in their receivers.

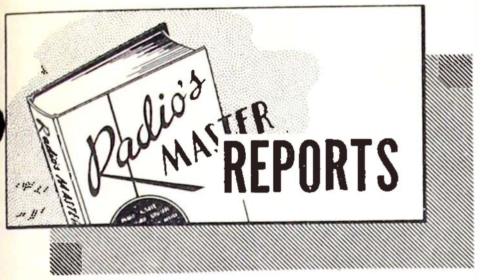
Summary

We realize that all possible items relating to capacitors have not been treated in this series. As it is, and even with these omissions the articles have extended over six issues of SUCCESSFUL SERVICING. We have much more to go in covering the other components used in television receivers.

The facts given herein, when supplemented with information contained in the capacitor manufacturers' catalogues, and when complemented with the information given in the Rider Replacement Part Listings, should be of material aid in the problem of understanding TV receiver capacitor components and replacements.

The statements made in these series of articles represent highlights of the factors which are important relative to this component. We say this to fend off possible misconceptions which may result from the occasional hap-hazard selection and use of a replacement capacitor in a television receiver without noting any undesirable effects. This may lead one to believe that the important points raised here are simply efforts to fill space. This is not so. Many service technicians have been greatly confused by the peculiar behavior of receivers after a capacitor replacement which, to all intents and purposes, should have worked properly because the capacitor was electrically perfect.

We might emphasize to the servicing industry that, as time passes, closer and closer attention will have to be paid to capacitance tolerance and temperature coefficients and that when a service technician takes in a stock of fixed capacitors he will require 10% units as well as 20% units, and in some few instances even 5% units. Fortunately this is not a problem, because an examination of the Rider Replacement Part Listings found in Rider Manuals, discloses the fact that some specific values of capacitors more than others, are of the 10% capacitance tolerance rating. Incidentally, this might be of interest also to the capacitor manufacturers who sell to the parts jobbers, and to the parts jobbers who in turn sell to the servicing industry.



A monthly summary of product developments and price changes supplied by RADIO'S MASTER, the Industry's Official Buying Guide, available through local parts distributors.

COMMENT: Over-all product activity continues to be heavy, with more manufacturers reporting changes for this period. As noted last month, tube, antenna and sound manufacturers continue their dominance of the "change activity" scene, while the steady increase in tube prices noted over the last three months has slackened off slightly.

New Items

AMERICAN MICROPHONE — Added Model RCS, crystal microphone with slide switch at $8.10 dealer net.

AMERICAN PHENOLIC — Added new bo-ty and reflector antenna package No. 114-065 at $4.65 dealer net, containing No. 114-053, bo-ty and No. 114-560, bo-ty reflector, with stacking bar included.

CLEVELAND ELECTRONICS — Added Model 88, UHF TV antenna at $5.97 dealer net.

CORNELL-DUBILIER — Added auto radio replacement vibrators; Model 6326 at $2.76 dealer net . . . Model 6330 at $2.76 dealer net . . . Model 6370 at $2.52 dealer net and Model 5370 at $2.52 dealer net, which supercedes Model 5520-4.

CREST LABS. — Added a number of Universal Variable Inductance Kits. Also added a new series of receiver replacement output transformers.

FRETCO — Added Bo-Ti UHF antennas; Model Bo-Ti at $2.70 dealer net . . . Model Bo-Ti reflector at $4.35 dealer net and Model Bo-Ti corner reflector at $8.97 dealer net.

GENERAL ELECTRIC — Added GL-6130, a hydrogen thyroton especially designed for pulsing applications which require a tube that will give dependable operation at high altitudes under stringent operating conditions at $18.00 dealer net and TV picture tube 21ZP4A at $38.50 dealer net.

HARVEY-WELLS ELECTRONICS — Added Bandmaster VFO at $47.50 dealer net.

HYTRON — Added point-contact transistors No. PT-2A at $17.40 dealer net and No. PT-2S at $17.40. dealer net. Also added receiving tubes 12X4 at $1.55 list . . . 12AQ5 at $2.00 list . . . 12V6GT at $2.00 list and germanium diode 1N133 at $1.20 dealer net.

ILLINOIS RESEARCH LABS — Added Silencer, gallon size at $24.00 dealer net and Sta-Clear, quart size at $4.50 dealer net.

MALLORY & CO., P. R. — Added new 12 volt replacement vibrator, Model G-874 at $3.30 dealer net. Also added Model 6SAC4, battery charger with selenium rectifier at $10.00 dealer net . . . Model 12SAC5, battery charger with selenium rectifier at $24.00 dealer net . . . Model R-670, output cable at $1.30 dealer net and Model 675, output cable at $1.49 dealer net.

MARKEL ELECTRIC PRODUCTS — Added No. A-7180 at $9.98 dealer net and No. A-7181 at $9.98 dealer net, both sapphire tipped Pfan-Tone Cartridges. (These models replace metal tipped Pfan-Tone cartridges No. A-7157 and No. A-7158.)

NATIONAL ELECTRONICS — Added full-wave rectififer, Model NL-606 at $16.63 dealer net and ignitron, Model NL-1005 at $80.50 dealer net.

PERMOFLUX — Added outdoor theater speakers Model 4C-DI at $2.73 dealer net and Model 52C-DI at $2.91 dealer net.

PREMAX PRODUCTS — Aluminum ground wire No. AW-810 at $1.62 dealer net . . . No. AW-825 at $3.60 dealer net and No. AW-850 at $7.20 dealer net have been added to their line.

QUAM-NICHOLS — Added Model QF-3, focalizer unit at $3.57 dealer net and Model IT-4, ion trap at $.60 dealer net.

RCA — Added No. 76323, sapphire at $.90 dealer net. Also added Volume VII to their Service Data series at $5.00 dealer net.

RADIO RECEPTOR CO. — Added a number of new germanium diodes.

REEVES SOUNDCRAFT — Added a number of new tape recording accessories.

RIDER, JOHN F. — Added No. 143-2, TV Manufacturers' Receiver Trouble Cures, Volume 2 at $1.80 dealer net . . . No. 145, TV Sweep Alignment Techniques at $2.10 dealer net and No. 2011, Rider Television Manual, Volume 11 at $24.00 dealer net (available in April).

SCALA RADIO — Introduced Model BZ-4, voltage doubler probe at $10.75 dealer net.

SCOTT INC., HERMAN — Added Model 214-AB at $196.75 dealer net and Model 214-X8 at $29.95 dealer net, both remote control amplifiers and Model 120-AB, equalizer pre-amplifier at $79.25 dealer net.

SPRAGUE PRODUCTS — Added a number of twist-lok electrolytic capacitors.

STANCOR — Added new ultra-miniature transistor transformers; No. UM-110, interstage at $7.35 dealer net . . . No. UM-111, output or matching at $9.00 dealer net . . . No. UM-112, high imp. mic. input at $8.25 dealer net . . . No. UM-113, interstage at $6.60 dealer net and No. UM-114, output or matching at $9.00 dealer net.

SYLVANIA — Added 21" TV picture tubes; 21-WP4 at $39.00 dealer net . . . 21XP4 at $40.50 dealer net . . . 21YP4 at $41.50 dealer net and 21ZP4 at $40.00 dealer net. Also radio receiving tube 6CS6 at $1.90 list.

TRIPLETT ELECTRICAL CO. — Added Model 420, volume unit meter at $16.50 dealer net and Model 420 (illuminated) at $18.00 dealer net.

TURNER CO. — Added Model 9R, microphone at $14.10 dealer net . . . Model SR9R, microphone at $16.80 dealer net and Model C-4, stand at $3.45 dealer net.

WHARFEDALE SPEAKERS — Added Model HS/CR/3, 3 way crossover network at $31.00 net.

Discontinued Items

ASTATIC CORP. — Discontinued Models AT-1B, BT-1 and BT-2 all TV and FM radio boosters.

ELECTRONIC MEASUREMENT — Discontinued Model 300, vacuum tube volt-ohm-capacity meter and Model 300P, same meter with portable case and cover.

GENERAL ELECTRIC — Discontinued Model RPX-051, triple play variable reluctance cartridge . . . Model RPX-042, single variable reluctance cartridge and Model SPX-001, phono preamplifier.

INTERNATIONAL RESISTANCE — Discontinued replacement control QJ-375.

RAYTHEON — Discontinued TV picture tubes 3KP4 and 12LP4.

SIMPSON MFG. CO. — Discontinued a number of items including driver pre-amplifiers; Models DR-5, DR-5M, DR-5MP and DR-5P.

SYLVANIA — Discontinued radio receiving tubes 1S6 . . . 1W5 and 1X2.

TRIPLETT ELECTRICAL CO. — Discontinued Model 466, electrodynamometer.

VIBRALOC — Discontinued their "W" series containing sloping wall type baffle . . . grill plate and reducers.

WIRT PRODUCTS — Model S-924, auto radio iginition suppressor, snap-on plug type, discontinued.

Price Decreases

CLEVELAND ELECTRONICS — Decreased price on Model T-WA, lightning arrester to $.90 dealer net.

CONTINENTAL CARBON — Model NF-½, metal film resistor, decreased to $.48 dealer net.

CORNELL-DUBILIER — Decreased price on a number of auto generator capacitors.

DUMONT LABS. — Decreased price on teletron tube 16K/RP4 to $28.00 dealer net.

GENERAL ELECTRIC — Decreased price on industrial and transmitting type tubes GL-5670 to $5.25 dealer net and GL-5844 to $2.25 dealer net. Also decreased TV picture tube 21ZP4A to $38.50 dealer net.

GONSET — Decreased price on rocket antennas; Model 1511 to $18.27 dealer net and Model 1510 to $8.55 dealer net.

RCA — Decreased price on batteries; No. VS216 to $2.30 dealer net and VS236 to $.21 dealer net.

SYLVANIA — Sub-miniature tube 5719 decreased to $9.80 dealer net.

Price Increases

ALPHA WIRE — Increased prices on numbers 286, 289, 292, 295 and 296, tinned copper bus-bar wire.

GENERAL ELECTRIC — Increased price on TV picture tube 17CP4 to $26.15 dealer net. Also increased price on Model RKP-009, replacement parts kit for triple play cartridges (less stylus assemblies) to $.19 dealer net.

GONSET — Model 3026, 2 meter transmitter receiver increased to $199.50 dealer net. Also increased price on Model 1508, rocket antenna to $5.67 dealer net and Model 1512, rocket antenna to $5.07 dealer net.

HYTRON — Increased price on radio receiving tubes 12A4 to $2.40 list . . . 12B4 to $2.40 list . . . 6BY5G to $2.90 list and germanium diode 1N51 to $.54 dealer net.

Correction

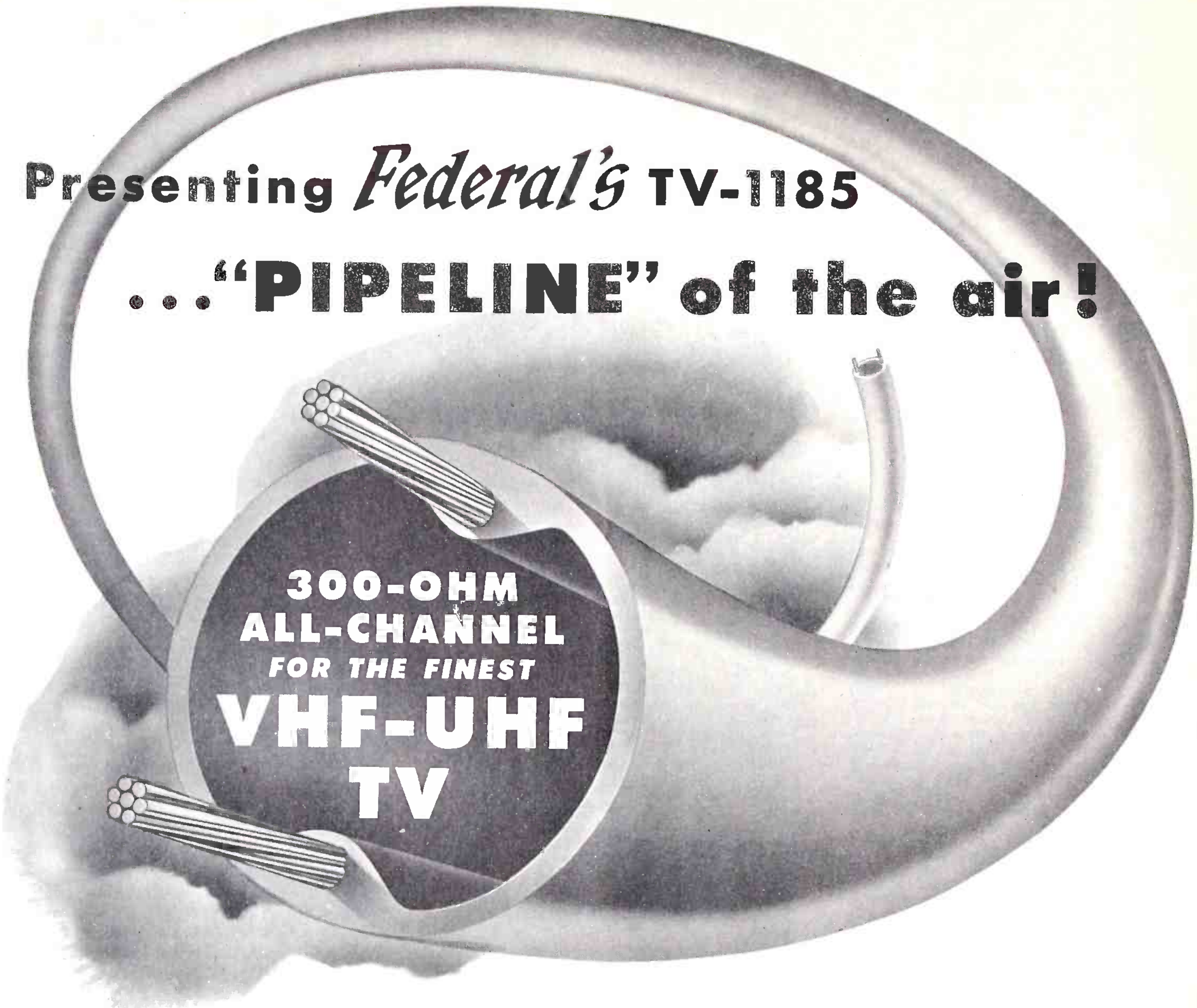
GONSET — Only the 1521 model radarray has been discontinued—not the complete series as was published in error.

INDEX OF CHANGES

Model No.	Manual Page From	To	Tek-File Pack
Gamble-Skogmo 05TV1-43-9014A, 15RA2-43-9105A, Ch. 16AY210	6-1	6-16	3
Magnavox Ch. CT-275, -276, -277, -278, -279, -280, -281, -282	7-14	7-28	30 30
Sylvania 1110X, Ch. 1-329	8-64	8-82	13
Sylvania 71M, 72M, 73B, 73M, Ch. 1-366(C08), 1-441(C02)	8-140	8-153	13

Presenting *Federal's* TV-1185

..."PIPELINE" of the air!



with the all-weather "silver" pigmentation that lets you

INSTALL IT and FORGET IT!

FEDERAL'S TV-1185—newest sensation of the top-quality twin-leads—is virtually a *"pipeline"* for better-than-ever TV reception ... VHF or UHF!

Insulated with the revolutionary Federal-developed "silver" polyethylene, TV-1185 is amazingly *tough* and *efficient.* It repels sunlight ... fights heat ... resists moisture and salt spray and other destructive deposits. Dirt and dust *tumble* off its fine, smooth, tubular surface!

TV-1185 keeps the energy field inside the weather-proof "silver" polyethylene sheath ... providing *low loss ... more constant impedance* ... a better TV picture regardless of area or length of lead!

There's nothing finer for VHF or UHF than Federal's "pipeline" twin-lead ... *because nothing but the finest has gone into its design and production!*

For complete details see your Federal distributor or write to Dept. D-5101.

OUTSTANDING FEATURES OF FEDERAL'S TV-1185

- **Exceptionally low loss**
- **Holds impedance values**
- **Copperweld conductors—7/#28**
- **Leads in Weatherometer tests**
- **Flexible in low temperatures**
- **Rejects ultra-violet rays at higher temperature levels**
- **Top performer in any area**
- **Attenuation- db/100 ft.**

10 mc—	0.50	400 mc—	2.6
50 " —	0.95	500 " —	3.0
100 " —	1.11	1000 " —	4.6
200 " —	1.7		

- **SO EASY TO INSTALL:**
Expose required length of wire by stripping off polyethylene. To tight-seal, heat end of tube with match or other flame and crimp together with pliers. Sealing assures quality performance under all atmospheric conditions.

Federal

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In Canada: Federal Electric Manufacturing Company, Ltd., Montreal, P.Q.
Export Distributors: International Standard Electric Corp., 67 Broad St., N. Y.

Setting Up For TV Service

(Continued from page 26)

ger of running out of an item before it can be ordered can be minimized by keeping a "want book". Anyone drawing parts should be required to note in this book if the stock of that particular item is low. This, of course, poses a problem of what is "low stock". Although it is possible to rely on the judgment of the parts clerk, a more desirable solution is to establish a minimum quantity. This can be posted on the bin or drawer where the part is stored. On small parts, the minimum quantity can be placed in a sealed envelope; when it becomes necessary to open the envelope, parts should be reordered.

What Does it Cost

Determining what maintenance of a good service shop and an adequate parts inventory will cost a dealer in dollars and cents investment is difficult to determine. Most servicemen feel that the dollars and cents figure is relatively unimportant when measured in terms of the return the dealer can expect from his service operation.

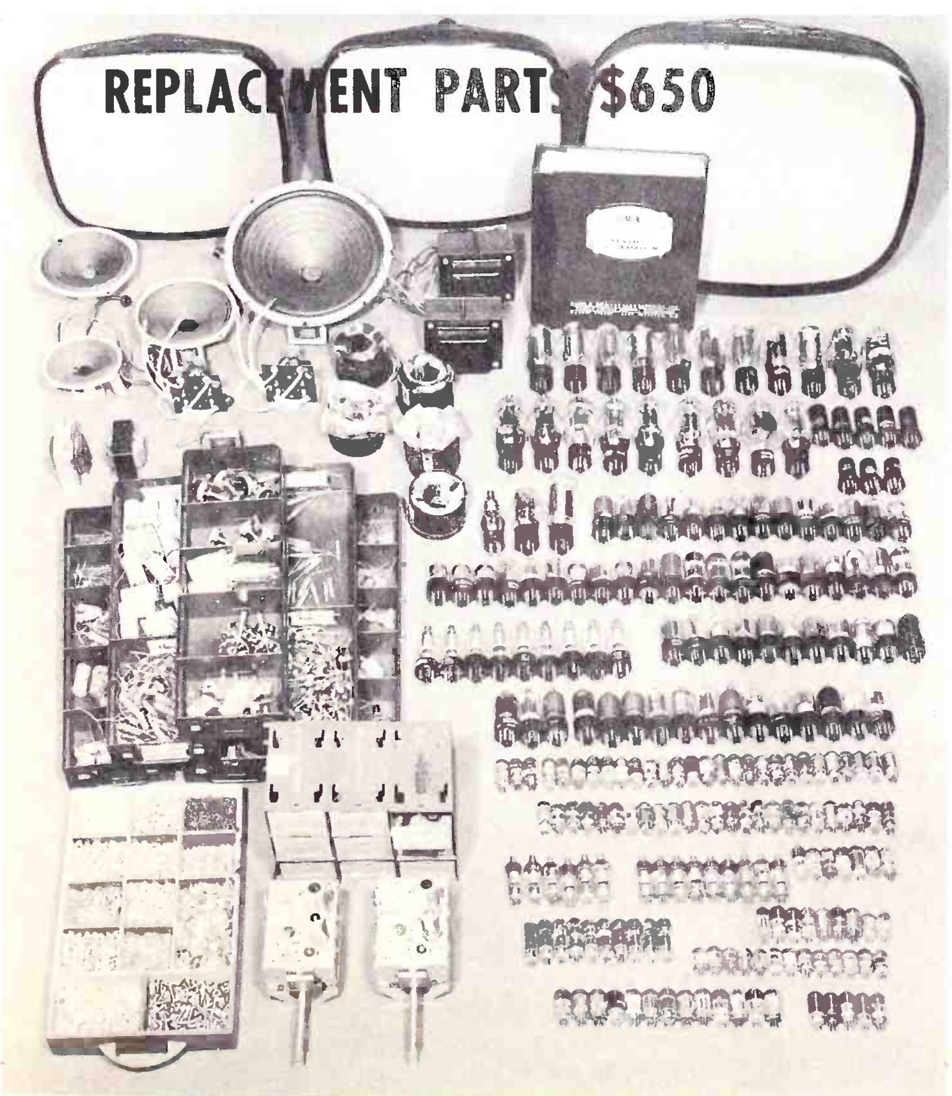
In addition, the investment varies with the dealer's location, the size of his shop and the volume of business he handles. Even with all these variables, one must consider also that dealers in the same area with the same business volume may differ in the amount of money they invest. One may feel that the "minimum" investment in equipment and parts is the wisest decision; the second may decide to spend considerably more in setting up his shop.

Du Mont's Schulman estimates the cost of a service shop in these terms (truck not included):

a. deluxe operation — about $2500 (including $1000 in parts)
b. average operation — about $1500 (in cluding $600 parts)
c. minimum operation — about $1000 (including $300 in parts).

Harold Bernstein, service manager for Emerson, uses a different basis in coming up with his estimate. For a one man operation, he says, equipment, tubes, fixtures and basic parts would require about $2500. For each additional man add about $125 more for extra tools, meters, tubes and so forth.

No matter whose estimate you accept, establishing a service shop is an expensive move in terms of dollars and cents alone. A decision as to whether the investment will pay off—both tangibly in the form of dollar income from service work and intangibly in the form of a good service reputation which builds additional set sales for the dealers—is one that must be made with reference to the dealer's own circumstances.



Some Questions and Answers, etc.

(*Continued from page 7*)

require substantial differences in the constants of the vertical output tube, or that the use of a 20% capacitance tolerance capacitor where a 5% unit is required results in instability and unsatisfactory receiver performance. We do not feel that a service technician should make changes in circuit constants in order to compensate for a replacement part that is not within the required tolerance ratings of the original component. Because we adhere to this philosophy in the listing of replacement parts, the service technician can have the greatest faith in the replacement parts which are shown in Rider Lists. It explains why our listings of suitable replacement parts show fewer parts than other listings.

Q—If you exercise care when selecting replacement parts for listing, why do you have to publish change notices?

A—For several reasons. Regardless of the extreme care which is used in checking, typographical errors in parts number listings occur. Remember that we are listing thousands upon thousands of numbers, and transpositions are possible. We try to keep the errors to the absolute minimum, but they occur.

A second reason is the changes which are made in receivers at the manufacturing point. If one part was a replacement and a change was made calling for a new replacement part, it is foolish to continue reprinting the original replacement part number—the new one with the changed part is the correct one.

We publish additions to the list because some of the replacement data arrives too late for inclusion in the printed list, and because the parts manufacturers we work with are adding new replacement parts to their line.

Q—Your replacement parts lists show only the set manufacturers' parts numbers, but not the receiver chassis in which they are used. Why?

A—This was so only in the Rider TV 10 Manual listing. In the new replacement parts listings for TV 11, which will be cumulative for TV 10 and TV 11; the parts numbers are related to the chassis in which they are used. A section of the replacement parts list for Emerson is shown herein as an example of our new listing format.

Q—Why don't you have replacement parts listing for Rider's TV 9 and earlier manuals?

A—Because we started the replacement part listing program with TV 10. However, we now are in the process of preparing data on TV 9 and earlier Rider TV Manual contents. The task of preparing the data is prodigious; we must prepare information specification sheets for the parts manufacturers, and before we do this it is necessary to correlate the contents of the receivers made during all the production runs. It will take time to do this, but it will be done. Such replacement parts guides will be available to service technicians sometime in the near future.

Fig. 2. Below: Type of spec. sheet on which the part's manufacturer lists his replacement suggestion.

This is your file copy.

JOHN F. RIDER PUBLISHER, INC.
480 CANAL ST., N. Y. 13, N. Y.

This information prepared by JOHN F. RIDER LABS. INC 480 CANAL ST., N. Y. 13, N. Y. for

Information requested below is required within 10 working days from date shown

DATE
RECEIVER Sylvania MFR. Same
MODEL NO
CHASSIS NO 1-502-3
SERIAL NO
CIRCUIT SYMBOL NO.
PART FUNCTION
REC. MFR PART NO 141-0022
~~COMPONENT MFR. & PART NO.~~ DWG # 55-77358

POWER TRANSFORMERS

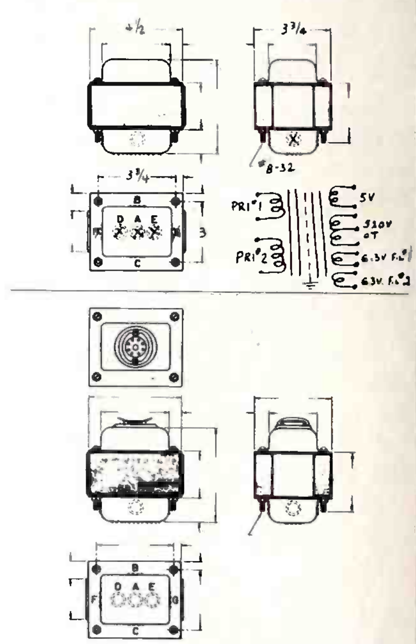
Windings	Lead Position	Lead Color	Minimum Lead Length	D-C Resistance	Volts / Cps / Amps
Primary #1	B	BLK. / BLK-RD	7 1/2 / 7 3/4		117V* 60~
~~Secondary~~ PRIMARY #2	B	WHITE / BLK-YEL	5 1/2 / 6 1/2		117V* 60~
Secondary #1 CT	B	RD / RD-YEL	7 7/8 / 3 1/4		@ 315 ma DC 260V-0-260V
Secondary #2 CT	B	YEL	6		5V 6A
Secondary #3	B FIL #1	GRN / ORANGE	5 3/8 / 5 3/8		6.3V 6.3A
Secondary #4	B FIL #2	BRWN / BLUE	6 5/8 / 5 3/8		6.3V 6.3A
Secondary #6					

Insulation Test Between FIL #1 and GROUND 2500 Volts RMS
Between and Volts Temp. Rise (Above Ambient) 55 c MAX.
Between and Volts
Ripple Input To Filter Volts Peak to Peak Ripple Output From Filter Volts Peak to Peak
Potting Compound Clearance Faraday Shield (Yes) No
Remarks: For 117V operation, Connect Pri #1 + #2 in parallel; for 234V in Series

SUGGESTED REPLACEMENTS

Manufacturer	Part Number	Remarks	Signature

JOHN F. RIDER PUBLISHER, INC., 480 Canal Street, N. Y. 13, N. Y.



VARIABLE RESISTANCE CONTROLS

NOTE: For single controls the identification may appear under the Cat. No. or Stock No. columns. If a special shaft number is shown for a single control, it appears under Inner Shaft column.

RECEIVER MANUFACTURER: EMERSON

COMPONENT TYPE and PART NUMBER	120153-B	120153-D	120160-B	120162-A	120163-D	120164-B	120166-D	120168-D	120171-B
390142	X	X	X	X					
390143	X	X	X	X					
390156					X	X		X	
390163	X	X	X	X					
390164	X	X	X	X					
390181					X	X		X	
390183					X	X		X	
390184	X	X		X					
390187			X						
390191	X	X	X	X					
390196					X	X	X	X	X
390197					X	X	X	X	X
390201					X	X		X	
390202				X	X	X	X	X	X
390207							X		X
390208							X		X
390209							X		X
390211							X		X
390219							X	X	X

REPLACEMENTS

PART NUMBER	CLAROSTAT Cat. No.	CLAROSTAT Inner Shaft	CLAROSTAT Switch No.	IRC Stock No.	IRC Kit. No.	IRC Panel Elem.	IRC Rear Elem.	IRC Outer Shaft	IRC Inner Shaft	IRC Switch No.	MALLORY Stock No.	MALLORY Kit. No.	MALLORY Panel Elem.	MALLORY Rear Elem.	MALLORY Outer Shaft	MALLORY Inner Shaft	MALLORY Switch No.
390142	AG-83-8	FKS-1/4		Q11-139							SU56						
390143	A43-5000	FKS-1/4		W-5000							R5000L						
390156	AG-61-8	KSS-5		Q11-137							U-54					DS-36	
390163	AG-61-8	KSS-3		Q11-137							U-54						
390164	AG-44-8	KSS-3		Q11-123							U-35						
390181	AG-52-8	KSS-5		Q11-129							U-43					DS-36	
390183	AG-44-8	KSS-3		Q11-123							U-35					DS-36	
390184	RTV-296			QJ-313	K-2	B17-110	B13-137	P1-224	R1-308	76-1			UF152R	UR16A			US-26
390187	RTV-362			QJ-237	K-2	B17-110	B13-137X	P1-224	R1-308	76-1			UF152L	UR16T25			
390191	AG-52-8	RS-2		Q11-129							U-43						
390196	AG-83-8	FKS-1/4		Q11-139							SU56						
390197	A43-5000	FKS-1/4		W-5000							SU14						
390201	RTV-296			QJ-313	K-2	B17-110	B13-137	P1-224	R1-308	76-1			UF152L	UR16A			US-26
390202	AG-83-8	FKS-1/4	SWB	Q11-139						76-1	U-56						US-26
390207	RTV-378			QJ-410	K-2	B17-109	B13-137	P2-116	R1-202	76-1			UF152L	UR16A			US-26
390208	AG-52-8	KSS-3		Q11-129							U-43						
390209	AG-44-8	KSS-3		Q11-123							U-36						
390211	AG-61-8	KSS-3		Q11-137							U-54						
390219	AG-52-8	FKS-1/4		Q11-129							U-43						

Fig. 3. A greatly reduced example of how variable resistors are shown in Rider's Replacement Parts Listings.

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SUCCESSFUL Servicing with TEK-FILE INDEX

MAY 1953

Checking the Accuracy of a Volt-ohm Milliammeter

by Milton S. Snitzer

A large number of service technicians put a great deal of faith in the readings they obtain daily on their volt-ohm-milliammeters. These readings, when compared with normal values of voltage, resistance, and current given in receiver service notes or obtained from a study of the schematic diagrams of the sets, often locate faults or serve as a basis for further troubleshooting. The question may arise, however, as to just how accurate are the readings obtained on a service-type volt-ohm-milliammeter (VOM). To help answer this question, we put a typical VOM through its paces. This article will describe the tests performed and will show the results obtained.

Nominal Accuracy

The nominal accuracy given by most of the manufacturers of service-type VOM's is usually 3 percent on the d-c ranges and 5 percent on the a-c ranges. These figures are percentages of the *full-scale deflection* of the meter. An accuracy of 3 percent on the 100-volt range, for example, indicates that the meter reading will be within 3 volts of the true voltage reading at any point on the scale. Assume for a minute, using this basis for rating, that a certain meter has a constant error of —3 percent over its entire 100-volt range. Then, at 100 volts applied, the meter reading will be 97 volts; at 50 volts applied, the meter reading will be 47 volts; at 10 volts applied, the meter reading will be 7 volts; and so on.

Suppose we stop to consider just what the error is at these points *expressed as a percentage of the actual voltage being measured.* At 100 volts, the error of 3 volts amounts to 3 percent (of 100 volts); at 50 volts, the error of 3 volts amounts to 6 percent (of 50 volts); and at 10 volts, the 3-volt error amounts to 30 percent (of 10 volts). Since the meter pointer is displaced from the true voltage reading by the same amount at these three values (even though the percentages just calculated increase at lower voltages), it is customary to describe this meter's error by a constant percentage. This can be done if the error is given as a percentage of the full-scale reading. In this case, the meter would be said to have a constant 3-percent error.

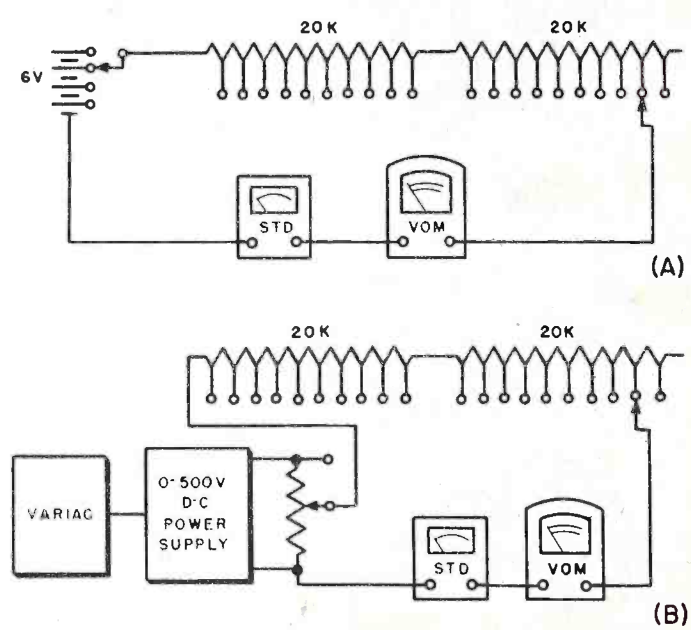

Fig. 1 Test set-ups for checking d-c current ranges on VOM.

The 3-percent accuracy usually specified for the d-c ranges of service-type VOM's represents the maximum tolerable error at any point on the d-c scale. In practice, the meter error is usually less than this amount and is *not* constant over the entire scale. In addition, the meter may read high (positive error) at some points on the scale or low (negative error) at other points. Of the 3 percent maximum possible error, a maximum of 2 percent may be caused by the meter movement itself and a maximum of 1 percent may be caused by series and shunt resistor tolerances. More recent and more exact meter movements being used in ordinary service-type VOM's have a somewhat closer tolerance than the 2-percent figure just mentioned.

The 5-percent accuracy usually specified for the a-c ranges also represents the maximum tolerable error at any point on the a-c scale. Of this figure, about 2-percent error may be the result of meter movement tolerances and 1-percent error may be the result of resistor tolerances. The remaining error is caused by variation in a-c rectifier characteristics.

D-C Current Ranges

The d-c current ranges of a representative VOM were checked up to a value of about 500 ma. The test set-up for low currents is shown in Fig. 1A, while the set-up for high currents is shown in part B of the figure. In both cases, a standard laboratory-type milliameter with an accuracy of ¼ percent of full scale was inserted into the circuit in series with the VOM (switched to its d-c current ranges). Two 20,000-ohm power resistors, with 10 fixed taps on each, served as current-limiting and current-regulating resistances. D-c voltages for the circuits were obtained from four 1½ volt dry cells in A or from the 0-500 volt d-c power supply in B. Input to the latter was regulated by means of a Variac; the output contained a variable voltage-divider resistor. With these set-ups, a wide range of currents was obtained, and it was only necessary to compare the current readings indicated on the VOM with those obtained on the laboratory-standard milliameter.

All d-c current ranges up to 500 ma were checked and the results were plotted on a graph. This graph showed the amounts by

(*continued on page* 9)

Mismatched Television Components

Part 1 - The Vertical Output Transformer

by Sidney C. Silver

This is the first in a series of articles on Mismatched TV Components.

Frequently a variety of conditions and circumstances relating to TV replacement parts set up a situation which requires very serious deliberation by the service technician. This is especially true where sweep components are concerned. Let's look into the matter of vertical output transformers. Some of the details will be presented in this issue of SUCCESSFUL SERVICING and more will follow in subsequent issues.

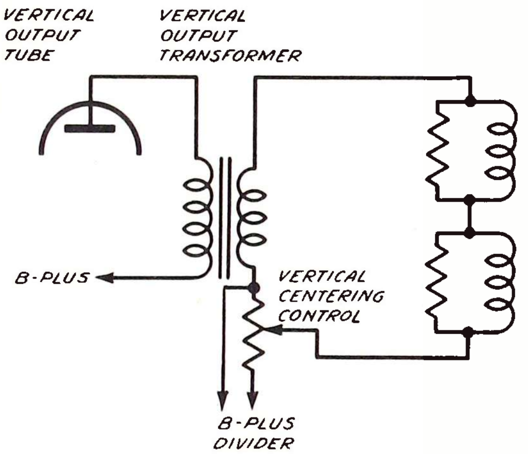

Fig. 1. Schematic of a typical vertical output transformer.

The fundamental purpose of this transformer is to couple the vertical deflection windings to the vertical output tube. A typical circuit is shown in Fig. 1. More rigorously stated, the output transformer matches the impedance of the vertical deflection winding to the plate impedance of the output tube. This is a requirement because the impedance of the deflection winding is very much less than that of the output tube's plate circuit.

When the impedance conditions in the vertical output system are correct, a linear vertical deflection is obtained. In addition, the output tube is operating within its rated plate current limits. The necessary latitude in variation of all the preset controls tied to the vertical output system is available and the signal voltage amplitudes required for the full vertical deflection prevail.

Output Transformer Ratings

Although the design of the vertical output transformer, since it is a pulse transformer, is somewhat elaborate, the description necessary for the determination of what is a suitable replacement is relatively simple. Since the transformer is supposed to present a rated value of primary impedance with a fixed amount of direct current flowing through the primary winding, this constant can be stated by simple numbers. Since it is supposed to provide a specific step-down turns ratio between the primary and secondary windings, this too can be stated by simple numbers. For example, a description might be "primary impedance is 19,000 ohms at 15 ma d.c. and 13:1 turns ratio". Given any one set of constants for the transformer, the vertical output tube *sees* the required high impedance when it looks into the vertical winding, and the yoke winding *sees* the required low impedance when it looks into the plate circuit of the output tube.

These two ratings are, therefore, sufficient to describe a vertical output transformer, but do not necessarily indicate its complete suitability as a replacement. The reason for this is the absence of the required plate load impedance information for the vertical output tube in service data. So, a change in transformer description is warranted. The turns ratio rating remains, but instead of quoting the required primary impedance of the transformer, the device is referred to specific tube type number(s) of the output tube with which it can be used. By and large, a description of this type is not unsatisfactory for this reason: while all vertical output tubes of like type number are not necessarily operated under exactly the same voltage and current conditions they are not too far apart. However, similar type tubes are frequently used with vertical deflection windings of unlike inductance, therefore impedance. This means that, while the impedance ratings of the primary of the transformer may be alike in a variety of receivers, the turns ratio ratings of the transformers will differ; that is, if different vertical deflection windings are used.

How does this turns-ratio rating of the transformer modify the selection of the replacement part? Much more so than might seem to be the case upon a casual evaluation of the figures involved. The following tests, while not the full range of experimental verifications which are being carried on, will illustrate the point satisfactorily.

A Case of Mismatch

The standard of comparison in one series of TV receiver tests is a transformer rated at a primary impedance of 19,000 ohms with 15 ma of direct current in the primary and a 13:1 turns ratio. A 10:1 vertical output transformer with the same primary impedance rating was then substituted in the perfectly operating receiver in place of the original transformer of 13:1 turns ratio. Before any preset control adjustments were made the following were observable on the picture: the linearity was bad, with the top of the picture compressed severely and the bottom spread vertically. Overall picture height was appreciably smaller. This is shown in Fig. 2. The plate current in the vertical output tube rose to 16 ma instead of the original 15 ma. The operating plate voltage dropped from 300 volts to 285 volts d.c.

The various controls associated with the vertical output system were then adjusted for the best possible picture. This required a compromise between these adjustments, ending up with the vertical linearity control adjusted to maximum and the height control reduced. This sequence of adjustment resulted in a marked downward shift of the picture, with the result that the top of the picture tube screen was blank, while a considerable portion of the bottom of the raster was driven out of view. Fortunately, this receiver had a vertical centering control that provided a broad enough range of compensation to correct this condition. When the picture was recentered, a bright horizontal bar, indicating foldover, became evident

(*continued on page 24*)

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★ Thrust Bearing, Model TA-6 . . .	4.95
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Curtain Time

Outlawing Bait Advertising

Bait advertising has been a common practice in many fields. The television receiver servicing field has frequently suffered from it. Some TV service facilities have offered the public sales approaches which just cannot be lived up to—and still stay in business. Under the circumstances the only reasonable conclusion one can draw from these ads is that it is *bait advertising*. Beginning with April 14th, it can no longer be done in the Commonwealth of Massachusetts.

A new law, was signed by the Governor of that state, on the date mentioned above. It imposes a $500 fine on any person, firm, or corporation found guilty of advertising merchandise or service for sale as part of a plan or scheme with the intent not to sell said merchandise or commodity of service, or with the intent not to sell at the advertised price.

A law of this kind cannot be criticized, except by those whose operations are in conflict with it. While we do not believe in the idea of setting up new laws to take care of everything that happens in daily life, a regulation of this kind could well be on the statutes of every state. If it exists, but never has been put to use, the time has come to do so.

For what it may be worth, the Better Business Bureau declares bait advertising to be "an alluring offer to sell something which the advertiser does not actually intend to sell or deliberately avoids selling. Its purpose is to get the customer into the store, or a salesman into the home so as then to sell something else instead, usually at a higher price, or on a basis more advantageous to the advertiser." There are many examples of this in TV service sales offers.

Every state should have a law against bait advertising. Service facilities interested in combating this type of advertising might do well to get their state legislators to enact a similar bill. *A law like the above is better than licensing!*

While on the subject of licensing radio and TV service technicians, it never ceases rearing its ugly head. We have not stopped analyzing the subject for more than 15 years. No matter how we look at it, it just is *no good*. If it would cure one evil it would create five others that are much worse. We have no axe to grind when we say that it will always be to the best interests of the servicing industry if they never cease their fight against licensing of the service technician.

Orchids to Raytheon

Raytheon TV and Radio Corp. has put on a series of UHF lectures to the public via several UHF television stations. The response has been tremendous. The talk, illustrated with slides and pictures of various kinds, attempts to get across to the public the idea that the station expends a substantial amount of money in the effort to put a program on the air, and that to receive the picture and sound properly, the receiving installation must be properly made.

Commercialism is made conspicuous by its absence. It is as much a public service as a program can be made. The sponsor's name is mentioned just twice—at the beginning and at the end of the program. From what we can gather, it is a sustaining program; hence the cost consists mainly in supplying the necessary talent and the displays. The lecture lasts about 30 minutes and Raytheon experienced no difficulty in getting time from a number of UHF stations. They have shown over stations in Atlantic City, Wilkes Barre, Reading, Youngstown, and are planning others.

They carry the viewer through various stages of receiver performance, involving such details as noise interference and good picture quality. The theme is that qualified technicians are required to make the installation, and unless it is done properly, all the effort made by the station to put a good program on the air is wasted, as is the knowledge and ingenuity of the TV receiver manufacturer.

Anything that can be done to bring the TV service technician to the attention of the public is worthwhile, as is everything which will aid the public in understanding not only the need for good UHF installations, but that it isn't just one of those casual things which involves no know-how. Congrats to Raytheon . . . Let's hope that other receiver manufacturers do likewise.

Picture Tube Implosions

It is said that familiarity breeds contempt. This certainly applies to the handling of picture tubes. Too many service technicians are prone to handle these tubes with a great deal of disdain, and in so doing are courting trouble — perhaps far more than they can take care of! Great credit is due the picture tube manufacturers for producing tubes which rarely implode. But this is no license for careless handling. The record of picture tube implosions is marvelous, but it is not perfect.

Personnel in factories are always cautioned and frequently penalized for not exercising the necessary care. But there is no one to remind the TV service shop owner or his service technician that one must always be on guard against implosions when handling these tubes. We have seen more than one technician grasp the tube by the neck and virtually heave it onto the back seat of an automobile, or even let it fall onto a bench.

One incident can be enough to maim someone for life. Why take the chance when it can be avoided. There is always the first time for everything — and usually when it is least expected. Wear gloves and protective glasses when handling picture tubes!

Knowledge is Power

One of the oldest phrases used in the field of education is "knowledge is power". Knowledge rather than luck or guesswork is behind the rise of civilization. From the highest to the lowest levels of human effort, knowledge has made things easier for the individual. The TV servicing industry is no exception. The more the technician knows the easier is his job . . . Even if you, as a technician, are interested in the practical details concerning receivers — get all the fact — not just some . . . There is only one place where you will find it — Rider Manuals—Tek-Files and Rider published text books . . . They are written to give you power through knowledge.

John F. Rider

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Video Amplifier Response Testing

The following material is excerpted from Chapter 10 of the brand new Rider publication TV SWEEP ALIGNMENT TECHNIQUES.

The broad response characteristics of video amplifiers generally exceed the range of service shop test facilities. Because of this, it becomes necessary to divide video response testing into two categories, namely, low frequency response and high frequency response. The low frequency response can be checked with square wave technique and the high frequency response, with a video sweep curve.

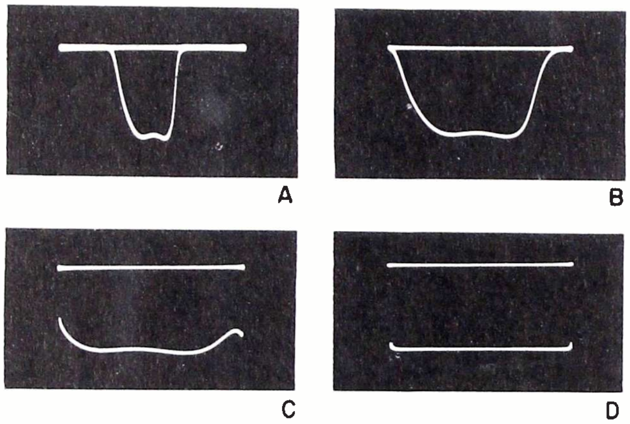

Fig. 1. Developing the essential ingredients of a square wave from a small portion of a sweep curve.

Although square wave generators are commonly available in receiver design laboratories, these instruments are rarely found in service shops, so it is impractical to assume that low frequency response testing can be done in the service shop with a square wave generator. An alternate source for an adequate low frequency signal is, however, to be found in the use of a rectified sweep signal.

The curve produced as the result of rectification of a sweep signal at the second detector and shown in Fig. 1A, is generally representative of frequencies in the lower portion of a 0 to 5 megacycle video spectrum.

Basically, this detector output curve is established by 60 cycle horizontal deflection of the cathode ray beam. The forward sweep through the curve consumes half of the cycle time and the return trace across the base line accounts for the other half.

By reducing the sweep width, the curve in Fig. 1A can be enlarged to a degree where the start and finish of the sweep range covers only a small portion of the original response range, as exhibited in Fig. 1B and C.

Fig. 1D shows how minimum sweep width includes only a very small part of the flattop of the original demodulated curve. Inasmuch as both ends of the sweep traces in Fig. 1D suddenly change between base line and maximum curve amplitude and both flattop and base line traces are parallel, the essential ingredients of a 60 cycle square wave are present in this segment of the sweep curve. The square wave is, however, folded back on itself producing a block formation. By changing the scope timing to employ 60 cycle sawtooth deflection, the square wave can be unfolded and presented in conventional fashion as in Fig. 2A. Further change in scope timing to a 30 cycle sawtooth deflection produces the more desirable exhibit of two complete cycles of the 60 cycle square waveform. This is pictured in Fig. 2B.

When observing this waveform at the grid of the first video stage, it is advisable to check for overloading by applying a d-c vacuum tube voltmeter to the same grid. The sweep input signal should be kept just below the level where negative voltage is noticed, so the stage will not be tested in an overloaded condition. However, when observing a square wave in video output circuits following the last tube, some grid overloading at the input stage may establish a better waveform as a basis for further comparison.

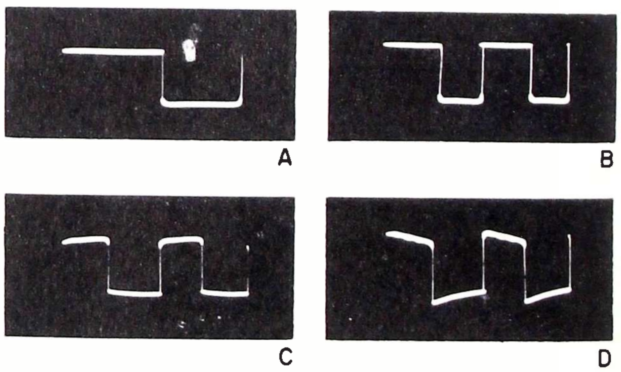

Fig. 2. Using the sweep generator developed square wave to check the low frequency response of a video amplifier.

Fig. 2C is indicative of the 60 cycle square waveform to be found at the video amplifier plate. Fig. 2D, taken after advancing the scope probe to the picture tube side of an output coupling capacitor, shows tilt in the waveform.

Due to the diminishing amplitude characteristic of the tilt, it indicates loss of low frequency response. Replacing the coupling capacitor with one of larger value should result in an improvement and in restoration of the kind of waveform pictured in Fig. 2C.

As a short cut to low frequency video response testing, the flattop portion of a sweep curve may be used directly. Observations of the amount of tilt introduced by changing from video input to video output will serve as a test which simulates that performed by the flat part of a square wave. Fig. 3A, made from a signal at the video input grid can thus be compared favorably with Fig. 3B, made from the same input signal at the video output.

After completing the foregoing test for low frequency response, the scope probe can be returned to the second detector output connection for high frequency response checking. The regular sweep curve is again reproduced from either an i-f or an r-f applied sweep signal. This is followed, in Fig. 4A, by the addition of a picture carrier marker from a closely coupled marker generator.

Increasing the strength of the marker signal causes an extension of the tapered beat frequency pattern on both sides of the carrier zero beat location, as exhibited in Fig. 4B. A further increase in the marker signal level produces a strong beat pattern and overloads the i-f amplifier sufficiently to compress the entire curve amplitude as in Fig. 4C. By adding still more marker voltage or by reducing the sweep input voltage, the original curve trace can be made to disappear completely into the base line. As shown in Fig. 4D the curve is completely replaced by a beat signal which extends to the extreme limit of the i-f pass band, simply because the sweep signal is applied through the i-f amplifier.

The result of impressing both the sweep and the strong marker signal on the second detector is the creation of a video sweep signal covering approximately 5 megacycles. The zero beat point is indicated by the notches both above and below the base line near the left end of the video sweep in Fig. 4D. The right end of the video sweep is limited by the maximum range of the i-f sweep signal, which is in turn controlled by sound trap absorption.

Using Sweep Alignment Equipment

by Art Liebscher

The exponential type curve along the video sweep range is indicative of the bandpass characteristics of the oscilloscope used for this observation. By substituting a laboratory oscilloscope with a 10 megacycle amplifier response, the video sweep range can be seen in its entirety, as shown in Fig. 5A.

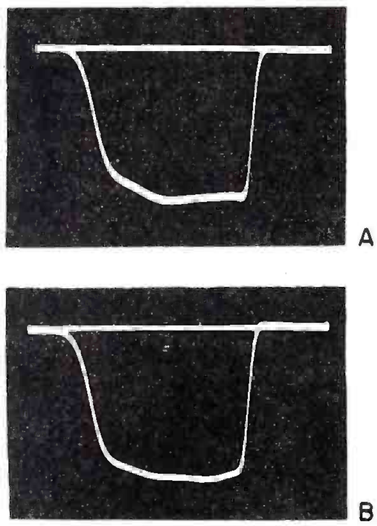

Fig. 3. Checking low frequency response of a video amplifier by noting the amount of flattop tilt.

After observing the video sweep signal with a direct scope connection at the second detector output, a crystal demodulator probe added to the scope cable and applied to the same test point will provide a peak rectified curve, as in Fig. 5B. This curve matches the outline of the video sweep signal of Fig. 5A.

Although, as previously indicated, scopes of moderate response capability can not show all of the video sweep signal, the signal is, nevertheless, present and is therefore responsible for the production of a complete demodulated curve. As an illustration of this typical condition, the demodulated curve in Fig. 6A originated from the video sweep signal portrayed incompletely in Fig. 4D by a service type oscilloscope.

The method explained herein, which is based on heterodyning a sweep signal and a fixed signal at the second detector has a technical advantage over the use of a 0 to 5 megacycle signal applied directly from a sweep generator to the video amplifier input. The advantage lies in the fact that it is not necessary to disturb any of the detector loading or to change any of the normal capacitive conditions surrounding the detector. The resultant video sweep signal thus incorporates the factors affecting the transfer of the signal from i-f to video.

The problem of distortion, constantly present in video curves just as in other sweep curves, can be checked in the usual manner of reducing the input signal to make the curve disappear into the base line and then observing the return of the curve to a level just below that which causes any change in its shape.

This test can be made by control of the marker generator output after the sweep generator has been set at a low enough output to maintain the video sweep signal in a consistently symmetrical form with equal amplitude both above and below the base line.

An RCA 17T153 receiver with a crystal second detector was used for the examples pictured here. It was noted that best results were obtained at less than —4 volts d-c, measured at the first video stage grid.

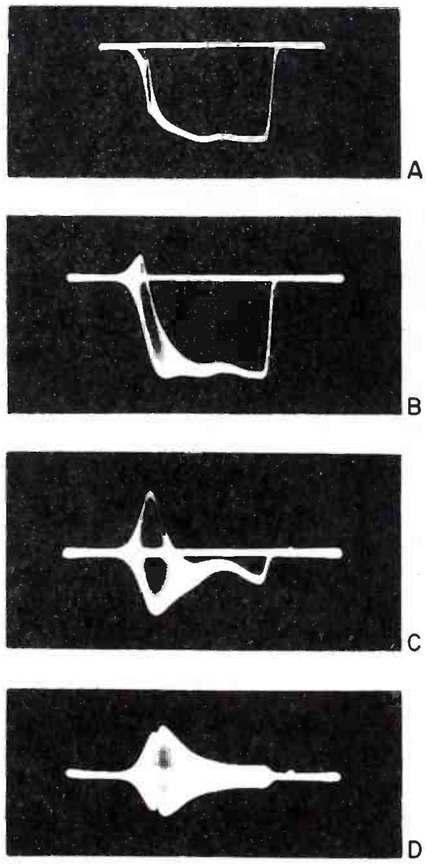

Fig. 4. Overcoupling a marker generator to create a video sweep signal covering approximately 5 megacycles.

Adjustment of sweep output voltage made little difference below the —4 volts d-c indication. The video sweep signal level was essentially determined by marker output voltage.

After demodulating the video sweep signal, shown in Fig. 4D, to obtain the video curve in Fig. 6A, the latter should be studied for comparison with the video output curve in Fig. 6B.

The actual difference between the video input curve in Fig. 6A and the output curve in Fig. 6B, indicates the change in video response resulting from the influence of the video amplifier circuits. Alteration of peaking coils, resistance loads, and capacitance values, including lead dress, may be employed to correct excessive differences between input and output curves.

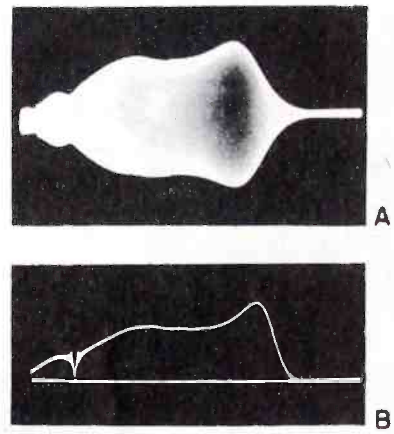

Fig. 5. Video sweep range is seen in its entirety on a wide band laboratory oscilloscope in curve A. Curve B shows a peak rectified curve, obtained through a crystal demodulator probe, which matches the outline of curve A.

If it is desired to check frequency points on the video curve, an auxiliary signal generator with a range of .1 to 5 megacycles can be used to furnish a variable marker. The marker output may be loosely coupled to the video amplifier input.

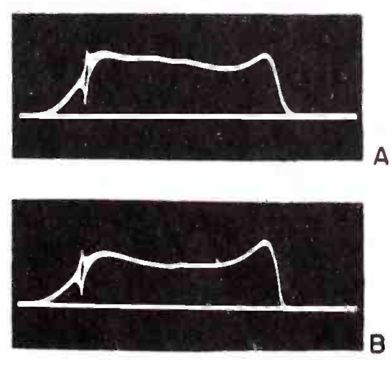

Fig. 6. Probe detected video sweep signal obtained at the input (A) and at the output (B) of the video amplifier.

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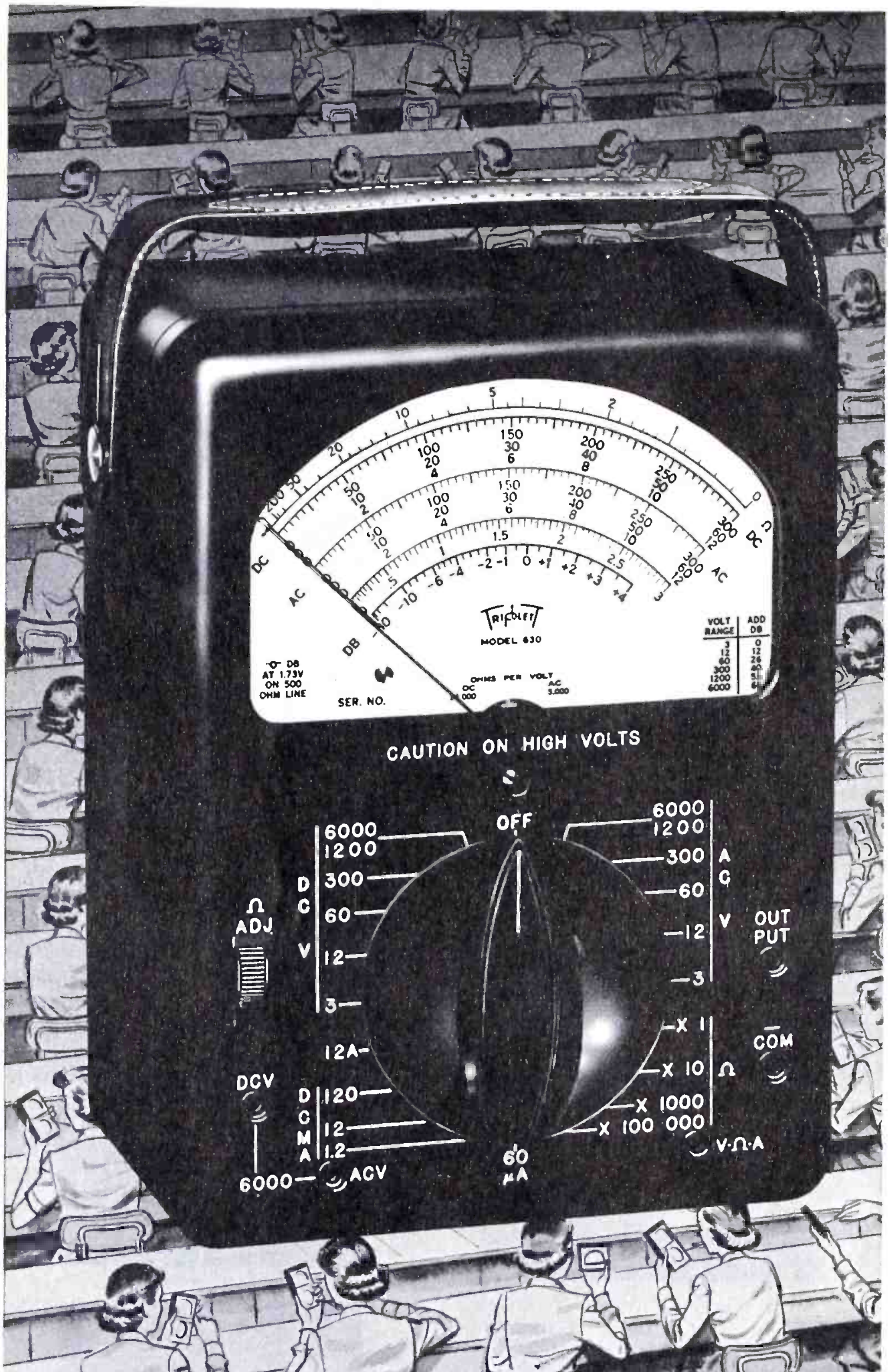
TV Replacement Parts Series

The continuation of the TV Replacement Parts series of articles will be picked up in June. Space limitations dictated its omission in the May issue.



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by R. L. Triplett
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Checking the Accuracy of a Volt-ohm Milliammeter

(*continued from page 1*)

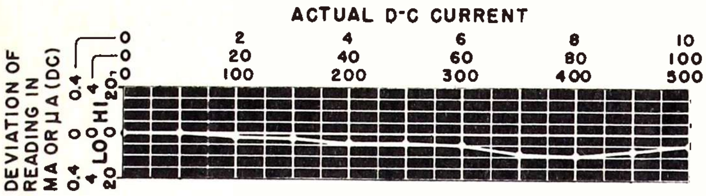

Fig. 2. D-C current readings of VOM compared with laboratory standard.

which the VOM readings were higher or lower than the true current (as indicated on the standard meter). Curves of all the current scales were found to be practically identical. Then an average curve was carefully drawn for all the d-c current ranges checked. This average curve is shown in Fig. 2.

It can be seen from this figure that where there is error in the VOM readings, this error is negative; that is, the meter reads low. The maximum error occurred at 4/5 of full scale, at which point the VOM reading was 0.2 ma low on the 10-ma range, 2 ma (or 2μa) low on the 100-ma (or 100-μa) ranges or 10 ma low on the 500-ma range. This represents an error of *—2 percent* of full scale. Note that, at all other points on the scale, the error was less than this amount. At midscale, for example, the error amounted to less than —1 percent of full scale.

D-C Voltage Ranges

The d-c voltage ranges of the VOM were then checked up to a value of about 500 volts. The same power supplies were used to supply voltages for this test as had been used to check the current ranges (see Fig. 3). Here, however, one of the 20,000-ohm power resistors (with its 10 taps) was used as a voltage divider across the source voltage. By varying the battery connections and the connections to the resistor a great number of test voltages were available to check the low-voltage ranges. The higher voltage ranges were checked on at least a dozen points on each scale by means of the 0-500 volt power supply, whose input could be regulated with the Variac and whose output could be controlled by means of the two tandem voltage dividers. In this set-up, a laboratory-standard voltmeter, accurate to within ¼ percent of full scale, was connected in shunt with the VOM (now switched to its d-c voltage ranges). The readings obtained on the VOM were then compared with those obtained on the standard meter.

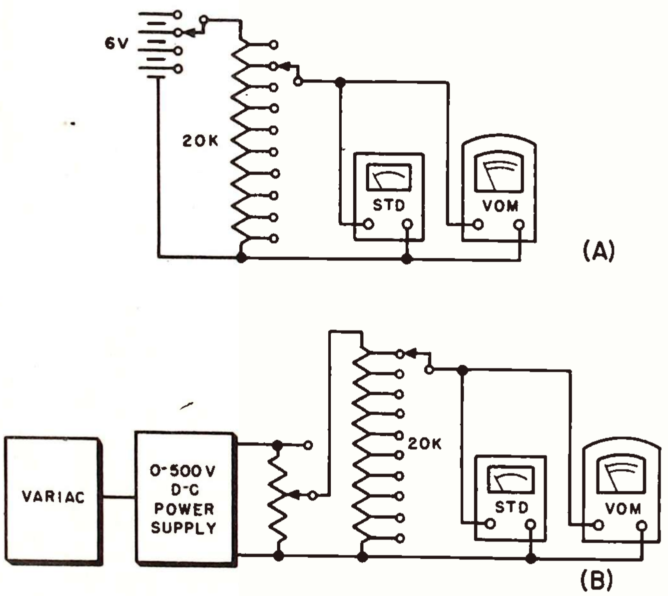

Fig. 3. Test set-ups for checking d-c voltage ranges on VOM.

Individual curves were then plotted showing the error in the meter reading for the d-c voltage ranges. These curves were almost identical from one range to another. Then an average curve was carefully constructed showing the extent by which the VOM readings differed from that of the standard. This average curve is reproduced in Fig. 4. Note that here, again, the readings obtained on the VOM were less than those obtained on the standard meter over most of the range; thus, the error was negative. Also, the maximum error occurred at 4/5 of full scale. On the 10-volt d-c range for example, the VOM reading was low by 0.15 volt. This amounted to a maximum error of *—1½ percent* of full scale. At midscale, the error was only about one-half of this amount, while at lower readings, the error diminished still more.

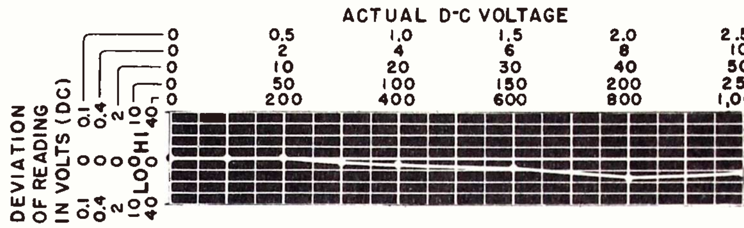

Fig. 4. D-C voltage readings of VOM compared with laboratory standard.

A-C Voltage Ranges

To check the a-c voltage ranges, the same test set-up as was shown in Fig. 3B was employed except that the full-wave rectifier tube was removed from the d-c power supply and the plate and filament transformers used furnished the required high and low a-c voltages. With this arrangement, sine-wave voltages up to almost 1,000 volts were available for checking. A laboratory-standard dynamometer, with an accuracy of ½ percent of full scale, furnished the a-c voltage readings against which the VOM (switched to its a-c voltage ranges) was checked.

When the individual curves were plotted showing the VOM readings against the true a-c voltages, it was found that, although the general shapes of the curves were similar, sufficient differences existed so that a single average curve would not tell the whole story. In the case of the d-c ranges, it was possible to draw an average curve that was, at any point, within ½ percent (of full scale) of corresponding readings taken on different ranges. The operation of the copper-oxide meter rectifier and the a-c shunts and multipliers made this impossible on the a-c ranges.

It was discovered that the error in readings obtained on the two high a-c ranges was just about identical. Hence, a single average curve was constructed for these two scales (see solid line in Fig. 5). This curve indicated a positive error over most of the scale (the VOM

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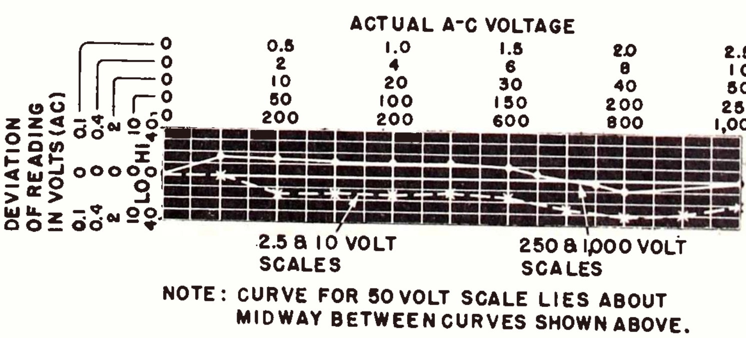


Fig. 5. A-C voltage readings of VOM compared with laboratory standard.

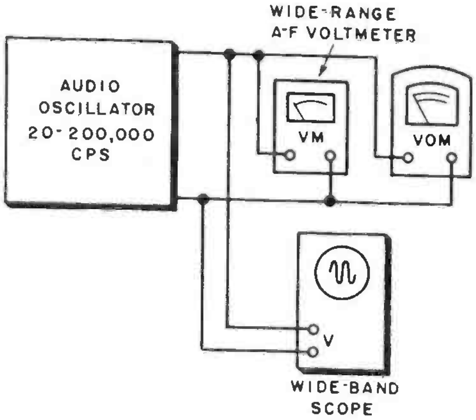


Fig. 6. Test set-up for checking frequency response of VOM.

read high). The greatest extent of this error, which occurred between 1/10 and 2/10 of full scale, amounted to *+1½ percent* of the full-deflection reading. The results obtained on the two low a-c ranges were quite similar to each other, so that a single average curve (shown dashed in Fig. 5) could be plotted for these ranges. Here, the VOM read low over most of the range, reaching its maximum error at 4/5 of full scale. At this point, the reading on the 10-volt scale, for example, was 0.3 volt too low. This amounted to an error of *—3 percent* of full scale. The curve for the intermediate a-c voltage range, which is not shown in the figure, lies about midway between the curves that are drawn.

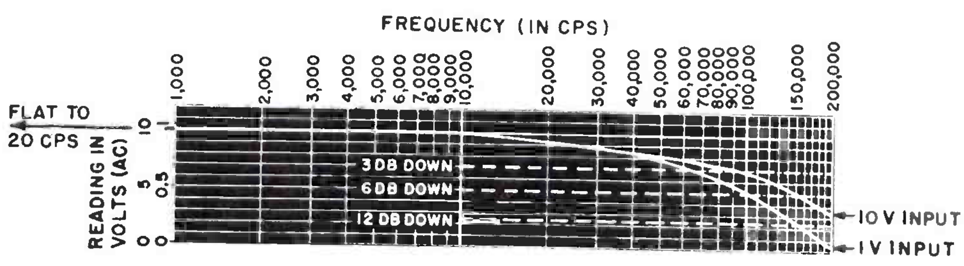


Fig. 7. Frequency-response curves of VOM at two input voltages.

Before leaving the a-c voltage ranges, it was decided to check the accuracy of the readings obtained over a wide band of frequencies to see the response of the meter and its copper-oxide rectifier. The test set-up used for this purpose appears in Fig. 6. Here the output of a wide-range laboratory audio oscillator, which can be adjusted over a frequency range from 20 cycles to 200 kilocycles, was connected to the VOM. A wide-band oscilloscope and a wide-range a-f voltmeter monitored the output of the oscillator at all times so that its signal could be kept at a constant level. Two frequency runs were taken, one with a constant input voltage of 1 volt and the other at 10 volts. The results of this procedure are shown in the curves of Fig. 7.

These response curves are quite flat from 20 cycles to 10,000 cycles, so that a-c readings taken between these frequencies need not be corrected. Above 10 kc, however, the readings begin to fall off. These reduced readings, which are quite normal for this type of a-c meter, are due to the shunt capacitance of the copper-oxide rectifier, the increased impedence of the meter itself to higher-frequency ripple currents delivered by the rectifier, and the increased resistance of the multiplier resistors. The response curves show that the a-c reading is down 10 percent of the actual input voltage at a little above 20 kc. At about 60 kc, the meter reading is down 30 percent (3 db) from the 1-volt level; at about 90 kc, the reading is down 30 percent (3 db) from the 10-volt input level. The reading is reduced to one-half (6 db down) of the 1-volt input at about 100 kc, and of the 10-volt input at about 150 kc.

Note: All the a-c measurements described above were made with sine-wave input voltages. Other waveshapes would have resulted in a greater error in reading.

Resistance Ranges

To check the resistance ranges of the volt-ohm-milliammeter, it was only necessary to use the meter to read the values of highly accurate resistors. These resistors were installed in precision decade-resistance boxes which supplied resistances ranging from 1 ohm to 10 megohms to an accuracy of 1/10 percent. Because of the highly nonlinear scales that are used in the resistance ranges, the same type of curve which was used previously (showing the extent of the high or low reading) is not satisfactory. For example, assume that the meter pointer reads low by about 1/16 inch on the resistance scale over most of the range. At the low end of the scale, 1/16 inch might represent about 0.2 ohm, while at the high end of the scale, this same 1/16-inch displacement might represent 500 ohms. As a result, if a curve were plotted in which the vertical axis showed the amount of high or low reading, such a curve would be highly misleading. This would be true since only a slight meter error could result in an actual reading that is many hundreds (or even thousands) of ohms too high or too low. If the vertical axis on such a graph could show these large values conveniently, it certainly could not show, on the same range, errors of a few tenths of an ohm such as might occur at the low end of the scale.

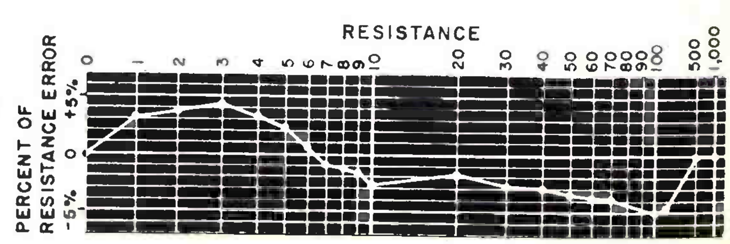
A much more satisfactory method of showing the results of a resistance check is illustrated by the curve in Fig. 8. This curve represents the average of similarly plotted curves for the individual resistance ranges of the VOM. Points on this graph show the extent of the error in reading *expressed as a percentage of the actual resistance at these points.* For example, consider the maximum error on the high side (positive error), which occurs at a resistance of 3 (or 300 or 30,000) ohms. This error amounts to about +4 percent of 3 (or 300 or 30,000) ohms. Thus, the VOM reads about 3.12 ohms on the lowest resistance scale when it should be reading exactly 3 ohms. The maximum error on the low side (negative error) occurs at a resistance of 100 (or of 10,000 or 1,000,000) ohms. This error amounts to about —5 percent of 100 (or of 10,000 or 1,000,000) ohms. Thus, the VOM reads about 95 ohms on the lowest resistance scale when it should be reading exactly 100 ohms.

Although the curve just shown is fairly convenient to use in determining the errors in resistance readings on a VOM, it is not the most common method of giving the accuracy of the resistance scales. Most manufacturers, when they do give a figure for percentage accuracy of resistance measurements, almost always express the error as a *certain percentage of a linear scale* (or linear arc length). This goes back to the idea of meter accuracy expressed as a percent of full scale and ties in the error obtained on the resistance ranges to the linear d-c scales. If the percentages of resistance error shown in the curve of Fig. 8 are converted into errors on a linear scale, then it would be found that the resistance accuracy is *better than 1½ percent* of the linear arc length on any resistance range.

Summary

This article has shown and described the methods used for checking the accuracy of a service-type volt-ohm-milliammeter. This accuracy was found to be within —2 percent of full scale on d-c current, within —1½ percent of full scale on d-c voltage, and from +1½ to —3 percent of full scale on a-c voltage. While the detailed step-by-step procedure described above was carried out in its entirety for one instrument, spot checks at various points on the scales of other volt-ohm-milliammeters disclosed that the results obtained are fairly typical.

Fig. 8. Resistance readings of VOM compared with standard resistors.



RIDER · TEK-FILE INDEX No. 9

PACKS 1-83

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BECAUSE OF CHANGES THAT HAVE BEEN MADE, THE NO. 9 TEK-FILE INDEX SUPERCEDES ALL OTHERS. DON'T USE THE EARLIER INDEXES.

To locate service data instantly, all you need to know is the manufacturer's name and the model or **chassis** number of the set.

The index is compiled alphabetically, according to manufacturer. Note the column headings at the top of each page: MODEL, PACK, PAGES.

Model numbers run in numerical sequence, starting with the smallest number under a manufacturer's name. This applies also to model numbers using letters (i.e. model AR precedes model CG). Model numbers starting with letters precede model numbers starting with numbers.

Under the column PACK, the number is the TEK-FILE Pack number.

Under the column headed PAGES, the first number indicates the Rider TV Manual in which the data originally appeared and second numbers indicate the page where the information starts.

As an example, let's look up ADMIRAL model 36X36AS. It shows that the information is in Pack No. 1, ADMIRAL. The data (8=23) starts on page 8-23.

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MODEL	PACK	PAGES
ARVIN INDUSTRIES, INC. (Cont'd)		
TE289, Ch.	43	6=10
TE-289-2, Ch.	1	8=1
TE289-3, Ch.	43	7=1
TE290, Ch.	43	7=5
TE300, Ch.	43	9=1
TE-302, Ch.	1	8=6
TE-302-1, Ch.	1	8=6
		8=9
TE315, TE315-1, TE315-2, Ch.	43	9=1
TE 331, Ch.	56	10=1
2120, 2121, Ch. TE289-3	43	7=1
2120CM, 2121TM, Ch. TE-289-2	1	8=1
2122TM, Ch. TE289	43	6=10
2123, Ch. TE289-3	43	7=1
2123TM, Ch. TE-289-2	1	8=1
2124, Ch. TE289-3	43	7=1
2124CCM, Ch. TE-289-2	1	8=1
2128, Ch. TE289-3	43	7=1
2126CM, Ch. TE-289-2	1	8=1
2160, 2161, 2162, 2184, Ch. TE290	43	7=5
3100TB, 3100TM, Ch. TE272-1	43	6=1
3101CM, Ch. TE272-1	43	6=1
3120CB, 3120CM, Ch. TE272-2	43	6=1
3121TM, Ch. TE272-2	43	6=1
3160CM, Ch. TE276	43	6=1
4080T, Ch. TE282	43	6=13
4162, Ch. TE 286	1	8=4
5170, Ch. TE-302	1	8=6
5170, Ch. TE-302-1	1	8=6
		8=9
5171, Ch. TE-302	1	8=6
5171, Ch. TE-302-1	1	8=6
		8=9
5172, Ch. TE-302	1	8=6
5172, 5173, Ch. TE-302-1	1	8=6
		8=9
5204, 5206, Ch. TE300	43	9=1
5210, 5211, 5212, Ch. TE315, TE315-1, TE315-2	43	9=1
6175TM, 6179TM, Ch. TE 331	58	10=1
ASTORIA See MACY'S		
AUTOMATIC RADIO MFG. CO., INC.		
TV-5217, TV-5217T	58	10=1
BELMONT See RAYTHEON TELEV. & RADIO CORP.		
BENDIX RADIO DIV.		
Belair, Guilford	48-B	7=1
C172, Belair	48-B	7=1
OAK3	58	10=1
C182	48-B	7=1
C200, Guilford	48-B	7=1
T170	27	5=1
T171	48-B	7=1
21K3, 21KD, 21T3, 21X3	56	10=1
2051	27	5=1
2060, 2070	27	5=1
3051	27	5=1
6001, 6003	27	5=1
6100	27	5=1
7001	27	5=1
BENRAY ELECTRONICS CORP. (SURREY)		
17T31, 20T31, 24T31, See VIDEO PRODUCTS 630 Series	69	10=1
621-20, 621-16, See TRAD T-20E Series	54	9=1
CADILLAC ELECTRONICS CORP.		
F-16	2	8=1

MODEL	PACK	PAGES
CBS-COLUMBIA INC. Also See AIR KING PRODUCTS CO., INC.		
17C18, 17M18, 17T18, Ch. 817	59	10=1
20M18, 20M28, 20T18, Ch. 820	59	10=1
817, 820, Ch.	59	10=1
CAPEHART-FARNSWORTH CORP.		
Atlantan	78	11=1
Bostonian	78	11=1
Charlestown	78	11=1
Chicagoan	78	11=1
Monmouth	78	11=1
Monticello	78	11=1
Redwood	78	11=1
Saratoga	78	11=1
Ticonderoga	78	11=1
Trenton	78	11=1
William Penn	78	11=1
C-278, C-279, Ch.	27	7=1
C-281, Ch.	27	5=1
CT-27, Ch. CX-33DX	27	9=1
CT-37, CT-38, CT-39, Ch. CX-33DX	27	9=1
CT-45, Ch. CX-33DX	27	9=1
CT52, Ch. Prelim.	59	10=1
CT52, Ch., Late	78	11=1
CT57, Ch., Prelim.	59	10=1
CT57, Ch., Late	78	11=1
CT58, Ch., Late	78	11=1
CTR68, Ch., Prelim.	59	11=1
CTR68, Ch., Late	78	11=1
CX-32, Ch.	27	7=1
CX-33, Ch.	27	5=1
CX-33DX, Ch.	27	9=1
CX-36, Ch., Prelim.	59	10=1
CX-36, Ch., Late	78	11=1
1T172B, Ch. CT52, CX-36, Trenton, Late	78	11=1
1T172M, Ch. CT52, CX-36, Prelim.	59	10=1
1T172M, Ch. CT52, CX-36, Trenton, Late	78	11=1
2C172M, Ch. CT52, CX-36, Prelim.	59	10=1
2C172M, Ch. CT52, CX-36, Monmouth, Late	78	11=1
3C212B, Ch. CT57, CX-36, Prelim.	59	10=1
3C212B, Ch. CT57, CX-36, Monticello, Late	78	11=1
3C212M, Ch. CT57, CX-36, Prelim.	59	10=1
3C212M, Ch. CT57, CX-36, Monticello, Late	78	11=1
4H212B, Ch. CT57, CX-36, Prelim.	59	10=1
4H212B, Ch. CT57, CX-36, Charlestown, Late	78	11=1
4H212M, Ch. CT57, CX-36, Prelim.	59	10=1
4H212M, Ch. CT57, CX-36, Charlestown, Late	78	11=1
5F212M, Ch. CT57, CX-36, Prelim.	59	10=1
5F212M, Ch. CT57, CX-36, Bostonian, Late	78	11=1
6F212B, Ch. CT57, CX-36, Prelim.	59	10=1
6F212M, Ch. CT57, CX-36, Chicagoan, Late	78	11=1
7F212M, Ch. CT57, CX-36, Prelim.	59	10=1
7F212M, Ch. CT57, CX-36, Redwood, Late	78	11=1
8F212B, Ch. CT57, CX-36, Prelim.	59	10=1
8F212B, Ch. CT57, CX-36, Atlantan, Late	78	11=1
9F212M, Ch. CT57, CX-36, Prelim.	59	10=1

MODEL	PACK	PAGES
CAPEHART-FARNSWORTH CORP. (Cont'd)		
9F212M, Ch. CT57, CX-36, William Penn, Late	78	11=1
10W212M, Ch. CTR68, CX-36, Prelim.	59	10=1
10W212M, Ch. CTR68, CX-36, Ticonderoga, Late	78	11=1
11W212M, Ch. CT58, CX-36, Saratoga, Late	78	11=1
3005-M, Ch. C-279, CX-32	27	7=1
3008-M, Ch. C-278, CX-32	27	7=1
3011-B, 3011-M, Ch. C-281, CX-33	27	5=1
3012-B, 3012-M, Ch. C-281, CX-33	27	5=1
CONRAC, INC.		
27-M-40, 27-W-40, Ch. 40, 44	2	8=1
28-B-40, 29-P-40, Ch. 40, 44	2	8=1
30-M-40, 30-W-40, Ch. 40, 44	2	8=1
31-P-40, Ch. 40, 44	2	8=1
40, 44, Ch.	2	8=1
CORONADO See GAMBLE-SKOGMO, INC		
COVIDEO, INC.		
T-1400	2	8=1
CROSLEY DIV. AVCO MFG. CORP.		
Ultratuner	78	11=9
DU-UHFP, Ch. 358, Ultratuner	78	11=9
DU-17CDB, Ch. 356-1	2	8=13
DU-17CDB, Ch. 356-3, 356-4	59	10=1
DU-17CDM, Ch. 356-1	2	8=13
DU-17CDM, Ch. 356-3, 356-4	59	10=1
DU-17CHB, Ch. 356-3, 356-4	59	10=1
DU-17CHM, Ch. 356-1	2	8=13
DU-17CHM, Ch. 356-3, 356-4	59	10=1
DU-17CHN, Ch. 356-1	2	8=13
DU-17CHN, DU-17CHN1, Ch. 356-3, 356-4	59	10=1
DU-17COB, Ch. 356-1	2	8=13
DU-17COB, DU-17COL, DU-17COLa, Ch. 356-3, 356-4	59	10=1
DU-17COM, Ch. 356-1	2	8=13
DU-17COM, Ch. 356-3, 356-4	59	10=1
DU-17PDB, DU-17PDM, Ch. 359	17	9=5
DU-17PHB, DU-17PHM, DU-17PHN, DU-17PHN1, Ch. 359	17	9=11
DU-17TOB, Ch. 356-1	2	8=13
DU-17TOB, Ch. 356-3, 356-4	59	10=1
DU-17TOL, Ch. 356-1	2	8=13
DU-17TOL, DU-17TOL1, DU-17TOL2, Ch. 356-3, 356-4	59	10=1
DU-17TOM, Ch. 356-1	2	8=13
DU-17TOM, Ch. 356-3, 356-4	59	10=1
DU-20CDM, DU-20CHB, DU-20CHM, DU-20COB, DU-20COM, Ch. 357	17	9=1
DU-20PDM, Ch. 363	17	9=17
DU-21CDM1, DU-21CDN, DU-21CHM1, Ch. 357-1	59	10=5
DU-21COB1, DU-21COL, DU-21COLB, DU-21COM1, Ch. 357-1	59	10=5
EU-17COL, EU-17COLB, Ch. 385	59	10=9
EU-17COM, Ch. 380	59	10=17
EU-17TOB, Ch. 380	59	10=17
EU-17TOLa, EU-17TOLB, Ch. 385	59	10=9
EU-17TOM, Ch. 380	59	10=17

MODEL	PACK	PAGES
CROSLEY DIV. (Cont'd)		
EU-21CDB, Ch. 381	59	10=17
EU-21CDBU, UHF 391, VHF Ch. 390	78	11=1
EU-21CDM, Ch. 381	59	10=17
EU-21CDMU, UHF Ch. 391, VHF Ch. 390	78	11=1
EU-21CDN, Ch. 381	59	10=17
EU-21CDNU, UHF Ch. 391, VHF Ch. 390	78	11=1
EU-21COBa, Ch. 381	59	10=17
EU-21COBUa, UHF Ch. 391, VHF Ch. 390	78	11=1
EU-21COLd, Ch. 386	59	10=9
EU-21COLe, Ch. 387	59	10=9
EU-21COLBd, Ch. 386	59	10=9
EU-21COLBe, Ch. 387	59	10=9
EU-21COMa, Ch. 381	59	10=17
EU-21COMU-a, UHF Ch. 391, VHF Ch. 390	78	11=1
EU-21TOL, EU-21TOLB, Ch. 386	59	10=9
S11-442M1U, Ch. 331-4	2	8=18
S11-444MU, Ch. 331-4	2	8=18
S11-447MU, Ch. 321-4	2	8=24
S11-453MU, Ch. 331-4	2	8=18
S11-459MU, Ch. 321-4	2	8=24
S11-472BU, Ch. 331-4	2	8=18
S11-474BU, Ch. 331-4	2	8=18
S17-CDC1, S17-CDC3, S17-CDC4, Ch. 331-4	2	8=18
S17COC1, S17COC2, S17COC3, Ch. 331-4	2	8=18
S20-CDC1, S20-CDC2, S20-CDC3, Ch. 323-6	2	8=30
9-422M-LD	17	5=1
9-423M-LD	17	5=14
10-401	17	5=25
10-404MU, 10-404M1U	18	6=1
10-412MU	18	6=1
10-414MU	17	5=37
10-416MU, 10-416M1U	17	5=37
10-418MU	18	6=1
10-419MU	17	5=42
10-421MU	18	6=5
10-428MU	18	6=10
10-429MU	17	5=37
11-441MU, Ch. 320	18	6=15
11-442M1U, Ch. 331	18	6=27
11-443MU, Ch. 323	18	6=35
11-444MU, Ch. 331	18	6=27
11-453, Ch. 331	18	6=27
11-454MU, Ch. 323	18	6=35
11-456MU, Ch. 323	18	6=35
11-460MU, Ch. 331	18	6=27
11-461WU, Ch. 320	18	6=15
11-470BU, Ch. 331	18	6=27
11-471BU, Ch. 320	18	6=15
11-472B1U, Ch. 331	18	6=27
11-473BU, Ch. 323	18	6=35
11-474BU, Ch. 331	18	6=27
11-476BU, Ch. 325, 325-1, 325-2	18	6=21
11-483BU, Ch. 331	18	6=27
11-484MU, Ch. 323	18	6=35
17CDC1, 17CDC2, 17CDC3, 17CDC4, Ch. 331, 331-1, 331-2	2	8=1
17COC1, 17COC2, 17COC3, Ch. 331, 331-1, 331-2	2	8=1
20CDC1, 20CDC2, 20CDC3, Ch. 323-3, 323-4	2	8=7
320, Ch.	18	6=15
321-4, Ch.	2	8=24
323, Ch.	18	6=35
323-3, 323-4, Ch.	2	8=7
323-6, Ch.	2	8=30
325, 325-1, 325-2, Ch.	18	6=21
331, Ch.	18	6=27
331, 331-1, 331-2, Ch.	2	8=1
331-4, Ch.	2	8=18

MODEL	PACK	PAGES
CROSLEY DIV. (Cont'd)		
356-1, Ch.	2	8-13
356-3, 356-4, Ch.	59	10-1
357, Ch.	17	9-1
357-1, Ch.	59	10-5
358, Ch.	78	11-9
359, Ch., DU-17PDB	17	9-5
359, Ch., DU-17PHB	17	9-11
363, Ch.	17	9-17
380, 381, Ch.	59	10-17
386, 387, Ch.	59	10-9
390, VHF Ch.	78	11-1
391, UHF Ch.	78	11-1
DE WALD RADIO MFG. CORP.		
FT-200	59	10-1
ALLEN B. DUMONT LABORATORIES, INC.		
Andover	18	7-1
Ardmore	33-B	6-1
Banbury	60	10-1
Beverly	60	10-35
Bradford	39-B	4-5
Brookville	33-B	6-1
Burlingame	33-B	6-1
Canterbury	39-B	1-31
		3-1
		4-1
Carlton	18	7-1
Chatham	39-A	1-31
Clinton	60	10-35
Devon	60	10-1
Dynasty	60	10-1
Fairfield	39-B	1-31
		3-1
		4-1
Flanders	60	10-1
Guilford	33-B	5-1
Hanover	33-A	5-1
Hastings	39-B	1-31
		3-1
		4-1
Mansfield	39-B	4-5
Milford	60	10-35
Mt. Vernon	33-B	6-1
Newbury	60	10-1
Park Lane	18	7-1
Putnam	33-B	5-26
Revere	33-B	6-1
Ridgewood	60	10-35
Royal Sovereign	33-A	5-1
		8-1
Rumson	39-B	1-31
		3-1
		4-1
Savoy	39-A	1-31
Sheffield	39-B	1-31
		3-1
		4-1
Shelburne	60	10-35
Sherbrooke	33-A	5-1
Sherbrooke, Late	78	11-1
Somerset	60	10-1
Stratford	39-A	1-31
Strathmore, Sumter	18	7-1
Sussex	39-B	4-5
Tarrytown	33-B	6-1
Wakefield	60	10-35
Wellington	39-B	1-31
		3-1
		4-1
Westerly	33-B	6-1
The Westminster	39-A	9-1
Westwood	39-B	1-31
		3-1
		4-1
Whitehall II	60	10-1
Whitehall Series II, Late	78	11-1
Wickford	60	10-1

MODEL	PACK	PAGES
ALLEN B. DUMONT LABORATORIES, INC. (Cont'd)		
Wimbledon	60	10-1
Winslow	33-A	5-1
Winthrop	39-A	1-31
RA-103, RA-103-A2, Chatham, Savoy, Stratford	39-A	1-31
RA-103C, Winthrop	39-A	1-31
RA-103-D, Canterbury, Rumson, Sheffield	39-B	1-31
		3-1
		4-1
RA-104-A, Hastings, Wellington	39-B	1-31
		3-1
		4-1
RA-105-B, Sussex	39-B	4-5
RA-108-A, Bradford, Mansfield	39-B	4-5
RA-110-A, Fairfield, Westwood	39-B	1-31
		3-1
		4-1
RA-109-A1, Winslow	33-A	5-1
RA-109-A2, Hanover	33-A	5-1
RA-109-A3, Sherbrooke	33-A	5-1
RA-109-A5, Winslow	33-A	5-1
RA-109-A6, Hanover	33-A	5-1
RA-109-A7, Sherbrooke	33-A	5-1
RA-111-A1, Putnam	33-B	5-26
RA-111-A2, Guilford	33-B	5-26
RA-111-A4, Putnam	33-B	5-26
RA-111-A5, Guilford	33-B	5-26
RA-112-A1, Ardmore	33-B	6-1
RA-112-A2, Westerly	33-B	6-1
RA-112-A3, Mt. Vernon	33-B	6-1
RA-112-A4, Ardmore	33-B	6-1
RA-112-A5, Westerly	33-B	6-1
RA-112-A6, Mt. Vernon	33-B	6-1
RA-113-B1, RA-113-B2, Brookville	33-B	6-1
RA-113-B3, RA-113-B4, Revere	33-B	6-1
RA-113-B5, RA-113-B6, Bruilngame	33-B	6-1
RA-113-B7, RA-113-B6, Tarrytown	33-B	6-1
RA-116A, The Westminster, Series II	39-A	9-1
RA-117-A1, Sumter	18	7-1
RA-117-A3, Carlton	18	7-1
RA-117-A5, Strathmore	18	7-1
RA-117-A6, Andover	18	7-1
RA-117-A7, Park Lane	18	7-1
RA-119A, Royal Sovereign	33-A	5-1
		8-1
RA-130A, Sherbrooke, Whitehall Series II, Late	78	11-1
RA-160-A1, Devon	60	10-1
RA-162-B1, Wickford	60	10-1
RA-162-B4, Banbury	60	10-1
RA-162-B5, Flanders	60	10-1
RA-162-B6, Wimbledon	60	10-1
RA-162-B7, Whitehall II	60	10-1
RA-162-B10, Flanders	60	10-1
RA-162-B11, Newbury	60	10-1
RA-162-B12, Somerset	60	10-1
RA-162-B13, Banbury	60	10-1
RA-162-B14, Dynasty	60	10-1
RA-162-B21 -- RA-162-B26, Banbury	60	10-1
RA-164-A1, Clinton	60	10-35
RA-165-B1, Milford	60	10-35
RA-165-B2, Beverly	60	10-35
RA-165-B3, Wakefield	60	10-35
RA-165-B4, Ridgewood	60	10-35
RA-165-B5, Shelburne	60	10-35
ELECTRONIC APPLIANCES INC.		
101, 102, 103, 104, 105, 107, 110, 111, Series, Lincoln, See VIDEO PRODUCTS 630-K3C	69	10-1

MODEL	PACK	PAGES
ELECTRO-TECHNICAL INDUSTRIES (TELEKIT)		
19C	3	8-1
EMERSON RADIO & PHONO. CORP.		
609, Ch. 120084-B	3	8-1
614D, Ch. 120095-B	26-A	6-1
637A, Ch. 120095-B	26-A	6-1
649A, Ch. 120094A	26-A	6-5
650B, Ch. 120118B	26-A	6-11
654B, Ch. 120118B	26-A	6-11
661B, Ch. 120134-B, 120134-G	26-A	7-1
662B, 663B, Ch. 120127-B, 120128-B	26-A	7-11
665B, Ch. 120131-B	26-B	7-20
666B, Ch. 120135-B	26-B	7-28
667B, 668B, Ch. 120134-B, 120134-G	26-A	7-1
669B, Ch. 120129-B	26-B	7-36
674B, Ch. 210134-G	26-A	7-1
675B, Ch. 120129-B	26-B	7-36
678B, Ch. 120140-B, 120140-G, 120140-H	26-B	7-45
676D, Ch. 120144-B, 120144-G, 120144-H	3	8-16
676F, Ch. 120143-B, 120143-H, similar to 681F, 686F, 687F, 696F	3	8-31
677B, 678B, Ch. 120134-B	26-A	7-1
680B, Ch. 120144-B, 120144-G, 120144-H	3	8-16
680D, 681B, Ch. 120140-B, 120140-G, 120140-H	26-B	7-45
681D, Ch. 120144-B, 120144-G, 120144-H	3	8-16
681F, Ch. 120143-B, 120143-H	3	8-31
683B, Ch. 120141-B	3	8-40
684B, 685B, Ch. 120134-B	26-A	7-1
686B, Ch. 120144-B, 120144-G, 120144-H	3	8-16
686D, Ch. 120140-B, 120140-G, 120140-H	26-B	7-45
686F, Ch. 120143-B, 120143-H	3	8-31
686L, Ch. 120142-B	3	8-46
687B, Ch. 120144-B, 120144-G, 120144-H	3	8-16
687D, Ch. 120140-B, similar to 680D, 686D	26-B	7-45
687F, Ch. 120143-B, 120143-H	3	8-31
687L, Ch. 120142-B	3	8-46
688B, 689B, 690B, Ch. 120129-B	26-B	7-36
692B, 693B, 694B, Ch. 120129-D, similar to 688B, 689B, 690B, Ch. 120129-B	26-B	7-36
696F, Ch. 120143-B, 120143-H	3	8-31
696L, Ch. 120142-B	3	8-46
897B, Ch. 120129-D, similar to 688B, 689B, 690B, Ch. 120129-B	26-B	7-36
699B, Ch. 120148-B	39-B	9-9
699D, Ch. 120160-B	60	10-1
700B, Ch. 120153-B	39-B	9-1
700D, Ch. 120158-B	50	9-17
700L, Ch. 120153-D	61	10-18
701B, Ch. 120153-B	39-B	9-1
701D, Ch. 120158-B	50	9-17
709A, Ch. 120162-A	61	10-9
711B, 712B, Ch. 120164-B	61	10-28
714B, Ch. 120153-B	61	10-18
714D, 715D, Ch. 120153-D	61	10-18
716D, Ch. 120163-D	79	11-1
717D, Ch. 120163-D	79	11-1
719D, Ch. 120163-D	79	11-1
720B, Ch. 120164-B	61	10-28
721D, Ch. 120166-D	79	11-13
722D, Ch. 120163-D	79	11-1

MODEL	PACK	PAGES
EMERSON RADIO & PHONO. CORP. (Cont'd)		
728D, Ch. 120166-D	79	11-13
736B, Ch. 120171-B	79	11-13
120084-B, Ch.	3	8-1
120094A, Ch.	26-A	6-5
120095-B, Ch.	26-A	6-1
120118B, Ch.	26-A	6-11
120127-B, 120128-B, Ch.	26-A	7-11
120129B, 120129D, Ch.	26-B	7-36
120131-B, Ch.	26-B	7-20
120134-B, 120134-G, Ch.	26-A	7-1
120135-B, Ch.	26-B	7-28
120140-B, 120140-G, 120140-H, Ch.	26-B	7-45
120141-B, Ch.	3	8-40
120142-B, Ch.	3	8-46
120143-B, 120143-H, Ch.	3	8-31
120144-B, 120144-G, 120144-H, Ch.	3	8-16
120148-B, Ch.	39-B	9-9
120153-B, Ch.	39-B	9-1
120153-B, Ch., Late	61	10-18
120153-D, Ch.	61	10-18
120158-B, Ch.	50	9-17
120160-B, Ch.	60	10-1
120162-A, Ch.	61	10-9
120163-D, Ch.	79	11-1
120164-B, Ch.	61	10-28
120166-D, Ch.	79	11-13
120171-B, Ch.	79	11-13
470651, Tuner	3	8-56
470662, Tuner	3	8-63
FADA RADIO & ELECTRIC CO., INC.		
R7C15, R7C25	4	8-1
Tuner 42.51 for all 'R' Series	4	9-1
R-1025, R-1050	32	5-1
S6C55, S6C70, S6T65	32	7-1
S7C20, S7C30	32	7-1
S7C20, S7C30, Rev.	32	9-11
S7C70, S7T65	32	7-1
S-1015, S-1020, S-1030	32	5-8
S-1055	32	5-10
		7-1
S-1055X	32	7-1
S-1060, S-1065	32	5-10
		7-1
S20C10, S20T20	32	9-11
7C42, 7C52, 7T32	61	10-1
721, 775T	61	10-1
42.55, 42.64, Tuners used with 'S' Series	32	9-3
THE FIRESTONE TIRE & RUBBER CO.		
13-G-44, 13-G-45	4	8-10
13-G-51, 13-G-52	4	8-25
13-G-53, 13-G-54, Ch. 700-90, 700-96	4	8-40
13-G-55, Ch. 700-93	4	8-40
13-G-56	4	8-52
13-G-57	4	8-1
13-G-58, 13-G-59, 13-G-79, Ch. 700-96	4	8-60
13-G-110, Code 334-2-MS31C/A	61	10-1
13-G-110, Code 334-2-MS29A	79	11-1
13-G-114, 13-G-114A, Ch. 817, Code 105-2-81700	79	11-11
13-G-115, 13-G-116, Code 334-2-MS31C/A	61	10-1
13-G-117, Ch. 817, Code 105-2-81700	79	11-11
13-G-119, 13-G-120, Code 334-2-MS31C/A	61	10-1
105-2-81700, Code	79	11-11
334-2-MS31C/A, Code	61	10-1
334-2-MS29A, Code	79	11-1
700-90, 700-93, Ch.	4	8-40

HOFFMAN RADIO CORP. (Cont'd)

MODEL	PACK	PAGES
830, 831, 832, Ch. 151	35	5-17
836, 837, 840, Ch. 153	29	7-1
841, 842, 843, Ch. 158	35	5-1
846, Ch. 151	35	5-17
847, 848, 849, Ch. 156	29	7-3 7-6
850, 851, 852, Ch. 151	35	5-17
856, 857, 858, Ch. 153	29	7-1
860, 861, 862, Ch. 157	29	7-3 7-6
866, Ch. 171	29	6-15
866A, Ch. 173	29	6-15
867, Ch. 171	29	6-15
867A, Ch. 173	29	6-15
866, Ch. 171	29	6-15
868A, Ch. 173	29	6-15
870, 871, 872, Ch. 170	29	6-15
876, Ch. 171	29	6-15
876A, Ch. 173	29	6-15
877, Ch. 171	29	6-15
877A, Ch. 173	29	6-15
878, Ch. 171	29	6-15
878A, Ch. 173	29	6-15
880, 881, 882, 883, 884, 885, 886, Ch. 183	6	8-8
886B, Ch. 183B, 183M	65	10-25
887, Ch. 183	6	8-8
887B, Ch. 183B, 183M	65	10-25
890, 891, 892, Ch. 175	29	6-15
893, 894, 895, Ch. 185	6	8-8
896, Ch. 185	6	8-8
897, Ch. 185	6	8-8
914, 915, 916, Ch. 150	35	5-7
917, 918, 920, Ch. 152	35	5-17
921, Ch. 150	35	5-7
930, 931, 932, Ch. 150	35	5-7
936, 937, 938, Ch. 152	35	5-17
946, 947, 948, Ch. 164	29	7-3 7-6
950, Ch. 172	29	7-22
950A, Ch. 174	29	7-22
951, Ch. 172	29	7-22
951A, Ch. 174	29	7-22
952, Ch. 172	29	7-22
952A, Ch. 174	29	7-22
953, 954, 955, Ch. 184	6	8-8
960, 961, 962, Ch. 176	29	7-22
963, 964, 965, Ch. 186	6	8-8

HYDE PARK
See MACY'S

INTERSTATE STORES BUYING CORP. (PLYMOUTH)

MODEL	PACK	PAGES
AR-21, AR-21B	50	9-1
AR-71, AR-71B	50	9-1
AR-73L	50	9-1
ARC-21, ARC-21B	50	9-1
ARC-71, ARC-71B	50	9-1
ARD-21M, ARD-22B	50	9-1
ARD-72, ARD-72B	50	9-1
250, 350	35	5-1
750	35	5-1
P1650T	35	7-1
P1652, P1653	35	7-1
P1751, P1752, P1753	35	7-1
P2052	35	7-1

JACKSON INDUSTRIES, INC.

MODEL	PACK	PAGES
114G, Ch.	6	8-1
114H, Ch.	65	10-10
116G, 117G, Ch.	6	8-1
117H, Ch.	65	10-10
120G, Ch.	6	8-1
120H, Ch.	65	10-10
217A, 217B, Ch.	65	10-1
220A, 220B, Ch.	65	10-1
221A, 221B, Ch.	65	10-1

JACKSON INDUSTRIES, INC. (Cont'd)

MODEL	PACK	PAGES
1400T, Ch. 114G, 116G, 117G, 120G	6	8-1
1700C, 1700T, Ch. 114G, 116G, 117G, 120G	6	8-1
1700T, Ch. 117H	65	10-10
2000C, Ch. 114G, 116G, 117G, 120G	6	8-1
2000C, 2000CD, 2000CDE, Ch. 120H	65	10-10
3170C, Ch. 114G, 116G, 117G, 120G	6	8-1
5120C, Ch. 114G, 116G, 117G, 120G	6	8-1

KAYE-HALBERT CORP.

MODEL	PACK	PAGES
Cambridge, Hideaway	30	6-1
Normandy, Windsor	30	6-1
014, 024, Ch. 253	6	8-1
044, 045, 046, Ch. 253	6	8-1
074, 076, 077, Ch. 253	6	8-1
231, Ch.	30	6-1
231, 232, 233, Ch. 231, 242	30	6-1
234, Ch. 231, 242, Hideaway	30	6-1
235, Ch. 231, 242, Windsor	30	6-1
236, Ch. 231, 242, Normandy	30	6-1
237, Ch. 231, 242, Cambridge	30	6-1
238, Ch. 231, 242	30	6-1
239, Ch. 231, 242, Hideaway	30	6-1
240, Ch. 231, 242, Windsor	30	6-1
242, Ch.	30	6-1
253, Ch.	6	8-1
424, Ch. 253	6	8-1
714, 724, Ch. 253	6	8-1
731, 733, Ch. 231, 242	30	6-1
744, 745, Ch. 253	6	8-1
777, Ch. 253	6	8-1
914, Ch. 253	6	8-1

MACY ASSOCIATES
See MACY'S

MACY'S

MODEL	PACK	PAGES
AR14L, Ch. TVG, Artone, Hyde Park	7	9-21
AR-16 T-68, Artone	7	9-31
AR17L, Ch. TVG, Artone, Hyde Park	7	9-21
AR-23TV-1, Artone	7	9-31
HP-21B, HP-21M	47-A	9-57
HP-71B, HP-71M	47-A	9-57
HPC-21B, HPC-21M, HPC-22X	47-A	9-57
HPC-71B, HPC-71M	47-A	9-57
HPD-21	47-A	9-57
MST12, Artone, Astoria, Hyde Park	7	9-45
Q-2617, Q-2617-1, Ch. 260-FM, 260-V, Macy Associates, Supremacy	7	9-53
Q-2619, Q-2619-1, Q-2620, Q-2620-1, Ch. 260-FM, 260-V, Macy Associates, Supremacy	7	9-53
S-20, Ch. 260-FM, 260-V, Macy Associates, Supremacy	7	9-53
S-210, S-211, S-212, S-213, Ch. 260-FM, 260-V, Macy Associates, Supremacy	7	9-53
TVG, Ch.	7	9-21
10C, 12X, Artone, Astoria, Hyde Park	7	9-45
16CD, Artone, Astoria, Hyde Park	7	9-1
16TR, Artone, Hyde Park	7	9-11
17CD, Ch. TVG, Artone, Hyde Park	7	9-21
17CR, Artone, Hyde Park	7	9-11
17CR, 17CRR, Ch. TVG, Artone, Hyde Park	7	9-21
17RDG, Ch. TVG, Artone,		

MACY'S (Cont'd)

MODEL	PACK	PAGES
Hyde Park	7	9-21
17RO, Artone, Hyde Park	7	9-11
17ROR, Ch. TVG, Artone, Hyde Park	7	9-21
19CD, Artone, Hyde Park	7	9-1
19CX, Artone, Hyde Park	7	9-1
20CD, 20TR, Ch. TVG, Artone, Hyde Park	7	9-21
112, 112X, Artone, Astoria, Hyde Park	7	9-45
114, Artone, Hyde Park	7	9-11
203D, 204CAF, Ch. TVG, Artone, Hyde Park	7	9-21
260-FM, 260-V, Ch.	7	9-53
312, Artone, Astoria, Hyde Park	7	9-45
316, Astoria, Hyde Park	7	9-1
516, Artone, Hyde Park	7	9-11
816-3CR, Artone, Astoria, Hyde Park	7	9-1
819, Artone, Hyde Park	7	9-1 9-10
819, 819-3CM, 920, Ch. TVG, Artone, Hyde Park	7	9-21
1000, 1001, Ch. TVG, Artone, Hyde Park	7	9-21
1920, Ch. TVG, Artone, Hyde Park	7	9-21
2400, 4620, Ch. 260-FM, 260-V, Macy Associates, Supremacy	7	9-53

THE MAGNAVOX CO.

MODEL	PACK	PAGES
CT-232, CT-236, Ch.	30	6-1
CT-239, CT-240, Ch.	30	6-1
CT-244, CT-245, CT-246, Ch.	30	6-1
CT-247, CT-248, CT-249, Ch.	30	6-15
CT-250, CT-251, Ch.	30	6-1
CT-252, CT-253, CT-255, Ch.	30	6-15
CT-257, CT-258, CT-259, CT-260	30	7-1
CT-262, CT-263, CT-264, CT-265, CT-266, CT-267, CT-269, Series 103 Ch.	30	6-29
CT-270, CT-271, CT-272, CT-273, CT-274, CT-275, CT-276, CT-277, CT-278, CT-279, CT-280, CT-281, CT-282	30	7-14
CT-283, CT-284, CT-285, CT-286, CT-287, CT-288, CT-289, CT-290, CT-291, CT-293, CT-294, Series 103 Cn.	30	6-29
CT-295, CT-296	30	7-1
CT-297, Series 103 Ch.	30	8-29
CT301, CT302, CT303, CT304, CT305, CT306, CT307, CT309, CT310, CT311, 104 Series	65	10-1
CT331, CT332, CT333, CT334, CT335, CT336, CT337, CT338, CT339, 105 Series	65	10-9
CT340, CT341, CT342, CT343, CT344, CT345, CT346, CT347, CT348, CT349, CT350, 105 Series	65	10-9

MAJESTIC RADIO & TELEVISION
DIV. OF WILCOX-GAY CORP.

MODEL	PACK	PAGES
A-70, Ch. 106A	6	8-1
A-712, Ch. 106A	6	8-1
7P1, 7P2, 7P3, Ch. 101A	30	7-1
7P10, 7P11, Ch. 101A	30	7-1
7PR12, 7PR13, Ch. 101C	30	7-1
9P4, 9P5, Cn. 103	30	7-1
9PR6, 9PR9, Ch. 103A	30	7-1
17DA, Ch. 101D	30	7-1
17FA, Cn. 106A	6	8-1
17GA, 17HA, Ch. 101D	30	7-1

MAJESTIC RADIO & TELEVISION (Cont'd)

MODEL	PACK	PAGES
17JA, 17K, Ch. 106A	6	8-1
20FP88, 20FP89, 109 Series	66	10-1
20K, Ch. 108C	6	8-1
20KA, 20LA, Ch. 108A	6	8-1
20UAT, Ch. 108B	6	8-1
20UC, 20UT, Ch. 108D	6	8-1
20X, Ch. 108B	6	8-1
70, 72, 73, Ch. 106	6	8-1
99, 100, 101, 101A, 101B, 101C, 101D, 102, 103, 103A, Ch.	30	7-1
105, Ch.	30	7-1
106, 106A, Ch.	6	8-1
108, 108A, 108B, 108C, 108D, Ch.	6	8-1
120, 121, 121B, Cn. 99	30	7-1
141, 141B, Ch. 100	30	7-1
141C, Ch. 101B	30	7-1
142, 142B, Ch. 100	30	7-1
143	30	7-1
160, 160B, Ch. 101	30	7-1
162, 163, Ch. 101	30	7-1
170, Ch. 101A	30	7-1
173	30	7-1
700, 701, Ch. 106	6	8-1
712, 715, 717, 718, 719, Ch. 106	6	8-1
800, 801, 802, 803, 804, Ch. 108	6	8-1
902, 903, Cn. 103	30	7-1
910, 911, Cn. 103	30	7-1
1400, 1400B, Cn. 100	30	7-1
1401, Ch. 105	30	7-1
1600, 1600B, Cn. 101	30	7-1
1605, 1605B, Cn. 102	30	7-1
1610, 1610B, Ch. 102	30	7-1
1700C, 1701C	30	7-1
1710, Ch. 101A	30	7-1
1720, 1721	30	7-1

JOHN MECK INDUSTRIES, INC.
DIV. OF SCOTT RADIO LABS., INC.
(MIRRORTONE)

MODEL	PACK	PAGES
JM-717C, JM-717T, Ch. 9021	7-1	8-1
JM-720C, JM-720T, Ch. 9023	7-1	8-1
MM-510T, MM-512C, MM-512T	45-2	6-1
MM-516C, MM-516T	45-2	6-1
MM-614C, MM-614T, Ch. 9018	45-2	7-1
MM-614TL, Ch. 9022, 9024	7-1	8-1
MM-616C, MM-616T, Ch. 9018	45-2	7-1
MM-617C, MM-617T, Ch. 9018	45-2	7-1
MM-617C, MM-617TL, Ch. 9022, 9024	7-1	8-1
MM-619C, Ch. 9018	45	7-1
XOB, XQA, XQR	45	6-1
XRA, XRPS, XRPT, XSA	45	6-1
XSB, XSC, XSD, Ch. 9018	45	7-1
XSPS, XSPT, XTA, XTR	45	6-1
17PCSB, 17PCW, 17PTE, Ch. 9033, 9034	66	10-1
20PCSB, 20PCW, Ch. 9033, 9034	66	10-1
20PTE, 20PTSB, 20PTW, Ch. 9033, 9034		
20TPRSB, 21PCS, Ch. 9033, 9034	66	10-1
21QDCS, 24QDCS, Ch. 9033, 9034	66	10-1
9018, Ch.	45	7-1
9021, 9022, 9023, 9024, Ch.	7	8-1
9033, 9034, Ch.	66	10-1

MIDWEST RADIO & TELEV. CORP.

MODEL	PACK	PAGES
BT-20, Ch.	7	8-1
CV-20, Ch.	7	8-7
DJ-19, Ch.	45	6-1
DM-16, DMA-16	45	7-1
DR-16, Ch.	45	6-1
DX-19, DXA-19, Ch.	45	7-1
K-19, KR-19, Ch. DJ-19	45	6-1
KX-19, Ch. DX-19	45	7-1
KXA-19, Ch. DXA-19	45	7-1
N-20, NC-20, Ch. BT-20	7	8-1
NV-20, Ch. CV-20	7	8-7
P-16, PR-16, Ch. DR-16	45	6-1

MIDWEST RADIO & TELEV. CORP. (Cont'd)

MODEL	PACK	PAGES
PX-16, Ch. DM-16	45	7-1
PXA-16, Ch. DMA-16	45	7-1

MIRRORTONE

See JOHN MECK INDUSTRIES, INC.

MITCHELL MFG. CO.

MODEL	PACK	PAGES
T16-2KB, T16-2KM	45	6-1
T16-B, T16-M	45	6-1
T17-B, T17-M	7	8-1

MONTGOMERY WARD (AIRLINE)

MODEL	PACK	PAGES
05BR-3034A, 05BR-3041A	8	8-1
05GCB-3019A	45	6-1
05WG-3038A	8	8-11
05WG-3045A	8	8-21
15BR-3035A	8	8-31
15BR-3048A	51	9-1
15BR-3053A, 15BR-3053B	8	8-41
15BR-3054A	66	10-1
15GSE-3047A, 15GSE-3047B	8	8-52
15WG-3046A	8	8-63
15WG-3049A	51	9-9
15WG-3049B	80	11-9
15WG-3046B	8	8-63
15WG-3050A	8	8-74
15WG-3050B	8	8-74
15WG-3051A	8	8-63
15WG-3051B	8	8-63
15WG-3059A	80	11-9
16K1/63-3019	45	6-1
25BR-3048B	66	10-11
25GSE-3057	80	11-1
25GSE-3065A	66	10-22
25WG-3049B	80	11-9
25WG-3059A	80	11-9
94GCB-3023A, 94GCB-3023B, 94GCB-3023C	45	6-1
94WG-3008A	45	6-11
94WG-3106A, 94WG-3016B, 94WG-3016C	45	8-11
94WG-3028A	45	6-23

MOTOROLA INC.

MODEL	PACK	PAGES
TS-53, Ch.	36-B	6-1
TS-60, Ch.	47-A	7-1
TS-74, Ch.	36-B	6-51
TS-88, Ch.	36-A	6-29
TS-89, Ch.	47-B	7-17
TS-94, Ch.	47-B	7-17
TS-95, Ch.	47-B	7-17
TS-101, Ch.	47-B	7-57
TS-114, Ch.	36-B	6-42
TS-115, Ch.	36-B	6-16
TS-118, Ch.	47-B	7-35
		7-66
TS-118A, TS-118B, Ch.	51	9-25
TS-119, TS-119A, TS-119B, TS-119C, Ch.	9	8-25
TS-119D, Ch.	67	10-51
TS-172, Ch.	47-A	7-46
TS-174, TS-174A, TS-175B, Ch.	9	8-1
TS-214, Ch.	51	9-33
TS-216, Ch.	9	9-1
TS-221, Ch.	9	8-16
TS-228, Ch.	70	10-1
TS-236, Ch.	9	9-9
TS-292, TS-292A, Ch.	81	11-1
TS-292A-01, TS-292A-02, TS-292A-03, TS-292A-04, Ch.	81	11-1
TS-292B, Ch.	81	11-1
TS-292B-01, TS-292B-02, TS-292B-03, Ch.	81	11-1
TS-307, Ch.	70	10-42
TS-314, Ch.	51	9-17
TS-314A, Ch.	51	9-41

MOTOROLA INC. (Cont'd)

MODEL	PACK	PAGES
TS-315, Ch.	51	9-17
TS-315A, Ch.	51	9-41
TS-324, TS-324A, Ch.	81	11-1
TS-324A-01, TS-324A-02, TS-324A-03, TS-324A-04, Ch.	81	11-1
TS-324B-01, TS-324B-02, Ch.	81	11-1
TS-325, TS-325B, Ch.	70	10-13
TS-326, TS-326A, TS-326B, Ch.	70	10-13
TS-351, Ch.	70	10-13
TS-401, Ch.	67	10-59
TS-501A, TS-501B-00, TS-501B-01. TS-501B-02, Ch.	81	11-1
12K1, 12K1B, Ch.	36-A	6-1
12K2, 12K2B, Ch. TS-53	36-A	6-1
12K3, 12K3B, Ch. TS-53	36-A	6-1
12T1, 12T1B, Ch. TS-53	36-A	6-1
12T2, 12T3, Ch. TS-53	36-A	6-1
14K1, 14K1B, Ch. TS-88	36-A	6-29
14K1BH, 14K1H, Ch. TS-115	36-A	6-16
14T1, 14T1B, Ch. TS-88	36-B	6-29
14T3, Ch. TS-114	36-B	6-42
14T4, 14T4B, Ch. TS-216	9	9-1
16F1, 16F1B, Ch. TS-60	47-A	7-1
16F1BH, 16F1H, Ch. TS-89	47-B	7-17
16K2, 16K2B, Ch. TS-74	36-B	6-51
16K2BH, 16K2H, Ch. TS-94	47-B	7-17
16T1, 16T1B, Ch. TS-60	47-A	7-1
16T1BH, 16T1H, Ch. TS-89	47-B	7-17
17F1, Ch. TS-118A, TS-118B	51	9-25
17F1, 17F1B, Ch. TS-118	47-B	7-35
17F1A, 17F1BA, Ch. TS-89	47-B	7-17
17F2W, Ch. TS-118	47-B	7-35
17F2W, Ch. TS-118A, TS-118B	51	9-25
17F2WA, Ch. TS-89	47-B	7-17
17F3B, Ch. TS-118	47-B	7-35
17F3B, Ch. TS-118A, TS-118B	51	9-25
17F3BA, Ch. TS-89	47-B	7-17
17F4, Ch. TS-118	47-B	7-35
17F4, Ch. TS-118A, TS-118B	51	9-25
17F4A, Ch. TS-89	47-B	7-17
17F5, Ch. TS-118	47-B	7-35
17F5, Ch. TS-118A, TS-118B	51	9-25
17F5A, Ch. TS-89	47-B	7-17
17F5B, Ch. TS-118	47-B	7-35
17F5BA, Ch. TS-89	47-B	7-17
17F6, Ch. TS-118	47-B	7-35
17F6, Ch. TS-118A, TS-118B	51	9-25
17F6B, Ch. TS-118	47-B	7-35
		7-66
17F6BC, 17F6C, Ch. TS-174 TS-174A, TS-174B	9	8-1
17F7, Ch. TS-118A, TS-118B	51	9-25
17F7B, Ch. TS-118	47-B	7-35
		7-66
17F7B, Ch. TS-118A, TS-118B	51	9-25
17F7BC, Ch. TS-174, TS-174A, TS-174B	9	8-1
17F8, Ch. TS-118	47-B	7-35
17F8, Ch. TS-118A, TS-118B	51	9-25
17F8C, Ch. TS-174, TS-174A, TS-174B	9	8-1
17F9, 17F9B, Ch. TS-118	47-B	7-35
17F9, Ch. TS-118A, TS-118B	51	9-25
		7-66
17F9BC, 17F9C, Ch. TS-174, TS-174A, TS-174B	9	8-1
17F11, Ch. TS-228	70	10-1
17F12, Ch. TS-325	70	10-13
17F12A, Ch. TS-326	70	10-13
17F12B, Ch. TS-325	70	10-13
17F12BA, Ch. TS-326	70	10-13
17F12D, Ch. TS-401	67	10-59
17K1A, 17K1BA, Ch. TS-95	47-B	7-17
17K1BE, 17K1E, Ch. TS-172	47-A	7-46
17K2BE, 17K2E, Ch. TS-172	47-A	7-46
17K3, Ch. TS-118	47-B	7-35

MOTOROLA INC. (Cont'd)

MODEL	PACK	PAGES
17K3, Ch. TS-118A, TS-118B	51	9-25
17K3A, 17K3BA, Ch. TS-89	47-B	7-17
17K3B, Ch. TS-118	47-B	7-35
17K4A, Ch. TS-95	47-B	7-17
17K4E, Ch. TS-172	47	7-46
17K5, Ch. TS-118	47-B	7-35
		7-66
17K5, Ch. TS-118A, TS-118B	51	9-25
17K5C, Ch. TS-174, TS-174A, TS-174B	9	8-1
17K5E, Ch. TS-221	9	8-16
17K6, Ch. TS-118	47-B	7-35
		7-66
17K6, Ch. TS-118A, TS-118B	51	9-25
17K6C, Ch. TS-174, TS-174A, TS-174B	9	8-1
17K7, 17K7B, Ch. TS-118	47-B	7-35
		7-66
17K7, Ch. TS-118A, TS-118B	51	9-25
17K7BC, 17K7C, Ch. TS-174, TS-174A, TS-174B	9	8-1
17K8, Ch. TS-236	9	9-9
17K8A, Ch. TS-228	70	10-1
17K8B, Ch. TS-236	9	9-9
17K8BA, Ch. TS-228	70	10-1
17K9A, 17K9BA, 17K10, Ch. TS-228	70	10-1
17K10E, Ch. TS-314	51	9-17
17K10E, Ch. TS-314A	51	9-41
17K10M, Ch. TS-228	70	10-1
17K11, Ch. TS-236	9	9-9
17K11A, Ch. TS-228	70	10-1
17K11B, Ch. TS-236	9	9-9
17K11BA, Ch. TS-228	70	10-1
17K11C, Ch. TS-236	9	9-9
17K12, Ch. TS-325	70	10-13
17K12A, Ch. TS-326	70	10-13
17K12B, Ch. TS-325	70	10-13
17K12BA, Ch. TS-326	70	10-13
17K12W, Ch. TS-325	70	10-13
17K12WA, Ch. TS-326	70	10-13
17K13A, Ch. TS-326A, TS-326B	70	10-13
17K13D, Ch. TS-401	67	10-59
17T1, 17T1B, Ch. TS-118	47-B	7-35
17T1A, 17T1BAmCh. TS-89	47-B	7-17
17T2, Ch. TS-118A, TS-118B	51	9-25
17T2, 17T2B, Ch. TS-118	47-B	7-35
17T2A, 17T2BA, Ch. TS-89	47-B	7-17
17T3, Ch. TS-118	47	7-35
17T3, Ch. TS-118A, TS-118B	51	9-25
17T3A, Ch. TS-89	47-B	7-17
17T3G, Ch. TS-221	9	8-16
17T3X1, Ch. TS-118A, TS-118B	51	9-25
17T4, Ch. TS-118	47-B	7-35
		7-66
17T4, Ch. TS-118A, TS-118B	51	9-25
17T4C, Ch. TS-174, TS-174A, TS-174B	9	8-1
17T4E, Ch. TS-221	9	8-16
17T5A, Ch. TS-214	51	9-33
17T5C, Ch. TS-228	70	10-1
17T5CA, Ch. TS-214	51	9-33
17T5D, Ch. TS-236	9	9-9
17T5E, Ch. TS-314	51	9-17
17T5E, Ch. TS-314A	51	9-41
17T5F, Ch. TS-315	51	9-17
17T5F, Ch. TS-315A	51	9-41
17T6BD, Ch. TS-236	9	9-9
17T6BF, Ch. TS-228	70	10-1
17T6C, 17T6D, Ch. TS-236	9	9-9
17T6F, Ch. TS-228	70	10-1
17T6G, Ch. TS-314A	51	9-41
17T7, Ch. TS-325	70	10-13
17T7A, Ch. TS-326	70	10-13
17T8, Ch. TS-325	70	10-13
17T8A, Ch. TS-326	70	10-13
17T8B, Ch. TS-325	70	10-13
17T8BA, Ch. TS-326	70	10-13

MOTOROLA INC. (Cont'd)

MODEL	PACK	PAGES
17T9, 17T9A, 17T9E, Ch. TS-326A, TS-326B	70	10-13
17T9EF, 17T9F, Ch. TS-401	67	10-59
17T10, Ch. TS-325B	70	10-13
17T10A, Ch. TS-326A, TS-326B	70	10-13
17T10D, Ch. TS-401	67	10-59
19K2, 19K2B, Ch. TS-101	47-B	7-57
19K2BE, 19K2E, Ch. TS-119, TS-119A	9	8-25
19K3, Ch. TS-101	47-B	7-57
19K4, 19K4B, Ch. TS-101	47-B	7-57
20F1, 20F1B, Ch. TS-119, TS-119A	9	8-25
20F2, 20F2B, Ch. TS-119B, TS-119C	9	8-25
20K1, 20K1B, 20K2, Ch. TS-119B, TS-119C	9	8-25
20K3, 20K3B, Ch. TS-119D	67	10-51
20K4, 20K4B, Ch. TS-119D	67	10-51
20K6, 20K6B, Ch. TS-307	70	10-42
20T1B, Ch. TS-119B, TS-119C	9	8-25
20T2, Ch. TS-119D	67	10-51
20T2A, Ch. TS-307	70	10-42
20T2B, Ch. TS-119D	67	10-51
20T2BA, Ch. TS-307	70	10-42
20T3, 20T3B, Ch. TS-307	70	10-42
21C1, 21C1B, Ch. TS-292, TS-292A	81	11-1
21F1, 21F1B, Ch. TS-351	70	10-13
21F2, 21F2B, Ch. TS-292, TS-292A	81	11-1
21F3, 21F3B, C h. TS-292, TS-292A	81	11-1
21K1, 21K1B, Ch. TS-351	70	10-13
21K2, 21K2B, Ch. TS-351	70	10-13
21K3, 21K3B, 21K3W, Ch. TS-351	70	10-13
21K4, 21K4A, 21K4B, 21K4W, Ch. TS-292, TS-292A	81	11-1
21K5, 21K5B, Ch. TS-292, TS-292A	81	11-1
21K6, 21K7, Ch. TS-292, TS-292A	81	11-1
21T1, 21T1B, Ch. TS-351	70	10-13
21T2, 21T2B, Ch. TS-351	70	10-13
21T3, Ch. TS-501A, TS-501B-00, TS-501B-01, TS-501B-02	81	11-1
21T4, Ch. TS-324, TS-324A	81	11-1
21T4AC, 21T4ACE, Ch. TS-292B	81	11-1
21T4EA, Ch. TS-324, TS-324A	81	11-1
21T5A, 21T5BA, Ch. TS-324, TS-324A	81	11-1

M. P. TELEVISION

MODEL	PACK	PAGES
16T503, 17T504	9	8-1

MULTIPLE TELEV. MFG. CO.

MODEL	PACK	PAGES
EC20, Ch. 630K3B	9	8-1
HFD17, HFD20, Ch. 630K3B	9	8-1
LFD17, LFD20, Ch. 630K3B	9	8-1
OF17, OF20, OF20R, Ch. 630K3B	9	8-1
630K3B, Ch.	9	8-1

MUNTZ T-V, INC.

MODEL	PACK	PAGES
M31, Ch. TV17A2	36-B	6-1
M31R, Ch. TV17A3	36-B	6-1
M32, M32R, Ch. TV17A3	36-B	6-1
M33, M34, Ch. TV17A4	36-B	6-1
M41, M42, Ch. TV17A3A	36-B	6-1
M46, M49, Ch. TV17A7	36-B	6-1
TV17A2, Ch.	36-B	6-1
TV17A3, TV17A3A, Ch.	36-B	6-1
TV17A4, TV17A7, Ch.	36-B	6-1
WG2060	51	9-13

MUNTZ T-V, INC. (Cont'd)

MODEL	PACK	PAGES
17B1, 17B2, 17B3, 17B4, Ch.	51	9=1
17B4, Carco, Ch.	67	10=1
17B5, 17B6, Ch.	51	9=1
17B6, Carco 17B6, Ch.	67	10=1
1750, 1751, 1752, Ch. TV17A3A	36-B	6=1
2053, 2054, 2055, 2056, Ch. TV17A7	36-B	6=1
2053-A, 2054-A, 2055-A, Ch. 17B1, 17B2	51	9=1
2055-B, Ch. 17B2	51	9=1
2056-A, Ch. 17B1, 17B2	51	9=1
2158-A, 2159-A, Ch. 17B5		
2158-A, 2159-A, Ch. 17B6, Carco 17B6, Late	67	10=1
2162-A, Ch. 17B5, 17B6	51	9=1
2162-A, Ch. 17B6, Carco 17B6, Late	67	10=1
2457-A, Ch. 17B3, 17B4	51	9=1
2457-A, 2461-A, Ch. Carco 17B4, Late	67	10=1

NATIONAL CO., INC.

MODEL	PACK	PAGES
TV1701	67	10=1

NORELCO

See NORTH AMERICAN PHILLIPS CO., INC.

NORTH AMERICAN PHILLIPS CO., INC. (NORELCO)

MODEL	PACK	PAGES
The Irvington	38	6=1
The Mt. Vernon	38	6=1
PT200, Ch.	38	6=1
PT200, Ch. PT200, The Irvington	38	6=1
PT300, Ch. PT200, The Mt. Vernon	38	6=1
588A	81	11=1
1200A	81	11=1

OLYMPIC RADIO & TELEV. INC.

MODEL	PACK	PAGES
Broadmoor	44	6=1
Catalina	44	6=1
Challenger	44	6=1
Lancaster, Marlborough	44	7=1
Monte Carlo	44	6=1
Prince George	44	6=1
Riviera	44	6=1
Riviera Deluxe	44	7=1
Windsor	44	7=1
DX-214, DX-215, DX-216	44	4=1
		5=1
DX-619, DX-620	44	5=1
DX-621	44	5=1
		6=13
DX-622	44	5=1
DX-931, DX-932	44	5=1
DX-950	44	5=1
TG, Ch.	67	10=1
TH, Ch.	67	10=10
XL-210, XL-211	44	5=8
XL-612, XL-613	44	5=8
17C24, 17K31, 17K32, Ch. TG	67	10=1
17T20, 17T33, Ch. TG	67	10=1
21C28, 21D29, Ch. TH	67	10=10
21K26, 21T27, Ch. TH	67	10=10
752, Riviera	44	6=1
752U	44	6=1
753, Monte Carlo	44	6=1
753U	44	6=1

OLYMPIC RADIO & TELEV. INC. (Cont'd)

MODEL	PACK	PAGES
755, Challenger	44	6=1
755U	44	6=1
762, Riviera Deluxe	44	7=1
764, Broadmoor	44	6=1
764U	44	6=1
766, Catalina	44	6=1
766U, 767	44	6=1
769, Prince George	44	6=1
783	44	7=1
967, Windsor	44	7=1
968, Lancaster	44	7=1
970, Marlborough	44	7=1

PACKARD-BELL CO.

MODEL	PACK	PAGES
2001-TV, 2002-TV	44	5=1
2091-TV, 2092-TV	44	5=3
2101, 2102, Ch. 2101-2	44	7=1
2101-2, Ch.	44	7=1
2105,2105A, Ch. 2101-2	44	7=1
2202-TV, 2204-TV	44	7=10
2111, Ch. 2111-2	52	9=15
2111-2, Ch.	52	9=15
2112, 2113, Ch. 2111-2	52	9=15
2114, Ch. 2114	52	9=15
2114, Ch.	52	9=15
2115, Ch. 2115-2	71	10=1
2115-2, Ch.	71	10=1
2116, DeLuxe, Standard, Ch. 2115-2	71	10=1
2117, DeLuxe, Standard, Ch. 2117	71	10=1
2117, Ch.	71	10=1
2118	71	10=17
2301, 2302	9	8=1
2311	52	9=1
2421, Ch. 2421-2	71	10=27
2421-2, Ch.	71	10=27
2422, DeLuxe, Standard, Ch. 2421-2	71	10=27
2423, DeLuxe, Standard, Ch. 2423-2	71	10=27
2423-2, Ch.	71	10=27
2601-TV	44	5=9
2602	44	7=1
		8=14
2611	52	9=21
2612, Ch. 2115-2	71	10=11
2692-TV	44	5=9
2801-TV, 2801A-TV	44	6=1
2803	9	8=1
2811	52	9=1
2811, Late	52	9=1
2822, Ch. 2822	71	10=27
2822, Ch.	71	10=27

PACIFIC MERCURY TELEV.MFG. CO.

MODEL	PACK	PAGES
150, 150-1, 150-2, Ch.	81	11=1
150-6, 150-9, 150-10, Ch.	81	11=1
150-11, 150-15, 150-21, Ch.	81	11=1
510-81, Ch.	81	11=1
2013, Ch. 150-2	81	11=1
2081, Ch. 150-2	81	11=1
2113, 2115, Ch. 150-11, 150-81	81	11=1
2116, Ch. 150-81	81	11=1
2192, Ch. 150-10	81	11=1
4120, 4220, Ch.150, 150-2	81	11=1
4317, Ch. 150-9	81	11=1
4320, Ch. 150-2, 150-15	81	11=1
4721, Ch. 150-10	81	11=1

PATHE TELEVISION CORP.

MODEL	PACK	PAGES
TAP, Ch.	10	8=1
14-PT	10	8=6
17-N25, Ch. TAP	10	8=1
17-PC	10	8=6
17-RPC, 17-RPT, Ch. TAP	10	8=1

PHILCO CORP.

MODEL	PACK	PAGES
RC-1 Remote Control Unit	10	8=1
C-2, CP-1, Ch.	22-B	9=1
F-2, Ch.	22-B	9=1
G-1, Ch.	71	10=1
G-2, Ch.	68	10=13
G-4, Ch.	68	10=22
H-1, Ch.	82	11=1
J-1, Ch.	68	10=35
33, 35, 37, 38, Ch.	22-B	9=1
42, Ch.	68	10=13
44, Ch.	68	10=22
50-T1104, Codes 121, 122	34	5=1
		6=18
50-T1105, Codes 121, 122	34	5=1
		6=19
50-T1106	34	5=1
		6=19
50-T1403, Code 125	34	5=7
		6=29
50-T1404, Codes 123, 124, 125	34	5=7
		6=29
50-T1406, Codes 123, 124, 125	34	5=7
		6=29
50-T1432, Code 124	34	5=7
		6=29
50-T1443, Codes 122, 123	37	6=33
50-T1478, 50-T1479	37	6=44
50-T1476, 50-T1477	37	6=44
50-T1481, 50-T1482	37	6=44
50-T1483	22-A	7=1
50-T1484	37	6=44
50-T1600, Code 121	34	5=17
50-T1600, Codes 121, 122	22-B	7=11
50-T1630, Code 121	22-B	7=18
		5=17
50-T1630, Code 122	22-B	7=18
50-T1632, 50-T1633, Code 121	34	5=17
50-T1632, 50-T1633, Codes 121, 122	22-B	7=11
50-702, Code 122	37	6=9
		5=17
51-PT1207, 51-PT1208	10	8=5
51-PT1234	10	8=5
51-PT1282	10	8=5
51-T1443B, 51-T1443L, 51-T1443M	22-A	7=33
51-T1443PL, 51-T1443PM, 51-T1443PW	22-A	7=41
51-T1443X, 51-T1443XL	22-A	7=33
51-T1601, 51-T1601T, 51-T1602, Codes 121, 122	22-A	7=51
51-T1604, Codes 121, 122,125	22-B	7=11
51-T1606, Codes 121,122,125	22-B	7=11
51-T1606, Codes 131, 132	22-B	7=11
51-T1634, Codes 121, 122	22-B	7=11
51-T1634, Codes 123, 124	22-A	7=51
51-T1634, Code 125	22-B	7=11
51-T1836, 51-T1836L, Code 123	10	8=14
51-T1838, Code 124	10	8=14
51-T1870, 51-T1872, Code 121	10	8=14
51-T1874, 51-T1874L, Code 121	10	8=14
51-T1875, Code 121	10	8=14
51-T1876, Code 124	10	8=14

PHILCO CORP. (Cont'd)

MODEL	PACK	PAGES
51-T2134, 51-T2136, 51-T2138, Code 124	10	8=14
51-T2175, 51-T2176, Code 124	10	8=14
52-T1802, Ch. 33, C-2, Code 122	22-B	9=1
52-T1802, Ch. 37, C-2, Code 123	22-B	9=1
52-T1802, Ch. 71, G-1, Code 124	71	10=1
52-T1804, Ch. 33, C-2, Code 122	22-B	9=1
52-T1804, Ch. 37, C-2, Code 123	22-B	9=1
52-T1804, Ch. 71, G-1, Code 124	71	10=1
52-T1808, Ch. 33, C-2, Code 122	22-B	9=1
52-T1808, Ch. 37, C-2, Code 123	22-B	9=1
52-T1810, Ch. 33, C-2, Code 122	22-B	9=1
52-T1810, Ch. 37, C-2, Code 123	22-B	9=1
52-T1810-L, Ch. 33, C-2, Code 122	22-B	9=1
52-T1812, Ch. 33, C-2, Code 122	22-B	9=1
52-T1812, Ch. 37, C-2, Code 123	22-B	9=1
52-T1820, Ch. 37, C-2, Code 123	22-B	9=1
52-T1820, Ch. 71, G-1, Code 124	71	10=1
52-T1821, Ch. 37, C-2, Code 123	22-B	9=1
52-T1821, Ch. 71, G-1, Code 124	71	10=1
52-T1822, Ch. 71, G-1, Code 124	71	10=1
52-T1831, Ch. 33, C-2, Code 122	22-B	9=1
52-T1831, Ch. 33, C-2, Code 124	22-B	9=1
52-T1839, Ch. 33, C-2, Code 122	22-B	9=1
52-T1839, Ch. 37, C-2, Code 123	22-B	9=1
52-T1840, Ch. 33, C-2, Code 122	22-B	9=1
52-T1840, Ch. 37, C-2, Code 123	22-B	9=1
52-T1841-L, Ch. 37, C-2, Code 123	22-B	9=1
52-T1842, Ch. 33, C-2, Code 122	22-B	9=1
52-T1842, Ch. 37, C-2, Code 123	22-B	9=1
52-T1842-L, Ch. 33, C-2, Code 124	22-B	9=1
52-T1842-L, Ch. 37, C-2, Code 123	22-B	9=1
52-T1844, Ch. 33, C-2, Code 122	22-B	9=1
52-T1844, Ch. 33, C-2, Code 124	22-B	9=1
52-T1844, Ch. 37, C-2, Code 123	22-B	9=1
52-T1845, Ch. 71, G-1, Code 124	71	10=1
52-T1882, Ch. 35, CP-1, Code 122	22-B	9=1
52-T1882, Ch. 38, CP-1,		

PHILCO CORP. (Cont'd)

MODEL	PACK	PAGES
Code 123	22-B	9=1
52-T2106, Ch. 35, F-2, Code 122	22-B	9=1
52-T2106, Ch. 38, F-2, Code 123	22-B	9=1
52-T2108, Ch. 35, F-2, Code 122	22-B	9=1
52-T2108, Ch. 38, F-2, Code 123	22-B	9=1
52-T2110, Ch. 35, F-2, Code 122	22-B	9=1
52-T2110, Ch. 38, F-2, Code 123	22-B	9=1
52-T2120, Ch. 71, G-1, Code 124	71	10=1
52-T2122, 52-T2122-L, Ch. 71, G-1, Code 124	71	10=1
52-T2140, Ch. 35, F-2, Code 122	22-B	9=1
52-T2140, Ch. 38, F-2, Code 123	22-B	9=1
52-T2142, Ch. 35, F-2, Code 122	22-B	9=1
52-T2142, Ch. 38, F-2, Code 123	22-B	9=1
52-T2150, Ch. 71, G-1, Code 124	71	10=1
52-T2151, Ch. 71, G-1, Code 124	71	10=1
52-T2151-L, Ch. 71, G-1, Code 124	71	10=1
52-T2152, Ch. 71, G-1, Code 124	71	10=1
52-T2175, 52-T2176, Ch. 35, F-2, Code 124	22-B	9=1
52-T2175, Ch. 42, G-2, Code 125	68	10=13
52-T2252, Ch. 71, G-1, Code 124	71	10=1
52-T2275, Ch. 35, F-2, Code 122	22-B	9=1
53-T1824, Ch. 71, G-1, Code 124	71	10=1
53-T1824, Ch. 81, H-1, Code 123	82	10=1
53-T1825, Ch. 71, G-1, Code 124	71	10=1
53-T1825, Ch. 81, H-1, Code 123	82	11=1
53-T1826, Ch. 71, G-1, Code 124	71	10=1
53-T1826, Ch. 81, H-1, Code 123	82	11=1
53-T1852, Ch. 71, G-1, Cdde 124	71	10=1
53-T1852, 53-T1852F, 53-T1852L, Ch. 81, H-1, Code 123	82	11=1
53-T1853, 53-T1853L, Ch. 91, J-1, Code 126	68	10=35
53-T1854, 53-T1854L, Ch. 81, H-1, Code 123	82	11=1
53-T1883, 53-T1884, Ch. 44, G-4, Code 125	68	10=22
53-T1886, 53-T1886L, Ch. 44, G-4, Code 125	68	10=22
53-T2124, 53-T2124L, Ch. 81, H-1, Code 123	82	11=1
53-T2125, 53-T2125L, Ch. 81, H-1, Code 123	82	11=1
53-T2126, Ch. 42, G-2, Code 125	68	10=13

PHILCO CORP. (Cont'd)

MODEL	PACK	PAGES
53-T2126, Ch. 81, H-1, Code 123	82	11=1
53-T2127, Ch. 91, J-1, Code 126	68	10=35
53-T2152, 53-T2152L, Ch. 81, H-1, Code 123	82	11=1
53-T2183, Ch. 44, G-4, Code 125	68	10=22
53-T2226, 53-T2227, Ch. 81, H-1, Code 123	82	11=1
53-T2260, Ch. 42, G-2, Code 125	68	10=13
53-T2260, Ch. 81, H-1, Code 123	82	11=1
53-T2262, Ch. 42, G-2, Code 125	68	10=13
53-T2262, Ch. 81, H-1, Code 123	82	11=1
53-T2264, Ch. 42, G-2, Code 125	68	10=13
53-T2264, Ch. 81, H-1, Code 123	82	11=1
53-T2266, 53-T2268, Ch. 91, J-1, Code 126	68	10=35
53-T2269, 53-T2270, 53-T2271, Ch. 91, J-1, Code 126	68	10=35
53-T2272, 53-T2272L, Ch. 81, H-1, Code 123	82	11=1
53-T2273C, 53-T2273M, Ch. 91, J-1, Code 126	68	10=35
71, Ch.	71	10=1
76-4402, 76-5411, 76-5433, Series; Tuners	37	6=1
81, Ch.	82	11=1
91, Ch.	68	10=35

PHILHARMONIC RADIO & TELEV. CORP.

MODEL	PACK	PAGES
C-6161, T-616	22-A	7=1
20C2B, 20CD2B	82	11=1
20T2B	82	11=1
21C2A, 21CD2A	82	11=1
111, 112	82	11=1
420	82	11=1
717T, 724	82	11=1
820	82	11=1
920, 924	82	11=1
1116	22-A	7=1
5221	82	11=1
5816	22-A	7=1
7171	82	11=1
8120	82	11=1
8820	82	11=1
9120, 9121A	82	11=1
9820, 9821	82	11=1

PILOT RADIO CORP.

MODEL	PACK	PAGES
TV-125	20	5=1
TV-127	37	6=1
TV-161	20	5=1
TV-163	20	5=1
TV-164	37	6=1
TV-165	20	5=1
TV-167A	37	6=1
TV-167B, TV-168	37	6=1
TV-191	37	6 1
TV-191	37	6=1

PILOT RADIO CORP. (Cont'd)

MODEL	PACK	PAGES
TV-271, TV-273, TV-274	53	9=1
TV-293, TV-294	53	9=1

PLYMOUTH

See INTERSTATE STORES BUYING CORP.

PRECISION

See THE HERTNER ELECTRIC CO.

RADIO CORP. OF AMERICA

MODEL	PACK	PAGES
Ainsworth	72	10=64
Albury	72	10=55
Ashton	72	10=55
Bancroft	82	11=1
Belgrove	74	10=73
Bently	16	9=1
Brandon	74	10=73
Brett	72	10=64
Bristol	16	9=73
Bristol, Late	72	10=17
Brookfield	74	10=73
Caldwell	72	10=17
Calhoun	72	10=17
Clarendon	16	9=45
Clarendon, Late	82	11=1
Colby	68	10=1
Covington	72	10=17
Crafton	68	10=1
Donley	16	9=45
Donley, Late	82	11=1
Fairfield, Final	16	9=53
Glenside	68	10=1
Hadley	72	10=55
Hampton	16	9=73
Hampton, Late	72	10=17
Haywood	16	9=17
Highland, Final	16	9=53
Hillsdale	11	8=62
Hillsdale, Late	72	10=35
Kentwood	72	10=55
Lambert	74	10=73
Lansford	74	10=73
Lindale	74	10=73
Kendall	16	9=73
Kent, Final	16	9=53
Meredith	82	11=1
Modern, Final	16	9=53
Newport, Final	16	9=53
Preston	16	9=73
Preston, Late	72	10=17
Provincial	11	8=62
Provincial, Final	16	9=53
Provincial	72	10=35
Regency, Final	16	9=53
Rockingham	16	9=45
Rockingham, Late	82	11=1
Rutland	10	8=31
Selfridge	82	11=1
Shelley	72	10=55
Somerville	10	8=1
Suffolk	16	9=45
Suffolk, Late	82	11=1
Talbot	16	9=31
Whitfield, Late	72	10=17
Winston, Final	16	9=53
York	11	8=62
York, Late	72	10=35
KCS31-1, Ch., S1000	20	5=48
KCS31-1, Ch., 9TW390	20	5=32
KCS34C, Ch.	34	5=80

RADIO CORP. OF AMERICA (Cont'd)

MODEL	PACK	PAGES
KCS38, Ch.	34	5=65
KCS38C, Ch.	20	5=1
KCS40, KCS40A, Ch.	37	6=1
KCS40B, Ch.	46-B	7=50
KCS41-1, Ch.	20	5=16
KCS45, KCS45A, Ch.	46-A	7=1
KCS46, Ch.	46-A	7=17
KCS47, KCS47A, KCS47AT, Ch.	46-B	7=33
KCS47B, KCS47C, KCS47D, Ch.; Final	16	9=53
KCS47E, Ch.	16	9=31
KCS47F, KCS47G, Ch.; Final	16	9=53
KCS47GF-2, Ch.	16	9=17
KCS47T, Ch.	46-B	7=33
KCS48A, Ch.	10	8=31
KCS49B, Ch.	11	8=62
KCS49B, Ch., Late	72	10=35
KCS49BF, KCS49BF-2, Ch.	72	10=35
KCS49C, Ch.	11	8=62
KCS49C, Ch., Late	72	10=35
KCS49CF, KCS49CF-2, Ch.	72	10=35
KCS60A, Ch.	11	8=77
KCS61, Ch.	16	9=1
KCS62, Ch.	10	8=1
KCS66, Ch.	16	9=73
KCS66, Ch., Late	72	10=17
KCS66A, Ch.	16	9=73
KCS66A, Ch., Late	72	10=17
KCS66C, Ch.	68	10=1
KCS66D, Ch.	72	10=17
KCS68C, Ch.	16	9=45
KCS68C, Ch., Late	82	11=1
KCS68E, Ch.	82	11=1
KCS68F, Ch.	82	11=1
KCS72, Ch.	72	10=55
KCS72A, Ch.	74	10=73
KCS74, Ch.	72	10=64
S1000, Ch. KCS31-1	20	5=48
T100, Ch. KCS38	34	5=65
T120, Ch. KCS34C	34	5=80
T121, Ch. KCS34C	34	5=95
T164, Ch. KCS40	37	6=1
TC165, TC166, TC167, TC168, Ch. KCS40A	37	6=1
2T51, Ch. KCS45	46-A	7=1
2T60, Ch. KCS45A	46-A	7=1
2T81, Ch. KCS46	46-A	7=17
4T101, Ch. KCS61, Bently	16	9=1
4T141, Ch. KCS62, Somerville	10	8=1
6T53, 6T54, Ch. KCS47, KCS47T	46-B	7=33
6T64, 6T65, Ch. KCS47A, KCS47AT	46-B	7=33
6T71, Ch. KCS47A, KCS47AT	46-B	7=33
6T72, Ch. KCS40B	46-B	7=50
6T74, 6T75, 6T76, Ch. KCS47A, KCS47AT	46-B	7=33
7T103, Ch. KCS47B, Newport, Final	16	9=53
7T104, Ch. KCS47B, Kent, Final	16	9=53
7T104B, Ch. KCS47F, Final	16	9=53
7T111B, Ch. KCS47GF-2, Haywood	16	9=17
7T112, Ch. KCS47C, Highland, Final	16	9=53
7T112B, Ch. KCS47G, Final	16	9=53
7T122, Ch. KCS47C, Fairfield, Final	16	9=53
7T122B, Ch. KCS47G, Final	16	9=53
7T123, Ch. KCS47C, Regency, Final	16	9=53

RADIO CORP. OF AMERICA (Cont'd)

MODEL	PACK	PAGES
7T123B, Ch. KCS47G, Final	16	9=53
7T124, Ch. KCS47C, Modern, Final	16	9=53
7T125B, Ch. KCS47G, Provincial, Final	16	9=53
7T132, Ch. KCS47D, Winston, Final	16	9=53
7T143, Ch. KCS48A, Rutland	10	8=31
9T105, Ch. KCS49B, York	11	8=62
9T105, Ch. KCS49B, KCS49BF, KCS49BF-2, York, Late	72	10=35
9T126, Ch. KCS49C, Hillsdale	11	8=62
9T126, Ch. KCS49C, KCS49CF, KCS49CF-2, Hillsdale, Late	72	10=35
9T128, Ch. KCS49C, Provincial	11	8=62
9T128, Ch. KCS49C, KCS49CF, KCS49CF-2, Provincial, Late	72	10=35
9T147, Ch. KCS60A	11	8=77
9T256, Ch. KCS38C	20	5=1
9TW309, Ch. KCS41-1	20	5=16
9TW390, Ch. KCS31-1	20	5=32
16T152, Ch. KCS47E, Talbot	16	9=31
17T150, Ch. KCS66C, Colby	68	10=1
17T151, Ch. KCS66C, Glenside	68	10=1
17T153, Ch. KCS66, Bristol	16	9=73
17T153, Ch. KCS66, Bristol, Late	72	10=17
17T154, Ch. KCS66, Whitfield, Late	72	10=17
17T155, Ch. KCS66, Preston	16	9=73
17T155, Ch. KCS66, Preston, Late	72	10=17
17T160, Ch. KCS66, Hampton	16	9=73
17T160, Ch. KCS66, Hampton, Late	72	10=17
17T162, Ch. KCS66A, Caldwell, Late	72	10=17
17T163, Ch. KCS66C, Crafton	68	10=1
17T172, Ch. KCS66A, Covington, Late	72	10=17
17T172K, Ch. KCS66D	72	10=17
17T173, Ch. KCS66A, Calhoun, Late	72	10=17
17T173K, Ch. KCS66D	72	10=17
17T174, Ch. KCS66A, Kendall	16	9=73
17T174K, Ch. KCS66D	72	10=17
17T200, Ch. KCS72, Shelley	72	10=55
17T201, Ch. KCS72, Hadley	72	10=55
17T202, Ch. KCS72, Kentwood	72	10=55
17T211, Ch. KCS72, Ashton	72	10=55
17T220, Ch. KCS72, Albury	72	10=55
17T250DE, Ch. KCS74, Brett	72	10=64
17T261DE, Ch. KCS74, Ainsworth	72	10=64
21T159, Ch. KCS68E, Selfridge	82	11=1
21T159DE, Ch. KCS68F, Selfridge	82	11=1
21T165, Ch. KCS68E, Merldith	82	11=1
21T174DE, Ch. KCS68F, Bancroft	82	11=1
21T176, Ch. KCS68C, Suffolk	16	9=45
21T176, Ch. KCS68C, Suffolk, Late	82	11=1
21T177, Ch. KCS68C, Donley	16	9=45
21T177, Ch. KCS68C, Donley, Late	82	11=1
21T178, Ch. KCS68C, Rockingham	16	9=45
21T178, Ch. KCS68C, Rockingham, Late	82	11=1
21T178DE, Ch. KCS68F, Rockingham, Late	82	11=1
21T179, Ch. KCS68C, Clarendon	16	9=45
21T179, Ch. KCS68C, Clarendon, Late	82	11=1
21T179DE, Ch. KCS68F, Clarendon, Late	82	11=1
21T208, Ch. KCS72A, Lambert	74	10=73
21T217, Ch. KCS72A, Brookfield	74	10=73

RADIO CORP. OF AMERICA (Cont'd)

MODEL	PACK	PAGES
21T218, Ch. KCS72A, Lansford	74	10=73
21T227, Ch. KCS72A, Lindale	74	10=73
21T228, Ch. KCS72A, Brandon	74	10=73
21T229, Ch. KCS72A, Belgrove	74	10=73

RADIO CRAFTSMEN

MODEL	PACK	PAGES
RC101	15	8=1
RC100A	38	5=1
RC201	15	8=6
RC202	74	10=1

RAYTHEON TELEV. & RADIO CORP.

MODEL	PACK	PAGES
Adams	2	8=1
Adams	83	11=21
The Belmont	27	5=1
Bermuda	83	11=21
Beverly	83	11=10
Catalina, Clayton	2	8=1
Colonial	83	11=21
Commander	58	10=1
The Console	27	5=1
Constellation	2	8=1
Essex	83	11=21
The Evanston	48	7=1
Glendale	83	11=10
Highland	58	10=11
Lakewood	83	11=10
Linden	58	10=1
Madrid	83	11=21
Malibu	83	11=10
The Marquis	48	7=1
The Mayfair	48	7=1
Montclair	83	11=10
The Mozart	48	7=1
Normandy	83	11=21
Northbrook	83	11=10
Pacer	83	11=1
Plymouth	83	11=10
Raleigh	58	10=11
The Rancho, The Revere	48	7=1
The Rocket	48	7=1
Roseland	58	10=1
The Rover	27	5=1
The Santung	48	7=1
Saratoga	83	11=10
The Savoy	48	7=1
Sensation	58	10=11
The Starlight	2	8=14
Stockholm	83	11=21
The Suburban	27	5=1
Vogue	58	10=11
Westport	83	11=10
C-1104B, Ch. 12AX27, The Console	27	5=1
C-1401, Ch. 14AX21	27	5=9
C-1602, Ch. 16AX23, 16AX25, 16AX26	27	5=21
C-1602, Series C, Ch. 16AX29	27	5=21
C-1614A, Ch. 16AY211, The Marquis	48	7=1
C-1614B, Ch. 16AY28, The Marquis	48	7=1
C-1615A, Ch. 16AY211, The Mayfair	48	7=1
C-1615B, Ch. 16AY28, The Mayfair	48	7=1
C-1616A, Ch. 16AY211, The Mozart	48	7=1
C-1616B, Ch. 16AY28, The Mozart	48	7=1
C-1714A, Ch. 17AY24, The Marquis	48	7=1
C-1714B, Ch. 17AY21, The Marquis	48	7=1
C-1715A, Ch. 17AY24, The Mayfair	48	7=1

RAYTHEON TELEV. & RADIO CORP. (Cont'd)

MODEL	PACK	PAGES
C-1715B, Ch. 17AY21, The Mayfair	48	7=1
C-1716A, Ch. 17AY24, The Mozart	48	7=1
C-1716B, Ch. 17AY21, The Mozart	48	7=1
C-1724A, Ch. 17AY21, The Evanston	48	7=1
C-1729A, Ch. 17AY21A, Roseland	58	10=1
C-1731A, Ch. 17AY21A, Linden	58	10=1
C-1735A, Ch. 17T1, Lakewood	83	11=10
C-1736A, Ch. 17T1, Glendale	83	11=10
C-2001A, Ch. 20AY21, Clayton	2	8=1
C-2002A, Ch. 20AY21, Catalina	2	8=1
C-2006A, Constellation	2	8=1
C-2103A, Ch. 21AY21, Raleigh	58	10=11
C-2105A, Ch. 21AY21, Highland	58	10=11
C-2108A, Ch. 21T1, Westport	83	11=10
C-2109A, Ch. 21T2, Montclair	83	11=10
C-2110A, Ch. 21T1, Malibu	83	11=10
C-2111A, Ch. 21T1, Plymouth	83	11=10
C-2112A, Ch. 21T3, Madrid	83	11=21
C-2113A, Ch. 21T3, Bermuda	83	11=21
C-2114A, Ch. 21T3, Essex	83	11=21
C-2115A, Ch. 21T3, Stockholm	83	11=21
C-2116A, Ch. 21T3, Normandy	83	11=21
C-2118A, Ch. 21T3, Colonial	83	11=21
M-1105B, Ch. 12AX27, The Suburban	27	5=1
M-1106, Ch. 12AX27, The Rover	27	5=1
M-1107, Ch. 12AX27, The Belmont	27	5=1
M-1402, M-1403, M-1404, Ch. 14AX21	27	5=9
M-1601, Ch. 16AX23, 16AX25, 16AX26	27	5=21
M-1611A, Ch. 16AY211, The Rocket	48	7=1
M-1611B, Ch. 16AY28, The Rocket	48	7=1
M-1612A, Ch. 16AY211, The Rancho	48	7=1
M-1612B, Ch. 16AY28, The Revere	48	7=1
M-1613A, Ch. 16AY211, The Revere	48	7=1
M-1613B, Ch. 16AY28, The Revere	48	7=1
M-1626, Ch. 16AY212, Pacer	83	11=1
M-1711A, Ch. 17AY24, The Rocket	48	7=1
M-1711B, Ch. 17AY21, The Rocket	48	7=1
M-1712A, Ch. 17AY24, The Rancho	48	7=1
M-1712B, Ch. 17AY21, The Rancho	48	7=1
M-1713A, Ch. 17AY24, The Revere	48	7=1
M-1713B, Ch. 17AY21, The Revere	48	7=1
M-1725A, Ch. 17AY21	48-B	7=1
M-1726A, Ch. 17AY21A, Commander	58	10=1
M-1728A, Ch. 17AY21A, Vogue	58	10=1
M-1733A, Ch. 17T1, Saratoga	83	11=10
M-1734A, Ch. 17T2, Northbrook	83	11=10
M-2101A, Ch. 21AY21, Sensation	58	10=11
M-2107A, Ch. 21T1, Beverly	83	11=10
P-301, Series B, Ch. 7DX22P	27	5=31
RC-1405, Ch. 14AX21	27	5=9

RAYTHEON TELEV. & RADIO CORP. (Cont'd)

MODEL	PACK	PAGES
RC-1618A, Ch. 16AY211, The Savoy	48	7=1
RC-1618B, Ch. 16AY28, The Savoy	48	7=1
RC-1619A, Ch. 16AY211, The Santung	48	7=1
RC-1619B, Ch. 16AY28, The Santung	48	7=1
RC-1718A, Ch. 17AY24, The Savoy	48	7=1
RC-1718B, Ch. 17AY21, The Savoy	48	7=1
RC-1719A, Ch. 17AY24, The Santung	48	7=1
RC-1719B, Ch. 17AY21, The Santung	48	7=1
RC-1720A, Ch. 17AY27, The Starlight	2	8=14
RC-2005A, Ch. 20AY21, Adams	2	8=1
RC-2117A, Ch. 21T3, Adams	83	11=21
6J6, 12AT7, Tuners	2	8=26
7DX22P, Ch.	27	5=31
12AX27, Ch.	27	5=1
14AX21, Ch.	27	5=9
16AX23, 16AX25, 16AX26, Ch.	27	5=21
16AX29, Ch.	27	5=21
16AY28, Ch.	48	7=1
16AY211, Ch.	48	7=1
16AY212, Ch.	83	11=1
17AY21, Ch.	48	7=1
17AY21A, Ch.	58	10=1
17AY24, Ch.	48	7=1
17AY27, Ch.	2	8=14
17T1, Ch.	83	11=10
17T2, Ch.	83	11=10
20AY21, Ch.	2	8=1
21AY21, Ch.	58	10=11
21T1, Ch.	83	11=10
21T2, Ch.	83	11=10
21T3, Ch.	83	11=21

REGAL ELECTRONICS CORP.

MODEL	PACK	PAGES
17C, 17T, Ch. Series 20, Codes 88, 90, 91, 93, 94, 99	83	11=1
20, Ch. Series	83	11=1
20C, 20T, Ch. Series 20, Codes 88, 90, 91, 93, 94, 99	83	11=1
21H20, Ch. Series 20, Codes 88, 90, 91, 93, 94, 99	83	11=1
2420, Ch. Series 20, Codes 88, 90, 91, 93, 94, 99	83	11=1

SCOTT RADIO LABS., INC.

MODEL	PACK	PAGES
Ashly, Chippendale, Cressy, Croydon, Ravenswood, Waverly, Wellington	54	9=1
AC-17, AT-17, Ch. 720, Ravenswood	54	9=1
310, Ch. 720, Croydon	54	9=1
320, Ch. 920, Croydon	54	9=1
510, Ch. 720, Cressy	54	9=1
520-TA, Ch. 920, Ashly	54	9=1
720, Ch.	54	9=1
910, Ch. 920, Waverly	54	9=1
920, Ch.	54	9=1
924, Ch. 924, Wellington	54	9=1
924, Ch.	54	9=1
1000-TC, Ch. 924, Chippendale	54	9=1

SEARS, ROEBUCK & CO. (SILVERTONE)

MODEL	PACK	PAGES
100.112, Ch.	11	8=1
100.120, Ch.	55	9=57
102-A, Ch. 549.100-7	55	9=49
110.111, Ch.	11	8=15
110.700, Ch.	74	10=1

SEARS, ROEBUCK & CO. (Cont'd)

MODEL	PACK	PAGES
110.700-1, 110.700-2, Ch.	74	10=1
110.700-10, 110.700-20, Ch.	74	10=1
110.700-40, 110.700-50, Ch.	74	10=1
110.700-90, 110.700-91, Ch.	74	10=1
110.700-92, 110.700-93, Ch.	74	10=1
110.700-96, 110.700-97, Ch.	74	10=1
111, 113, Ch. 110.700	74	10=1
116, Ch. 110.700-1, 110.700-10	74	10=1
116A, Ch. 110.700-1, 110.700-10, 110.700-90	74	10=1
127-12, Ch. 110.700	74	10=1
128-16, Ch. 478.337	55	9=13
131, Ch. 110.700-1, 110.700-10	74	10=1
131A, Ch. 110.700-1, 110.700-10, 110.700-90	74	10=1
132.014, Ch.	55	9=53
132.890, 132.890-1, 132.890-2, Ch.	12	8=53
134, Ch. 110.700-2, 110.700-20	74	10=1
139, 140, Ch. 110.700	74	10=1
143, Ch. 100.111	11	8=15
143A, Ch. 100.111	11	8=15
150-14, Ch. 478.338	11	8=32
153-16, Ch. 478.341	55-3	9=9
161-16, Ch. 100.112	11	8=1
162-16, Ch. 110.700-10, 110.700-90	74	10=1
163-16, Ch. 478.319	55	9=1
165-16, Ch. 100.120	55	9=57
166-16, Ch. 478.339	55	9=21
166-17, Ch. 478.339-A	55	9=21
167-16, Ch. 549.101	11	8=40
167-16A, Ch. 549.101-1	11	8=40
168-16, Ch. 549.100-7	55	9=49
172-16, Ch. 549.101-4	74	10=31
173-16, Ch. 110.700-10, 110.700-90	74	10=1
175-16, 175-16A, Ch. 549.100-5, 549.100-8, 549.100-9	55	9=37
176-19, Ch. 549.100-6	55	9=50
177-19, Ch. 110.700-40, 110.700-91	74	10=1
179-16, 180-16, Ch. 132.890, 132.890-1, 132.890-2	12	8=53
185-16, Ch. 549.101-2	11	8=40
186-19, Ch. 549.101-3	11	8=40
187-16, 188-16, Ch. 110.700-10	74	10=1
189-16, Ch. 110.700-1 110.700-10	74	10=1
191-16, Ch. 110.700-50, 110.700-92	74	10=1
192-16, Ch. 110.700-50	74	10=1
194-16, Ch. 132.890, 132.890-1, 132.890-2	12	8=53
195-16, Ch. 132.890, 132.890-1, 132.890-2	12	8=53
478.319, Ch.	55	9=1
478.337, Ch.	55	9=13
478.338, Ch.	11	8=32
478.339, 478.339-A, 478.339-B, Ch.	55	9=21
478.341, Ch.	55	9=9
478.361, 478.361-A, Ch	55	9=21
478.375, 478.376, Ch.	55	9=13
549.100-5, Ch.	55	9=37
549.100-6, Ch.	55	9=50
549.100-7, Ch.	55	9=49
549.100-8, 549.100-9, Ch.	55	9=37
549.101, 549.101-1, 549.101-2, 549.101-3, Ch.	11	8=40
549.101-4, Ch.	74	10=31
1116-16, Ch. 110.700-90	74	10=1
1117-17, 1130-17, Ch. 110.700-96	74	10=1
1132-17, Ch. 478.376	55	9=13
1135-17, Ch. 110.700-96	74	10=1
1141-20, Ch. 110.700-93	74	10=1
1146-20, Ch. 132.014	55	9=53
1150-14, Ch. 478.361, 478.361-A	55	9=21
1162-16, Ch. 110.700-90	74	10=1
1162-17, Ch. 110.700-96	74	10=1
1163-17, Ch. 478.375	55	9=13
1166-17, Ch. 478.339-B	55	9=21
1191-17, Ch. 110.700-97	74	10=1

SENTINEL RADIO CORP.

MODEL	PACK	PAGES
YA, YB, YC, Ch.	38	7=1, 9=1
1U416	38	5=1
1U419, 1U420	38	5=9, 6=1
1U424	38	6=1
1U425, 1U428, Ch. YA, YB, YC	38	7=1
1U432, Ch. YA, YB, YC	38	7=1
1U435, Ch. YB, YC	38	7=1
1U438, 1U439, 1U440, Ch. YA, YB, YC	38	9=1
1U441, 1U443, 1U444, Ch. YA, YB, YC	38	9=1
1U446, Series XD	38	9=1
1U-447-A, 1U-448-A, 1U-449-A	75	10=1
1U-450-A, 1U-451-A	75	10=1
416	38	5=1
419, 420	38	5=9
420B	38	6=1
423, 424	38	6=1
425, 428, Ch. YA, YB, YC	38	7=1
432, Ch. YA, YB, YC	38	7=1
435, Ch. YB, YC	38	7=1
438, 439, 440, Ch. YA, YB, YC	38	9=1
441, 443, 444, Ch. YA, YB, YC	38	9=1

SHERATON TELEV. CORP.

MODEL	PACK	PAGES
260-DX, 260-FM	54	9=1
260-S, 260-V	54	9=1

SILVERTONE

See SEARS, ROEBUCK & CO.

SKYRIDER

MODEL	PACK	PAGES
519, 520	12	8=1

SONORA RADIO & TELEV. CORP.

MODEL	PACK	PAGES
323, 324	54	9=1

SPARTON RADIO-TELEVISION DIV. OF THE SPARKS-WITHINGTON CO.

MODEL	PACK	PAGES
Berkeley	56	9=1
Del Mar	56	9=22
Gramercy	56	9=17
Hanover	56	9=11
Harrison	75	10=1
Hastings	75	10=1
Radmoor	75	10=1
Rochelle	56	9=22
Roxbury	75	10=1
Sheffield	56	9=22
The Sparcraft	24	7=3, 8=1
The Westmont	24	7=3, 8=1
Whitney	56	9=1, 9=17
25RD190, Ch.	24	7=10, 8=7
25SD201, Ch.	24	7=10, 8=14
25SD201A, Ch.	56	9=11
26SD160, Ch.	24	7=3
26SD170, Ch.	24	7=3, 8=1, 8=21

SPARTON RADIO-TELEVISION (Cont'd)

MODEL	PACK	PAGES
26SD170, DeLuxe, Ch., 5078BB	24	7=3, 8=6, 8=31
26SD170, DeLuxe, Ch., 5079B	24	7=3, 8=22, 8=25
26SD170P, Ch.	24	7=3, 8=2, 8=21
26SD170X, 26SD170XP, Ch.	24	7=3, 8=2, 8=21
26SD171, Ch.	56	9=22
26SD172C, Ch.	75	10=1
26SS160, 26SS160B, 26SS160L, Ch.	24	7=3
26SS170, Ch.	24	7=3, 8=23, 8=27
26SS170D, 26SS170DD, Ch.	56	9=1
26SS170D, 26SS170DP, Ch.	24	7=5, 8=23, 8=27
26SS170P, Ch.	24	7=5, 8=23, 8=27
26SS171, 26SS171A, Ch.	56	9=17
5025, Ch. 26SS160	24	7=3
5025BA, Ch. 26SS170	24	7=3, 8=28
5026, Ch. 26SS160	24	7=3
5029, 5030, Ch. 26SD160	24	7=3
5035, 5036, 5037, Ch. 26SS160L	24	7=3
5075BA, Ch. 26SS170	24	7=3, 8=28
5076, Ch. 26SS160	24	7=3
5076BA, Ch. 26SS170	24	7=3, 8=28
5076BB, Ch. 26SS160B	24	7=3
5077, Ch. 26SS160	24	7=3
5077B, Ch. 26SS160B	24	7=3
5077BA, Ch. 26SS170	24	7=3, 8=28
5078BB, Ch. 26SD170, DeLuxe	24	7=3, 8=6, 8=31
5079, Ch. 26SD160	24	7=3
5079B, Ch. 26SD170, DeLuxe	24	7=3, 8=22, 8=25
5079BB, Ch. 26SD170, DeLuxe	24	7=3, 8=6, 8=31
5080, Ch. 26SD160	24	7=3
5080BB, Ch. 26SD170, DeLuxe	24	7=3, 8=6, 8=31
5082, 5083, Ch. 26SD170	24	7=3, 8=1
5082, 5083, Ch. 26SD170X, 26SD170XP	24	7=3, 8=2, 8=21
5085, 5086, Ch. 25RD190	24	7=10, 8=7
5088, Ch. 26SD170, The Westmont	24	7=3, 8=1
5089, Ch. 26SD170	24	7=3, 8=1
5090, Ch. 26SD170, The Sparcraft	24	7=3, 8=1
5101, 5102, 5103, Ch. 26SS170, 26SS170P	24	7=5, 8=23, 8=27
5104, 5105, Ch. 26SS170D, 26SS170DP	24	7=5, 8=23, 8=27
5107X, Ch. 26SS170D, Whitney	56	9=1
5107X, Ch. 26SS171, Whitney	56	9=17
5108, Ch. 26SS170D, Whitney	56	9=1
5110, Ch. 26SS170DD, Berkeley	56	9=1
5125, Ch. 26SS170DD	56	9=1
5152, 5153, 5154, Ch. 26SS170, 26SS170P	24	7=5, 8=23, 8=27
5155, 5156, 5157, Ch. 26SD170X, 26SD170XP	24	7=3, 8=2, 8=21
5158, Ch. 26SD170, 26SD170P	24	7=3, 8=2, 8=21
5162X, 5163X, Ch. 26SS171A, Gramercy	56	9=17
5165X, 5166X, Ch. 26SD171, Sheffield	56	9=22
5170, 5171, Ch. 25SD201	24	7=10, 8=14
5175X, Ch. 26SD171, Rochelle	56	9=22
5178X, Ch. 26SD171, Del Mar	56	9=22
5182, 5183, Ch. 26SD170, 26SD170P	24	7=3, 8=2, 8=21
5188, 5189, Ch. 26SD170, 26SD170P	24	7=3, 8=2, 8=21
5191, 5192, Ch. 25SD201A, Hanover	56	9=11
5220, Ch. 26SD172C, Harrison	75	10=1
5225, Ch. 26SD172C, Hastings	75	10=1
5226, Ch. 26SD172C	75	10=1
5270, Ch. 26SD172C, Roxbury	75	10=1
5271, Ch. 26SD172C	75	10=1
5272, 5273, Ch. 26SD172C, Radmoor	75	10=1

SPENCER-KENNEDY LABS., INC.

MODEL	PACK	PAGES
212TV, Booster	12	8=1

STANDARD COIL PRODUCTS CO. INC.

MODEL	PACK	PAGES
B-51, Booster	12	8=1

STARRETT TELEVISION CORP.

MODEL	PACK	PAGES
117H, Ch.	75	10=1
120H, Ch.	75	10=1
472.17XMC, 472.17XMT, Ch. 117H	75	10=1
472.20XMC, 472.20XMT, Ch. 120H	75	10=1
Eli Whitney	75	10=1
James Buchanan	75	10=1
James Madison	75	10=1
Patrick Henry	75	10=1
Peter Stuyvesant	75	10=1
The Riviera	75	10=1
12S1, Ch.	75	10=1
14S1, Ch.	75	10=1
15S1, Ch.	75	10=1
17BM1, Ch. 12S1, James Buchanan	75	10=1
20BM1, Ch. 15S1, Peter Stuyvesant	75	10=1
27BM1, Ch. 12S1, Patrick Henry	75	10=1
29AM1, Ch. 14S1, Peter Stuyvesant	75	10=1

STARRETT TELEV. CORP. (Cont'd

MODEL	PACK	PAGES
30BM1, Ch. 15S1, James Madison	75	10=1
37BB1, Ch. 12S1, Eli Whitney	75	10=1
37BM1, Ch. 12S1, The Riviera	75	10=1
39AM1, Ch. 14S1, James Madison	75	10=1

STEWART-WARNER ELECTRIC DIV. OF STEWART-WARNER CORP.

MODEL	PACK	PAGES
9120-A, 9120-B, 9120-C, 9120-D, 9120-E, 9120-F	24	7=1
9121-A, 9121-B	24	7=18
9122-A	12	8=1
9125-A	56	9=19
9126-A, 9126-B	56	9=37
9127-A	56	9=42
9200-A, 9200-C, 9200-D, 9200-FA, 9200-G	12	8=20
9202-A, 9202-B	75	10=1
9202-C	12	8=37
9202-C, Late	75	10=1
9202-DA	12	8=37
9202-DA, Late	75	10=1
9202-DB	12	8=37
9202-DB, Late	75	10=1
9202-DD	12	8=37
9202-DD, Late, 9202-DDA	75	10=1
9202-E	12	8=37
9202-E, Late	75	10=1
9202-F	12	8=37
9202-F, Late, 9202-FA	75	10=1
9203-A	25	9=1
9204-A	75	10=1

STRAND TELEVISION CORP.

MODEL	PACK	PAGES
32-B The Vermont, 80, 2406-C Riverdale, 2412 The Commodore, 2415-C The Cosmopolitan, 2417-C The Van Courtland, 3203-C The Regal, 3214 The Aristocrat, 3217 The Provence, 3224 The Carolinian, 3255 The Danberry, 3353 The Madison, 3356 The Roosevelt, 3357 The Jackson, 3642 The Scarsdale, 3644L The Crestwood, 3645 The Yorktowne, 4000 The New Yorker, 4000 Ch. L, See VIDEO PRODUCTS 630-K3C, 630-DX, 630-FM	69	10=1

STROMBERG-CARLSON CO.

MODEL	PACK	PAGES
Brighton	76	10=1
Cavalier, Futura	23	9=1
Invader	76	10=8
Mandarin	76	10=1
Pan American	76	10=8
Panatomic	76	10=8
24C, 24CM, Ch. 112126	23	7=1
24RP, 24 Series, Ch. 112119	23	7=1
24RPM, 24 Series, Ch. 112119	23	7=1
119CDM, 119CM, Ch. 112107	23	7=9
119M5A, 119M5D, 119M5G, 119M5I, 119M5M, 119M5R, Ch. 112114	23	7=9
119RPM, 119RPM2, Ch. 112114	23	7=9
317RPM, Ch. 112120	15	8=1
317TM, Ch. 112121	15	8=1
321CD2M, 321CD2O, 321 Series, Ch. 112127, Futura	23	9=1
321CF, 321C2M, Ch. 112127, Cavalier	23	9=1
417C5M, 417C5O, 417 Series	76	10=1
417C5-Dec, 417 Series, Mandarin	76	10=1
417TX, 417 Series, Brighton	76	10=1

STROMBERG-CARLSON CO. (Cont'd)

MODEL	PACK	PAGES
421CDM, 421 Series, Pan American	76	10=8
421CM, 421 Series, Invader	76	10=8
421TX, 421 Series, Panatomic	76	10=8
112107, Ch.	23	7=9
112114, Ch.	23	7=9
112119, Ch.	23	7=1
112120, 112121, Ch.	15	8=1
112126, Ch.	23	7=1
112127, Ch.	23	9=1

SUPREMACY
See MACY'S

SURREY
See BENRAY ELECTRONICS CORP.

SYLVANIA ELECTRIC PRODUCTS INC.

MODEL	PACK	PAGES
1-197-2, Ch. 1-227	13	8=53
1-227, Ch.	13	8=53
1-231, Ch.	13	8=105
1-245-2, Ch. 1-227	13	8=53
1-247-1, Ch. 1-231	13	8=105
1-260, 1-261, Ch.	23	7=1
1-329, Ch.	13	8=64
1-356(CO5), Ch.	13	8=160
1-366, Ch.	23	7=1
1-366(CO8), Ch.	13	8=140
1-366-66, Ch.	23	7=1
1-381, Ch.	13	8=64
1-387, Ch.	13	8=83
1-387(CO7), Ch.	13	8=118
1-387-1, Ch., 22M-1	13	8=118
1-387-1, Ch., 25M	25	9=15
1-437, Ch.	23	7=24
1-437-1, Ch.	25	9=1
		9=41
1-437-2, 1-437-3, Ch.	69	10=39
1-441, Ch.	23	7=1
		8=99
1-441(CO2), Ch.	13	8=140
1-442, Ch.	23	7=24
1-502-1, Ch.	25	9=31
1-502-2, Ch.	76	10=1
1-502-3, Ch.	76	10=1
1-502-5, Ch.	76	10=1
1-507-1, Ch.	76	10=22
1-507-2, Ch.	76	10=22
22B-11, Ch. 1-507-1	76	10=22
22M, Ch. 1-387(CO7)	13	8=118
22M-1, Ch. 1-387-1	13	8=118
22M-11, Ch. 1-507-1	76	10=22
22M-11A, 22M-11B, Ch. 1-507-2	76	10=22
23B, Ch. 1-387-1	13	8=118
23B-11, Ch. 1-507-1	76	10=22
23M, Ch. 1-387-1	13	8=118
23M-11, Ch. 1-507-1	76	10=22
24M-1, Ch. 1-387-1	13	8=118
25M, Ch. 1-387-1	25	9=15
71M, Ch. 1-441(CO2)	13	8=140
71M-1, 72B-1, Ch. 1-502-1	25	9=31
72B-11, Ch. 1-502-3	76	10=1
72M, Ch. 1-366	23	7=1
72M, Ch. 1-366(CO8)	13	8=140
72M-1, Ch. 1-502-1	25	9=31
72M-2, Ch. 1-437-3	69	10=39
72M-11, Ch. 1-502-3	76	10=1
72M-11A, 72M-11B, Ch. 1-502-5	76	10=1
73B, Ch. 1-366(CO8)	13	8=140
73B-5, Ch. 1-437-3	69	10=39
73B-11, Ch. 1-502-3	76	10=1
73M, Ch. 1-366	23	7=1
73M, Ch. 1-366(CO8)	13	8=140
73M-1, 73M-2, Ch. 1-502-2	76	10=1
73M-3, 73M-5, 73M-6, Ch. 1-437-3	69	10=39
73M-11, Ch. 1-502-3	76	10=1
74B-1, Ch. 1-437-1	25	9=41
74B-2, Ch. 1-437-2	69	10=39

SYLVANIA ELECTRIC PRODUCTS INC. (Cont'd)

MODEL	PACK	PAGES
74M, Ch. 1-356(CO5)	13	8=160
74M-1, Ch. 1-437-1	25	9=41
74M-2, 74M-3, Ch. 1-437-2	69	10=39
75B, 75M, Ch. 1-437-1	25	9=1
1110X, Ch. 1-329	13	8=64
1210X, Ch. 1-381	13	8=64
2221M, Ch. 1-387	13	8=83
4120M, 4130B, Ch. 1-260, 1-261	23	7=1
4130E, Ch. 1-260	23	7=1
4130M, 4130W, Ch. 1-260, 1-261	23	7=1
6110X, Ch. 1-261	23	7=1
6120B, 6120M, 6120W, Ch. 1-260, 1-261	23	7=1
6130B, 6130M, 6130W, Ch. 1-260, 1-261	23	7=1
7110X, Ch. 1-366	23	7=1
7110XB, Ch. 1-441	23	7=1
		8=99
7110XF, Ch. 1-366-66	23	7=1
7110XFA, Ch. 1-442	23	7=24
7111M, Ch. 1-441	23	7=1
		8=99
7111MA, Ch. 1-366	23	7=1
7120B, 7120M, 7120W, Ch. 1-366	23	7=1
7120BF, 7120MF, Ch. 1-366-66	23	7=1
7120MFA, Ch. 1-442	23	7=24
7120WF, Ch. 1-366-66	23	7=1
7130, 7130M, 7130W, Ch. 1-366	23	7=1
7130BF, 7130MF, Ch. 1-366-66	23	7=1
7130MFA, Ch. 1-442	23	7=24
7130WF, Ch. 1-366-66	23	7=1
7140MA, 7140WA, Ch. 1-437	23	7=24

TECH-MASTER PRODUCTS CO. (VIDEOLA)

MODEL	PACK	PAGES
17U-A, Ch.	14	8=1
630D19, 630S10	69	10=1
1930 Final, 1930D	69	10=1
2430, 2431C, 2431P	69	10=1
5116, Ch. 17U-A	14	8=1

TELE KING CORP.

MODEL	PACK	PAGES
K-21, K-21B, K-22, Ch. TVJ	41	9=1
K-71, K-72, K-72B, Ch. TVJ	41	9=1
K-73L, K-74, Ch. TVJ	41	9=1
KC-21, KC-21B, Ch. TVJ	41	9=1
KC-71, KC-71B, Ch. TVJ	41	9=1
KD-21M, KD-22B, Ch. TVJ	41	9=1
KD-71, KD-72B, Ch. TVJ	41	9=1
TVG, Ch.	41	7=1
TVJ, Ch.	41	9=1
172LO, 172M, Ch. TVG	41	7=1
174LO, 174M, Ch. TVG	41	7=1
202LO, 202M, Ch. TVG	41	7=1
203, 205, Ch. TVG	41	7=1
916, 916CAF, Ch. TVG	41	7=1
919, 919CAF, Ch. TVG	41	7=1
1014, 1016, Ch. TVG	41	7=1

TELEKIT
See ELECTRO-TECHNICAL INDUSTRIES

TELEQUIP RADIO CO.

MODEL	PACK	PAGES
C517, C517B, Ch. 5050, 5050A	14	8=1
C617, C617B, Ch. 5050, 5050A	14	8=1
C720, C720B, Ch. 5050, 5050A	14	8=1
C820, C820B, Ch. 5050, 5050A	14	8=1
T417, T417B, T620, Ch. 5050, 5050A	14	8=1
12TR	41	6=1
14T, 14TR	41	6=1
16T, 16TR	41	6=1
19T, 19TR	41	6=1
5050, 5050A, Ch.	14	8=1

TELE-TONE RADIO CORP.

MODEL	PACK	PAGES
TAA, TAB, Ch.	41	6=9
TAG, Ch.	41	6=18
		7=4
TAJ, Ch.	41	6=18
TAM, Ch.	41	7=7
TAO, Ch.	14	8=4
TAP-2, Ch.	41	7=1
		8=1
TH, TJ, Rev., Ch.	41	6=1
TT, Ch.	41	6=1
TV-284, Ch. TT	41	6=1
TV-286, Ch. TH, TJ, Rev.	41	6=1
TV-287, TV-288, Ch. TT	41	6=1
TV300, TV301, Ch. TW, TX	41	6=9
TV304, TV305, Ch. TW, TX	41	6=9
TV306, Ch. TZ	41	6=18
TV307, Ch. TX	41	6=18
TV314, Ch. TAJ	41	6=18
		7=1
TV315, Ch. TAA, TAB	41	6=9
TV316, Ch. TZ	41	6=18
TV317, Ch. TAG	41	6=18
		7=4
TV318, Ch. TAM	41	7=7
TV322, TV323, Ch. TAM	41	7=7
TV324, TV325, TV326, Ch. TAP-2	41	7=1
		8=1
TV328, TV329, Ch. TAP-2	41	7=1
		8=1
TV330, TV331, TV332, TV333, Ch. TAO	14	8=4
TV335, TV336, Ch. TAP-2	41	7=1
		8=1
TV340, TV345, Ch. TAP-2	41	7=1
		8=1
TW, Ch.	41	6=9
TX, Ch.	41	6=9
		6=18
TZ, Ch.	41	6=18

TELEVISION EQUIPMENT CORP.

MODEL	PACK	PAGES
S505, Booster	14	8=1

TRAD TELEVISION CORP.

MODEL	PACK	PAGES
C-2020, C-2420, CD-2020, Series T-20E	54	9=1
T-1720, Series T-20E	54	9=1

TRANS-VUE CORP.

MODEL	PACK	PAGES
1700C, 1700CD, 1700T	14	8=1

TRAV-LER RADIO CORP.

MODEL	PACK	PAGES
33A2, 34A2, 35B2, Ch.	69	10=1
217-10, 217-11, 217-12, 217-14, Ch. 33A2, 34A2, 35B2	69	10=1
220-9, 220-9B, Ch. 33A2, 34A2, 35B2	69	10=1

TRUETONE
See WESTERN AUTO SUPPLY CO.

VIDAIRE TELEVISION CO.

MODEL	PACK	PAGES
501	14	8=1

VIDEOLA
See TECH-MASTER PRODUCTS CO.

VIDEO PRODUCTS CORP.

MODEL	PACK	PAGES
630-DXC, 630-DX24, 630-K3C, 630-K24C	69	10=1
630-S, 630-SDX, 630-S24, 630-S24DX	69	10=1

MODEL	PACK	PAGES
JOHN WANAMAKER		
C1720T, C1720T, See TRAD Ch. T-20E	54	9=1
T-1720, Series T-20E	54	9=1
C2020T, C2020V, See TRAD Ch. T-20E	54	9=1
C2420D, CD2020W, See TRAD Ch. T-20E	54	9=1
WESTERN AUTO SUPPLY CO. (TRUETONE)		
2D1091, Ch. 12AX27	53	9=41
2D1092	53	9=37
2D1094A	14	8=1
2D1095A, Ch. 16AX27	53	9=1
2D1185A	14	8=20
2D1190A	14	8=28
2D1190B	14	8=28
2D-1191A, Ch. 20AY22	73	10=9
2D1194A	14	8=10
2D2043A, 2D2047B, Ch. 12AX27	53	9=41
2D2049A, Ch. 16AY210	53	9=9
2D2052A, 2D2052B, Ch. 16AY210	53	9=9
2D2052C, Ch. 17AY23	53	9=21
2D2052D, 2D2052E, Ch. 17AY28	53	9=29
2D2053	73	10=1
2D2149A, Ch. 17AY212	73	10=21
2D-2152A, Ch. 17AY26	73	10=20
12AX27, Ch.	53	9=41
16AY210, Ch.	53	9=9
16AX27, Ch.	53	9=1
17AY23, Ch.	53	9=21
17AY26, Ch.	73	10=20
17AY28, Ch.	53	9=29
17AY212, Ch.	73	10=21
20AY22, Ch.	73	10=9
WESTINGHOUSE ELECTRIC CORP.		
Carlyle	54	9=17
H-606K12, H-607K12, Ch. V-2150-111	42	6=1
H-609T10, Ch. V-2150-94C	42	6=10
H-610T12, Ch. V-2150-136	42	6=18
H-611C12, Ch. V-2152-16	42	6=25
H-613K16, Ch. V-2150-146	42	6=33
H-614T12, Ch. V-2150-136	42	6=18
H-615C12, Ch. V-2152-16	42	6=25
H-617T12, Ch. V-2150-176	42	6=41
H-618T16, Ch. V-2150-186, V-2150-186A, V-2150-186C, V-2150-186CA	21	7=1
H-619T12, Ch. V-2150-176	42	6=41
H-619T12U, Ch. V-2150-176U, V-2150-177U	42	6=41
H-620K16, H-622K16, Ch. V-2150-186, V-2150-186A, V-2150-186C, V-2150-186CA	21	7=1
H-625T12, Ch. V-2150-197	21	7=9
H-626T16, Ch. V-2172	21	7=16
H-627K16, H-628K16, H-629K16, Ch. V-2171	21	7=16 7=34
H-630T14, Ch. V-2176	21	7=16
H-633C17, H-634C17, Ch. V-2173	15	8=4
H-636T17, Ch. V-2175	21	7=16 7=34
H-637T14, Ch. V-2177	21	7=16
H-638K20, Ch. V-2178	21	7=27
H-639T17, Ch. V-2192, V-2192-1	15	8=14
H-640T17, Ch. V-2175-3, V-2175-4	15	8=14 8=28
H-640T17, Ch. V-2192, V-2192-1, V-2192-2, V-2192-3	15	8=14
H-640T17A, Ch. V-2192	15	8=14

MODEL	PACK	PAGES
WESTINGHOUSE ELECTRIC CORP. (Cont'd)		
H-641K17, Ch. V-2175-1, V-2175-5	15	8=14 8=28
H-641K17, Ch. V-2192, V-2192-1, V-2192-2, V-2192-3	15	8=14
H-641K17A, Ch. V-2192-1	15	8=14
H-642K20, Ch. V-2178-1, V-2178-3	15	8=32
H-642K20A, Ch. V-2194, V-2194-1	15	8=32
H-643K16, Ch. V-2179, V-2179-1	21	7=36
H-646K17, H-647K17, Ch. V-2175-3, V-2192	15	8=14
H-648T20, Ch. V-2201-1	21	9=9
H-649C17, Ch. V-2200-1	15	8=45
H-649T17, Ch. V-2192-4	15	8=14
H-650T17, Ch. V-2192-4	15	8=14
H-650T17, Ch. V-2200-1	15	8=45
H-651K17, Ch. V-2200-1, V-2204-1	15	8=45
H-652K20, Ch. V-2194-2, V-2194-3	15	8=32
H-652K20, Ch. V-2201-1	21	9=9
H-653K24, Ch. V-2202-2, V-2202-3, V-2210-1, Carlyle	54	9=17
H-654T17, Ch. V-2175-3, V-2175-4, V-2192, V-2192-1	15	8=14
H-655K17, H-656K17, H-657K17, Ch. V-2200-1	15	8=45
H-658T17, Ch. V-2192, V-2192-1	15	8=14
H-659T17, Ch. V-2204-1	15	8=45
H-660C17, H-661C17, Ch. V-2203-1	21	9=1
H-662K20, Ch. V-2201-1	21	9=9
H-663T17, Ch. V-2192, V-2192-2	15	8=14
H-664K17, Ch. V-2200-1	15	8=45
H-667T17, H-668T17, Ch. V-2216-1	77	10=11
H-673K21, H-676T21, Ch. V-2217-1	77	10=11
H-678K17, H-679K17, Ch. V-2216-1, V-2216-2	77	10=11
H-681T17, Ch. V-2215-1	77	10=11
H-689T16, Ch. V-2214-1	77	10=11
H-690K21, H-691K21, Ch. V-2217-1	77	10=11
H-692T21, H-695K21, Ch. V-2217-2	77	10=11
H-699K17, Ch. V-2216-2	77	10=11
H-700T17, H-701T17, Ch. V-2216-2	77	10=11
H-702K17, H-703K17, Ch. V-2216-2	77	10=11
H-704T17, H-705K17, Ch. V-2216-2	77	10=11
H-706T16, Ch. V-2207-1	73	10=1
H-708T20, Ch. V-2220-1	73	10=1
H-710T21, H-711T21, Ch. V-2217-2	77	10=11
H-713K21, H-714K21, H-715K21, Ch. V-2217-2	77	10=11
H-718K20, Ch. V-2220-2	73	10=1
H-720K21, H-721K21, H-722K21, Ch. V-2217-2	77	10=11
H-724T20, H-725T20, Ch. V-2220-2	73	10=1
H-730C21, Ch. V-2218-1	77	10=30
H-732C21, H-733C21, Ch. V-2218-1	77	10=30
V-2150-94C, Ch.	42	6=10
V-2150-111, Ch.	42	6=1
V-2150-136, Ch.	42	6=18
V-2150-146, Ch.	42	6=33
V-2150-176, Ch.	42	6=41

MODEL	PACK	PAGES
WESTINGHOUSE ELECTRIC CORP. (Cont'd)		
V-2150-176U, V-2150-177U, Ch.	42	6=41
V-2150-186, V-2150-186A, V-2150-186C, V-2150-186CA, Ch.	21	7=1
V-2150-197, Ch.	21	7=9
V-2152-16, Ch.	42	6=25
V-2171, Ch.	21	7=16 7=34
V-2172, Ch.	21	7=16
V-2173, Ch.	15	8=4
V-2175, Ch.	21	7=16 7=34
V-2175-1, V-2175-3, V-2175-4, V-2175-5, Ch.	15	8=14
V-2176, Ch.	21	7=16
V-2177, Ch.	21	7=16
V-2178, Ch.	21	7=27
V-2178-1, V-2178-3, Ch.	15	8=32
V-2179, V-2179-1, Ch.	21	7=36
V-2192, V-2192-1, V-2192-2, V-2192-3, Ch.	15	8=14
V-2194, V-2194-1, V-2194-2, V-2194-3, Ch.	15	8=32
V-2200-1, Ch.	15	8=45
V-2201-1, Ch.	21	9=9
V-2202-2, V-2202-3, Ch.	54	9=17
V-2203-1, Ch.	21	9=1
V-2204-1, Ch.	15	8=45
V-2207-1, Ch.	73	10=1
V-2210-1, Ch.	54	9=17
V-2214-1, V-2215-1, Ch.	77	10=11
V-2216-1, V-2216-2, Ch.	77	10=11
V-2217-1, V-2217-2, Ch.	77	10=11
V-2218-1, Ch.	77	10=30
V-2220-1, Ch.	73	10=1
V-2220-2, Ch.	73	10=1
ZENITH RADIO CORP.		
Aldrich	42	6=1
Barrett, Barrie	21	9=1
Burton, Byron	42	6=1
Carlyle, Chesterton	21	9=1
Churchill	42	6=1
Coleridge, J2051E	21	9=1
Coleridge, H2439R	42	6=1
Conrad	21	9=1
Fielding, J2030R	21	9=1
Fielding, H2437E	42	6=1
Galsworthy	21	9=1
Garland	42	6=1
Hawthorne, J2026R	21	9=1
Hawthorne, H3267	42	6=1
Irving, Kilmer	42	6=1
Kipling	21	9=1
Lowell	42	6=1
Mansfield	42	6=1
Markham	21	9=1
Meredith, Morley	42	6=1
Shelley	42	6=1
Tennyson	42	6=1
Thackeray, J2054R	21	9=1
Thackeray, H3477R	42	6=1
Walpole	42	6=1
Walton, J2044R	21	9=1
Walton, H2328R	42	6=1
Warton	42	6=1
Wordsworth, J2043R	21	9=1
Wordsworth, H3469E	42	6=1
H-2029R, H-2030E, H-2030R, Ch. 20H20	15	8=1
H-2041R, Ch. 20H20	15	8=1
H-2052R, H-2053R, Ch. 20H20	15	8=1
H2226E, Ch. 22H20	42	6=1
H2226R, Ch. 22H20, Warton	42	6=1
H2226RQ, Ch. 22H20	42	6=1
H2227E, Ch. 22H20, Garland	42	6=1
H2227EQ, Ch. 22H20	42	6=1
H2227R, Ch. 22H20, Walpole	42	6=1
H2227RQ, Ch. 22H20	42	6=1

MODEL	PACK	PAGES
ZENITH RADIO CORP. (Cont'd)		
H2250R, Ch. 22H20, Lowell	42	6=1
H2250RQ, Ch. 22H20	42	6=1
H2255E, Ch. 22H20, Morley	42	6=1
H2255EQ, Ch. 22H20	42	6=1
H2328E, Ch. 23H22	42	6=1
H2328EZ, Ch. 23H22Z	42	6=1
H2328R, Ch. 23H22, Walton	42	6=1
H2328RQ, Ch. 23H22	42	6=1
H2328RQZ, H2328RZ, Ch. 23H22Z	42	6=1
H2329R, Ch. 23H22, Burton	42	6=1
H2329RQ, Ch. 23H22	42	6=1
H2329RZ, Ch. 23H22Z	42	6=1
H2352R, Ch. 23H22, Mansfield	42	6=1
H2352RQ, Ch. 23H22	42	6=1
H2352RQZ, H2352RZ, Ch. 23H22Z	42	6=1
H2353E, Ch. 23H22, Meredith	42	6=1
H2353EQ, Ch. 23H22	42	6=1
H2353EQZ, H2353EZ, Ch. 23H22Z	42	6=1
H2437E, Ch. 24H20, Fielding	42	6=1
H2437EQ, Ch. 24H20	42	6=1
H2437R, Ch. 24H20, Irving	42	6=1
H2437RQ, Ch. 24H20	42	6=1
H2438R, Ch. 24H20, Aldrich	42	6=1
H2439R, Ch. 24H20, Coleridge	42	6=1
H2438RQ, Ch. 24H20	42	6=1
H2445R, Ch. 24H21, Tennyson	42	6=1
H2445RQ, Ch. 24H21	42	6=1
H2447R, Ch. 24H21, Byron	42	6=1
H2447RQ, Ch. 24H21	42	6=1
H2449E, Ch. 24H20, Churchill	42	6=1
H-2868R, Ch. 20H20	15	8=1
H-3074R, Ch. 20H20	15	8=1
H3267, Ch. 24H20, Hawthorne	42	6=1
H3267R, H3267RQ, Ch. 24H20	42	6=1
H3469E, Ch. 24H20, Wordsworth	42	6=1
H3469EQ, Ch. 24H20	42	6=1
H3475R, Ch. 24H20, Kilmer	42	6=1
H3475RQ, Ch.24H20	42	6=1
H3477R, Ch. 24H21, Thackeray	42	6=1
H3477RQ, Ch. 24H21	42	6=1
H3478E, Ch. 24H21, Shelley	42	6=1
H3478EQ, Ch. 24H21	42	6=1
J2026R, Ch. 20J22, Hawthorne	21	9=1
J2027E, Ch. 20J21, Barrett	21	9=1
J2027R, Ch. 20J21	21	9=1
J2029E, J2029R, Ch. 20J21, Markham	21	9=1
J2030E, Ch. 20J21	21	9=1
J2030R, Ch. 20J21, Fielding	21	9=1
J2040E, Ch. 20J21, Conrad	21	9=1
J2042R, Ch. 20J21, Galsworthy	21	9=1
J2043R, Ch. 20J21, Wordsworth	21	9=1
J2044E, Ch. 20J21	21	9=1
J2044R, Ch. 20J21, Walton	21	9=1
J2051E, Ch. 20J22, Coleridge	21	9=1
J2053R, Ch. 20J22, Chesterton	21	9=1
J2054R, Ch. 20J22, Thackeray	21	9=1
J2055R, Ch. 20J22, Carlyle	21	9=1
J2126R, Ch. 21J21	21	9=1
J2127E, J2127R, Ch. 21J20	21	9=1
J2129E, J2129R, Ch. 21J20	21	9=1
J2130E, J2130R, Ch. 21J20	21	9=1
J2140E, J2142R, J2143R, Ch. 21J20	21	9=1
J2144E, J2144R, Ch. 21J20	21	9=1
J2151E, J2153R, J2154R, J2155R, Ch. 21J21	21	9=1
J2868R, Ch. 20J21, Kipling	21	9=1
J2968R, Ch. 21J20	21	9=1
J3069E, Ch. 20J21, Barrie	21	9=1
J3169E, Ch. 21J20	21	9=1
K1812E, K1812R, Ch. 19K22	77	10=1
K1815E, K1815R, Ch. 19K20	77	10=1
K1820E, K1820R, Ch. 19K20	77	10=1
K1846E, K1846R, Ch. 19K20	77	10=1

MODEL	PACK	PAGES
ZENITH RADIO CORP. (Cont'd)		
K1850E, K1850R, K1880R, Ch. 19K20	77	10=1
K2229R, Ch. 19K23	77	10=1
K2230E, K2230R, Ch. 21K20	77	10=1
K2240E, K2240R, Ch. 21K20	77	10=1
K2258R, Ch. 19K23	77	10=1
K2260R, K2263E, Ch. 21K20	77	10=1
K2266, K2266R, Ch. 21K20	77	10=1
K2267E, K2268R, Ch. 21K20	77	10=1
K2270H, K2270R, Ch. 21K20	77	10=1
K2286R, K2288E, Ch. 19K23	77	10=1
K2290R, K2291E, Ch. 21K20	77	10=1
19K20, 19K22, 19K23, Ch.	77	10=1
20H20, Ch.	15	8=1
20J21, 20J22, 21J20, 21J21, Ch.	21	9=1
21K20, Ch.	77	10=1
22H20, 23H22, 23H22Z, Ch.	42	6=1
24H20, 24H21, Ch.	42	6=1

ADDITIONS and CORRECTIONS RIDER'S TV MANUAL 11

Here are more data that will keep your RIDER'S DEPENDABLE REPLACEMENT PARTS LISTING published in TV Volume 11 up to date.

Set Mfr.	Set Mfr.'s Original Part No.	
FIXED CAPACITORS		
Arvin	D40108-102	Add HVD-1-1000mmf 1KV to Aerovox column.
"	D40108-103	Add HVD-6-.01mf 1KV to Aerovox column.
"	D40108-472	Add HVD-4-4700mmf 1KV to Aerovox column.
Gamble-Skogmo	C42-Pt L-13	Add NPO-SI-7-56mmf to Aerovox column.
"	C84-Pt T-7	Add NPO-SI-19-120mmf to Aerovox column.
Majestic	B-4.125-1	Add BPD2X.005mf to Aerovox column.
"	B-4.129	Add HVD-4-56mmf 2KV to Aerovox column.
"	B-4.129-2	Add HVD-4-39mmf 2KV to Aerovox column.
"	B-4.129-4	Add HVD-4-68mmf 2KV to Aerovox column.
Montgomery Ward	8G-19498	Add SI-3-150mmf SL 1.5KV to Aerovox column.
"	MW23E23	Add NPO-CI-2-30mmf to Aerovox column.
Sheraton	ECC-103	Add 29C48 to Sprague column.
Starrett	CO-1051	Add 29C48 to Sprague column.
Sylvania	169-0015	Add 20DK-T5 to Sprague column.
Western Auto	47X568	Add MS-336 to Sprague column.
ELECTROLYTIC CAPACITORS		
De Wald	2044A-8	Change TVA 1716 to TC 49 in Mallory column.
VARIABLE RESISTANCE CONTROLS		
De Wald	3031-A-12	Change AG-64-2 to AG-64-Z in Clarostat Cat. No. column.
Sonora	N-7338	Change B-123 to B11-123 in IRC Rear Elem. column.
VERTICAL OUTPUT TRANSFORMERS		
Montgomery Ward	12C18743-1	Delete Part No. from Vertical Output Transformer section.
HORIZONTAL OUTPUT TRANSFORMERS		
Montgomery Ward	53X319	Delete A-3037 from Merit column.
"	"	Delete 8-8123 from Stancor column.
"		Delete A-102X from Triad column.
"	53X326	Delete A-97X from Triad column.
"	201-19999	Delete A-104X from Triad column.
SPEAKERS		
RCA	76834	Add 46J6 to Jensen column and Viking to Remarks column.
	77000	Add P5-V ST-107 to Jensen column.

Mismatched Television Components

(continued from page 3)

at the bottom of the raster. An idea of what the picture looked like after readjustment appears in Fig. 3.

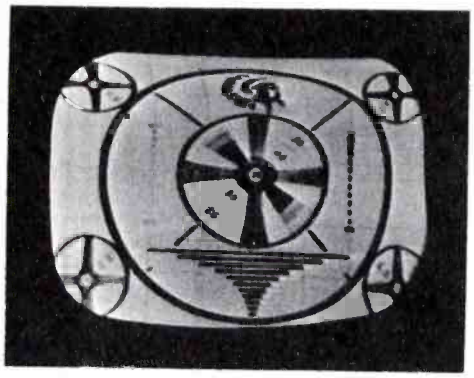


Fig. 2. Faulty picture-tube pattern produced by the substitution of a 10:1 vertical-output transformer for a 13:1 unit.

Equally important was the rise in plate current to 20 ma and the drop in plate voltage from 300 originally, to 250 volts with the compromise adjustments. As can be seen from these figures, the plate current of the vertical output tube has risen 33 1/3% above its normal value, as has the average value of the primary current through the transformer. It is conceivable that one might consider the picture shown in Fig. 3 as being an acceptable compromise, but let it be said immediately that it is far inferior to what was available with the correctly rated transformer in the receiver. Moreover, the increase in tube plate current is a hidden condition which can reduce the operating life of the tube as well as the transformer. The point being stressed here is that, while a tolerable compromise can be achieved in the *appearance* of the picture, it is not sufficient to let the matter go at that; it is also important to determine what hidden conditions have been established in related parts of the circuit. It must be remembered that an increase in current drain of this amount can very easily affect the voltage available at the related plate voltage supply bus, and so cause reduced voltages all along the line.

As stated, some compression existed at the top of the picture even after adjustment, and there was definite foldover at the bottom. The transition in the sweep currents in the vertical deflection coil for the three different conditions is shown in Figs. 4,

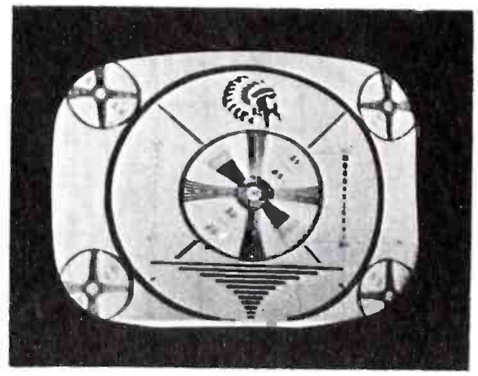


Fig. 3. Picture tube pattern obtained under same conditions as Fig. 2 after compromise adjustment of controls.

5 and 6. In Fig. 4 is shown the vertical sweep current when the original vertical output transformer was used; in Fig. 5 is shown the change in vertical sweep current when the 10:1 turns-ratio transformer was used and before any adjustments were made on the preset controls in order to improve the picture. (Refer to Fig. 2.) The curvature introduced in the sweep trace is very easy to see. The peak-to-peak amplitude of the sweep voltage across the yoke winding also was substantially less.

When adjustments were made on the preset controls so as to improve the picture, and that in Fig. 3 resulted, the corresponding sweep current waveform is that shown in Fig. 6. A fair amount of linearity is present in the waveform, but the foldover is evident at the top of the sawtooth. This is the flat portion of the current waveform. The rising part of the waveform still has some curvature, but it is very much less than before the controls were readjusted.

A series of other measurements were made with other vertical output transformers which differed in primary impedance ratings as well as turns ratio. Interestingly enough, the turns ratio rating seemed to be the more important of the two. For instance a 12:1 transformer rated at 15,000 ohms at 18 ma d-c primary impedance, proved to be a much better replacement than the one with a 10:1 turns ratio and 19,000 ohms at 15 ma d-c primary impedance. The results were not ideal but they were substantially less severe in degradation of the picture than when the lower turns ratio unit was used.

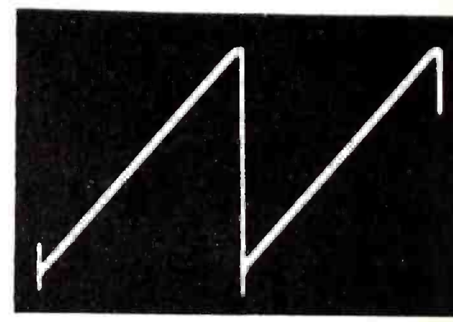


Fig. 4. Vertical-sweep current with original vertical output transformer.

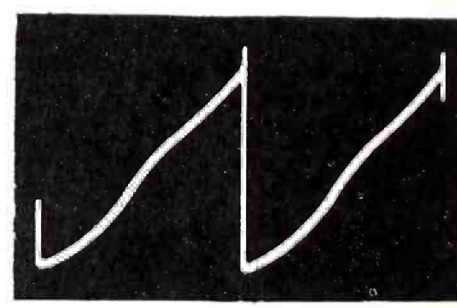
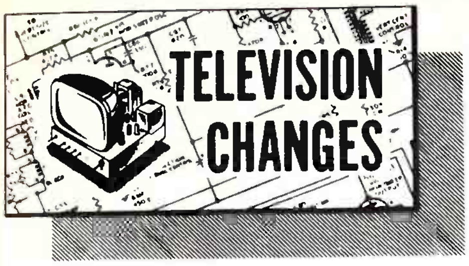


Fig. 5. Vertical-sweep current with 10:1 vertical output transformer before adjustments.

Conclusions.

It is to be understood that tests made with a number of components on relatively few receivers cannot be declared as being conclusive without any reservations. However, it is entirely reasonable to say that such tests are productive of information. Interestingly enough, these findings conform with the opinions of people who have been close to the design of television receivers. When stated in general terms, the opinion is that when selecting a replacement for a vertical output transformer the turns-ratio constant should not differ by more than 10% from the rating of the original part.

(continued on page 33)



In compliance with the many requests we have received from our readers, this and future issues of SUCCESSFUL SERVICING will again contain the feature, TV PRODUCTION CHANGES.

The Rider Manual pages and TEK-FILE pack which include the original data and schematics to which the following production changes apply, appear in the index on page 36 of this issue.

RCA **CHASSIS KCS66 series**
MODELS 17T150, -1, -3, -4, -5, 17T160, -2, -3, 17T172, -K, 17T173, -K, 17T174, -K

In some KCS66 series Chassis, the 1B3GT (V119) socket, terminal 5, has been used as a tie point. Some brands of tubes have an intermal jumper in the tube base between pins 5 and 7, however, and will not operate in the KCS66 series Chassis wired in the above manner. To avoid this difficulty the serviceman may employ any of the three following solutions:

1. Use a brand of tube which does not have a jumper between pins 5 and 7.
2. Rewire the 1B3GT tube stocket so that terminal 4 is used as the tie point instead of terminal 5.
3. If the tube has a jumper between pins 5 and 7, clip pin 5 off the tube base.

●

JACKSON INDUSTRIES **CHASSIS 114G, 117G, 120G**

The part No. for C34 (located in the sound i-f circuit) is incorrectly shown in the original service infromation. The part No. should be CPZ06102M.

●

STROMBERG-CARLSON **MODEL TC19**

Resistor wattage change.

In the R152 position (located schematically near the power rectifier and focus control) the 1,000-ohm, 10-watt resistor (part No. 149216) has been changed to a 1,000-ohm, 20-watt value (part No. 149367) to accommodate the required dissipation.

●

RADIO AND TELEVISION INC. **MODEL 3219B**

Model 3219B, "The Georgian," is a new model resembling Models 1116 and C-6161. The new model differs from the previous models using the same chassis in that it uses a 20-inch picture tube, has a built-in color jack, and is designed for uhf conversion.

Complete service information on Models 1116 and C-6161 applies in almost every case to Model 3219B. This service data will be found in TV Manual, Volume 6, pages 1-10.

STROMBERG-CARLSON **MODEL 24 series**

Capacitor revision.

The voltage rating of the C-215 (part No. 110724) .1μf paper capacitor in the retrace suppression circuit, has been increased from 400 volts to 600 volts (new part No. is 110743). All subject receivers date coded 51-31 and later include this change and it is recommended that the higher voltage rating capacitor be used for field replacement.

●

STEWART-WARNER **MODELS 9126-A, -B**

Service data correction.

The r-f tuner for the 9126 series has been erroneously identified as part No. 520247. The correct tuner number is 508890.

PILOT **MODEL TV116**

The basic chassis used in the above model is the same as that used in Model TV161. For complete service information on this chassis see TV Manual, Volume 5, pages 1-12.

●

STROMBERG-CARLSON **MODEL 17 series**

Focus coil substitution.

When focus coil No. 114683 is used with General Electric or DuMont 17BP4 picture tubes in place of the 114687 focus coil, it should be positioned as far away as possible from the deflection yoke. This will permit picture focus within range of the focus control.

The man who brought back a smile

EXCITED? Cynthia was practically bursting! Last thing Dad said was "Now you look close, Cindy. You'll see me right there in the audience tonight, and I'll wave to you." (They always do!)

Long about three o'clock Cynthia's mother turned on the set . . . "just to make sure." Well, there was a picture, if you could call it that . . . but so dim and fuzzy they'd never even recognize Dad that evening. And Cindy . . . disappointed? She was brokenhearted!

But, you know the happy ending . . . the serviceman's competent analysis . . . replacement of a worn-out tube with a Federal "Best-in-Sight" Picture Tube . . . and there are smiles again.

Federal's

Line of Popular-Size Picture Tubes will take care of over 90% of all TV replacements.

Write for free copy of Federal's TV Picture Tube Data Book, Dept. N-2101

THE SERVICEMAN gives his customers years of experience and expert technical ability. His business is knowing what's best . . . and giving the best. Customers rely on his judgment just as thoroughly as he relies on Federal "Best-in-Sight" Picture Tubes for the sharpest, brightest, clean-cut pictures possible. He *knows* that when he picks up the carton with the blue and white Federal label, he's going to make some customer a lot happier for a long, long time.

Consult your local Federal Distributor or write to

Federal Telephone and Radio Corporation

VACUUM TUBE DIVISION **100 KINGSLAND ROAD, CLIFTON, N. J.**

In Canada: Federal Electric Manufacturing Company, Ltd., Montreal, P. Q.
Export Distributors: International Standard Electric Corp., 67 Broad St., N. Y.

Signal Generator Connections In Television Alignment

Wm. P. Mueller
Engineer - Sylvania Radio Tube Div.

This material appeared originally in the Sylvania Electric Products, Inc. publication SYLVANIA NEWS.

The higher frequencies involved in tv receiver alignment require that precautions be taken to keep the loads between the coaxial cable of the signal generator and the receiver as short as possible. The alligator clip technique, though satisfactory in the majority of instances because it permits one to connect so conveniently from one stage to the other without even shifting the position of the ground connections, sometimes gets one into trouble from regeneration in aligning high-gain i-f amplifiers. When the i-f amplifiers are centered about 44 mc instead of 24 mc, the chances for trouble increase in proportion.

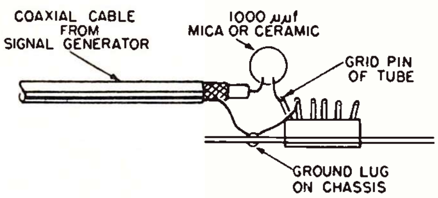


Figure 1—Acceptable connection to i-f grid.

The next time you encounter regeneration trouble try the connection shown in Figure 1. An even better arrangement, with somewhat reduced output, is that shown in Figure 2. The value of the resistor should be about equal to the characteristic impedance of the coaxial cable, which is usually 53 or 73 ohms. Keep the leads short as shown in the figures.

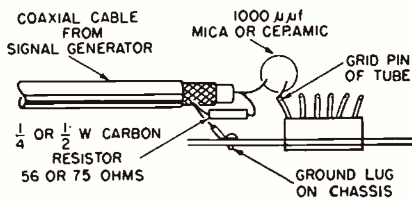


Figure 2—Preferred connection to i-f grid.

In aligning the front ends of tv sets the signal generator output is connected to the antenna terminals. To obtain the proper response characteristic, the signal generator should look like a source of the proper impedance, usually 300 ohms. The proper circuits to be used are shown in Figures 3 and 4 using standard values of resistances. (Be sure to use carbon or composition-type resistors, not wire-wound

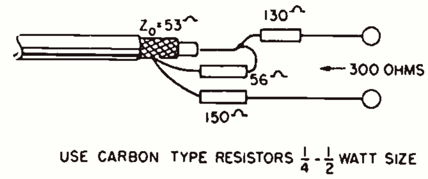


Figure 3—Connection for 300-ohm source impedance with 53-ohm cable.

resistors in these circuits). It is assumed that the generator end of the coaxial cable is terminated in its characteristic impedance. This may not be so, however, the circuit shown is about as good an approximation as is possible, without going to more elaborate matching sections of several db loss.

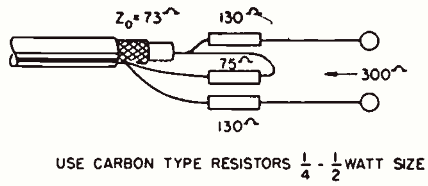


Figure 4—Connection for 300 ohm source impedance with 73 ohm cable.

In r-f tuner alignment the output of the sweep generator is usually not high enough to enable one to put in matching circuits of appreciable loss. Sometimes it is necessary to have more output than that obtained with the circuits of Figures 3 and 4. If the sweep generator has a 73-ohm coaxial cable terminated

(*Continued on next page*)

Signal Generator Connections

(*Continued from preceding page*)

at the generator end in essentially 73 ohms, an acceptable connection to the receiver is shown in Figure 5. If the receiver has no obvious 75-ohm input connection, the circuit of Figure 6 may be used to convert a 75-ohm generator to a 300-ohm balanced-to-ground input.

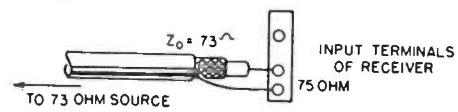


Figure 5—Connection for greatest output from a 73 ohm source to a receiver with 75 ohm input terminals.

This circuit may be thought of as two 150-ohm lines connected in series to match a 300-ohm line at one end, and connected in parallel at the opposite end to match the 75-ohm

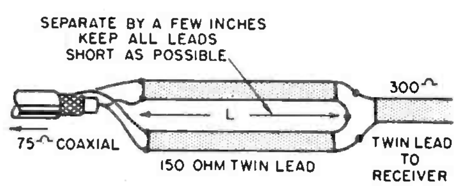


Figure 6—Connection for greatest output from a 73 ohm source to a 300 ohm receiver input.

coaxial cable. It produces a good match over a much broader band of frequencies than is possible with a half-wave coaxial matching section which has also been used for this purpose. The lengths, L, of the 150-ohm line are approximately a quarter wave at center frequency, or 39" for use on channels 2-6 and 14½" for channels 7-13.

Letter to the Editor

Editor
Successful Servicing,
480 Canal Street,
New York 13, N. Y.
Gentlemen:

Your editorial in the April issue of SUCESSFUL SERVICING observes that there is a definite trend to TV servicing in the home; and I agree, there is such a trend.

Whether or not this type of service will eventually supplant the shop in most service work is, to say the least, very doubtful. For one thing, what happens to that highly desirable feature of shop repair known as "preventive maintenance?" Home service does not lend itself to complete receiver checks after repair. Lack of necessary quipment for such checks in the home is self evident. And then, can't you just imagine the housewife's annoyance with the serviceman, when she observes him standing around, apparently doing nothing, for two or more hours, while the set is given a heat run? And yet, if this procedure is omitted, can a guarantee be honestly given?

I think the trend will evaporate; but only after the public is properly educated. This promises to be a very drawn out project, but one that must be undertaken by everyone even remotely connected with the servicing industry.

With every good wish, I remain,
Faithfully yours,
Harry M. Layden

Ed. Note: As we pointed out last month, shop service will always continue because certain types of service can never be done in the home.

Because of changes made, Tek-File Index No. 9 replaces all preceding ones.

Be Sure To Use No. 9!

A NEW CBS-HYTRON CTS-RATED* TUBE

*CTS-RATED: Rated for Continuous Television Service. In TV receivers, five tubes work . . . like transmitting tubes . . . *hard!* Account for almost 90% of your replacements. You know them: rectifiers, deflection amplifiers, damper diode. Larger-screen sets aggravate this problem. CBS-Hytron recognizes your need for huskier tubes for these sockets. Brand new designs, not just improved tubes. CTS-Rated 5AW4 . . . another CBS-Hytron first . . . is your answer for the low-voltage rectifier socket. It is CTS-Rated: (1) For heavier average (250 ma. max. d-c) and peak (750 ma. max. d-c) currents, (2) With big safety margins at these currents. You can depend upon the 5AW4 for continuous, trouble-free service. Yes, more CBS-Hytron CTS-Rated tubes are coming. Watch for them.

CBS-HYTRON
5AW4†

NEW HEAVY-DUTY WORK HORSE
CUTS 5U4G CALL-BACKS

MECHANICAL ADVANTAGES

PLATE — Note formed A-frame construction. Each plate of 5AW4 is formed into two cylinders containing the filament. Uniform filament-to-plate spacing and uniform filament performance avoid hot spots on filament, plate . . . and bulb. Oversize radiating fins and extra large surfaces between formed cylinders dissipate heat faster. Sturdy structure is rigidly supported at *eight* points.

FILAMENT — Massive, heavy-duty, 20-watt filament offers generous reserve of emission. Cuts burn-outs due to ionization attack and back emission. Transmitting-tube-type filament hook and spring suspension prevent sagging — yet reduce stresses on filament. Permit mounting 5AW4 in any position. Useful filament area is contained within formed cylinders of plate . . . to minimize internal voltage drop.

Worried about slumping TV set performance, because of heavily loaded 5U4G's? Forget it. Use new CBS-Hytron CTS-Rated* 5AW4. A replacement for the 5U4G, the 5AW4 recaptures . . . and keeps . . . that new-set sparkle. Maintains full voltage, despite heavy load. Minimizes burn-outs. Avoids filament shorts while testing chassis on side. Loafs on tough jobs. Gives long, long, trouble-free life. The 5AW4 will cut your call-backs. Boost your profits. See it . . . buy it . . . soon. At your CBS-Hytron jobber's.

†Patent applied for

COMPLETE 5AW4 DATA FREE

See your CBS-Hytron jobber. Or write direct today.

New . . . Free DECAL

sells for you! *Sells* your magic ability to recapture new-set sparkle. Let this decal pull customers to you. Get it from your CBS-Hytron jobber today.

CBS HYTRON

Manufacturers of Receiving Tubes Since 1921

CBS-HYTRON Main Office: Danvers, Massachusetts

A Division of Columbia Broadcasting System, Inc.

RECEIVING . . . TRANSMITTING . . . SPECIAL-PURPOSE AND TV PICTURE TUBES • GERMANIUM DIODES AND TRANSISTORS

TELL-A-FAULT Symptom Sheet

HORIZONTAL FOLDOVER

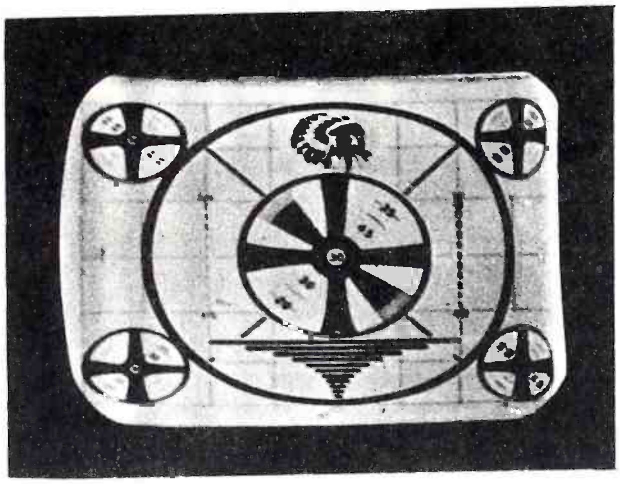


FIG. 1

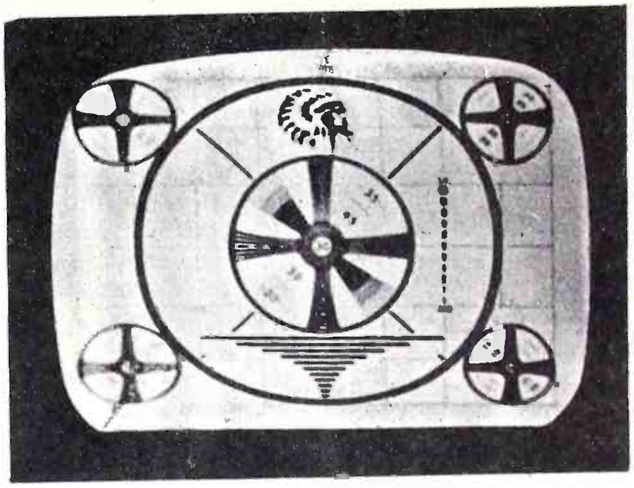
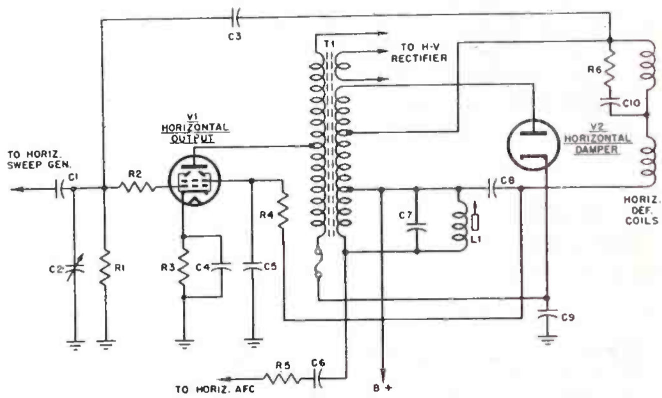


FIG. 2

(NOTE: Refer to CIRCUIT GUIDE IV-3 for identification of components.).

Fig. 1 shows a faulty picture-tube pattern in which a slight horizontal foldover appears at the right-hand side. In addition, horizontal nonlinearity occurs along with a slight defocusing. Compare this with the normal pattern for this receiver shown in Fig. 2.



ABNORMAL

NORMAL

FIG. 3

FIG. 4

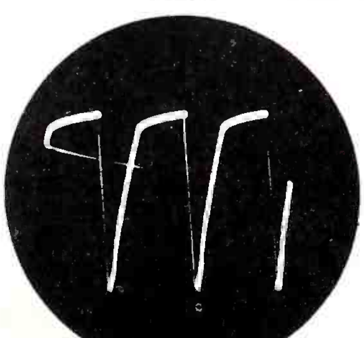


FIG. 5

FIG. 6

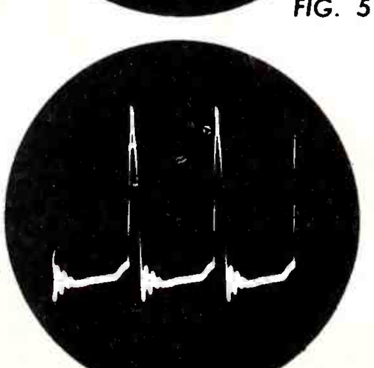


FIG. 7

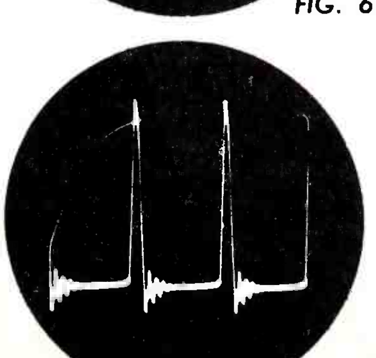


FIG. 8

The input waveform to the horizontal oscillator (multivibrator) was normal. When the scope was connected to the sweep-output plate of the multivibrator, the abnormal waveform shown in Fig. 3 occurred (F=H/3). Compare this with the normal waveform shown in Fig. 4, which occurred after the fault was repaired. The P-P value of the abnormal waveform was slightly less than normal. D-c voltage and resistance to ground from this point were both normal.

At the grid of the horizontal-output tube *(V1)*, the abnormal waveform in Fig. 5 appeared (F=H/3). The normal waveform is shown in Fig. 6 for comparison. The P-P value of the abnormal waveform was about 10% below the normal value. The d-c voltage at the grid of *V1* was only about 1/3 of the normal negative value, while the resistance to ground was less than ½ of the anticipated value, which is the combined resistance of *R1* and *R2*.

The waveform at the plate of *V1*, taken with a high-voltage capacitive-divider probe, appeared as in Fig. 7 (F=H/3). Note the abrupt but low-amplitude voltage rises which occur just before the high amplitude peaks. These do not occur in the normal waveform of Fig. 8. The P-P voltage of the abnormal waveform was about ¾ of the normal value. The d-c voltage was about 10% below normal. The P-P voltage at the plate of the h-v rectifier, obtained by using a capacitive-divider probe, was also only ¾ of normal.

> The receiver fault which produced the above effects was a defective feedback coupling capacitor C3. This capacitor was found to have slight leakage.

Suffix Letters on TV Receiver Chassis

Quite frequently suffix letters such as *A, B, C,* etc. are found after the chassis number. These suffix letters are, in many cases, extremely important relative to identifying the receiver on the service bench and in service notes. Every so often the addition of a suffix letter to a chassis reflects only a minor change in the electrical or mechanical organization of the chassis. But, much more often the letter denotes *major* changes of such character as would cause confusion in a service shop unless all the servicing data were on hand.

For instance, the difference between A and B suffix designations may be a difference in location of the preset controls and some of the continuously variable controls, resulting in two separate chassis views. Unless both views are on hand the service technician comparing one view with a chassis on the bench in which the components are differently arranged, can waste an hour or more in the attempt to correlate the controls with what is shown on the schematic.

In other instances the suffix letters can mean substantial changes in constants of components, thus demanding the presence of more than one schematic. The tube complement need not be too different for this to be true, which might conceivably make the entire matter even more difficult to cope with.

We can mention a number of variations which are introduced by the different forms of suffix letter chassis coding, but we believe that even these few words are sufficient to stress the fact that chassis number coding cannot be treated too lightly.

A serviceman has knowledge and time to sell. It is important that a job be done well, but is even more important that it be done in the shortest possible time. Diagnosis takes longer than actual repair, but a part of the repair effort is the proper identification of a circuitry relative to the chassis. This must be done most rapidly. Any item which is bought with the ultimate objective of saving servicing time is a capital investment of the most important kind.

The modifications which are made in manufacturing plants involving huge investments are, in most instances, means of *reducing manufacturing time.* In the servicing business, this finds its parallel in reducing servicing time. The service technician cannot afford to ponder over the differences between schematic and chassis wiring. This particular point has always been uppermost in our minds during the preparation of Rider Manuals and Tek-Files. This is why, in many cases, 3 or 4 or even more schematics may be found associated with any one TV receiver model or with any one TV receiver chassis. It would be penny wise and pound foolish on our part to try to save on pages by using one schematic and assigning a series of chassis suffixes when whe know that the receiver manufacturer produced a number of different schematics to satisfy the suffix letters. Our function is to provide the service technician with the utmost convenience in his operations. Whenever possible it has been our practice to include every production run schematic because we feel that then and only then can the service technician accomplish his job in the least amount of time. If we can save a service technician only 10% of his time on every job, we feel happy in the thought that every Rider Manual which a TV service technician owns is being paid for by saving time on as few as from 15 to 20 jobs, if not less.

Mismatched TV Components

(Continued from page 24)

This relatively low tolerance is not unexpected in view of the fact that the impedance ratio varies as the square of the turns ratio rather than changing in direct proportion. For instance, the impedance transformation in a vertical output transformer rated at 13:1 is 169:1; whereas, in a transformer with a turns ratio of 10:1, the impedance transformation ratio is only 100:1. For a transformer rated at 12:1 turns ratio, the impedance tranformation ratio is 144:1

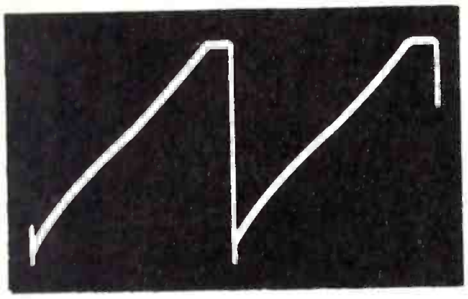


Fig. 6. Vertical-sweep current with 10.1 vertical output-transformer after adjustments.

which is not too far from the rated 169:1.

It might seem that a way around the inability to secure a picture as good as that obtained with the original part when a replacement part of somewhat different constants is used, is to modify the operating voltages fed to the vertical output tube. This is fine if someone will reimburse the technician for his time, and if the result can be assured. The former always is in doubt, and the latter, never a certainty, may result in wasted effort.

Some semblance of standardization of vertical output tube impedance values exists, which is why replacement vertical output transformers are available in a variety of turns-ratio ratings for substantially the same plate impedance and d-c current ratings. In this way they accomodate the variety of vertical deflection windings. But it must be realized that, in order to achieve an acceptable kind of picture so that call-backs are minimized and the set owner is kept happy, the selection of a replacement vertical output transformer cannot be haphazard.

Equally important are the hidden effects—the increase in plate current and current load on the B+ supply, as well as the increased current flow through the transformer primary. While it is not as bad in vertical output systems as it is in horizontal output systems which are operating incorrectly, any increase in plate current shortens the operating life of the tube. In every test which was made so far, the plate current in the vertical output tube increased by at least 30 percent when the wrong vertical output transformer was used.

Attention Service Technicians in the Metropolitan Area

Effective April 24, 1953, John F. Rider Publisher, Inc., discontinued over-the-counter sales of the Individual Diagram Service.

For an indefinite period of time, service technicians requiring servicing information on individual receiver models may *mail* their requests to 480 Canal Street, New York 13, N. Y.

TEK-FILE, Rider's monthly service data on TV receivers, may be purchased from any Rider distributor in the area. This is the ideal method of securing the latest in complete TV servicing information. Free TEK-FILE indexes may be obtained from Rider distributors or directly from the publisher. This issue of SUCCESSFUL SERVICING contains the current TEK-FILE index. New indexes are published every other month. See your Rider jobber for future editions of the TEK-FILE index, or write to us.

We regret the necessity of discontinuing the over-the-counter-sales division of the Rider Individual Diagram Service.

RCA Alumni Association Holds Philco TV Service Lecture

A TV Service Lecture-Demonstration conducted by Philco Distributors, Inc., New York Division, was given at the April 16th meeting of the Alumni Association of RCA Institutes. The speaker of the evening was Bob Dargan, Chief Instructor in charge of Training & Technical Information of Philco Distributors, Inc., N.Y. Division. Mr. Dargan, speaking to an enthusiastic group of independent servicemen, lectured and demonstrated the identification and service techniques used on Philco tv receivers.

Many guests were on hand to witness the meeting. Among these were Ed Harrje, Gen'l. Mgr. of Philco Dist. N.Y. Div.; Harold Bernstein, Nat'l. Service Mgr. of Emerson Radio & Phono Inc.; Fred Tiederman, Service Mgr. of DuMont-N.Y.; Joe Durant, Service Mgr. of G.E. Supply N.Y.; Ike Borashafsky, Technical Publications Editor of Newark Regional Office, Eastern Air Procurement District; Chuck Tepfer, Service Editor of Radio & TV News; and Milt Snitzer, Hal Alsberg and Stan Schiffman, of John F. Rider Publisher, Inc.

ATTENTION AUTHORS:

We are soliciting articles concerning radio, television, and allied electronic maintenance. All aspects are of interest. Articles of 1,000 to 2,000 words are desired. Preference is given to subject matter which reflects practical work rather than theory. The presentation should be *direct*, to the *point*, and amply illustrated. Finished art work will be prepared by us from the roughs submitted. Photographs are welcome. The rate of payment is on a word basis — and, needless to say, good writing rates good pay!

Submit all articles and inquiries to Editor, *Successful Servicing.*

A monthly summary of product developments and price changes supplied by RADIO'S MASTER, the Industry's Official Buying Guide, available through local parts distributors.

COMMENT: Showing only a slight decrease in the number of manufacturers reporting changes since last month, over-all product activity continues to be heavy. While tube, antenna, and sound manufacturers once again dominate this "change activity" scene, we note that several capacitor and wire manufacturers have made considerable revisions in their lines.

New Items

AEROVOX CORP.—Added a number of new ceramic capacitors.
ALLIANCE MFG.—Added Model BB2 cascamatic TV booster at $17.97 dealer net.
AMERICAN TELEVISION & RADIO—Added Model 11012T inverter replacement vibrator at $8.10 dealer net.
BROWNING LABS.—Added Model RJ-42 FM-AM tuner at $166.50 dealer net.
CORNELL-DUBILIER—Added a number of new vibrators.
EBY SALES—Added terminal lug strips: T21A at $2.10 dealer net; T22 at $3.00 dealer net; T25 at $2.10 dealer net; T26 at $2.10 dealer net; T29 at $2.10 dealer net. Also added Model K303 test harness kit at $4.77 dealer net.
EITEL-McCULLOUGH—Added new series of Klystron tubes: 3K20,000LA at $2975.00 dealer net; 3K20,000LF at $2975.00 dealer net; 3K20,000LK at $2975.00 dealer net. Also added No. 3C24 vacuum tube at $9.00 dealer net.
FRETCO—Added Model MR-S two stack mi-tee-ray screen at $4.35 dealer net; Model MR-C mi-tee-ray corner reflector at $8.97 dealer net.
GENERAL ELECTRIC—Added receiving tube 1AX2, a half wave high-voltage rectifier used in TV sets, at $2.55 list. Also added industrial and transmitting types GL-6146 at 4.90 dealer net; GL-6159 at $4.90 dealer net, both beam-power amplifiers with high power sensitivity.
GREAT EASTERN MFG.—Added Model 5-23 super refractor at $2.95 dealer net; Model 29 isolation unit at $3.55 dealer net.
HALLDORSON TRANSFORMER — Added: Model FB409 at $5.97 dealer net; Model FB410 at $5.97 dealer net; Model FB411 at $6.00 dealer net.
HY-LITE ANTENNA—Added Quadrapole antenna at $7.95 amateur net.
HYTRON—Added No. T-2 special glass-filled-plastic socket at $0.30 dealer net, fitting both PT-2A and PT-2S transistors.
INDUSTRIAL TELEVISION — Added Model IT-105RB field strength meter at $97.95 dealer net; UHF strip for Model IT-105RB at $8.37 dealer net.
LOUIS BROS.—Added a number of new items to their television chassis and remote control series.
NATIONAL UNION RADIO CORP.—Added new series of germanium diodes and transistors.
OAK ELECTRONICS — Added 4-way auxiliary speaker switch at $0.90 dealer net.
OHMITE MFG.—Added Type AB (Stock No. CCU) 2-watt molded potentiometer at $4.20 dealer net.
RADELCO MFG.—Added Model VT-3A indoor antenna at $2.25 dealer net.
R.C.A.—Added No. 4-1000A power tetrode tube, forced air-cooled type, at $132.00 dealer net; TV picture tube 21EP4A at $41.50 dealer net. (21" all-glass, rectangular picture tube of the magnetic-focus and magnetic-deflection type.)
RADIO RECEPTOR CO.—Added germanium diodes: 1N82 at $1.15 dealer net; 1N110 at $1.15 dealer net.
RAULAND—Added: two 17"; two 20"; two 21" TV picture tubes.
RAYTHEON—Added: TV picture tubes 10FP4 at $26.00 dealer net; 21AP4 at $41.25 dealer net; 21MP4 at $43.00 dealer net; receiving tubes 6AJ4 at $6.00 list, a 9 pin miniature triode designed for use as a grounded-grid amplifier in UHF TV receivers; 6SN7GTA at $2.20 list, a dual triode designed for use as a combined vertical oscillator and vertical deflection amplifier in TV receivers.
SCALA RADIO—Added Model SMI-53 oscillograph probe at $67.50 dealer net.
SERVICE INSTRUMENT—Added Up-Down voltage booster at $5.97 dealer net.
SOUTH RIVER METAL PRODUCTS—Added: UHF antenna mast adaptors Model UHM-1 at $1.80 dealer net; Model UHM-2 at $1.80 dealer net; chimney corner guard at $0.30 dealer net.
SYLVANIA—Added: hydrogen thyratrons HT-415 at $101.15 dealer net; HT-457 at $21.55 dealer net; HT-458 at $28.75 dealer net; rocket tube RT-434, planar triode, at $35.95 dealer net; microwave crystal diode 1N21BM at $14.40 dealer net; special purpose tube 6145 at $8.60 dealer net; receiving tube 6V8 at $3.55 list.
TELREX—Added Model DFBT-1 dual channel "fish-bone" jr., channels 4 and 5 at $20.10 dealer net.
TERADO CO.—Added new portable converter, Trav-Electric Master, 6 volt model at $24.95 list and 12 volt model at $29.95 list.
TRICRAFT PRODUCTS—Added Model 200 outdoor UHF antenna at $5.97 dealer net; Model 210 indoor UHF antenna at $7.77 dealer net.
VIDAIRE ELECTRONICS—Added Model A-2 TV signal attenuator at $3.30 dealer net; Model F1 high pass TV filter at $3.15 dealer net.

Discontinued Items

AEROVOX CORP. — Discontinued a number of ceramic capacitors.
AMERICAN PHENOLIC—Discontinued No. 14-318 twin-lead transmission wire; No. 14-317 remote control wire.
EITEL-McCULLOUGH—Discontinued: No. 6C21 vacuum tube; Model HV-1 vacuum pump; Pump Oil for Model HV-1; Vacuum switch coils 12V and 24V.
JACKSON ELECTRICAL INSTRUMENT—Discontinued: Model 106 challenger test oscillator; Model 112 challenger condenser tester; Model 648C dynamic tube tester with counter-base.
JOHNSON CO., E.F.—Discontinued copperweld wire No. 144-348, No. 144-350, No. 144-352.
McINTOSH ENGINEERING LABORATORY—Discontinued Model 20W-2 20 watt amplifier.
NATIONAL CO. — Discontinued: Model MB-40-L low-power multi-band tank; crystal mounting sockets for crystal holders Model SC-1; Model SC-2; Model SC-3.
OXFORD ELECTRIC — Discontinued weatherproof speakers Model 4CMWS; Model 6CMWS.
RADIO CRAFTSMAN — Discontinued Model C300 equalizer-preamplifier.
RAYTHEON—Discontinued No. 310A special purpose tube.
REK-O-KUT CO.—Discontinued Model TR-12 dual-speed recording turntable.
SIMPSON MFG. CO.—Discontinued super sky-chief (two-stage) TV booster.
STEELMAN PHONOGRAPH & RADIO—Discontinued: Model 3D4 three-speed portable phonograph; Model 3ET2 transcription record player; Model 3K1 three-speed portable electric phonograph; Model 3RP2 radio-phonograph.
SUPREME INC.—Discontinued Model 574 (VTVM) set tester; Model 616 tube and set tester.
TELREX—Discontinued: Model DOX Duo-Orienting; Model TVB-1 Telrex V-Beam; Model TVB-2 Telrex V-Beam.
WIRT PRODUCTS—Discontinued Model S-991 auto radio ignition suppressor.

Price Decreases

GENERAL ELECTRIC—Decreased prices: receiving tubes 35B5 to $1.95 list; 50B5 to $1.95 list; germanium diodes 1N64 to $0.57 dealer net; G7B to $0.90 dealer net; G7C to $0.90 dealer net; industrial and transmitting tubes GL-1B35A to $11.50 dealer net; GL-1B37A(1B37) to $15.00 dealer net; GL-1B63A to $56.00 dealer net.
HALLDORSON TRANSFORMER—Decreased prices on several yokes and flybacks.
RADIO RECEPTOR—Decreased price on 1N72 germanium diode to 1.10 dealer net.
RAYTHEON—Decreased price on receiving tube 12AZ7 to $2.50 list.

Increased Prices

BRADLEY LABS.—Increased prices on their line of selenium rectifiers.
JACKSON ELECTRICAL INSTRUMENT — Increased prices: Model 648-B bench type dynamic tube tester to $104.50 dealer net; Model CB18 counter-base for dynamic tube tester to $8.50 dealer net; Model 648-P portable tester in wooden case to $109.50 dealer net.
PACIFIC TRANSDUCER—Increased price on Model 231 microscope groove analyzer to $24.50 dealer net.
R.C.A.—Increased price on 5ABP1 C-R oscillograph type tube to $34.50 dealer net.
RAYTHEON—Increased prices on receiving tubes: 12AV6 to $1.60 list; 12F5GT to $1.90 list: 12K7GT to 2.20 list; 6AU5GT to $2.75 list.
REK-O-KUT — Increased prices: Model LP-743 three-speed transcription turntable to $59.50 dealer net; Model P-43-C three-speed record player to $99.50 dealer net; Model P-43-M three-speed record player to $104.50 dealer net; Challenger Deluxe disc recorder to $459.95 dealer net.
SIMPSON ELECTRIC—Increased prices: Model 303 vacuum tube volt-ohmmeter to $68.00 dealer net; Model 479 FM-TV signal generator to $325.00 dealer net; Model 488 field strength meter to $115.00 dealer net.
SYLVANIA—Increased price on special purpose tube 7AK7 to $10.00 dealer net.
WEBSTER ELECTRIC—Increased prices on public address amplifiers: Model 81-15 to $74.25 dealer net; Model 82-25 to $89.25 dealer net.

Rider's TV11 Sectionalized for Up-to-Date Coverage

RIDER TELEVISION MANUAL VOLUME 11 introduces the sectionalized Manual. This volume is divided into four parts. Each section is indicated by a full length separator page.

The purpose of this sectionalization is to enable Rider to release to the servicing industry up-to-the-minute servicing data. Whereas formerly, if one of the receiver manufacturers submitted new data when a volume was about to go to press, it was impossible to include this data in its proper alphabetical sequence. The new sectionalized plan allows for increased flexibility inasmuch as data may be included in the last section of the volume without regard to the alphabetical sequence of the previous sections. However, each section runs alphabetically by manufacturer.

It's just as easy to locate a model with this improved system as it was with the old. The Rider index lists the section number and pages in which the servicing data will be found. Knowing the section and the manufacturer, you merely turn the pages until you come to the specific model. This is another Rider aid to give the servicing industry the most up-to-date servicing information possible.

INDEX OF CHANGES

Model No.	Manual Page From	Manual Page To	Tek-File Pack
Jackson Industries Ch. 114G, 117G, 120G	8-1	8-18	6
Pilot TV116	5-1	5-12	--
Radio & TV, Inc.	6-1	6-10	--
RCA Ch. KCS66 series; 17T150, -1, -3, -4, -5, 17T160, -2, -3, 17T172, -K, 17T173, -K, 17T174, -K	10-1	10-34	68, 72
Stewart-Warner 9126-A, -B	9-37	9-41	56
Stromberg-Carlson Model 24 Series	7-1	7-8	23
Stromberg-Carlson Model 17 Series	6-5	6-10	--
Stromberg-Carlson	5-1	5-7	--

The No. 9 Index replaces all preceding indexes. DON'T USE EARLIER TEK-FILE INDEXES!

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METROPOLITAN
NEW YORK — NEW JERSEY
edition
JUNE 1953

in this issue . . .

One Hand Washes The Other

This issue initiates a program of parts distributor advertising in alternate issues of SUCCESSFUL SERVICING in the local trading areas of the United States. It is an effort to enable the parts distributor to get his message across to the service technician. Time alone prevented the inclusion of more parts distributors' advertising than appears in this issue.

The welfare of the electronic service technician and the parts distributor is bound in the operations of each other. The parts distributor needs the buying power of the service facilities and the service facilities in turn require the financial backing which credit furnishes — as well as the convenience of on-the-spot supply. This is a broad base for mutual understanding and there are no problems between service technician and parts distributor which cannot be resolved to the fullest satisfaction of both.

JOHN F. RIDER

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SUCCESSFUL Servicing

JUNE 1953

A Signal Tracing Demodulator Probe For the Oscilloscope

by George Fleishman, TV Instructor

Eastern School of Radio and Television

Signal tracing was a well established system of troubleshooting in the pre-television days. Television servicing has elevated this system to a fine art with a fancy name—"waveform analysis." One reason for this is the increased complexity of tv receivers, especially in the circuits following the video detector. For example, many of the more obscure troubles occur in the sync and horizontal circuits.

The endeavors of technicians to master the post-detector circuits have unfortunately led, in part, to a neglect of the pre-detector circuits. Contributing to this situation is the relative simplicity of the r-f and i-f circuits. Most troubles are relatively minor, involving merely a defective tube or a shorted capacitor sometimes accompanied by a tell-tale burnt resistor. A signal disturbance test and perhaps voltage and resistance measurements suffice for most of these problems.

Importance of Signal Tracing

Ever so often (increasingly so, as receivers get older), a "dog" comes into the shop. Its trouble may be, among others, a case of picture flicker which cannot be ascribed to a defective antenna system, or perhaps an intermittent, especially in the front end. On such occasions, the signal tracer, which is reliable in troubleshooting radios, is not as effective in dealing with tv signals. Some signal tracers cannot operate on high-frequency signals. The basic objection, however, to the ordinary signal tracer, is that it gives its indications in terms of an audio indication from a speaker. Tv technicians have come to realize that signal tracing in tv receivers is best accomplished in terms of a visual representation of the signal on the face of an oscilloscope screen, hence the term "waveform analysis." It is apparent, therefore, that the serious technician is in need of a signal-tracing instrument for visually investigating tv circuits carrying r-f signals in much the same manner as he does in troubleshooting aurally in radio circuits.

Unfortunately, the service oscilloscope cannot usually be used directly for probing in high-frequency circuits, since it is essentially a low-frequency instrument. It is possible, however, to demodulate the r-f signal before applying it to the input terminal of the oscilloscope. A practical solution to this problem is the use of an oscilloscope preceded by a demodulator detector probe as shown in Fig. 1. The demodulator can then be removed when the oscilloscope is employed in circuits following the video detector.

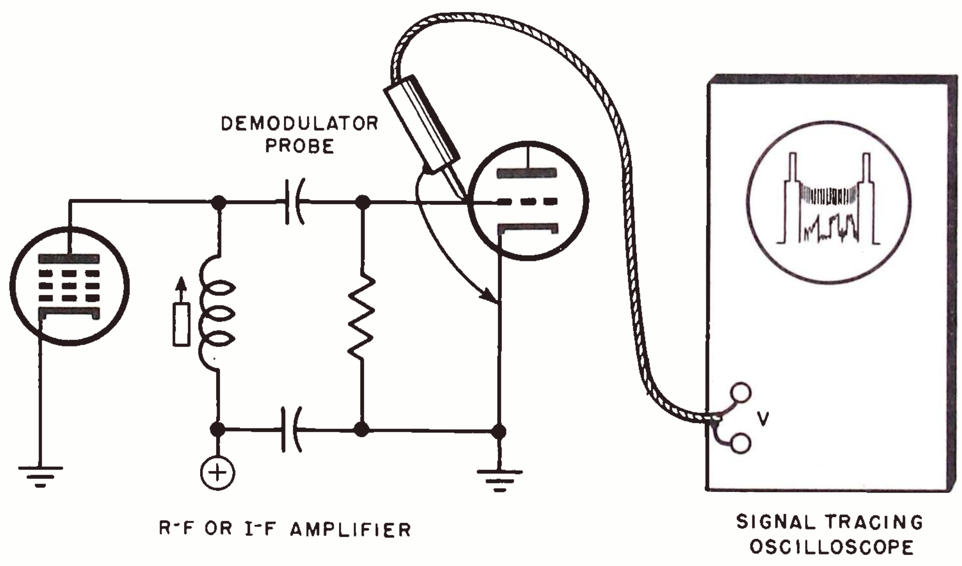


Fig. 1. Using a demodulator probe with a service scope for signal tracing.

Many technicians will recognize this version of a tv signal tracer. It is really a variation of the untuned type of signal tracer where the oscilloscope has replaced the audio amplifier. Some technicians have actually used this set-up with varying degrees of success. Its utility, in most cases, is confined to the video i-f amplifier, particularly the later stages.

More extensive application of this system is prevented by the lack of proper equipment. The oscilloscope (preferably a sensitive one, though not always necessarily so) must be used with a sensitive crystal-diode probe designed as a demodulator for an oscilloscope. In many cases, a crystal-diode probe designed for a vacuum-tube voltmeter is used for demodulation purposes. Many home-built varieties are taken from circuits intended for applications other than signal tracing.

The modern tv service shop can usually fill the oscilloscope requirements. What is obviously needed is a sensitive demodulator probe for signal-tracing purposes. This article gives a brief survey of crystal-detector probes in general and suggests a probe admirably suited for troubleshooting in the early stages of the tv receiver.

Basic Shunt Diode Peak Rectifier

Figure 2(A) shows the circuit of the shunt diode peak rectifier which is basic to almost all types of crystal probes. Capacitor C1 charges rapidly during the positive alternation of the input a-c signal, through the low forward resistance of diode D. During the nonconducting period of D, C1 discharges slowly through the high load resistance of R_L developing a d-c voltage drop that is negative with respect to ground. At signal frequencies above $10/R_LC1$, the discharge of C1 between successive cycles is so small that

(*Continued on page 10*)

A Manufacturer Looks at the Serviceman's Replacement Problem

by Grant Graham, *Engineer*

Triad Transformer Corporation

Photo Courtesy Merim

Grant Graham

About a year ago our firm started listing their products in Rider Manuals and Tek-File. The task of compiling the most effective replacement in the Triad line of transformers was assigned to me.

The original set manufacturers furnish the individual specifications of the various components used in their circuits. By comparing the specifications of the originals, a duplicate for replacement use can be suggested.

With an air of assurance I looked forward to receiving the initial package of data sheets. Little did I realize the task and its obstacles that lay before me.

With my varied background in radio servicing, selling parts to servicemen, and design engineering, I felt it should be pretty easy to make these simple recommendations. After all, matching voltage, current, resistance, inductance, etc., was all that needed to be accomplished.

Slowly, however, I began to get a feeling of doubt. I was getting a few rejections because I had overlooked a detail or two. It didn't seem too serious. After all the serviceman could drill a few holes or move components around a bit! Even after assuring myself this could be done. I was still not "sold". Perhaps if I could get a little closer to the problem at hand, the actual requirements would become clearer.

In talking this problem over with my boss, Mr. Lew Howard, we decided that there were two ways to approach this problem, and probably both ways should be followed. (a) We could drop in on technicians and discuss the problem. (b) We could actually acquire some first-hand experience on the television bench. It was decided to adopt system (b) as the most direct approach.

Not wishing to be treated as "an honored guest", it was decided that my Triad plant affiliation would not be mentioned in applying for this job. I found, due to the shortage of service personnel in Southern California, that it was really quite easy to obtain even a part-time job. I had had some television service experience, but it was limited to working on my own set and those of my friends.

The shop in which I was employed was a combination sales and service organization. They held franchises on six major television lines. The shop was quite modern with very good equipment and manned, at that time, by four men. It was probably as near to an average Southern California television service shop as could be found.

How well I remember that first job—a four year old set! Four regular technicians were employed at this shop, each quite busy on his own job, but I felt like a prima donna on her debut. They were watching me out of the corners of their eyes, this I felt was certain. I flipped the chassis over and propped the tube up on a roll of paper. With my first inspection I spotted a resistor burned to a crisp, with a nice big crack in it. "What luck, an easy one", I thought! That was my first mistake. I had drawn a real "sick dog", whether by accident or as a qualifying test I'll never know. Anyway, about three hours later and after tying up a large percentage of the shop's equipment, I got it cured, but was still a bit worried about the time I had spent on it. However, after the foreman assured me this was not excessive I felt considerably relieved about my first "professional" television repair job.

I won't go into a "blow-by-blow" description of my "professional" career as a television technician; of the sets I repaired, and a few I called for help on. But believe me, I certainly have developed a high respect for the television serviceman and his problems. No more of this "let the guy move something" or "its pretty close" attitude. True replacement parts cannot always be exact duplicates, but they should certainly be close enough so that alteration of the rest of the set is not necessary to accomodate the new part.

It might be well at this time to make a few observations on some recommendations I have made and also some made by others. At one time, I recall, I recommended a certain flyback transformer which would work, in fact it was electrically an excellent replacement. The only "fly in the ointment" was the fact that when mounted in the high-voltage cage, the corona ring arced to the cage, and if a spacer was used the transformer would stick out of the cage completely. Another case of misapplication I have noticed, is where another person has recommended one universal power transformer to replace a multitude of models. It may be necessary to mount the picture tube in a separate chassis to accommodate such a transformer. This, of course, is the problem of the serviceman!

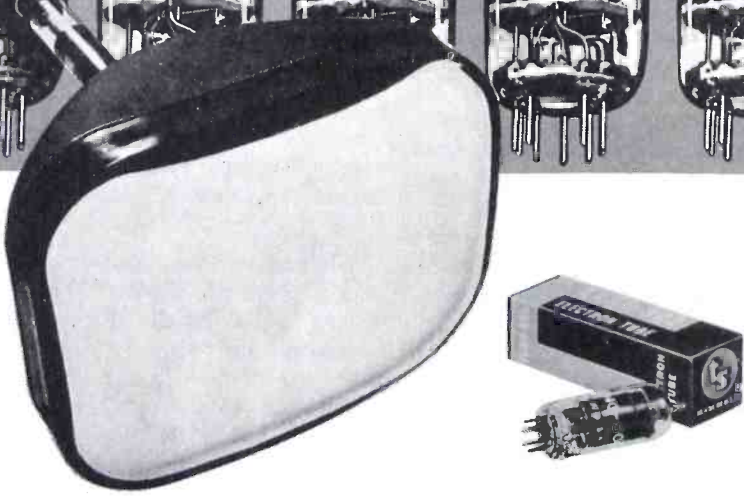
I am sure that I have learned a lot from my experience and heartily recommend furnishing the trade with the most complete data possible, both physically and electrically. In failing to do so the manufacturer is hurting himself as much or more than anyone else, because, after a sad experience or so, the serviceman is forced to go to another manufacturer for replacement parts. Parts manufacturers should not expect the serviceman to re-engineer a television chassis. Even if he is able to do so, he certainly doesn't want the extra work, nor does he want to pass such a charge on to his customer.

By careful consideration of the replacement, it should not be too difficult to recommend the proper part, or, if our part does not meet the specifications, to state that we do not make the replacement. It is certainly preferable to state "no replacement" than to give erroneous information. The ultimate user will appreciate the savings of not having to perform a major modification in order to use the part.

I know that there are bound to be errors even in the most carefully prepared data. If I live long enough to make just an occasional error, I'll be quite satisfied. However, to reiterate, the recommendations presented to the serviceman should be as carefully studied and as honestly made as is possible.

After spending some time on the service bench, I fully appreciate what the technician is up against. It is a tough job to ascertain the trouble in a set, and then to repair it, without having to reconstruct the entire chassis in the process.

We, here at Triad, are now engaged in the second phase of "Project Rider". We are talking to servicemen all over the country and getting their slant on what can be done to do a better job in the replacement field. In this way, along with the experience gained "on the bench", we hope to be able to offer much better replacements to the serviceman.



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VOLUME 14 NUMBER 6 **JUNE, 1953**

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Curtain Time

Color TV

The pressure for color TV is hot. Some segments of the industry want it and some don't. We think that those who do, are going to win out. But even then it looks like it will be 1955 before any substantial production takes place. From what we hear the production of tri-color tubes will be relatively low at the start, perhaps 100,000 to maybe 150,000 the first year . . . Maybe we are wrong but it looks like a 16 x 12 inch picture at the start. The tube is reputed to cost about $175 at the beginning. The receiver will have between 35 and 40 tubes. (It looks like 1955 before anything substantial will happen but don't be surprised to see color TV in 1954.)

What interests us is that despite the greater complexities in the color TV receiver, we have every confidence in the world that the independent TV service technician will be doing the service work. Sure he'll have competition from many sources, but he'll be in there pitching his time and knowledge. In the long run the edge is with the independent because he is all over the four corners of the nation and ready to serve.

Hi-Fi

Each year an electronic parts show is run in Chicago. This year it was a 4-day session beginning with May 19th through May 22.

The item which received great attention was high-fidelity. It appears as if all manufacturers of amplifiers and loudspeakers are aiming their sights at the high fidelity fan. At the moment there does not seem to be any definite information about how many people fall within this category, but if one is to judge by the sales of LP recordings of operas and other types of classical music, there must be great numbers of devotees of good music.

There are two points we wish to make in connection with high-fi equipment. One of these relates to the urgent need for some engineering standards concerning what is and what is not high-fidelity reproduction. Frequency range alone is not the determining factor.

The second point relates to servicing facilities. Who will service these equipments? What equipment will be used? No matter how well the equipment is made, servicing will be necessary. But in view of the attitude of the high-fi listener — the increased order of criticalness — the technical requirements for service will be more severe than is the case with an audio amplifier in a receiver or an ordinary power amplifier. The high-fi enthusiast is a hobbyist. Hobbyists do not look at their possessions in the same light as individuals who use electronic equipment for commercial purposes or for those who use the equipment for everyday listening to radio broadcasts, plays and news. The hobbyist is much more of a perfectionist. So again we arrive at the question "who will do the service. and with what?" It stands to reason that the competent television service facility is the logical organization (or individual) to do this work. But in order to do it properly it is necessary that adequate background concerning high-fidelity reproduction exist. The average high-fi enthusiast has a much greater appreciation of musical reproduction than the average owner of a radio or television receiver. He may know very little or nothing about electronics, but he does recognize when the sound issuing from his loudspeaker indicates proper or improper performance of the units he owns — this begins with the turntable through the pick-up, all the way to the speaker. The background necessary in the servicing facility can be no less.

As to the equipment with which service can be rendered, all of it is available but not necessarily in possession of those who might do the work. A possible exception is the scope. Square wave generators, intermodulation-distortion checkers, test recordings, a-m sweep generators are on the market but limited generally to laboratory use.

Admittedly there isn't enough high-fi service work to justify all present television service organizations entering this field, but it is almost a certainty that enough equipment of this kind will eventually be sold to justify organizations in every large center of population looking into this source of income.

The cost of a good high-fi system oftentimes is much more than even a fancy television receiver and it is a fairly safe bet that the high-fi fan is willing to pay a fair price for good services rendered. Considering the nature of the installation and the attitude of the owner it is not unreasonable to assume that he will not shop for the lowest price when service is needed. Will the wide awake TV service facility miss the growing high-fi market as a source of income?

Home Air Conditioning

The home air conditioning business is growing by leaps and bounds. More and more manufacturers of home electronic products are entering this field. While it is true that heavy-duty air conditioning service activities have been in the hands of a relatively few organizations, it is not inconceivable that individual room air conditioning equipment service be done by present day TV service facilities. Investigation among organizations producing such equipments discloses that they can see the television service technician doing this work. As a matter of fact, it would be a very good idea to take up the normal slack which occurs each summer in the servicing of radio and television receivers, by servicing home air conditioning equipment.

John F. Rider

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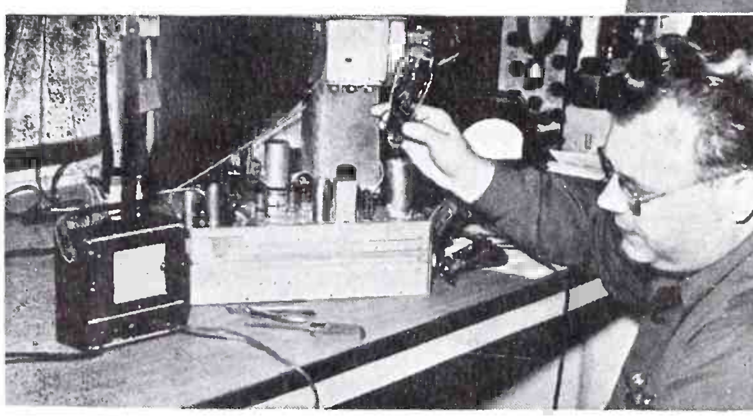

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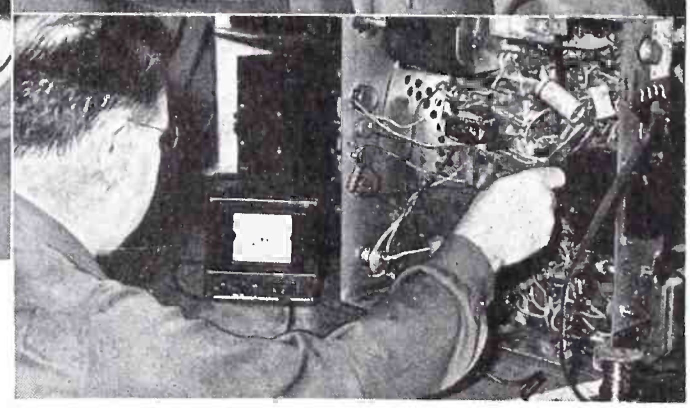

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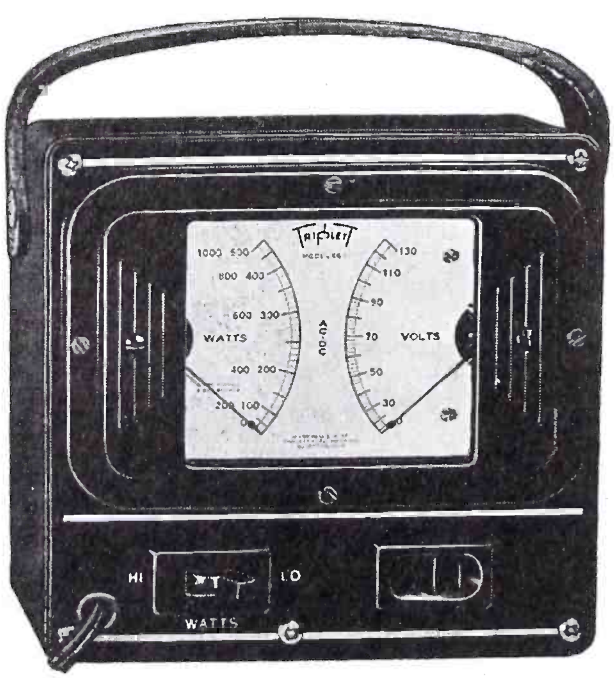

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Successful Servicing, June, 1953

Basic Principles of Air Conditioning

Prepared by the Commercial Service Section
of the RCA Service Co., Inc.

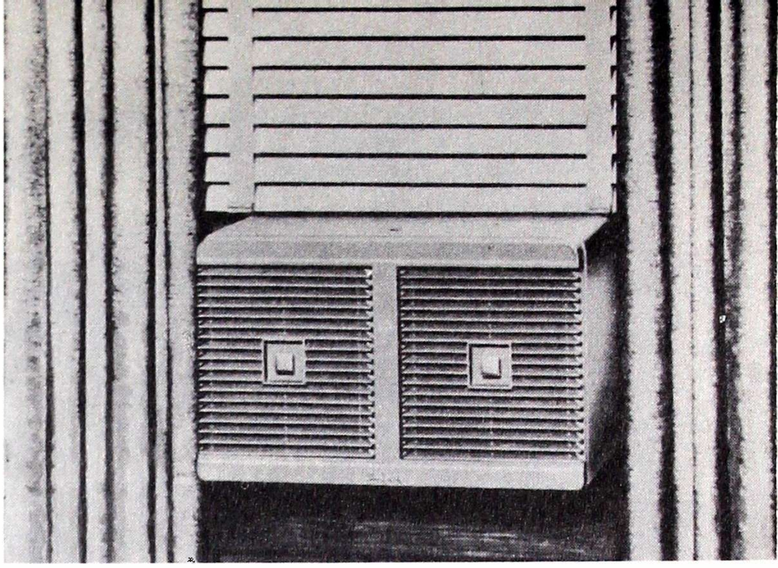

Fig. 1—RCA Window Model Room Air Conditioner

The following article and its illustrations are reprinted through the courtesy of the RCA Service Co. from their brochure entitled "Introduction to Room Air Conditioning."

Introduction

Air Conditioning is the art of controlling the temperature, humidity and cleanliness of the air as well as air movement and ventilation in the places where we live or work. The control of these conditions may require either the addition or the removal of heat and moisture to the air surrounding us in order to provide comfort. Addition of heat and moisture may be accomplished either by a furnace in the basement or by a room heater. Similarly removal of heat and moisture may be accomplished by either a central cooling unit or by a cooling unit designed for use in one room only.

In general usage, the term "room air conditioner" is applied to an appliance designed to *remove* heat, moisture, and foreign particles from the air and to provide air movement with ventilation as desired in a single room. Heating provisions may be added to some room air conditioners.

"Dehumidifier" is the term applied to a unit designed primarily for the removal of moisture from the air without cooling of the air in the room.

This article will describe the basic principles upon which air conditioners work.

Objective

The objective of air conditioning is to maintain a desirable level of heat losses from the human body in order that a feeling of comfort will be provided. Individuals have different reactions to the temperature and moisture conditions of the air which surround them; consequently, no one set of conditions will satisfy everyone.

A range of conditions, known as the "summer comfort zone," has been established within which most people will be comfortable. Air conditioning should maintain the temperature and humidity conditions of the air within this zone. These temperatures and humidity conditions may be represented on what is technically known as a psychrometric chart, the use of which will be described later.

Air Conditioning Requirements

Air conditioning must deal with four basic factors in order to meet the cooling requirements for health and comfort. These factors are: air temperature, humidity, air movement and the temperature of surrounding surfaces.

The human body is constantly creating heat as the result of the body process. The body must give off excess heat to maintain its normal temperature of 98.6° Fahrenheit. The surrounding air will absorb this excess heat at a rate proportional to the difference in temperature between it and the human body. The body is also giving off moisture through the pores of the skin. This is known as perspiration. When perspiration evaporates, it absorbs heat and thereby helps to keep the body cool. If the air is nearly saturated with moisture, it will absorb very little body perspiration. The degree of moisture saturation is called relative humidity.

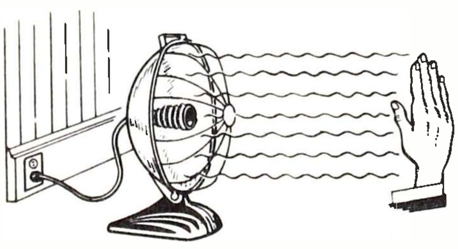

Fig. 2—Heat Transfer by Radiation

To absorb heat and moisture from the body and thereby keep it cool, the air must come in contact with it. The air, after absorbing heat and moisture, must be taken away and the heat and moisture removed from it. To move this air, a fan is used. The temperature of surrounding objects must be considered because of two reasons. First, because heat will be exchanged directly between them and the human body. Second, because they affect the temperature of the air in contact with them.

Two requirements other than cooling must be taken into consideration. Ventilation must be provided in occupied rooms to freshen the air. For this purpose, outside air is mixed with recirculated room air.

Minute particles of dust and other undesirable substances are suspended in the air and must be removed for greatest health and comfort. These particles are removed by causing the circulated room air to pass through a filter before being returned to the room.

Meeting Air Conditioning Requirements

There are several ways in which some degree of comfort can be obtained. We can use a fan but this does not remove heat, moisture or impurities from the air. Another method would be to use ice and natural circulation.

The most satisfactory way is to use an electric refrigerating unit to cool, dehumidify, and circulate the air in the room. Fresh air can be added as desired or (in most conditioners) stale air can be exhausted from the room.

As mentioned before, an air conditioner can be a central unit to condition the air of an entire house or may be a unit to condition the air of only one room. Central unit systems, as yet, are not in common use for the home; however, room air conditioners have become very popular.

Most room air conditioners are of the type in which the heat which has been removed from the room is dissipated directly into the outside air. They are easily installed without plumbing or duct work. Some larger size room air conditioners and central unit systems use water to carry off the excess heat. They do require plumbing and an adequate supply of water.

Heat Transfer

Heat flows from warmer bodies to colder bodies. The higher the temperature difference between the bodies, the faster the heat flow. This heat flow continues until the bodies reach the same temperature or equilibrium. Heat transfer is the movement of heat from one place to another and is accomplished by any one or any combination of three methods.

1. RADIATION—Passage of heat from one object to another without warming the space between. The heat is transmitted by wave motion similar to light, as illustrated in Fig. 2.

2. CONDUCTION—Passage of heat from one point to another by transmission of molecular energy through a conductor from particle to

(continued on page 16)

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Replacement Parts In T V Receivers

Part 2 - Transformers

by John F. Rider

This is the seventh in a series of articles on "Replacement Parts in TV Receivers."

By definition a transformer is an electrical device whereby electrical energy of alternating character can be transferred from a high voltage and low current, to a low voltage and high current.

The phenomenon employed to accomplish the transformation of electrical energy in a transformer is the induction of a voltage in a coil by cutting the turns of the coil by varying lines of flux which issue from another coil that is carrying a changing current. This is symbolized in Fig. 1. One winding is the primary winding P. The primary voltage is applied across this winding and the resultant current creates varying flux lines which link with the turns of the secondary winding S.

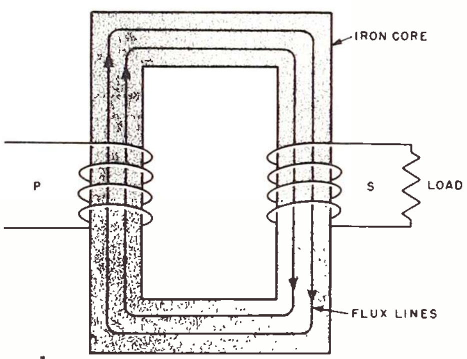

Fig. 1—Simple Transformer

The use of an iron core enables closer coupling between the two windings by providing an easy path for the flux lines. The electrical relations between the primary and the secondary coils, or any number of secondaries is fixed. The voltage induced in the secondary winding is proportionate to the turns-ratio between the primary and secondary coils, or

$$\frac{Ep}{Np} = \frac{Es}{Ns}$$

Where Ep is the voltage across the primary
Es is the voltage across the secondary
Np is the number of turns in the primary
Ns is the number of turns in the secondary.

If the number of turns in the secondary winding is greater than the number of turns in the primary winding, the secondary voltage will be higher than the primary voltage; if the reverse is true, the secondary voltage will be lower than the primary voltage. The above applies to any number of secondary windings, for example to the three secondaries shown in Fig. 2. If the number of turns in the secondary winding exceeds the number of turns in the primary winding a voltage *step-up* occurs; if the reverse turns relationship prevails in the two windings, a voltage *step-down* occurs. The relationship between the secondary voltage and the primary voltage can be expressd:

$$Es = \frac{Ep \times Ns}{Np}$$

As to the current transformation which occurs in a transformer it varies in a direction opposite to the voltage, namely if a step-up in voltage occurs, a step-down in current occurs; if the voltage is stepped-down the current is stepped-up. In both instances we are speaking about the current available from the secondary winding, which will be seen later, to be related to still another detail, namely the wire used for the secondary winding. But regardless of whether voltage or current are stepped-up or stepped-down, the total power output from the secondary (or secondaries) of a transformer never can exceed never can exceed the power input of the primary. As a matter of fact it always is less by some small amount because of losses which take place in the transformer.

The above are fundamental conditions that have a great bearing on the suitability of transformers as replacements in television receivers. This point is so important relative to one particular type of transformer that we emphasize the fact that the voltage output from any one winding is subject to definite limitations as set by the number of turns. Even if a secondary winding is visualized with taps, the number of turns between any one end of that winding and any one of the taps, is definitely fixed. The reason for stressing this limitation will be made clear later.

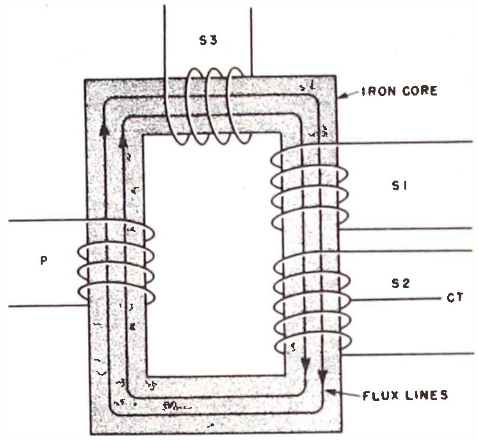

Fig. 2—Transformer with more than one Secondary

A television receiver makes use of a variety of transformers. The vast majority of them, however, contain a device which, in function, parallels the transformer used in power distribution systems. Its function is to furnish electrical energy required for the operation of the receiver at different values of alternating voltage and current, and which energy is distributed to different parts of the receiver. It is appropriately named the *power transformer.* It transfers the primary source of electrical power available from the local a-c power line to a high voltage (and relatively low current) required by the power rectifying system for conversion to d.c. which then is applied as the operating voltages to the control grids, plates and screens of the vacuum tubes in the receiver. Simultaneously it provides a variety of low a-c voltages (and relatively high currents) required by the heaters of the same vacuum tubes.

Varieties of Transformers in TV Receivers

But as we said earlier a number of types of transformers are used in television receivers. All are not power transformers. Some are related to the generation of alternating current in association with vacuum tubes. While they are of various kinds they go by the general name of oscillation transformers, although in some instances they may bear names which more closely identify the device with a particular section of the receiver. Such are, for example, the vertical blocking transformer, the horizontal oscillator transformer, etc.

Another type of transformer is a frequency selective device wherein the transformation of electrical energy occurs at a slected frequency or over a band of selected frequencies. Ex-

(continued on page 27)

A Signal Tracing Demodulator Probe, etc.

(*Continued from page* 1)

the conductive period of the diode is limited to an almost infinitesimal period at the positive peaks when the input-signal amplitude exceeds the opposing voltage across C1. The negative voltage across R_L is substantially constant and is approximately equal to the voltage at the peaks of the positive alternations as shown in part (B) of the figure. Reversing the leads to the diode brings about a positive d-c voltage across R_L approximately equal to the negative peaks of the input signal.

diode has a finite back resistance which varies with the value of the back voltage. Then the load resistance, R_L, is the back resistance of the diode paralleled by the series resistance R_S and R_M. The back resistance of a 1N34 or similar type crystal and, for all practical purposes, the total load resistance shunting the diode, may only amount to a few hundred thousand ohms, varying slightly with signal amplitude. Using a value for C1 of 500 $\mu\mu f$, measurements with this probe can begin with the higher audio frequencies and extend to

circuit under test. As seen in Fig. 4(A), if R_S were not in the probe, a capacitance C2 of from 100 to 250 $\mu\mu f$ would appear in series with C1 across the circuit under test causing undesirable disturbances. Additional filtering, too, is seen in the low-pass filter formed by R_S and the cable capacitance C2 (see part B of the figure) which smooths the ripple developed during the conducting period of the diode.

VTVM Probes for the Oscilloscope

A mistaken practice among technicians mentioned heretofore, is that of using the VTVM crystal-diode probe as a demodulator for an oscilloscope. Figure 5(A) shows schematically the crystal probe connected to the oscilloscope input. The effect of C3 can be disregarded in this analysis since its reactance at 60 cycles is quite low.

The demodulated component then appearing across the series resistance of R_S and R_O is mainly that of the vertical sync signal and part of the horizontal sync signal in their negative phase. For signal-tracing purposes, the signal in this polarity suffices. Resistor R_S presents the real problem. The propor-

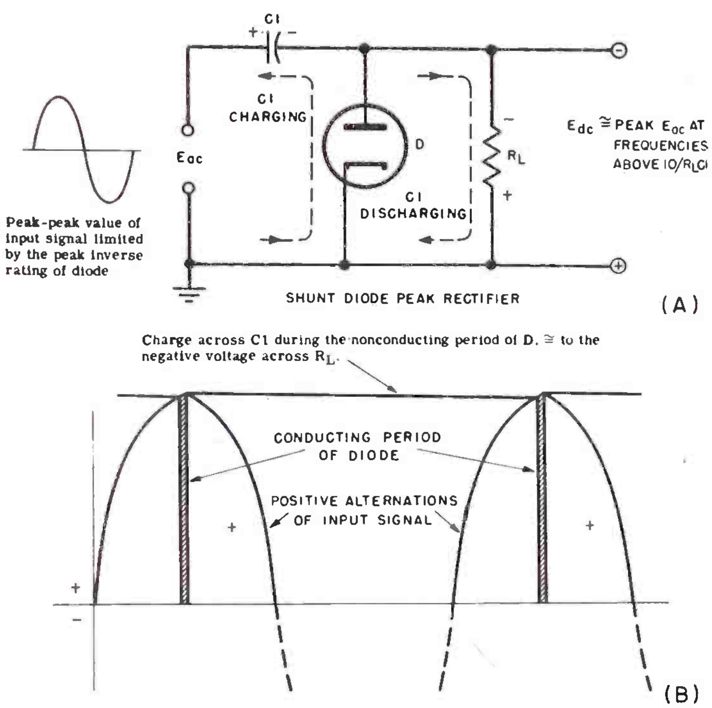

Fig. 2, Left. Circuit of shunt-diode peak rectifier.

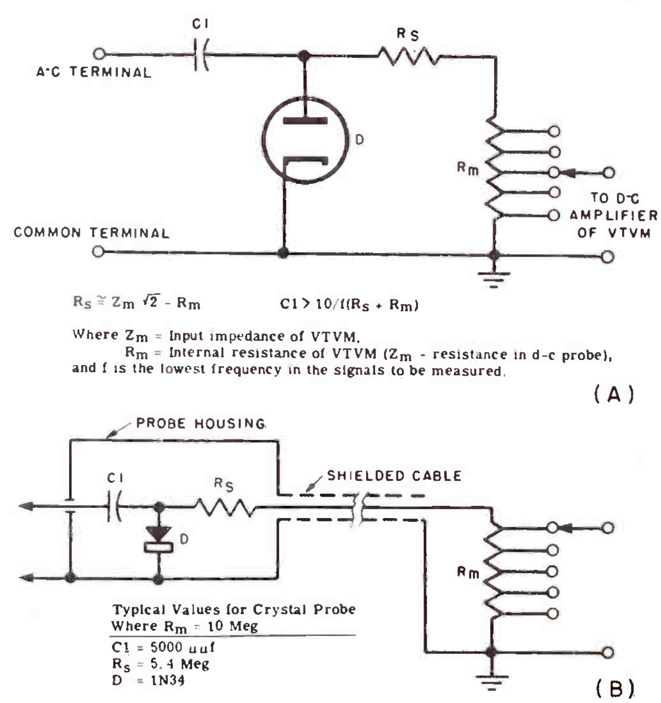

Fig. 3, Right. Diode probes for VTVM's.

Where the input signal is amplitude modulated, the voltage across R_L follows the modulation envelope at positive peaks of the r-f signal when the modulation frequencies are less than $1/10R_LC1$. The voltage across R_L will follow the modulation envelope at the negative peaks of the r-f signal if the diode were reversed. This is the principle of most video detectors as well as the detector found in demodulator probes.

Peak Rectifier Probes for VTVM's

The shunt diode peak rectifier is shown in Fig. 3(A) modified for use as an a-c signal rectifier in a vacuum-tube voltmeter. It is usually built into the VTVM and becomes active when the function switch is set to the a-c position. It should be noted that R_L, in this case, is the series resistance of R_S and R_M, the d-c range selector.

At the higher signal frequencies, the test leads from the VTVM cause circuit disturbances. The remedy for that is the crystal-diode probe of Fig. 3(B), which brings the rectifier to the circuit under test, when its cable is connected to the d-c input of the VTVM. In this case, it should be understood that unlike a thermionic diode, a crystal

about 250 mc, but the maximum input signal must not exceed 28 volts peak because of the low inverse rating of the crystal diode.

The reader's attention is directed in particular to resistor R_S. The presence of R_S is necessitated by the use of a peak detector with an instrument having an rms calibration for a-c readings. The d-c voltage across R_S and R_M is just about equal to the peak value of the measured a-c signal. R_S produces a voltage drop which leaves, at the input to the VTVM, a voltage 70 percent of the maximum. In practice, the voltage across R_M is slightly less than 65 percent of the maximum, since the value of R_S includes also the value of the isolating resistor (usually 1 meg) in the d-c probe.

Another purpose of R_S is to isolate the cable and instrument capacitance from the

tion of the resistance of R_O to the resistance of R_O in series with R_S (R_O/R_O+R_S) is such that only about 15 percent of the total demodulated output appears at the input to the oscilloscope (see part B of the figure). The signal attenuation is even greater for the horizontal sync pulses when the low-pass filter formed by R_S and the cable capacitance is considered.

It is obvious then, that much of the signal gain contributed by the vertical-deflection amplifier of the oscilloscope is negated by the losses in this crystal probe.

This probe has its place with the instrument for which it was designed. In the absence of an oscilloscope, the crystal probe—VTVM combination can perform many signal-tracing tests in the high-level stages of

(*Continued on page* 15)

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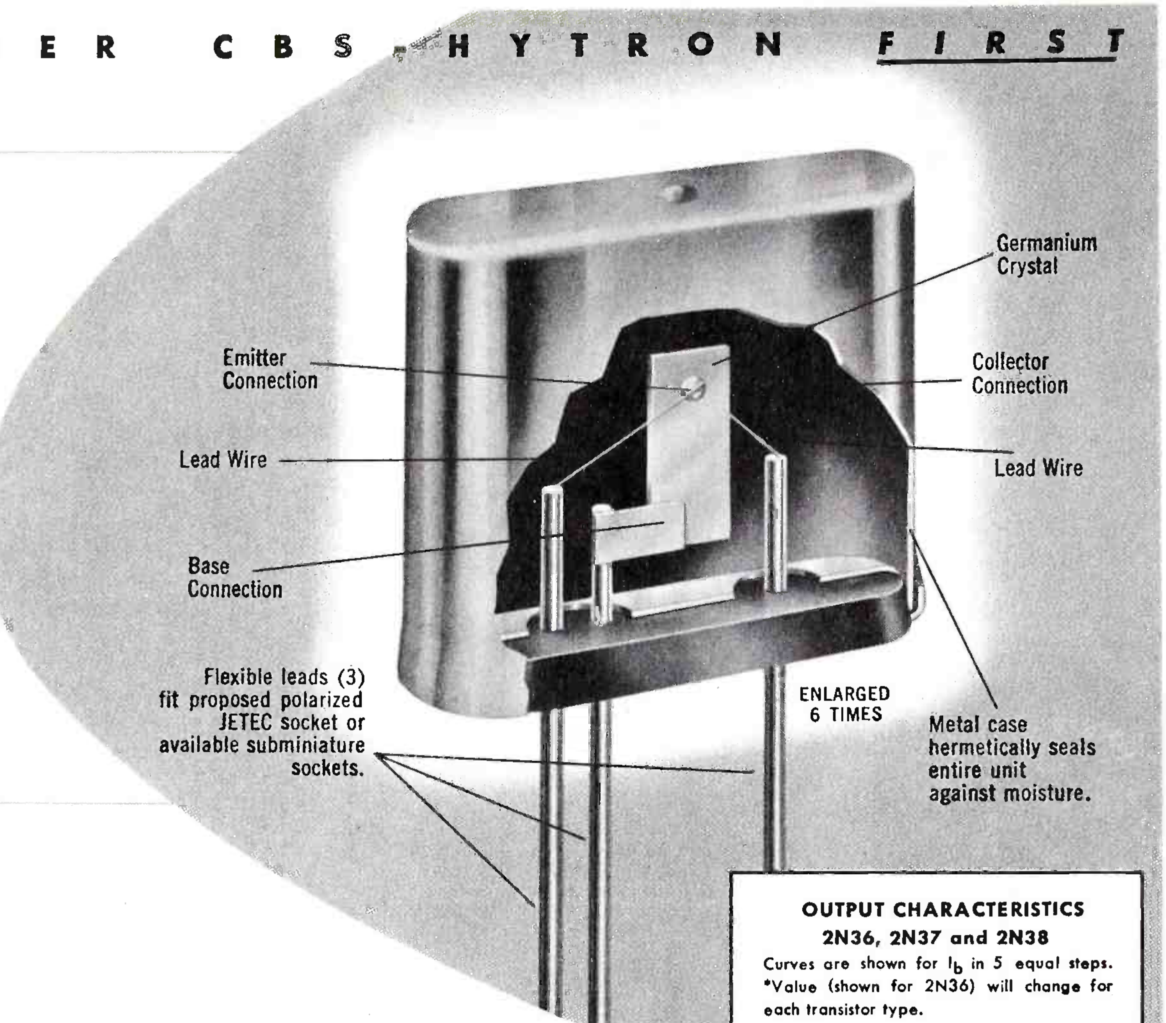
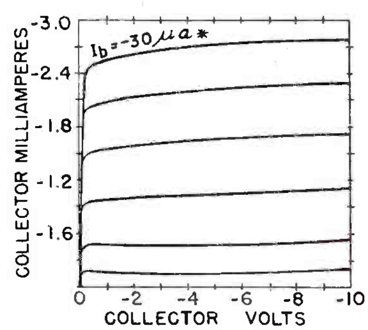
2N36
(Actual size)

2N37
(Actual size)

2N38
(Actual size)



OUTPUT CHARACTERISTICS
2N36, 2N37 and 2N38
Curves are shown for I_b in 5 equal steps. *Value (shown for 2N36) will change for each transistor type.



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Characteristic	2N36	2N37	2N38	
Collector voltage	—6	—6	—6	v
Collector current	—1	—1	—1	ma.
Current amplification factor #	45	30	15	
Power gain #	40	36	32	db

†Typical values at 25°C. #Grounded emitter connection.

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Mismatched Television Components

Part 2 - The Deflection Yoke (Horizontal Windings)

by Sidney C. Silver

This is the second in a series of articles on Mismatched TV Components. Deflection yokes will be continued next month.

In last month's article bearing the same general heading, the first in this series, consideration was given to the overall effects of replacing a defective vertical-output transformer with one that introduced some mismatch. One conclusion seemed clear at the time: apparently slight changes in the turns ratio or primary impendance produced serious symptoms, evident or concealed, that seemed entirely out of proportion to the actual changes—until consideration was given to the factors involved. These results raised a question. Was the conclusion a fair one to draw, for inductive replacements in general, on the basis of a single type of component? After all, chance could have led us to the one circuit where the problem was most complicated.

For that reason, although the first line of inquiry is far from being fully explored, it was decided to abandon the vertical-output system for the time being, and to seek elsewhere for confirmation or altration of the early assumption. To this end, attention was directed to the horizontal windings of the deflection yoke. The results obtained from using mismatched yokes were so dramatic as to turn the first conclusion into an understatement of classic dimensions.

The Yoke and the Output System

It is not a good idea to plunge into the maze of widespread results without at least some anticipation of what is involved. To begin, the yoke's horizontal windings do not lie, as first thought would seem to indicate, on some isolated tap of the flyback transformer's secondary, loftily unconcerned with the rest of the receiver. Figure 1 is a conventionalized and simplified representation of what a horizontal output circuit looks like from the plate of the output tube to the yoke. Closely allied to it, by direct or indirect connection or by inductive coupling, are the high-voltage, width, linearity, damper, boosted B-plus, and normal B-plus circuits—not to mention the yoke itself. This list is by no means definitive. In most receivers, other circuits are supplied by the boosted B-plus; in many, the flyback transformer is tapped at one point or another for a control pulse which is fed back to the horizontal oscillator and oscillator control circuit; in receivers using keyed agc, the keying pulse is almost always extracted from some point in the output stage.

The horizontal coils, which always appear across a part of the output transformer in one way or another, are therefore associated with all of these circuits. A poor match with respect to the coils can produce secondary effects in any or all of the systems mentioned, and in others.

What Factors Were Checked

A thorough run-down of all possible varieties of mismatch with all possible effects cannot be encompassed in a single article. Three representative exampls are prrsented here. In each of these instances, a replacement yoke whose vertical coils met the requirements of the original circuit was put into the receiver.

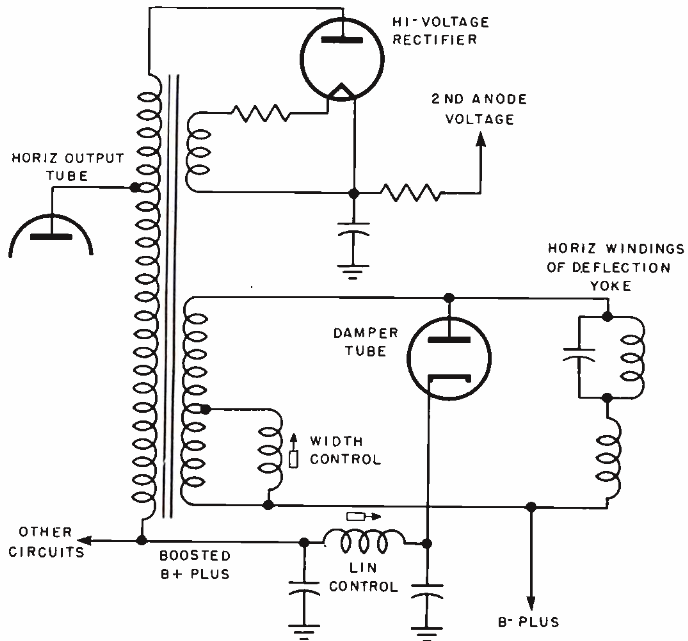

Fig. 1—Schematic of a typical horizontal-output circuit.

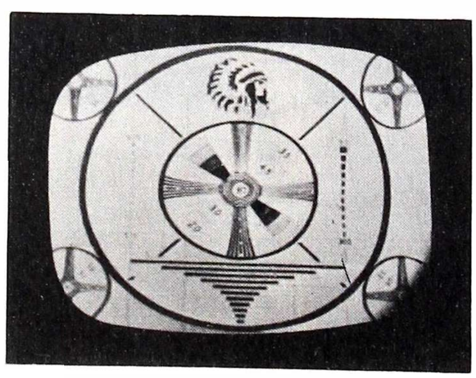

Fig. 2—Normal pattern produced by the original deflection yoke.

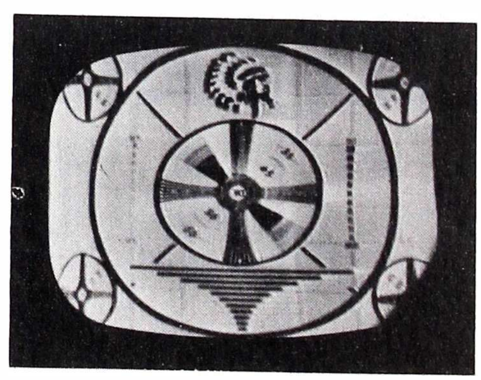

Fig. 3—Effects on pattern when yoke induction is reduced.

In each case, however, a single specification for the horizontal coils was changed. A mere half-dozen items—in addition to the obvious effects on the picture-tube screen—were checked for effects. These were: output from the low-voltage power supply, boosted B-plus (which is also the plate voltage for the horizontal-output tube), plate current at the output tube, the voltage waveform at the plate of this stage, the current-sawtooth waveform in the yoke, and second-anode voltage.

The First Case: Yoke Inductance Reduced

With the original yoke still in the circuit, the receiver was adjusted for optimum perperformance and reference measurements were taken. At this time, the picture-tube pattern appeared as shown in Fig. 2. The first vagrant yoke was identical to the original in all respects but one: inductance of the horizontal windings, required to be 12.8 millihenrys, was measured at 9 millhentrys. This represents a reduction of about 30 percent. For the rest, the yoke was a 70-degree, cosine-wound device, as required, whose vertical windings corresponded to those of the original part.

When it was first put into the circuit, no readjustment of preset controls was attempted. Effects on the picture are shown in Fig. 3. De-

(continued on page 21)

A Signal Tracing Demodulator Probe, etc.

(*Continued from page* 10)

the i-f amplifiers, especially where f-m signals are involved. With a signal generator used for signal injection, these tests can be extended to cover the entire r-f and i-f section of the receiver.

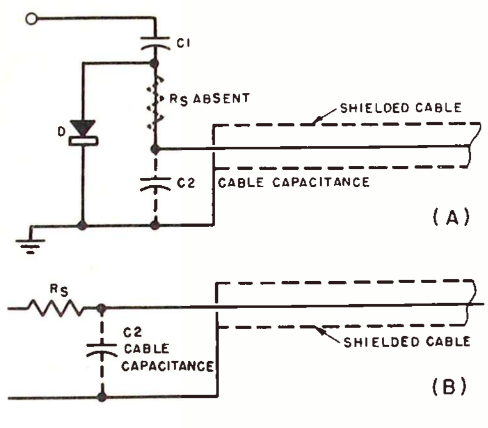

Fig. 4. Resistor R_S *serves as an isolating device and forms a low pass filter with the cable capacitance.*

for an oscilloscope, it is a simple matter to bridge R_S, (usually about 5.4 megohms) with a 50k-ohm resistor. R1 may be omitted, and capacitor C1 need not be changed. This procedure avoids dismantling the probe completely, yet it displays the essential demodulation characteristics for signal tracing. A converted probe can still be used with a VTVM. The calibration will no longer hold since the meter readings will be considerably higher. The increased sensitivity, however, to r-f signals renders the instrument more effective for signal-tracing purposes.

The demodulator probe, when used with a high-gain oscilloscope, gives reasonable performance in the early stages of tv receivers. Many instrument manufacturers provide such a probe as an accessory for their oscilloscopes. In weak-signal areas, however, where only a low-gain oscilloscope is available, a more sensitive demodulator probe based on the peak-to-peak rectifier is indicated. Also, the voltage-doubler probe suggested itself at the

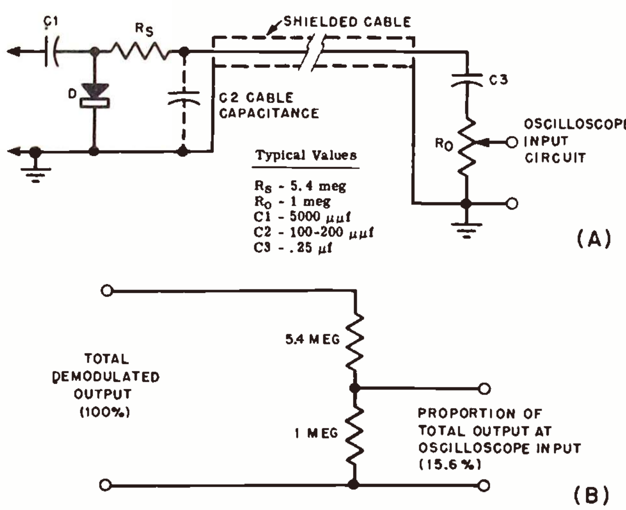

Fig. 5. Using a VTVM crystal probe as a demodulator for an oscilloscope.

Crystal Probe for the Oscilloscope

A crystal demodulation probe for oscilloscope use is shown in Fig. 6. A comparison with Fig. 3(B) shows that the essential difference between the two is the value of the components employed. The crystal diode is shown reversed, in this instance, only to provide a composite video signal in its positive-pulse phase as shown in Fig. 1. The value of resistance for R_S for example, is such that 80 percent of the diode output is at the oscilloscope input, a far more satisfactory situation. For signal-tracing purposes, an even lower value of resistance for R_S might be preferable except that less isolation is provided. Also notice the reduced value of the R_LC1 and R_SC2 time constants resulting in more faithful reproduction of the horizontal sync pulses. R_L, in this case, is the paralleled resistance of R1 with the back resistance of the diode. The similarity of the two circuits points to a simple way of converting from one to another. Where a VTVM crystal-diode probe is to be used as a demodulator

time transformerless receivers incorporating selenium rectifiers in voltage-multiplier circuits appeared on the market.

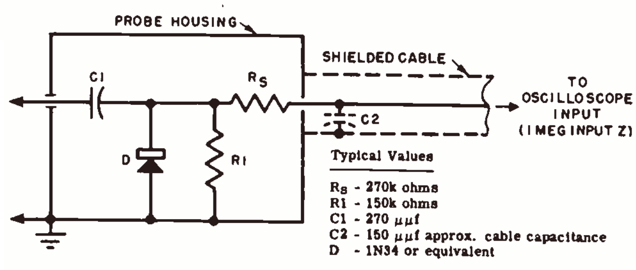

Fig. 6. Crystal demodulator probe for oscilloscope use.

Voltage-Doubler Crystal Probe for the Scope

Figure 7 shows the schematic of one such voltage doubler. Capacitor C1 charges to the positive peak voltage of the input signal through shunt diode D1 while series diode D2 is nonconducting. During the peak of the next alternation, while D1 is nonconducting. C1 discharges in series with the input signal through series diode D2. This serves to charge capacitor C2 to the peak-to-peak value of the a-c signal.

Actually this circuit is that of the a-c signal rectifier of the peak-to-peak type of vacuum-tube voltmeter. In this instance the value of resistance for R_S to give an rms calibration on an 11 megohm input-impedance VTVM is about 22 megohms.

There is no need for peak-to-peak r-f measurements in service work where the r-f signal is essentially symmetrical. Therefore, a peak-to-peak crystal-diode probe for the VTVM is unnecessary in this instance. Experience, however, has proven the value of the peak-to-peak, or voltage-doubler crystal-diode demodulator, for the oscilloscope.

Figure 8 shows the circuit of a voltage-doubler crystal demodulator probe which the author has used successfully for several years. Note that the crystal diodes have been reversed in order to produce positive-going sync pulses at the oscilloscope input. A comparison of Fig. 8 with the circuits in Figs. 3 and 7 provides several significant points of interest:

1. The demodulated waveform is approximately twice that obtained from the single-diode peak detector.

2. The low internal capacitance of D2 (approximately 1 μμf) appears in series with the cable capacitance, and thus isolates C2 from the circuit under test. This eliminates the necessity of an isolating resistor such as R_S, making for slightly higher signal input to the scope and permitting the use of cable capacitance for C2. This allows for more compact probe construction.

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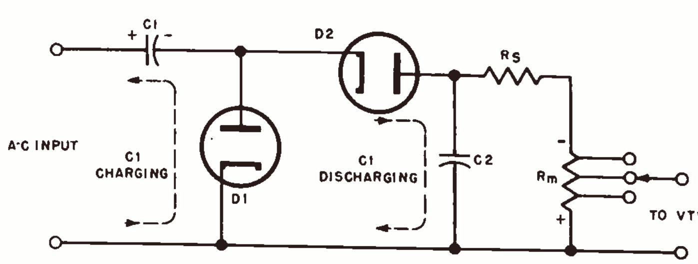

Fig. 7. Peak-to-Peak a-c signal rectifier for the VTVM.

$R_S \cong Z_m \, 2\sqrt{2} - R_m$ $C1 = C2 > 20/f\,(R_S + R_m)$

Where Z_m is the input impedance of the VTVM,
R_m is the internal resistance of the VTVM (Z_m - resistance in the d-c probe), and
f is the lowest frequency expected in the signals to be measured.

Basic Principles of Air Conditioning

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particle of the conductor material. This is illustrated in Fig. 3.

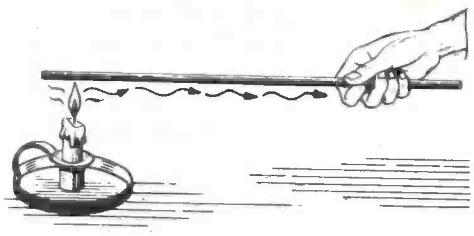


Fig. 3—Heat Transfer by Conduction

3. CONVECTION—Passage of heat from one point to another by means of circulation of a fluid. Either air or water may be considered as a fluid. Gravity circulation results from a change in density caused by the addition or loss of heat in the fluid, as illustrated in Fig. 4. Forced circulation by means of a fan or pump hastens heat transfer.

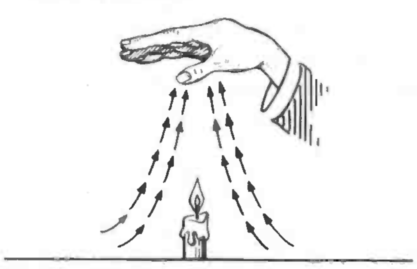


Fig. 4—Heat Transfer by Convection

Change of State

"Change of State" is also a very important factor when considering transfer of heat. When a substance changes from a solid to a liquid or from a liquid to a gas, heat is transmitted into the substance. The heat is transmitted out of the substance when changing from a gas to a liquid or from a liquid to a solid. This is illustrated in Fig. 5.

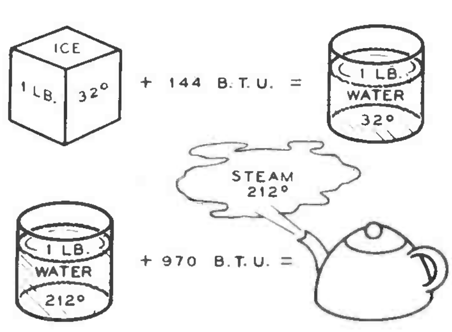


Fig. 5—Change of State

Ice is a familiar substance, so let us consider one pound of ice at 0°F. As heat is added the ice will increase in temperature until it reaches 32°F, at which point it starts to melt.

As more heat is added, the temperature remains at 32°F until all the ice is melted into water. Continuing to add heat will raise the temperature of water until the boiling point (212°F) is reached. Here again the temperature remains constant until all of the water is converted to steam or water vapor.

Converting the ice to steam involves a considerable quantity of heat. A comparison of the heat quantities required for the various steps is illustrated in Fig. 5.

A British Thermal Unit (BTU) is defined as the measure of heat required to raise one pound of water one degree F (Fahrenheit) at sea level. Addition or removal of 1000 BTU of heat in a period of one hour is stated as 1000 BTU/hr.

Specific Heat

We have been dealing with water but frequently such substances as air, Freon or a metal may be concerned and a correction factor is necessary in heat calculations for the substance involved. This correction factor is called "Specific Heat" and it is the ratio of the quantity of heat required to raise the temperature of one pound of a substance one degree to that required to raise one pound of water one degree.

In heating one pound of air one degree F, the quantity of heat required is only 24/100 as much as that required for raising the temperature of one pound of water one degree F (BTU). This means that the specific heat of air is .24.

Fig. 6 illustrates the concept of specific heat, using water and lead as an example. Heating one pound of water from 32°F to 42°F (10°) requires 10 BTU of heat as the specific heat of water is 1. Adding the same amount of heat to one pound of lead at 32°F will raise its temperature to approximately 355°.

The reason for this large difference in final temperature of the lead is due to the differences of specific heat, that of lead being .031 as compared to 1 for water.

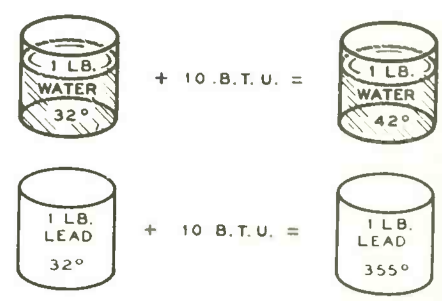
Latent Heat, Sensible Heat, Superheat

Referring again to the "Change of State" illustration, Fig. 5, the heat required to raise the temperature of one pound of ice from 0°F is 32 times its specific heat (.5 for ice) or 16 BTU. An additional 144 BTU is required to melt the ice without raising the temperature above 32°F. This adding of heat without a temperature change is called *latent heat,* and the heat required to bring about this melting is called *latent heat of fusion.* Raising the temperature of water from 32°F to 212°F requires 180 BTU per pound (212°F—32°F times 1 (Sp. heat of water) = 180 BTU per pound.). This adding of heat with subsequent temperature change is known as *sensible heat.* Changing water to steam at 212°F requires 970 BTU. The heat required to bring about this change is termed *latent heat of vaporization.* Steam may be heated above 212°F, if confined, by applying .45 BTU per pound for each degree over 212°F temperature. This is called *superheat.*

Humidity

The air we breathe is actually a mixture of various gases (nitrogen, oxygen, carbon dioxide, etc.) and water vapor. Humidity is the term used to indicate water vapor which is contained in the air and is one of the variables we must deal with in air conditioning. Relative humidity, which we hear so much about, is the ratio of the amount of moisture in the air to the amount of moisture that is required to saturate the air at any given temperature.

Reducing the humidity by condensing the water vapor from the air requires an appreciable amount of air conditioner capacity. This is usually referred to as the *latent cooling load.* The temperature of the room air in passing over the cold fins and tubes of the evaporator is reduced below the dew point (the temperature at which the water begins to condense out of the air as it is cooled), and drops of water form on the fins and tubes. This condensate gathers in the bottom of the unit and is conducted to the condenser fan where means are provided to remove it by blowing it onto the hot condenser.



INCREASE OF TEMPERATURE DEPENDS UPON CAPACITY OF A SUBSTANCE TO ABSORB HEAT. THIS CAPACITY IN RELATION TO WATER IS KNOWN AS SPECIFIC HEAT.

Fig. 6—Specific Heat

The evaporator coil and fins, which are wet with condensate, are also effective in removing minute particles of dust and pollen which may pass through the filter.

Measurement of Humidity

The amount of water vapor in the air is measured by an instrument called a psychrometer. This instrument is composed of two thermometers, one of which has a cloth wick on the bulb. When taking a reading the wick is dipped in water and the psychrometer placed in an air stream or moved through the air at a rapid rate.

The "Wet Bulb" temperature is read on the thermometer having the wetted wick covering the bulb. The reading of the other thermometer is termed a "Dry Bulb" reading.

The water on the wet bulb evaporates at a rate dependent on the moisture content of the air passing over the wet bulb which is cooled by evaporation. At saturated conditions, where the relative humidity is 100% and no cooling takes place, both thermometers would read the same. Conversely, if the air is very dry (low

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These TOP QUALITY PM speakers with ALNICO V magnets are the choice of servicemen everywhere for use as replacements or original equipment. At prices that defy all competition! Voice coil 3.2 ohm, except the 12" speaker, which is 6-8 ohms.

Stock No.	SIZE	EACH	Lots of 3
SK-9	2½"	1.29	1.15
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SK-13	6"	2.19	2.09
SK-14	8"	3.35	3.19
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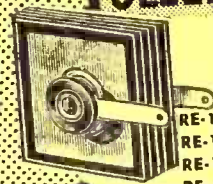

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RE-12, 65 MA., ea. 59c		57c ea.
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SERVICEMEN... *you'll* ALWAYS *get your* DOLLARS' WORTH at *Lafayette*

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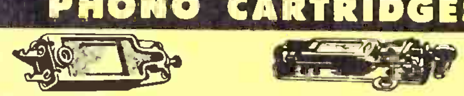

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3.5 VOLT OUTPUT exact duplicate for direct replacement of all standard cartridges such as L70, L82, L92, W60B, N10, and many others. Reg. list price $5.50.

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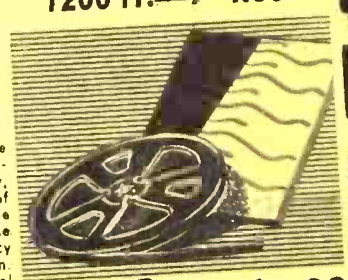
1200 ft.—7" Reel



Lafayette made a terrific deal with one of the leading manufacturers of recording tape in the country. Highest quality, optimum performance for thousands of playings. The finely pulverized red oxide particles are securely bound to the base in a smooth, uniform coating. Frequency response 50 to 8,000 cycles. Facing in. At this price you can't lose. Plastic reel included.

PER 1200 ft. Roll.......... *Special* 1.89

7-PIECE SUPER NUT-DRIVER SET

Most popular socket sizes—polished, hardened steel detachable shafts. Plastic handle with precision clutch. Contains: 1—³⁄₁₆" hex nut shaft, 1—¼" hex nut shaft, 1—5/16" hex nut shaft, 1—11/32" hex nut shaft, 1—⅜" hex nut shaft, 1—7/16" hex nut shaft, 1—amber handle with chuck. Shpg. Wt. 2 lbs.

Stock No. HD-14, Complete with plastic tool roll.. 1.99

GIANT 100 BY-PASS TUBULARS CONDENSER KIT in 4-drawer STEEL Cabinet!

$4.99

Here is your chance to get 100 by-pass tubular condensers made by one of the top condenser manufacturers in the industry. In a beautiful 4-drawer steel cabinet, blue hammertone finish, size 6" wide, 6¼" high and 8" deep. Complete at a price that defies all competition. An assortment of 100 tubular by-pass condensers consisting of the most popular values for all radio and TV sets. Voltages ranging from 200 volts to 1600 volts. All brand new and guaranteed.

STOCK No. KT-13, Complete Kit of 100 Tubular By-Pass Cond. & 4-Drawer Steel Cabinet.......... 4.99

QUALITY MAKE— VIBRATORS

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All are fully Guaranteed. Need we say more?

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Standard 4 prong—Replaces Mallory 294, 859, 901M, Radiart 5300, 5301, etc. Can size 1½" dia. x 2⅞".

Each.......... 1.29 — **10 Lots, Each.......... 1.19**

455 KC UNIVERSAL I.F. TRANSFORMER

49c ea. Lots of 10

Only ¾" Square

The most popular replacement I.F. at half the regular price! Exceptionally high gain powdered iron core, compression tuned, 455 KC midget I.F.—only ¾" square by 1⅞" high. For both input and output circuits. Supplied with mounting clip and adapter plate to replace both midget and larger size cans. Shpg. Wt. 4 ozs.

Stock No. MS-22, singly, ea.......... 59c

Lots of 10, ea.......... 49c

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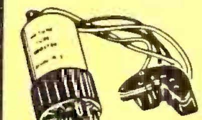

each $1.45

A startling new discovery in the TV field! Absolutely no tools or soldering needed for installing this handy inexpensive tube rejuvenator. You simply attach two plugs as directed on the instructions.

- Fits all makes of tubes
- Renews brightness, contrast

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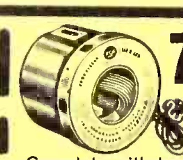

Complete with leads and network. Replacement for hundreds of TV sets. Horizontal inductance 30 MH, vertical inductance 50 MH.

TS-19, Single, ea. 2.15 — **Lots of 6, ea. 1.95**

RCA 70° cosine deflecting yoke for direct drive systems, with leads and plug. RCA part no. 74952. Regular price $6.17.

STOCK NO. TS-20, SPECIAL.......... 2.95

***Write for* NEW BARGAIN Catalog 5-53**

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FAMOUS IN RADIO FOR 32 YEARS

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NEWARK, N. J.	24 Central Ave.
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humidity) an appreciably lower temperature will be obtained on the wet bulb thermometer. The higher the wet bulb temperature, the greater the heat content of the air and corresponding load imposed on the air conditioner.

The reason for using "Wet Bulb" (WB) and "Dry Bulb" (DB) temperature readings in air conditioning is that from these readings it is possible to determine the quantity of water vapor in the air and also to determine the cooling capacity required to cool the air and reduce the humidity to a desired condition.

Vapor Pressure

The water vapor in the air exerts a vapor pressure dependent on temperature and humidity. There is always a tendency for the water vapor in the air to go from a high vapor pressure area to a lower vapor pressure area. The air conditioner produces a low vapor pressure condition by removing moisture from the room air. The water vapor in the outside air passes through openings and cracks as well as building material by diffusion. A building may be well constructed and insulated, but will not be able to prevent water vapor from passing through the walls unless it is vapor-sealed.

Figure 7 shows a section of a room maintained at a standard condition (80°DB — 67°WB) and an outdoor condition of 95°DB —78°WB. The vapor pressure differential of 18.7 lbs. per square foot under these conditions will be constantly trying to drive water vapor through the walls of the building and through any cracks or openings not properly sealed.

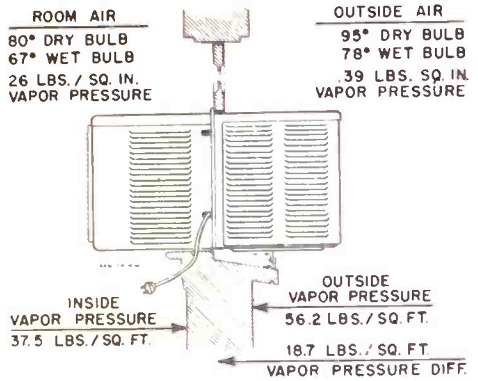


Fig. 7—Vapor Pressure Difference

It can readily be understood that a tightly sealed air conditioner installation is required to obtain maximum satisfaction from the unit. It is much easier to condition space in a well constructed building than in a building which is poorly constructed or in a poor state of repair.

Psychrometric Chart

The most common way of representing the relationship between the various properties of air is by the psychrometric chart. The psychrometric chart illustrated in Fig. 8 is simple to use in spite of the imposing number of lines and curves that criss-cross its face. Primarily the psychrometric chart shows the relationship between the following factors:

1. Dry bulb temperature
2. Wet bulb temperature
3. Dew point temperature
4. Relative humidity
5. Moisture content
6. Vapor pressure.

If any two of these factors are known, the remaining factors may be determined from the chart. The chart has a large field of usefulness beyond the presentation of these elementary relationships.

The skeleton chart (Fig. 9) illustrates the construction of the psychrometric chart. Lines of dry bulb temperature are vertical and lines of dew point temperature are horizontal. The lines of wet bulb temperature slope downwards and to the right. The curved lines on the chart represent the different percentages of relative humidity. Grains (weight) of moisture per pound of dry air are shown on the ver-

(*continued on page 30*)

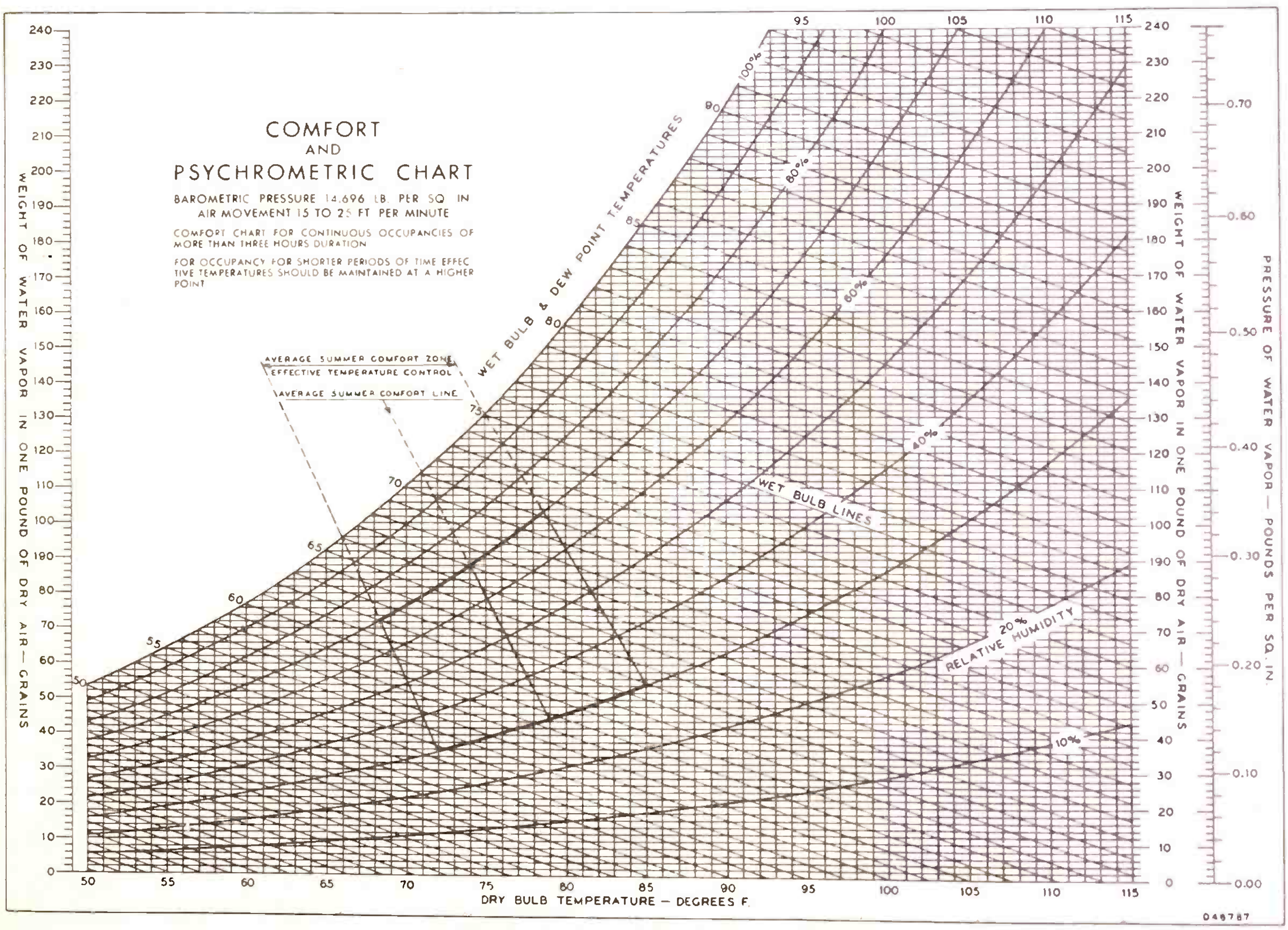


Fig. 8—Comfort and Psychrometric Chart

Antenna and Transmission Line Length Formulas

In answer to requests for information regarding the lengths of antennas and transmission-line matching sections for specific frequencies, the following table of formulas is given. In all cases, L is the total length of the antenna or line section in *inches*, and F is the center frequency of operation in *megacycles.*

The formulas for antenna length take into account a 5 percent reduction of length due to end effect. Although this percentage is not absolutely exact (the effect depends on the length-to-diameter ratio of the antenna), the figure obtained is a good approximation. The formulas given for 300-ohm line include a correction of 83 percent to take into account the reduction in velocity of wave travel in the ordinary 2-wire polyethylene-insulated transmission line. This percentage represents an average of flat and oval lines made by several manufacturers. The formulas given for coaxial line include a correction of 66 percent, which applies to flexible polyethylene-insulated coaxial lines with impedances from 50 to 75 ohms.

	Half wave	Quarter wave
Free-space length	$L = 5904/F$	$L = 2952/F$
Antenna length	$L = 5609/F$	$L = 2805/F$
300-ohm line	$L = 4900/F$	$L = 2450/F$
Coaxial line	$L = 3897/F$	$L = 1949/F$

M. Snitzer

TVI BOOK

Remington Rand's Laboratory of Advanced Research announces the availability of the new Third Edition of its popular booklet entitled "Television Interference" about August 1, 1953. This new edition, distinguished by its red cover, is almost completely new. It now contains 30 articles dealing with all phases of TVI of which 24 articles are new. Six of the more basic original articles have been retained to make this new edition complete in itself.

The material in "Television Interference" has been reprinted from such leading technical magazines as Electronics, Electrical World, Modern Plastics, *Successful Servicing,* Service, Popular Science, QST and CQ. Eight of the articles were published in 1953 and 13 in 1952. They are arranged chronologically in the Table of Contents beginning with May, 1953 and ending with December, 1948. In the back of the book there is a three-page bibliography of material on TVI appearing in QST arranged by subject.

The Preface suggests certain articles for study by the TV viewer, TV serviceman, TV engineer, radio amateur, power company engineer, as well as the industrial engineer.

The supply of the First and Second Editions of "Television Interference" has been exhausted since June 1st and therefore, those requesting either of these editions will be sent the new edition.

To obtain your free copy of this brand new red-covered Third Edition of Remington Rand's TVI book, send twenty-five cents (25¢) in coin August 1st to cover postage and handling charges to:

Miss Anne Smith
Remington Rand, Inc.
315 Fourth Avenue
New York 10, New York

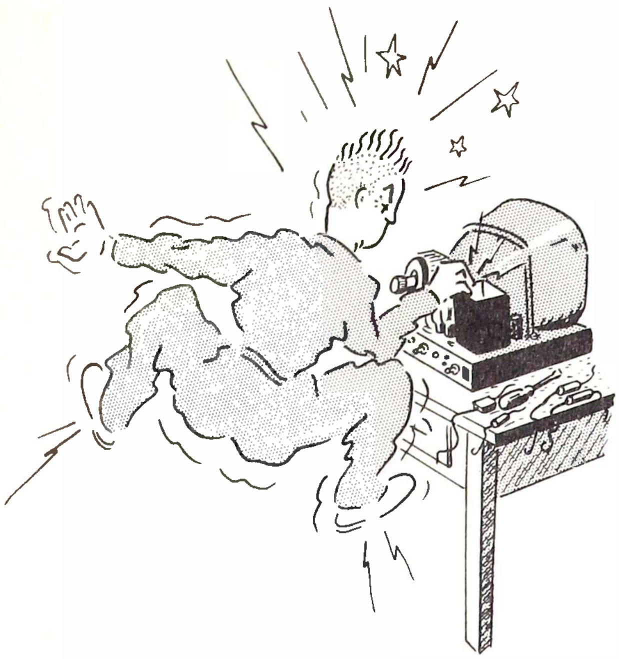
LITTLEFUSE PREPARES NEW UP-TO-DATE TV FUSE GUIDE

A new and up-to-date TV Fuse Guide containing the very latest information on fuse useage in modern television sets has been prepared by Littelfuse, Inc. of Des Plaines.

The style of the revised Littelfuse TV Fuse Guide has been changed because of the increase in the numbers of TV sets and models since the previous issue was published.

The new TV Fuse Guide is in booklet form and is perforated so that set manufacturers, jobbers and service men can hang it on the wall conveniently and easily.

For your copy of the latest TV Fuse Guide, contact your Littelfuse jobber or write directly to Littelfuse, Inc., 1865 Miner St., Des Plaines, Ill.



Some Thoughts and Questions

About the Hi-Voltage Section of a TV Receiver!

by John D. Burke

Let the chips fall where they may, I feel impelled to chop away a bit on some aspects of television hitherto undiscussed. Consider the high-voltage section in a TV receiver.

The Safety Factor

What about the safety factor? Is it possible to get killed by contact with 10,000 to 20,000 volts — developed, it is true, by a relatively low-powered device, the flyback transformer?

If the answer is *yes,* then why do some TV sets have the high-voltage transformer and rectifier sitting right on top of the chassis, fully exposed? No protective cover, no box, no screws.

If *yes,* why are some metal picture tubes not provided with plastic shields?

On the other hand, why, if some sets have no safety provisions, do others still have elaborate box arrangements? They drive us nuts with all the screws to remove before we can reach that which other manufacturers place out in the open.

Then again, what about the location of high-voltage assemblies. On the left, on the right, under the chassis, on a separate chassis, etc.

Replacing a High-Voltage Transformer

These thoughts were inspired by a recent experience with an English TV set. A few tests indicated at once that the high-voltage transformer was defective. Quite unaware of what I was getting into, I asked the stockroom man if he had a replacement.

Then it came out. Grins from my shopmates, and the remark of the shop boss, "Oh, I see you are getting into one of those. Sort of an initiation!"

Advice from all sides. The fact dawned on me that this set had been avoided by my buddies for good reasons.

To replace that transformer I had to:

1. Remove chassis from cabinet.
2. Remove picture tube. (The high-voltage transformer was mounted on the chassis directly below the yoke.)
3. Remove a pre-amplifier sub-chassis from the back of bracket supporting the yoke.
4. Remove an enclosure surrounding the horizontal amplifier and high voltage rectifier.
5. Completely disassemble high-voltage socket mounting to unsolder filament leads.
6. Move the vertical amplifier output transformer so as to get at some other screws holding down the bracket which enclosed the *sponge rubber covered* high-voltage transformer.
7. Having unsoldered all connections above chassis, I now had four more wires to unsolder and remove from the clutter under the chassis.
8. Reverse the process - put in now transformer and reassemble the set.

Now - lest you take the above for a joke on the British let me assure you there are almost such awkward assemblies in some American TV sets. Incidentally, after doing all the above, I took the high-voltage transformer out of its sponge-rubber case, and discovered that the whole trouble was just an *unsoldered connection* on one solder lug. (Note: the reason for the sponge rubber used on some British sets is that the horizontal frequency of 10,125 cps is more audible than the American 15,750 cps and more likely to disturb viewers.)

Discussing this experience with my mates, they showed me how that manufacturer had learned his lesson. In recent models he has the high-voltage transformer so mounted that a new one can be put in - in little more than a few minutes.

High Voltage Rectifier Tubes

Turning to another aspect of the problem, consider high-voltage rectifiers. As we know, the plug-in tube types, such as the 1B3 and the 1X2, are quite convenient for high-speed repair. Quite often the job is done simply by such a replacement.

But, there are disadvantages. Let me call your attention to some of them. For example, when would-be home fixers discover that their high-voltage rectifier is (1) cold, (2) a tube they can pull out and take to a shop to be tested, and (3) a tube they insist on buying and trying even when you advise them their trouble is elsewhere, we are caught between two fires. On the one hand, the more often TV sets break down, the more work we have. On the other hand, when they do break down, it is not good to have to sell people a lot of tubes all at once.

Until I came to England, one of my pet peeves was the introduction by a couple of American manufacturers of the soldered-in type of high-voltage rectifiers. I never had had occasion to change one, but I was sure that such an arrangement was a silly idea, and of no help to the repairman. However, now I have seen the light! These little soldered-in rectifiers are OK. They last a long time. They work very well. And when they need changing, the soldering job is not too bad, provided you are working under favorable conditions.

The English trust these "valves" so much they even bury them in wax in some sets, and drown them in oil in other sets. That is going too far, say I! But, on the whole, they appear to be better performers than the plug-in tubes.

In any case, no English set owner is in a position to carry such a "valve" into a shop to be tested!

Same General Proposals

To wind up, I should like to make some proposals to the set manufacturers.

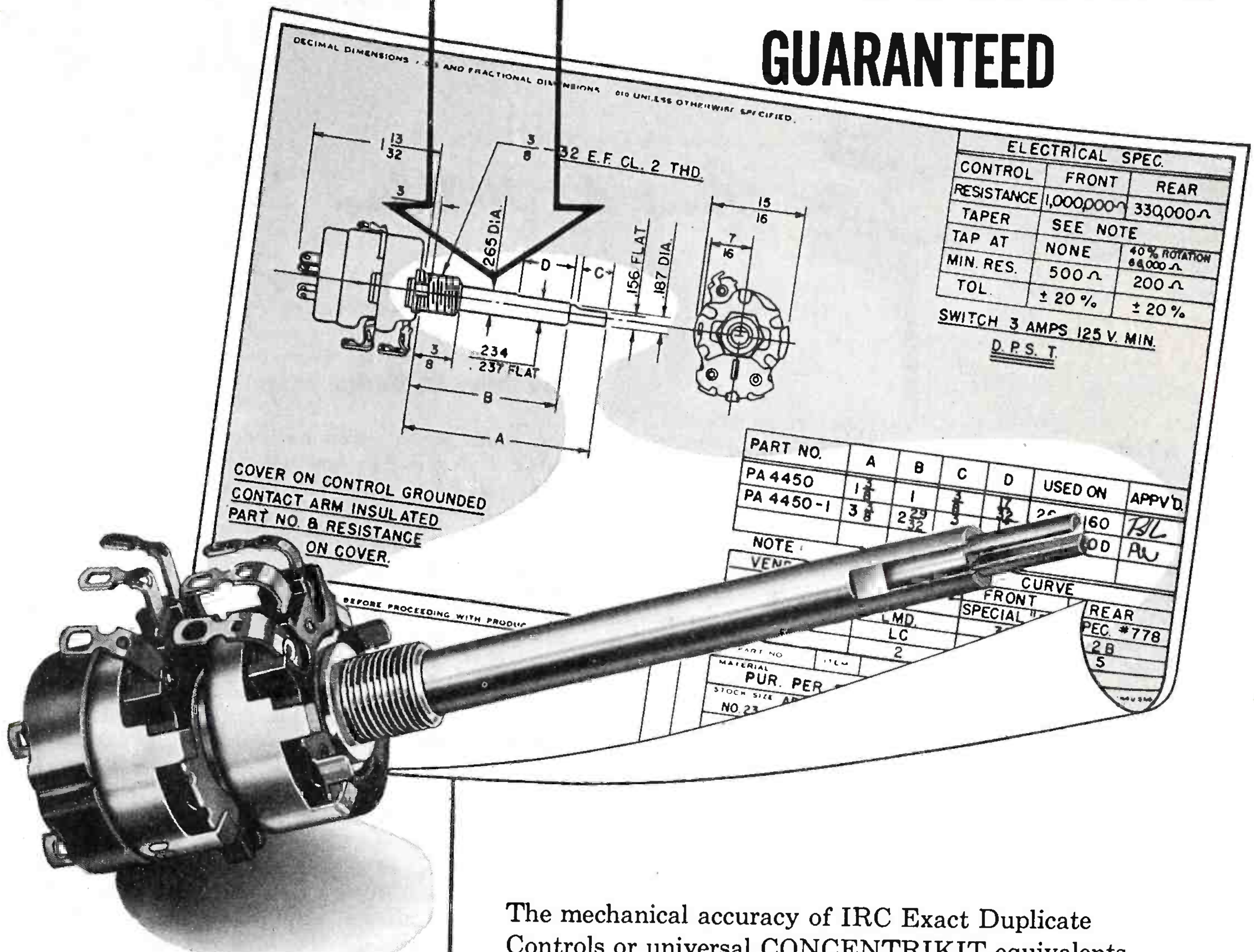
How about striking a happy medium?

We have learned to work around fly-back generated high-voltage. True, the power-line systems are still lethal, and no relaxation should be made in their safety factors.

But, let us have *some* protection on flyback sets. No mechanic should be unable to reach freely around inside a cabinet and tap

(*continued on page 30*)

HERE'S WHY IRC EXACT DUPLICATES ARE DOUBLE-MONEY-BACK GUARANTEED



ONLY IRC GUARANTEES SATISFACTORY MECHANICAL FIT AND ELECTRICAL OPERATION OR DOUBLE-YOUR-MONEY-BACK

The typical manufacturer's specifications shown here are *exactly* duplicated by IRC QJ-180 control. CONCENTRIKIT assembly includes P1-229 and R1-312 shafts with B11-137 and B18-132X Base Elements, and 76-2 Switch.

The mechanical accuracy of IRC Exact Duplicate Controls or universal CONCENTRIKIT equivalents is based on set manufacturers' procurement prints. Specifications on those prints are closely followed.

Shaft lengths are *never less* than the set manufacturer's nominal length—*never more* than 3/32″ longer.

Shaft ends are precisely tooled for solid fit.

Inner shaft protrusion is accurately duplicated for perfect knob fit.

Alterations are never needed.

For Exact Duplicate Controls, specify IRC. Most Service Technicians do.

IRC

Wherever the Circuit Says —ᴧᴧᴧ—

INTERNATIONAL RESISTANCE CO.

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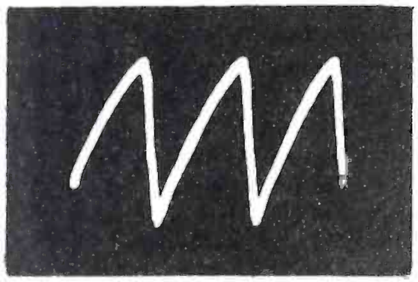
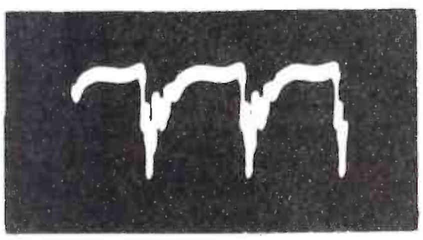
Mismatched Television Components

(*continued from page 13*)

focusing was marked, brightness dropped considerably, height increased, but width decreased, and horizontal linearity was poor. In addition, neck shadow became somewhat more evident than was normal and the raster tended to pull toward the left. Restoration of the picture to normal appearance was achieved without excessive readjustment of any one control, but consider the number of these that had to be reset in combination: horizontal linearity, width, focus, horizontal centering, horizontal drive, brightness, height, vertical centering, and vertical linearity. In addition, the ion trap had to be repositioned.



(A)



(B)

Fig. 4—A,B. Current waveforms in deflection yoke.

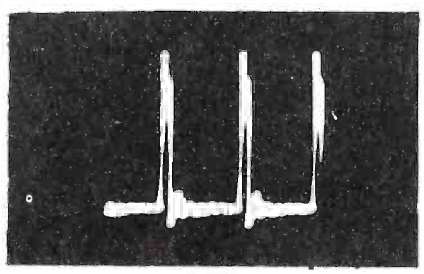
Some significant changes were shown by measurements. Those noted here are attributed exclusively to the change in the yoke, since readings taken before and after readjustment of the controls showed little variation. The second-anode voltage went from 15 kv normal to 12.8 kv. Plate current for the output tube rose from 93 to 110 ma. Plate voltage (boosted B-plus) dropped from 360 volts to 310. D-c output from the power supply fell from 300 to 270 volts. All of these represent changes of 10 percent or more. No significant alteration in peak-to-peak value or shape occurred with respect to the voltage waveform at the output-tube plate or the current sawtooth in the yoke's horizontal coils.

It would seem to some servicemen that the above effects are not too serious, particularly since readjustments can be made and changes of only 10 percent occur. It would also seem to some that tolerances for yoke specifications are rather broad, allowing considerable mismatch with little effect on the circuit. Neither of these assumptions are true. Justification for this belief is reserved for the conclusion of this article, but a sweeping statement, to be supported later, is in order here: *a replacement of the kind made here is distinctly dangerous.*

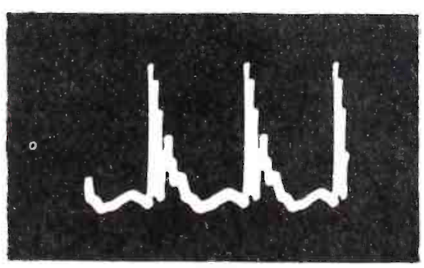
The Second Case: Inductance Too High

With the original yoke returned to the circuit, the receiver was restored to normal performance. A substitute was then chosen which, again, showed a single deviation from the original. This time inductance of the horizontal windings was too high, being about twice that of the original. When the receiver was put into operation, no raster could be obtained at all. Furthermore, no combination of adjustments of the ion trap and the associated controls could produce any sign of a raster.

A check showed second-anode voltage to have fallen from 15 kv to a few hundred volts. Boosted B-plus (normally 360 volts) and regular B-plus (normally 300 volts) had dropped to the same fractional figure, 140 volts. Evidently boost voltage was no longer being developed. Plate current at the output tube increased from 93 to 120 ma. Waveforms had altered radically in shape, amplitude, and frequency. The normal current sawtooth in the yoke and the one noted in the mismatched yoke are shown respectively in A and B of Fig. 4. B had less than half the amplitude of A. In addition, it had increased in frequency from the normal 15,750 cps to more than 20 kc. Waveforms at the plate of the output tube are shown in Fig. 5. A was seen when the original yoke was in use; B occurred during the mismatch. B was less than one-fourth the amplitude of A. The increase in frequency, already noted in the yoke, was evident here too.



(A)



(B)

Fig. 5—A,B. Voltage waveforms at the plate of the output tube.

Generally speaking, symptoms like these have less serious consequences than those noted for the first case. A substitution of this kind, since it obviously cannot be made to work, is not likely to be left in the receiver for any appreciable time. The risk of damage is thereby reduced. These considerations will be evaluated later.

A Signal Tracing Demodulator Probe, etc.

(*Continued from page* 15)

3. The series connection of the low internal capacitance of D2 with the relatively larger value of C2, places the internal capacitances of D1 and D2 effectively in parallel. This results in more disturbances to the circuits under test than with the demodulator circuit of Fig. 3. In broad-band circuits this does not ordinarily present a problem, especially with the signals found in the i-f amplifier, and in the front end when tuned to the low-band channels.

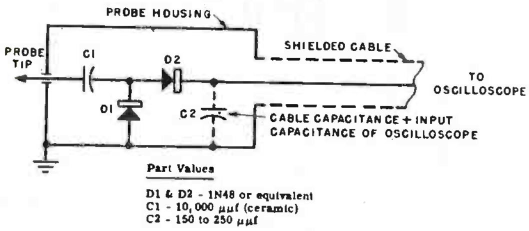


Fig. 8. Voltage-doubler demodulator probe for the oscilloscope.

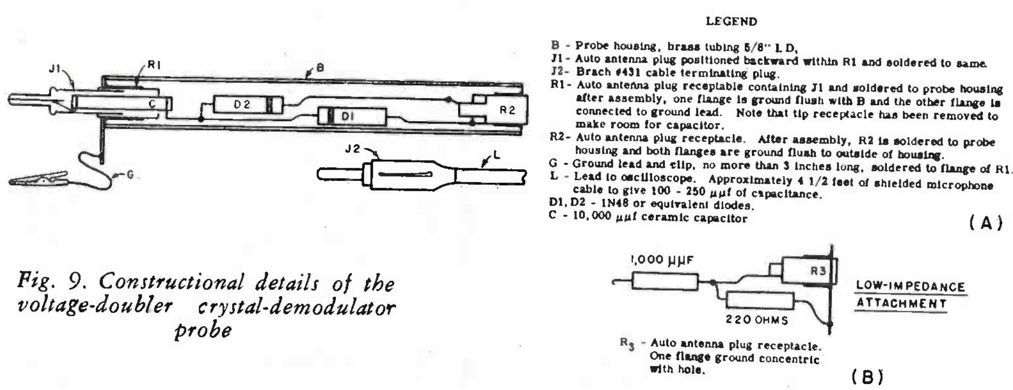


Fig. 9. Constructional details of the voltage-doubler crystal-demodulator probe

The physical layout of this probe is shown in Fig. 9(A). Constructional details are best left to the devices of the builder. The builder's attention, however, is directed to the detachable arrangement of the probe and cable which is favored by the author. This permits a rapid changing of various probes besides the demodulator probe as the occasion arises. The plug arrangement at the prod end, instead of the usual phone tip, is suggested in order to accommodate the low-impedance attachment shown in Fig. 9(B). This attachment reduces the input impedance of the demodulator circuit to a value necessary to load down the tuned circuits at the test point during the alignment of a single i-f amplifier stage. In effect, it makes this probe comparable to the ones suggested by DuMont and other manufacturers for the single-stage alignment of their overcoupled i-f amplifiers.

Applications of the Scope Probe

It is customary with most technicians to "play" with newly acquired instruments. The "toy" period in the life of test equipment lasts until the features and characteristics are fully understood. Demodulator probes are no exception.

A suggested procedure is to make a "pass" with the demodulator probe and scope through the i-f and tuner circuits of the different types of television receivers that pass through the shop until the characteristics of the probe in connection with the various circuits are fully understood. The author's experience can be briefly summarized as follows:

1. The demodulator-probe output is the waveform viewed on the oscilloscope shown in Fig. 1. This is the composite video signal in its positive pulse phase. Horizontal pulses are attenuated somewhat, as the demodulator probe does not have the frequency characteristics of a video detector. Furthermore, in the early stages of stagger-tuner circuits, the demodulator probe does not "see" the full video i-f bandpass which appears at the video-detector input.

2. A video-signal waveform can be obtained at the input of any stage between the second-detector input and the transmission line at the antenna terminals. Waveforms obtained from unterminated transmission lines may lead to unwarranted conclusions however.

3. Signal amplitudes at the antenna terminals in some local areas may cause the scope pattern to deflect off the screen of a 5-inch tube in a 20 mv/in oscilloscope with the vertical-gain controls wide open. Other areas may not fare as well.

4. Waveforms obtained in the tuner, and even in the 1st i-f stage may have less amplitude than those obtained at the antenna. This is due in part to the detuning effect of the probe, and to the agc action in the preceding and respective stages under strong signal conditions.

5. To obtain a satisfactory waveform at the mixer grid, the r-f oscillator should be disabled without effecting mixer operation.

6. It is imperative when probing in low-level stages, to connect the ground lead on the demodulator probe to a ground point at the stage under test. Do not rely on a common ground lead from the oscilloscope to the receiver chassis.

During the initial period of familiarization, it may be well if the probe were to be used in connection with some of the more obvious troubles in the video strip. In many cases, as long as the chassis is up-ended on the bench, a pass through the video strip with the probe will localize the defective stage in faster time than could be accomplished by the usual tube substitution and circuit disturbance tests.

As the technician becomes more familiar with the use of the demodulator probe and oscilloscope combination, he will find it of inestimable value in tracking down intermittents, or obscure sync troubles which have their origins in i-f and agc circuits.

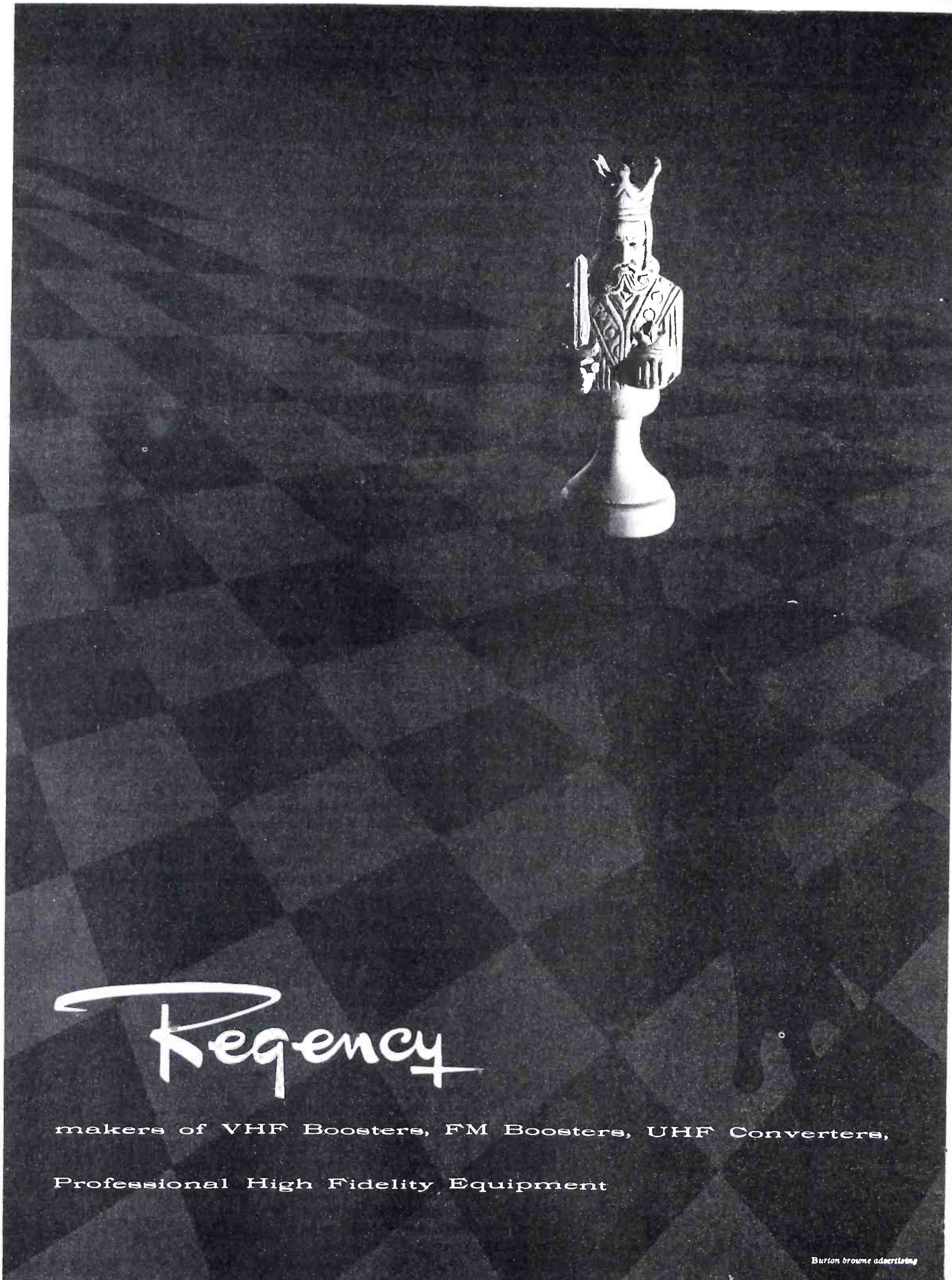
Finally, he may devise special troubleshooting techniques of his own. Consider the audio i-f amplifier of an intercarrier receiver. Unlike the situation in a dual-channel receiver, this circuit amplifies a signal with considerable a-m component. The presence of the vertical sync pulse in the ratio-detector circuit will suggest to the progressive technician not only a means of signal tracing intercarrier sound i-f circuits, but a way of coping with excessive intercarrier buzz.

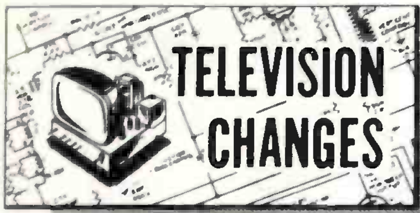
TV SUPPLEMENTARY SHEET NO. 3

MODEL & CHASSIS	PART #	CATALOG #	FUNCTION	DESCRIPTION	LIST PRICE
GAMBLE-SKOGMO (Coronado)					
K-21 K-72 K-73L 43-9030 43-9031 43-9041	P-2D	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	P-5D	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	P-12D	AG-8-S FKS-1/4	AM Rejection	1000 Ω carbon	$1.25
	P-13	AG-61-S KSS-3	Vert. Hold	1 Meg. Ω carbon	$1.25
	* P-14	AG-44-S KSS-3	Hor. Hold	50K Ω carbon	$1.25
	P-15	AG-49-S KSS-3	Bright.	100K Ω carbon	$1.25
	PD-9	RTV-347	Contrast Vol./Sw.	2000 Tap 1400/500K Ω Conc. Dual carbon SPST	$4.30
	* Some Models Use Alternate Part # P-17B Replacement Being AG-61-S/KSS-3				
15TV4-43-8948A	* TVC-528D	RTV-232	Contrast/ Vol./Sw.	1500/500K Ω Conc. Dual carbon--SPST	$3.70
15TV4-43-8949A	TVC-543D	AG-44-S FS-3	Hor. Hold	50K Ω carbon	$1.25
	TVC-544D	AG-61-S FS-3	Bright/ Vert. Hold	1 Meg. Ω carbon	$1.25
	TVC-545D	AG-61-S KSS-3	Height	1 Meg. Ω carbon	$1.25
	TVC-546D	AG-19-S KSS-3	Vert. lin.	5000 Ω carbon	$1.25
	* Some Models Use Alternate Part # TVC-557D				
GENERAL ELECTRIC					
12T3 12T4 12T7 12C107 12C108 12C109 (B Version)	RRC-096 K68J766-1	AG-85-S FKS-1/4	Height	3 Meg. Ω carbon	$1.25
	RRC-127 K71J112-1	A43-4000 FKS-1/4	Vert. Lin.	4000 Ω 2W-W.W.	$1.25
	RRC-128 K71J71-2	RTV-230	Contrast/ Vol./Sw.	2 Meg./500K Tap 280K Ω Conc. Dual carbon SPST	$3.70
	RRC-130 K71J69-1	RTV-276	Focus/ Bright.	100K/500K Ω Conc. Dual carbon	$3.10
	RRC-136 K71J397-1	RTV-157	Vert./ Hor. Hold	100K/125K Ω Conc. Dual carbon	$3.10
	RRC-140 K71J442-1	AG-40-S FKS-1/4	Drive Control	25K Ω carbon	$1.25
20C105 20C106 20T2 21C200	RRC-096 K68J766-1	AG-85-S FKS-1/4	Height	3 Meg. Ω carbon	$1.25
	RRC-127 K71J12-1	A43-4000 FKS-1/4	Vert. Lin.	4000 Ω 2W-W.W.	$1.25
	RRC-140 K71J442-1	AG-40-S FKS-1/4	Hor. Drive	25K Ω carbon	$1.25
	RRC-173 K82J327-2	AG-49-S RS-2	Hor. Hold	100K Ω carbon	$1.25
	RRC-174 K82J326-2	AG-49-S RS-2	Vert. Hold	125K Ω carbon	$1.25
	RRC-175 K82J255-2	AG-58-S RS-2	Bright.	500K Ω carbon	$1.25
	RRC-186 K83J475-1	RTV-375	Contrast Vol./Sw.	2 Meg./500K Ω Conc. Dual carbon--SPST	$3.70
HALLICRAFTER					
1000 1008 1019	25A858	AG-44-S FKS-1/4	Hor. Drive	50K Ω carbon	$1.25

MODEL & CHASSIS	PART #	CATALOG #	FUNCTION	DESCRIPTION	LIST PRICE
CHASSIS W1000D X1000D Z1000D	25B711	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	25B712	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	25B888	RTV-237	Contrast/ Vol./Sw.	2500/1 Meg. Conc. Dual--carbon--SPST	$3.70
	25B995	RTV-235	Focus/ Bright.	2500/50K Ω 2W-W.W. carbon Conc. Dual	$3.10
	25B917	RTV-40	Vert./Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	$3.10
1002 1003 1004 1007 CHASSIS F1100D	25A858	AG-44-S FKS-1/4	Hor. Drive	50K Ω carbon	$1.25
	25B711	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	25B712	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	25B888	RTV-237	Contrast Vol./Sw.	2500/1 Meg. Conc. Dual carbon--SPST	$3.70
	25B917	RTV-40	Vert. Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	$3.10
	25B994	RTV-350	Focus/ Bright.	1.5 Meg./50K Ω Conc. Dual carbon	$3.10
1005 1006 1015 1016 1017 1018 1019 CHASSIS A1100D	25A858	AG-44-S FKS-1/4	Hor. Drive	50K Ω carbon	$1.25
	25A970	AG-83-S KSS-3	Focus	1.5 Meg. Ω carbon	$1.25
	25B711	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	25B712	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	25B890	RTV-239	Hor./ Vert. Hold	50K/1 Meg. Conc. Dual carbon	$3.10
	25B969	AG-63-Z FS-3/SWB	Vol./Sw.	1 Meg. Ω carbon--SPST	$1.25 .60
	25B971	RTV-351	Contrast/ Bright	2500/50K Ω Conc. Dual carbon	$3.10
1025 CHASSIS C1000D	25A858	AG-44-S FKS-1/4	Hor. Drive	50K Ω carbon	$1.25
	25B711	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	25B712	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	25B917	RTV-40	Vert./ Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	$3.10
	25B966	RTV-337	Contrast Vol./Sw.	2500/1 Meg. Tap 100K Ω Conc. Dual carbon SPST	$4.30
	25B967	RTV-338	Focus/ Bright	2500/1 Meg. 2W-W.W. carbon Conc. Dual	$3.10
HYDE PARK					
AR14L AR17L 17CD 17CRR 17ROG 20CD 203D 1000 1001 2nd Run	P-2	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	P-5	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	P-7	AG-60-Z FS-3/SWB	Vol./Sw.	500K Ω carbon--SPST	$1.25 .60
	P-12	AG-8-S FKS-1/4	AM Rejection	1000 Ω carbon	$1.25
	PD-5	RTV-146	Vert./ Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	$3.10
	PD-6	RTV-253	Contrast/ Bright.	2000/100K Ω Conc. Dual carbon	$3.10

Form No. 751837010-5M-11/52


Regency
makers of VHF Boosters, FM Boosters, UHF Converters,
Professional High Fidelity Equipment
Burton browne advertising



The Rider Manual pages and TEK-FILE pack which include the original data and shematics to which the following production changes apply, appear in the index on page 32 of this issue.

STROMBERG-CARLSON MODEL 116

Tube substitution.

Chassis of later production have been fitted with octal sockets to employ 6SN7GT tubes in the three positions where 12AU7 tubes were used previously. These three positions are (1) V7, the d-c restorer and sync-clipper stages, (2) V1, the vertical-sweep output stage, and (3) V22, the sync clipper and vertical sweep-oscillator stage.

No circuit modifications are required to accommodate the 6SN7GT tubes in these positions except the necessary wiring revisions to the correct terminals of the octal sockets.

STROMBERG-CARLSON MODEL 317 series

Tube location revision.

On the tube location diagram and voltage chart for the above series of models, the positions of V12 (the 6AU6 ratio detector drive) and V16 (the 6AU6 keyed agc tube) are shown interchanged. The position of V12, its function and description, should be in the V16 position and vice versa.

Also, on the tube location diagram, the functional description of V15 (a 12AU7) should be labeled "Noise Reference and Retrace Horizontal Blanking."

STROMBERG-CARLSON MODELS TC10, TC125

Horizontal-output transformer substitution.

The horizontal-output transformer (part No. 161028) used in TC125 series "O" models, can be used in TC10 and TC125 receivers where part No. 161016 was originally used. When substituting part No. 161028 for part No. 161016, the following wiring changes must be made:

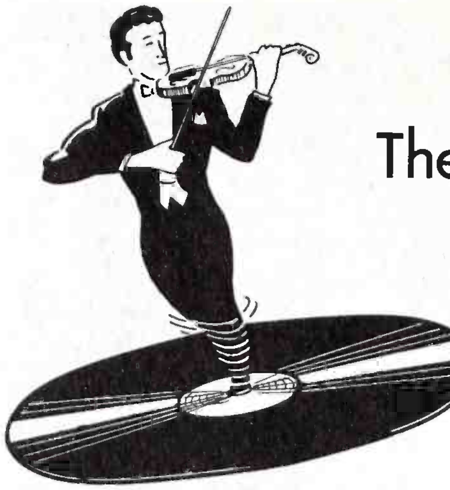
1. Connect terminals No. 5 and No. 7 together, with a piece of insulated hook-up wire, on the No. 161028 transformer.
2. Dress this connection so that there is at least one-fourth of an inch of spacing for intervening terminals.
3. Make all other connections as if wiring in a No. 16101 transformer.

STROMBERG-CARLSON MODEL TC125

Focus coil changes.

In the L31 position, focus coil assembly part No. 114660 is used when a 12LP4 picture tube is employed; and focus coil assembly part No. 114661 is used when a 12KP4 or 12QP4

(*continued on page 26*)



The Service Technician and High Fidelity

Television has become the darling of more than 23,000,000 TV set owners. But it's a bugaboo to the motion picture industry, which thinks they have the antidote in 3-D, three dimensional pictures.

While television and motion pictures both have their millions of devotees, there's a new group growing, not quite so numerous, but equally as enthusiastic. These are the audiophiles or high fidelity fans.

And you can't blame them either because high fidelity in the home is doing for sound reproduction what 3-D is doing for motion pictures. Hi-fi is opening the door to a new concept of music in the home.

And it's going to get tremendous support in the near future—almost immediately—the biggest names in receiver production soon will be waving hi-fi banners.

From all indications, the enthusiastic turnouts for audio fairs in New York, Chicago, and Los Angeles show that high fidelity is here to stay. More and more, quality component manufacturers are rushing into production units for high fidelity systems. More and more, electronics parts distributors and music dealers are installing audio salons so that the public can sit and listen to good music and decide for themselves the difference between ordinary and high fidelity reproduction.

Anyone can make his own test in his own home with his own equipment and determine if he is receiving the full measure of reproduction he is seeking. There's a big difference between ordinary and high fidelity reproduction. The hi-fi fan can detect it on his own equipment if he listens selectively.

Owners of the book HIGH FIDELITY SIMPLIFIED are told to listen with discrimination when they test their present equipment, or equipment they intend to buy. In fact, a special record is furnished each purchaser of the book so they may make the test. Here are the questions the book asks the reader.

"Do you hear cymbals as a crashing sound followed by a sustained shimmering? Do you hear the triangle as a clear-ringing sound? Can you actually feel the vibration of the tom-tom, the bass drum, or the lowest note of the organ? A staccato passage in a piano solo should be crisp and clear, each note standing out by itself. Do you hear it that way? Does your system sound well at low volume or is it necessary to increase the level before the reproduction is fairly good? Although they are near the opposite ends of the range of strings, can you always differentiate between the violin and the violoncello? Can you tell the difference between string bass and brass bass?"

* * *

Yes, high fidelity is coming into its own. Sales for the various units that compose a home high fidelity system are increasing daily. While there are many sources for *selling* these units to the public, there are a limited number of establishments for *servicing* this equipment.

The radio and TV service technician is the ideal individual to logically step in and repair high fidelity equipment. However, he must have some background if he is to successfully compete. HIGH FIDELITY SIMPLIFIED, by Harold D. Weiler enables the service technician to become fully acquainted with high fidelity in that it explains all hi-fi terminology, basic units of a high-fidelity system, and how high fidelity may be used in the home. The best way to learn about this fast growing public activity is to read this best-selling book. Buy HIGH FIDELITY SIMPLIFIED and pave the way for a profitable "extra" to your TV and radio servicing income.

Television Changes

(*continued from page 25*)

PILOT **MODELS TV271U, TV273U, TV275, TV291U, TV293U, and TV295**

Pack 53 Vol. 9 — 1-14

The basic chassis used in the above models is the same as that used in Models TV271 and TV273. For complete service information on this chassis see Tek-File pack 53 and TV Manual, Volume 9, pages 1-14

STROMBERG-CARLSON **MODEL 317 series**

Pack 15 Vol. 8 — 1-8

Removal of horizontal-size potentiometer.

On all the above receivers date coded 51-32 and later, the horizontal-size potentiometer has been repositioned to the rear chassis flange so as to be accessible for adjustment from the rear of the receiver.

REPLACEMENT PARTS, Etc.

(*continued from page 9*)

amples of these are i-f, r-f and a-f transformers. Finally other transformers function simply as links between a vacuum tube and the device which is the load of the vacuum tube, and so enable the most effective transfer of energy between the vacuum and the load. When identified, such transformers are generally called output transformers, which function embraces the action of impendance matching. Each of these types establishes a category which will be dealt with individually in this series.

Power Transformers

The general category of power transformers can be sub-divided into three groups, although only two of these find application in television receivers. The three groups are:

A—Plate and filament transformers
B—Filament transformers
C—Plate transformers

These names are completely functional and identify the device in two ways. One is in terms of the use to which the voltage and current available from the transformer is put; and the second gives some, but not complete, indication of the number of secondary windings which are to be found on the transformer. Every transformer has a primary winding, which in almost all instances is singular in number. The rare exception has two primary windings. For the moment we shall neglect this special variety. On the other hand multiple secondary windings are common.

For example the name filament and plate transformer immediately indicates that the device is related to two functions and apparently is capable of furnishing at least two different values of voltage. The plate reference implies high voltage for application to the plate or plates of the rectifier tubes in a power rectifying system, and the filament reference implies a low voltage for application to the filament or heaters and one or more vacuum tubes. This form of identification is, of course, very limited. While it has a functional meaning it does not in any way indicate the value of the high voltage available from the plate winding, or the amount of current which can be supplied by that winding at whatever may be its voltage rating. Neither does it state whether the transformer has one or more plate windings, or if the plate winding has a center tap. In similar fashion the reference to the filament in the identifying name of the device does not state the electrical contants of the winding relative to voltage or current, nor does it state whether one or more such filament windings are in part of the transformer. Hence, the full identification of a transformer which is capable of furnishing plate voltages to a rectifier system and filament voltages, requires specific details concerning the current and voltage output of each and the number of windings.

The name filament transformer as another variety of transformer is a form of identification but once more it has a limited use, serving simply to stipulate that the transformer furnishes *only* filament voltages and does not afford a high voltage for application to a power rectifying system.

The plate transformer on the other hand is one which affords a high voltage for application to a rectifying system, but does not furnish any low voltages to serve the heaters of the vacuum tubes. We shall refrain from further reference to the plate transformer because seldom, if ever, is it used in a television receiver. Our discussion of power transformers will therefore be limited to the combination filament and plate variety, and to the filament voltage source device.

A monthly summary of product developments and price changes supplied by RADIO'S MASTER, the Industry's Official Buying Guide, available through local parts distributors.

A monthly summary of product developments and price changes of radio, electronic, and television parts and equipment, supplied by United Catalog Publishers, Inc., New York City, publishers of RADIO'S MASTER. These REPORTS will help you to buy and sell to best advantage. They will also help you to keep your inventory up to date. A complete description of most products will be found in the Official Buying Guide, RADIO'S MASTER available through local parts distributors.

New Items

AMERICAN PHENOLIC—Added No. 66-213 Tubular Twin-Lead End Seal at $3.00/c dealer net.

ARCO ELECTRONICS—Added several new Capacitor Kits.

BEAM INSTRUMENTS—Added Model 1CP1 Miniature CRT at $12.95 dealer net.

BLONDER-TONGUE LABS.—Added Model BTU-2 "Ultraverter" All-Channel UHF Converter at $23.97 dealer net.

CREST LABS.—Added Model LVB "Jr" Voltage Booster at $5.85 dealer net; Model UHF 10-A UHF Converter at $13.50 dealer net; Model MA4 Linearity Bar Generator at $10.95 dealer net.

DUOTONE—Added Columbia Replacement Needles No. 360 at $1.75 dealer net; No. 360D at $14.00 dealer net.

ELDICO OF N.Y.—Added Exciter; Modulator; Power Supply in both kit and factory wired and tested form to their Model TR-1 TV Transmitter.

ESCO-LITE—Added new series of TV Lamps, "The Laurel".

GARRARD SALES—Added Model T three-speed Manual Player at $25.95 dealer net; Model WB (wood base) for Model T at $5.25 dealer net Model RC80 AC/DC Record Changer at $57.95 dealer net.

GENERAL ELECTRIC—Added Receiving Tube 6-AU5GT at $2.70 list; TV Picture Tubes 17MP4 at $29.50 dealer net; 21JP4 at $44.75 dealer net; 21UP4 at $50.75 dealer net; 24TP4 at $79.00 dealer net.

HAMMARLUND MFG.—Added Model HQ140X Receyier fitholt Speaker at $264.50 net; 8" Speaker in Matching Cabinet at $14.50 amateur net; Model SP-600-JX Receiver without Speaker at $985.00 amateur net; 8" Speaker in Matching Cabinet at $18.50 amateur net.

MALLORY & CO.—Added No. 2600 Midgetrol Control Kit at $15.60 dealer net.

MILLER MFG., M.A.—Added a number of new Replacement Needles for American Microphone, Audak, Astatic, General Electric, Magaavox, RCA. Webster Electric.

RCA—Added Kinescope 27MP4 at $124.00 dealer net; Model 240A1 TV Set Coupler at $1.17 dealer net; Model 219D1 deflection Yoke at $12.00 dealer net.

RAYTHEON—Added TV Picture Tube 21YP4 at $41.25 dealer net.

RIDER, JOHN F.—Added No. 143-3 "TV Manufacturer's Receiver Trouble Cures", Volume 3 at $1.80 dealer net.

SCOTT, HERMAN H.—Added Models 140-A; 615-A to their series of Professional Laboratory Measuring Instruments.

SOUTH RIVER METAL PRODUCTS—Added: CT Chimney Mount Replacement Kit at $1.49 dealer net; Model ZM-ST Chimney Mount with 10 foot stainless steel strap at $2.10 dealer net.

SYLVANIA—Added Receiving Tubes 1AX2 at $2.55 list; 6CL6 at $3.15 list; 6CM6 at $2.20 list; TV Picture Tubes 24CP4 at $71.00 dealer net; 24VP4 at $71.00 dealer net; 27EP4 at $118.00 dealer net; 27LP4 at $118.00 dealer net.

TELREX—Added several new UHF Antennas.

TRANSVISION—Added several new television assembly kits.

TRIO MFG.—Added several new UHF Antennas.

VARI CORP.—Added Model R-115-B Vari-Hot Electric Soldering Iron at $7.75 list.

VIDAIRE ELECTRONICS—Added Model C-1 Two-Set Coupler at $1.17 dealer net.

Discontinued Items

BARKER & WILLIAMSON—Discontinued No. 3905. 3906, 3907 Inductor Material Enameled Wire.

BLONDER—TONGUE LABS.—Discontinued Model HA-2-M All-Channel TV Booster.

EITEL-MCCULLOUGH—Discontinued Vacuum Tube 3C24.

GARRARD SALES—Discontinued Model M three-speed Manual Player.

GRAYBURNE CORP.—Discontinued Model CL Deluxe Tube Carrier.

LITTELFUSE—Discontinued No. 094023 Assorted Fuse Kit.

RADIO APPARATUS CORP.—Discontinued Model M-51 FM Receiver.

RECORDISC CORP.—Discontinued Record Preserver; Turntable Lubricant; 1 Hour Recording Wire Spool.

SIMPSON ELECTRIC—Model 266 Vacuum Tube Voltmeter has been discontinued.

SOUTH RIVER METAL PRODUCTS—Discontinued Model WB-6 SPEC Wall Bracket.

UNITED TRANSFORMER—Discontinued Model V-4 Varitran Control Unit.

VARI CORP.—Discontinued Model R-115-A Vari-Hot Electric Soldering Iron.

Price Decreases

CORNELL-DUBILIER—Decreased prices on several vibrators. Also decreased prices on Model U-4 UHF TV Antenna to $4.77 dealer net; Model LDX-1 Indoor Antenna to $3.57 dealer net.

FRETCO—Decreased price on Model MR-C Corner Reflector to $7.50 dealer net.

GENERAL ELECTRIC—Decreased prices on TV Picture Tubes 10BP4A to $20.50 dealer net; 20DP4A to $38.50 dealer net; 24AP4 to $83.00 dealer net.

NATIONAL UNION RADIO—Decreased prices on one 16"; five 17"; two 20"; five 21" TV Picture tubes.

PACIFIC TRANSDUCER—Decreased price on Model 221 Four-Position Equalizer to $8.64 dealer net.

RCA—Decreased the dealer return allowance on TV Picture Tubes 16AP4-A; 16GP4; 16GP4-B; 19AP4-A; 19AP4-B; 20CP4; 20MP4; 21AP4: 21MP4.

SYLVANIA—Decreased price on Special Purpose Tube 7AK7 to $7.25 dealer net.

TELEMATIC INDUSTRIES—Model AM-44 TV Receiver Coupler decreased to $2.14 dealer net.

TUNG-SOL ELECTRIC—Decreased prices on Receiving Tubes 6SA7GT to $1.80 list; 12SF7GT to $1.90 list; Special Purpose Tube 5654 to $4.75 list.

VIDEO INDUSTRIES—Decreased price on Model 103 Fan Antenna to $3.38 dealer net.

Price Increases

CHICAGO INDUSTRIAL INSTRUMENT—Increased prices on Simplex Volt-Ohm Milliammeters Model 312 to $9.00 dealer net; Model 371 to $7.00 dealer net.

CORNELL-DUBILIER—Increased prices on several vibrators.

GENERAL ELECTRIC—Increased prices on Industrial and Transmitting Type Tubes GL-5674 to $100.00 dealer net; GL-5740/FP-54 to $88.00 dealer net; GL-6044 to $56.00 dealer net.

MILLER MFG., M.A.—Increased prices on a number of Astatic Replacement Needles.

RCA—Increased prices on Kinescopes 16DP4A to $29.25 dealer net; 17HP4 to $28.75 dealer net; 17LP4 to $28.75 dealer net; 20MP4 to $40.50 dealer net.

SIMPSON ELECTRIC—Increased price on Model 303 Vacuum Tube Volt-Ohmmeter in roll top safety case to $76.00 dealer net.

SOUTH RIVER METAL PRODUCTS — Increased prices; Model ZM Chimney Mount with 12 foot galvanized strap to $1.45 dealer net; Model DM-LKK Duo-Mount Antenna Base to $2.25 dealer net; Model SN-50 Chimney Mount to $2.25 dealer net.

SYLVANIA—Increased price on Receiving Tube 6BK5 to $2.55 list; TV Picture Tube 7JP4 to $21.50 dealer net.

VIDEO INDUSTRIES—Increased price on Model 105 Inline "V" Antenna to $3.32 dealer net.

Correction Notice

EITEL-McCULLOUGH—has not discontinued but withdrawn the following: No. 6C21 vacuum tube; Model HV-1 vacuum pump; Pump Oil for Model HV-1; Vacuum switch coils 12V and 24V.

Some Thoughts and Questions, etc.

(*continued from page 19*)

tubes, pull tubes, make adjustments, etc. *with the set turned on.*

Therefore, all exposed sources of shock should be covered in some simple and easily removable fashion.

This includes *metal picture tubes.* Cover them with plastic.

It includes the top caps of horizontal-amplifier tubes, and fuse holders as well.

It includes all solder lugs liable to be touched accidentally while reaching around inside the cabinet.

Certainly any manufacturing design engineer can easily apply the above common-sense tests to any chassis, and solve the problem.

If the manufacturers' main concern is the prevention of radiation from the horizontal amplifier, with some using boxes and others using shielding inside the cabinets, they ought not forget us repairmen. Make the chassis safe and easy to work around without worrying about shock, but at the same time, make the shielding arrangement easily removable so that we can get inside if we have to.

We have come a long way since the introduction of the relatively safe fly-back system. All of us recognize the big advances which have been made in getting higher and higher voltages, better sweep and linearity, greater reliability. All I ask is that the repairman not be forgotten.

Basic Principles, etc.

(*continued from page 17*)

tical axis on the left side of the chart. (7000 grains is equal to one pound)

The wet and dry bulb temperatures can be measured with a psychrometer (wet and dry bulb thermometer). Knowing or assuming the following two conditions, all others may be found by use of the chart as described below.

DRY BULB TEMPERATURE—Follow vertically up from "Dry Bulb (DB) Temperature —Degrees F"

WET BULB TEMPERATURE — Follow wet bulb line—sloping downward to the right from "Wet Bulb and Dew Point Temperatures." (Refer to Fig. 10.)

The point of intersection will indicate the RELATIVE HUMIDITY (curved line).

Following horizontally to the left from the point of intersection to the "100% Relative Humidity" curve will indicate the DEW POINT TEMPERATURE. (Refer to Fig. 11).

Following horizontally to the right from the intersection to "Weight of Water Vapor in One Pound of Dry Air" will indicate MOISTURE CONTENT and VAPOR PRESSURE. (Refer to Fig. 12.)

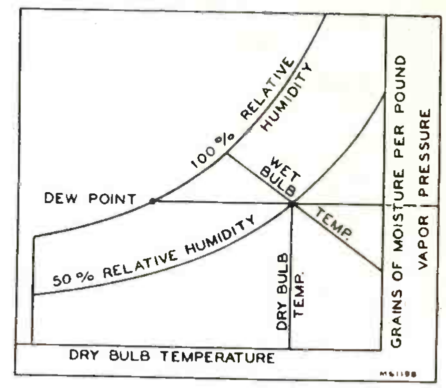


Fig. 9.—Skeleton Psychrometric Chart

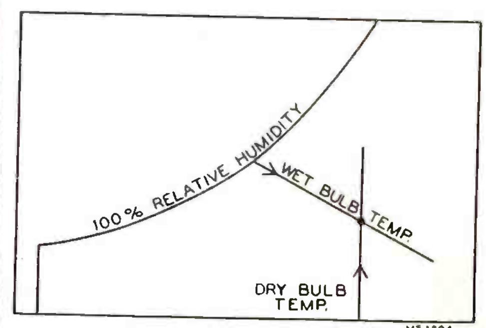


Fig. 10—Dry and Wet Bulb Temperatures

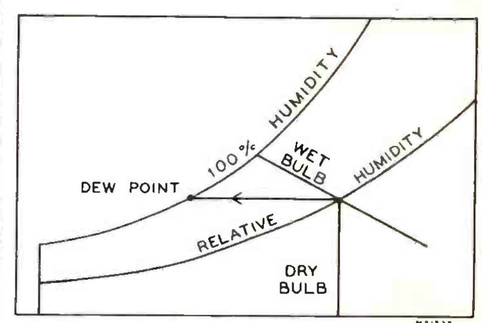


Fig. 11—Dew Point Temperature

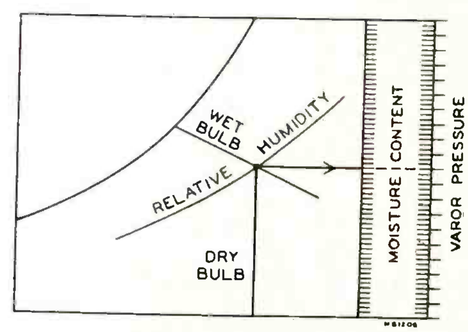


Fig. 12—Moisture Content and Vapor Pressure

TELL-A-FAULT Symptom Sheet

LOSS OF HORIZONTAL SYNC

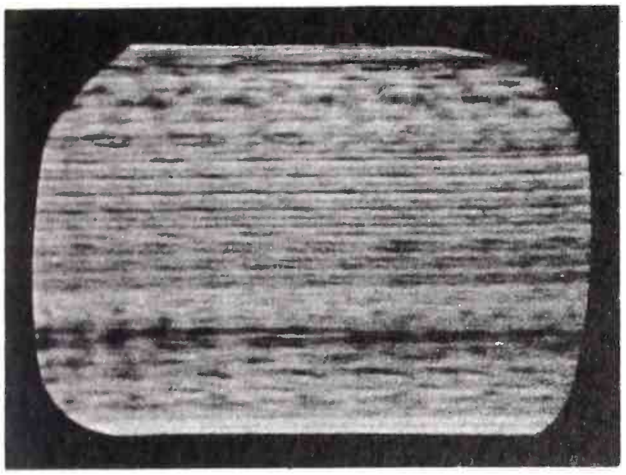


FIG. 1

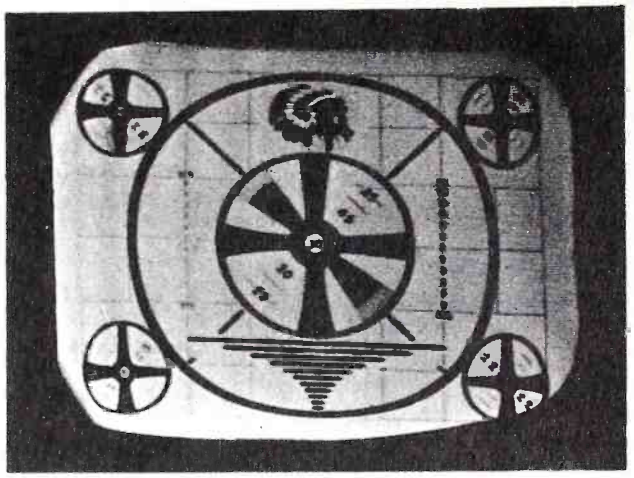
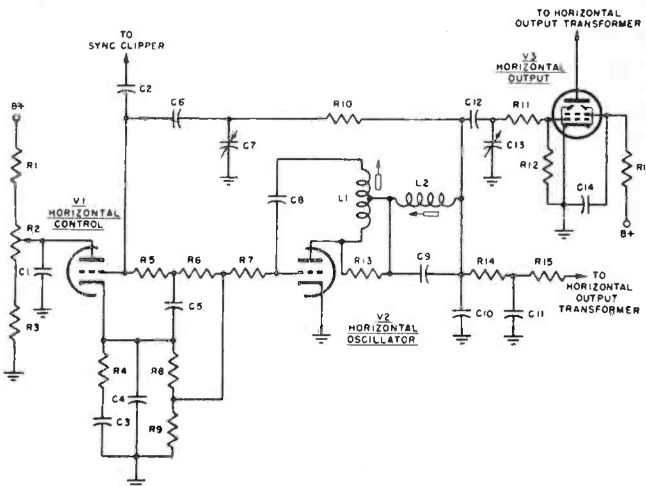


FIG. 2

(NOTE: Refer to CIRCUIT GUIDE IV-1 for identification of components.)

Fig. 1 shows an unstable picture-tube pattern indicating loss of horizontal sync. In this case, it was possible to obtain the normal pattern shown in Fig. 2 by adjusting the horizontal-hold control *(R2)* to its extreme counterclockwise position.



ABNORMAL

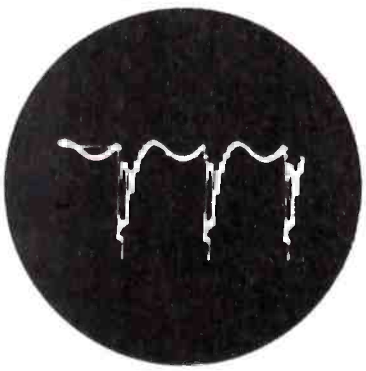


FIG. 3

NORMAL

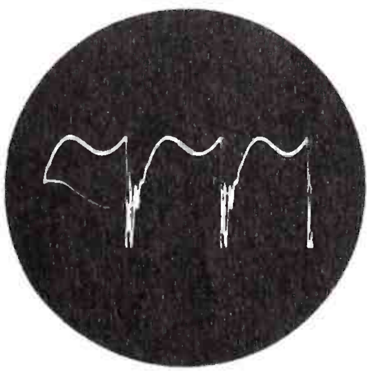


FIG. 4

ABNORMAL

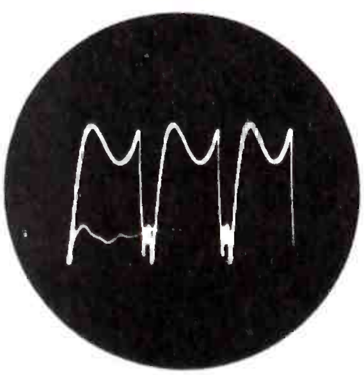


FIG. 5

NORMAL

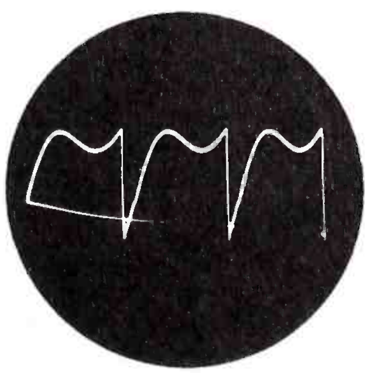


FIG. 6

The waveform at the horizontal-sync take-off point was normal. An oscilloscope was connected to the plate of the horizontal-oscillator tube *(V2)* with its internal sweep adjusted for ⅓ the horizontal scanning rate. The abnormal waveform shown in Fig 3. occurred. Compare this with the normal waveform which appears in Fig. 4. Note that the thin, horizontal pulses in the abnormal waveform have a greater relative amplitude than in the normal waveform and that the high-frequency damped oscillations continue for a somewhat longer period of time in the abnormal waveform. The peak-to-peak amplitude of the abnormal voltage was about 1.5 times that of the normal voltage at the same point, and the d-c voltage was constant.

A scope connected to the center-tap of *L1* and adjusted as above displayed the abnormal waveform shown in Fig. 5. The normal waveform is shown in Fig. 6 for comparison. Note the high-frequency oscillations that are superimposed on the waveform which seem to give the abnormal waveform a ragged appearance. The peak-to-peak voltage of the abnormal waveform was about 30% higher than the normal value, while the d-c voltage was constant at this point.

The receiver fault responsible for the above effects was an increase in the value of R13. As a result, less damping of the shock-excited oscillations in the blocking oscillator occurred.

Comments on Rider's Sectionalized TV Manuals

We have received numerous communications since the publication of the sectionalized Rider TV Manual, Volume 11. Many owners of this volume have expressed unhappiness over the sectionalization of the receiver manufacturers. Please believe us when we say that we would have preferred it otherwise. It was a sincere attempt to incorporate the maximum amount of service information in one volume.

All receiver manufacturers do not release their service manuals at the same time. Sectionalizing the volume enabled us to include manufacturers whose names begin with letters in the front of the alphabet after previously received data had already been sent to the printer. Witness the Admiral service data in section IV. This was received approximately two weeks before we went to press. Had the manual not been sectionalized it would have been impossible to incorporate it. The same applies to RCA, Raytheon, and other manufacturers included in section IV. However, our primary concern is to please our service technician customers. If it is the opinion of Rider TV Manual buyers that we should not sectionalize the manual, the forthcoming Volume 12 will be organized in the fashion that we have been using for years. Please let us know your comments. Thank you.

Combarable Skill and Comparable Knowledge

The individual who has had factory training in the servicing of a particular brand of television receiver is acknowledged to be able to demonstrate superior skill in the diagnosis and correction of faults in that receiver. Many such men are functioning in the servicing industry; some of them in receiver distributors' service activities. It is the problem of the independent service technician handling all brands of TV receivers and who has not had such specialized training, to compete with the individual brand specialist.

The independent must deliver comparable service. He must display equal familiarity with the contents of each of these particular brands of products even though he sees the receiver for the first time when it appears on his bench.

How can this be done most easily? . . . By the simplest of means . . . By working with the same information which is available to the set distributor — to the factory controlled service facility . . . This is the information in Rider TV Manuals . . . Anything less places the independent service facility at a competitive disadvantage.

The whole thing is as simple as 2 plus 2 equals 4. The TV receiver manufacturer is not keen on being in the TV servicing business. He feels he must do certain things to protect his reputation and the hundreds of millions of dollars worth of receiver sales. Given adequate independent servicing facilities (which incidentally is on the upgrade,) set distributor and other factory participation in public TV servicing will decline . . . The independent servicing facility is in a position to dominate the servicing effort if it founds its capability on accurate-complete knowledge. This it can do if it uses the same information as the receiver manufacturers — as the receiver distributors — as the factory-controlled service facilities.

Two avenues of securing this information exist . . . One is the receiver manufacturer — the other is Rider TV Manuals. The latter is the same as the former — except that it is a complete service with the data filed and indexed and easy to use. In this respect it is more economical to procure and use than if the information is obtained gratis from the different receiver manufacturers. The point we wish to make is that the welfare of the nation's independent TV servicing rests on its ability to do a competent, rapid and efficient servicing job, one which will stand up in comparison with those rendered by organizations which have affiliations with the receiver manufacturers . . . This can't be done by working with limited or abridged servicing information . . . Everything known by a set distributor about a TV receiver should be known to the independent service technician. Everything known to a factory controlled service facility —or a set dealer's service facility, should be known to an independent service facility. . . Rider TV Manuals furnish this background.

Attention Service Technicians in the Metropolitan Area

Effective April 24, 1953 John F. Rider Publisher Inc., discontinued over-the-counter sales of the Individual Diagram Service.

For an indefinite period of time, service technicians requiring servicing information on individual receiver models may *mail* their requests to 480 Canal Street New York 13, N. Y.

TEK-FILE, Rider's monthly service data on TV receivers may be purchased from any Rider distributor in the area. This is the ideal method of securing the latest in complete TV servicing information. Free TEK-FILE indexes may be obtained from Rider distributors or directly from the publisher. New indexes are published every other month. See your Rider jobber for future editions of the TEK-FILE index, or write to us.

We regret the necessity of discontinuing the over-the-counter sales division of the Rider Individual Diagram Service.

INDEX OF CHANGES

Model No.	Manual Page From	Manual Page To	Tek-File Pack
Stromberg-Carlson Model 116	6-5	6-10	
Stromberg-Carlson Model 317 Series	8-1	8- 8	
Stromberg Carlson Models TC10,TC125	4-1	4- 8	
Stromberg-Carlson TC125	4-5	4- 8	
Stromberg-Carlson	8-1	8-18	15
Pilot Models TV271U, TV273U, TV275, TV291U, TV293U and TV295	9-1	9-14	53

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17QP4	36.25	24.53	3.00	21.53
17RP4/17HP4	37.50	25.42	3.00	22.42
17VP4/17LP4	37.50	25.42	3.00	22.42
19AP4A/B	58.75	39.60	6.00	33.60
20CP4A	51.25	34.00	5.50	28.50
20DP4A	51.50	34.65	5.50	29.15
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SUCCESSFUL Servicing with Tek-File Index

JULY 1953

CROSS-BAR TV TEST PATTERN GENERATOR

by M. E. Blaisdell

(This article may not be reprinted without written permission of the author.)

Every radio and tv technician knows the value of a signal generator. Here is a generator (see Fig. 1), constructed by the writer, that provides several signals, one at a time or both together for the proper adjustment of linearity controls and for localizing common trouble in sweep circuits of television receivers. These signals produce a series of horizontal and vertical lines or bars that are equally spaced when the linearity controls are properly adjusted. Signal-injection tracing may also be accomplished from antenna to picture tube or speaker. This instrument is especially useful because of the lack of a station test pattern at many times. The use of people or objects that are televised as a reference for the adjustment of linearity controls is not satisfactory, as these objects are in motion and of irregular shapes. Servicemen may put their own test pattern on the screen with this unit, whether or not a tv station is on the air. The generator contains a master carrier oscillator which is variable and may be set to any desired low-band channel (2 to 6). The harmonics may be picked up from channels 7 to 13. A quick and accurate adjustment of television receiver controls can now be made when the cross bars are evenly spaced. The instrument also provides for the injection of horizontal and vertical sweep signals into the sweep circuits of the receivers.

Some features of the cross-bar generator, whose schematic diagram is shown in Fig. 2 are as follows:

1. Horizontal lines — 6 to 14 (variable)
2. Vertical bars — 9 to 10 (fixed-trimmer adjusted)
3. Carrier oscillator — (variable channels 2 to 6, 7 to 13 by harmonics)
4. Vertical sweep output (60-cycle output)
5. Horizontal sweep output (approximately 15,750-cycle output)

Construction Details

The cross-bar generator can be built inexpensively from junk-box parts or parts may be purchased at reasonable cost. Any metal cabinet and chassis can be used, provided sufficient shielding is utilized both above and below the chassis. A handle may be attached to the top of the cabinet for ease in carrying. The entire unit constructed by the writer and shown in Fig. 1 measures 10½" x 5½" x 5".

Shielded wires are as shown in the schematic diagram, and all other wires are kept short and are dressed close to chassis.

The heater choke coils (*RFC1, 2, 3*) are wound on 5-meg, ½-watt resistors. The carrier oscillator plate choke (*RFC4*) is wound on a ⅜" polystyrene coil form which is placed directly over the 6T8 tube socket. Care must be taken that the coil does not touch the underside of the chassis. A 2.5-millihenry, 4-pi r-f choke is used as the vertical bar oscillator coil (#1) in a Hartley circuit with 10 feet of wire removed from the high end and tapped between the first and second pi's from the ground end. The horizontal line oscillator uses an interstage plate to push-pull grid audio transformer in a variable feedback circuit. The carrier oscillator is also a Hartley circuit. The oscillator coil (#2), is space-wound on a ½-inch ceramic or polystyrene coil form with 16 turns of #20 enameled wire, tapped at the 4th turn from the ground end. This coil is placed on top of the chassis.

A 2-pole, 4-position switch (*S3*), gives the technician his choice of horizontal lines,

(*continued on Page 8*)

Fig. 1. Photograph of cross-bar TV test pattern generator.

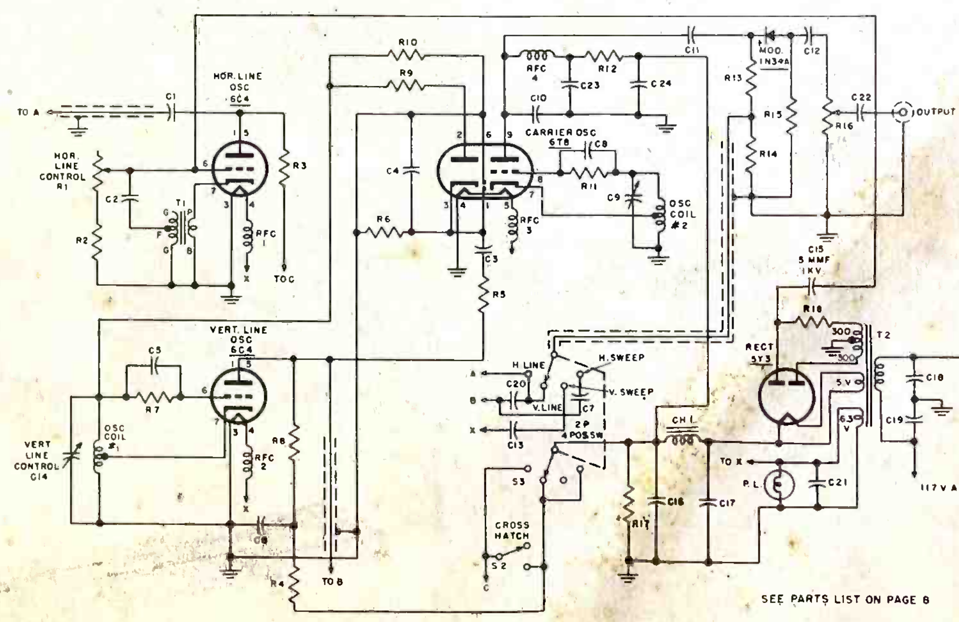

Fig. 2. Schematic diagram of cross-bar TV test pattern generator.

WE BELIEVE *Norman Foster's recent advertisement in the Chicago "TV Guide" is of interest to the entire television and radio industry. Consequently, with Mr. Foster's permission, we are reprinting it here as a public service for every television and radio service technician in America.*

Harry Kalker

(HARRY KALKER, President)

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2. The reason that a service man would attempt to sell you something you do not need is because he had something to gain personally. Many Television service operators hire men, driving their own cars, on a percentage basis. This is advantageous because the service company can be in business with practically no investment. Under these conditions if this man needs money, it's only human nature that he is going to want to do the thing to your television set that will make him the most money—whether it be 5 tubes or haul it to the shop.

3. Every man that I have, works by the hour and punches a time clock. He drives a company owned new truck bearing my name and his equipment and uniforms are furnished to him without charge. He has orders to repair your set in your home whenever possible. He receives the same amount of money whether he repairs 1 set or 10, and whether he charges $1 or $10. His rate of pay and his advancement are based on the number of sets he can repair in the home.

4. Our service call price is a flat $3 and covers all labor necessary to make any repair possible in your home except cleaning a screen, for which we charge $1 extra. It is evident that on this basis we do not make money on every job, but with the large volume of business we do, it has averaged out to a modest profit at the end of the year. You can bring your set into our shop and not only save this service charge, but also see it repaired while you wait. There is no minimum charge on this service. You pay only for the actual time spent on your set.

5. How fast can service be? I have a large fleet of trucks operating throughout Chicago from 9:30 A.M. to 11:00 P.M. I do not advertise one hour service and I do not believe that anything but a coincidence could give such fast service. Because it is impossible to predict in advance how long each job will take a man, the best we can do is to offer same day service. Occasionally at this time of the year, bad weather causing slow driving, makes it necessary to postpone calls received late, until the next day.

6. Quality of parts. I use only nationally advertised tubes and parts. Every tube I sell is new, fresh and cartoned, bearing a name and a date, and is coded by the manufacturer to indicate that it is a tube manufactured and guaranteed for replacement use. I do not use bulk or surplus tubes. Every picture tube I sell bears a serial number and has a factory registration certificate to guarantee that it is a new first quality tube. I do not sell rebuilt or rejuvenated picture tubes. I use only Sprague plastic sealed condensers, which are far superior to the parts used in many TV sets.

7. I guarantee every part I replace for 90 days. If a part or tube I have replaced fails, it is replaced at absolutely no charge to you. Our guarantee is further underwritten by the American Mutual Liability Insurance Co. by arrangement with the Raytheon Manufacturing Co.

8. I have not satisfied everybody and I do not claim to. I cannot repair a set that needs a new picture tube for $3 and I cannot give a $60 service contract with each call. Nothing less would satisfy certain people. However, if you hear a complaint against Foster Television, that same person will generally have one against the plumber, the auto mechanic, the dentist and nearly everyone else who is unfortunate enough to do business with him. I need and value your patronage and I will sincerely respect it.

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Servicing Hints For
FARM BATTERY RADIOS

by John A. Dewar

The apparent simplicity of the average 1.4-volt battery radio can be deceiving to the uninitiated. In servicing them a somewhat different approach is required and the following factors should be considered:

1. For battery economy very light drain tubes are used. These are necessarily low-gain types compared to ordinary a-c filament tubes.
2. The number of tubes is limited so that the radio must be operating at peak efficiency.
3. Battery sets are used in areas not serviced by a-c power, which usually means they are remote from broadcast stations.
4. Many are used in rough and rocky country where daytime reception falls off rapidly with distance.
5. Most important of all, battery voltage drops gradually with use. The radio must operate efficiently throughout the usual life of the battery.

This brings up a point which has not been sufficiently stressed. Battery-type tubes will test OK in a tube tester and operate satisfactorily in a receiver at full filament voltage but weak tubes will not when the A-voltage is reduced to 1.25 volts and below.

The following effects are noted with weak tubes:

1. Converter tubes (1R5, 1A7, 1LC6, etc.) stop oscillating.
2. Output tube emission drops resulting in distortion and poor tone.
3. R-f and i-f tubes lose gain; the reception is poor. Therefore, all battery radios should be checked at low A-voltage, say down to 1.1 or 1.2 volts. Otherwise the customer will be throwing away batteries which have months of useful life when he really needs new tubes. Figure 1 shows a useful setup for reducing A-voltage. The milliammeter indicates immediately if any tubes are burned out. By simple mental arithmetic a four-tube set with a 100-ma output tube filament requirement should draw 250 ma at 1.4 volts. A tube with an open filament makes no change in drain (as indicated by milliammeter) when the tube is removed. The voltmeter is useful in measuring the A-voltage applied.

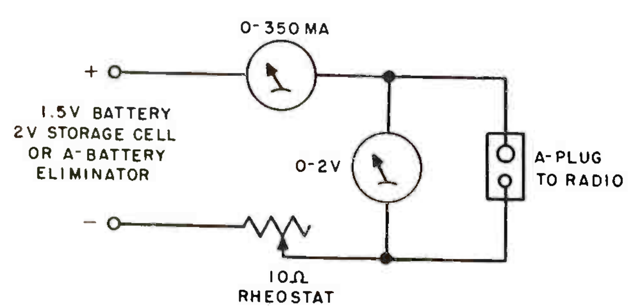

Fig. 1. Useful set-up for reduction of filament voltage to check weak 1.4-volt tubes.

Another useful device in servicing battery sets is the B-battery eliminator whose schematic diagram is shown in Fig. 2. A photograph of this unit as constructed by the writer is shown in Fig. 3. The eliminator not only shows at a glance the plate current drawn but, most important, if the B-supply is accidentally shorted to the filaments in testing, all the tubes are not blown out.

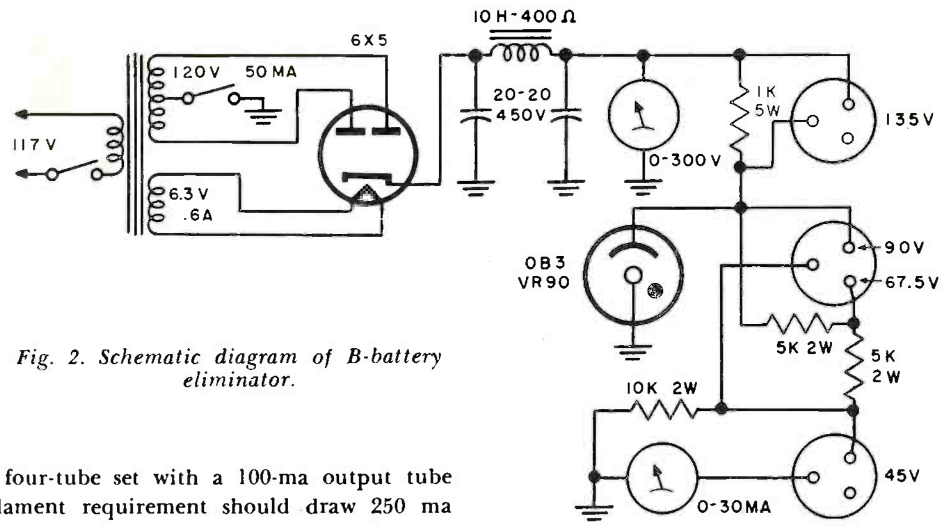

Fig. 2. Schematic diagram of B-battery eliminator.

Alignment. I have found that country people are notorious tinkers and cannot resist a twiddle at the aligning screws. If the set will not operate for any obvious reason, check the alignment with the signal generator. It may be so far out that a station will not come through.

Aside from weak tubes probably the most common fault is an electrolytic capacitor which has lost its capacitance. All sets have an electrolytic, usually about 10 μf at 150 volts, bypassing B+ to the chassis. A dried-out capacitor has two effects depending on the circuit — the i.f.'s oscillate, or degeneration takes place, leading to weak signals and distortion. It is surprising the number of sets I have found where the i.f.'s were thrown out of alignment by some screwdriver mechanic to stop the i-f oscillation.

Lightning. Since aerials in the country pick up large electrostatic charges due to lack of lightning arrestors, burned out or scorched antenna coil primaries are fairly common. Frequently scorched insulation cannot be detected visually but a loss of Q results in poor performance. A new antenna coil will have to be substituted to check.

Antennas. In low signal strength areas a good aerial and ground are essential. In many sets with loops the addition of an aerial throws the antenna stage out of alignment so that it will not track with the oscillator. This results in serious image and oscillator harmonic interference with even short-wave stations riding in on the broadcast band. Replacement with an adjustable iron-core antenna coil is advisable. Since loops are low Q devices, a good antenna coil is an improvement in any low signal strength district, increasing gain and selectivity.

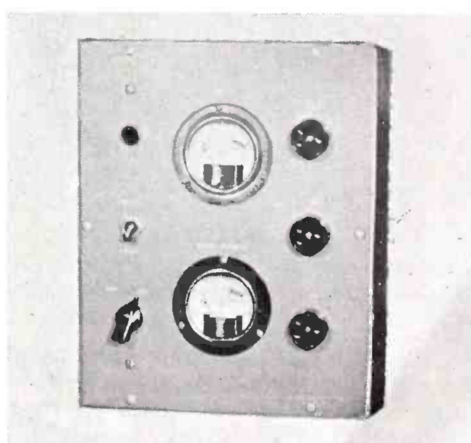

Fig. 3. Photograph of B-eliminator constructed by author.

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VOLUME 14 NUMBER 7 JULY, 1953

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Hi-Fi and the FM Stations

The rising interest in Hi-Fi offers an opportunity for the FM stations of this nation to recover their listening audience. These stations have not done too well over the years. They have had an audience, but certainly far below that which was expected when the FM station went on the air.

What with the whole electronics industry aiming its sights at Hi-Fi, the FM station is the means for gettting the kind of music that falls within this category into the homes of the Hi-Fi enthusiast. The AM station can't do it because the frequency range transmitted is too limited.

Also of interest is the opportunity being presented to local parts jobbers who are selling Hi-Fi equipment to advertise their wares on FM stations. Station rates are low and, with the pin-pointed audience covered by these stations, little of the audience coverage is wasted. Many large receiver manufacturers have declared that they will be making Hi-Fi equipments. They too could use the FM stations to good advantage.

Tailor Made

We have felt for a long time that replacement parts sold to the servicing industry through parts distributor channels should be the equivalent of the original parts put into the receiver by the receiver manufacturer. Nothing less than this equivalence is justified. There is every reason . . . moral and financial . . . why this should be so. Whatever may be the reason in back of a choice made by a receiver design engineer for the selection of a certain constant and a certain component characteristic, that same constant and characteristic should, within reasonable tolerances, be found in the part sold to the service technician as a replacement. If one component is a replacement for another, the two should be alike within reasonable bounds.

Now that almost a year has passed since we started the *Rider Replacement Parts Program*, it is with much pleasure that we note the adherence to original equipment tolerances in the replacement parts made by the manufacturers with whom we have been working. More and more replacement parts are being tailor made to fit all needs.

Progress is being made all along the line. The fact that replacement parts are subject to less fabrication in order to make them fit a space, and that their performance characteristics more closely satisfy the receiver's design needs, should prove a boon to the service technician. Having only time and knowledge for sale, he has no time to waste when completing a replacement.

We are indeed happy to note the appearance of much closer tolerances for fixed capacitors for replacement purposes than existed before the start of our program. The receiver manufacturer has been using them for a long time; now the capacitor manufacturers with whom we have been working not only are making them for replacement purposes, but some have actually set up a new parts number coding for accurate identification.

Inductor type components which satisfy the physical and electrical requirements of original receiver equipment designs are appearing in increasing numbers as replacement items. As might be expected, these apply more to those receivers which have been sold in greatest quantities to the nation's population; however, the receivers sold in moderate quantities are not being neglected.

So, all in all, we take this opportunity to say thanks to those parts manufacturers with whom we have been working, thanks for their cooperation in enabling us to fill spaces in the replacement parts columns, thereby enabling the nation's TV service technicians to get what they need to keep America's TV receivers in good repair.

Thanks also to all the receiver manufacturers of America for the cooperation they have, and are, extending to us in our effort to establish a parts replacement situation which will function to the best interests of the receiver owner and the TV service technician . . . thereby enabling the creation of harmony between the two which, in the long run, results in maximum benefits to the receiver manufacturer . . . the parts manufacturer . . . the parts distributor . . . and in general to the entire radio and television industry.

TV Antennas—Who Has An Idea?

It is indeed unfortunate that the television industry, especially the TV antenna manufacturer, parts distributor, and service technician, are unable to conceive a plan which will convince the public that TV antennas which have seen years of service require replacement before they fall apart.

A receiver owner gets a good deal for the money he spends for an antenna installation; but, no matter how well it is put together, the ravages of the weather during two or three years of exposure greatly decrease the overall efficiency of an antenna and transmission line system.

Admittedly the deterioration is progressive, and while reception may be getting worse each day, it passes unnoted, until one day a corroded connection opens or an element breaks off. Then and only then is the public receptive to replacement.

It's hard to say how many millions of TV antennas still in use should have been discarded a long time ago. A safe guess is several million, if not several times that amount. If only it were possible to conveniently demonstrate to the receiver owner the difference between the performance of a new antenna and transmission line and the erratic performance of one which has become corroded, is leaky to ground, has connections covered with soot and grime, or a transmission line with cracked insulation, or which is water logged . . . in every respect an inefficient signal pick-up and delivery system.

We cannot help but wonder if the increase in TVI in many parts of the country where TV has been in effect for a number of years is not due to the reduced effectiveness of the antenna system, and possibly to the rectifying effects of bad connections. Isn't it possible that some of the complaints which arise concerning the gradual increase in instability of a TV receiver with age, might be due to a gradual decrease in the signal pick-up effectiveness of the antenna, and to the harmful effects of a deteriorating metal structure? We wonder.

John F. Rider

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Refrigeration
And Service Procedure For

Prepared by the
of the RCA

This is the second of three articles. The text and illustrations are reprinted through the courtesy of the RCA Service Co. from their booklet entitled "Introduction to Room Air Conditioning."

Definition of Refrigeration

Refrigeration is the process of extracting heat from a body or substance. This may be done by keeping the temperature of its surroundings below that of the body or substance itself. Heat transfer will take place thru radiation, conduction and/or convection. Another method is by lowering the temperature of the body or substance itself. This may be done by evaporative cooling (change of state).

The melting of ice was one of the first means of accomplishing refrigeration. One pound of ice at 32°F melting to one pound of water at 32°F would absorb 144 BTU (latent heat). One ton of ice (2000 pounds) at 32°F would require 288,000 BTU of heat to melt it to water at 32°F. This was designated as one ton of refrigeration when accomplished in a 24 hour period. Therefore a ton of refrigeration is the removal of 288,000 BTU in 24 hours, or 12,000 BTU per hour.

Mechanical Refrigeration

The principle upon which mechanical refrigeration is based is that a liquid may be vaporized by heating or by reducing the pressure above it. The liquid absorbs heat in the process of evaporation and dissipates heat when compressed and cooled into a liquid.

Mechanical refrigeration comprises: (a) the refrigerating fluid, (b) the heat absorber, an evaporator, (c) a refrigerant compressor, (d) the heat disposer, a condenser, and (e) a restrictor, a capillary tube or expansion valve. Oil which mixes with the refrigerating fluid provides lubrication for the motor and compressor.

In mechanical refrigeration the refrigerating fluid is evaporated in the evaporator, the vapor is compressed by the compressor, condensed to a liquid in the condenser and restricted in its return to the evaporator by a capillary tube or expansion valve. Heat is absorbed at the evaporator and dissipated at the condenser.

It is a common practice to use a liquid (known as a refrigerant) with as low a boiling point and as high a latent heat of vaporization as practicable. Several other design factors enter into the choice of liquid to be used.

The most common liquid used in present design home refrigerators and room air conditioners is Freon-12. It has a boiling point of — 22° Fahrenheit at atmospheric pressure and a latent heat of vaporization of 72 BTU per pound. Freon-22, used in some larger room air conditioners, has a boiling point of —41°F and a latent heat of 100 BTU per pound:

If the refrigerant has a boiling point below room temperature and is in a container at or below atmospheric pressure it will boil or evaporate. When it boils it will absorb heat in an amount dependent upon the latent heat of vaporization of the refrigerant and the temperature difference between original and final conditions of the refrigerant.

A simple example of cooling can be illustrated by an open container of refrigerant or other liquid whose boiling point is below room temperature which is allowed to boil or evaporate freely into the air.

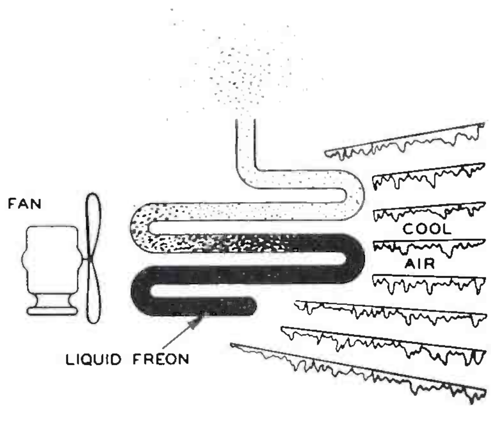


Fig. 1—Evaporation cooling without recovery

(See Fig. 1.) This simple device is good as long as there is liquid to evaporate; however, means must be provided to collect the refrigerant vapor and liquefy it, so that it may be evaporated or boiled again and thus produce a refrigeration cycle. (See Fig. 2.)

The refrigerant is caused to flow by a compressor driven by an electric motor. When the pressure is increased by the compressor, the volume of the vapor is decreased accordingly. The amount of heat (BTU) is thus contained in a smaller volume and the temperature of the vapor is increased accordingly.

The hot compressed vapor is conducted to the condenser where it is cooled by a stream of either air or water. This gives rise to the type designation "air cooled" or "water cooled."

When the vapor is cooled it will condense into a liquid. Much heat is given off in the process of condensation.

Some means must be used to restrict the flow of the condensed refrigerant from the condenser to the evaporator. This must be done for two reasons; first, that a high pressure be maintained in the condenser to help condensation of the vapor into a liquid, and secondly, to allow the suction of the compressor to maintain a low pressure in the evaporator. This restrictor may be either an expansion valve or a length of small diameter tubing called a capillary tube.

In the early stages of development compressors were belt driven, but as design and manufacturing techniques improved, it was found practical to enclose both motor and compressor into a single unit. This led to the accessible type hermetic unit and to the completely sealed hermetic unit which are illustrated in Figs. 3 and 4.

The accessible hermetic unit provides means to remove compressor and motor parts in the field. This system generally utilizes an expansion valve and liquid receiver together with service valves on the high pressure and low pressure sides of the com-

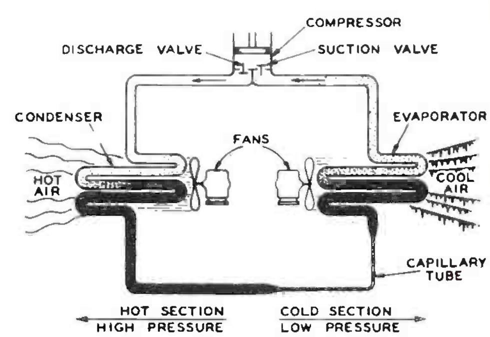


Fig. 2—Evaporation cooling with recovery

pressor. The trend is toward the hermetic unit which is completely sealed by welding at the factory and is not accessible for servicing in the field. Due to rigid factory controlled conditions of assembly and cleanliness, it is possible to use the small capillary tube system which does away with the expansion valve and service valves. This system reduces the number of joints and sources of leaks to a minimum. It provides for an extremely dependable trouble-free system.

Recommended Service Procedure

Most room air conditioners employ a hermetically sealed compressor and refrigerant system which is not designed to be repaired in the field. The only field service

Fundamentals
Air Conditioning Units

Commercial Service Section
Service Co., Inc.

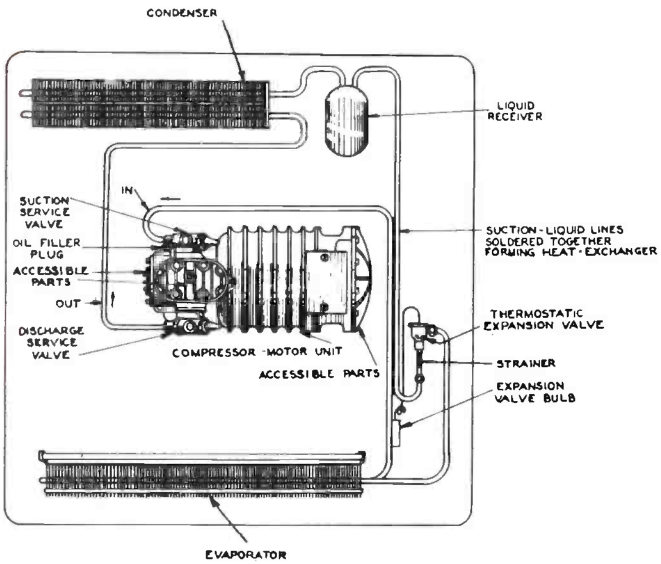


Fig. 3—Accessible hermetic refrigerant system

required is to correct troubles in the air flow and electrical systems that prevent or impair the operation of the unit.

If thorough performance tests prove the existence of a defect in the refrigerant system, repair or replacement is generally handled through the manufacturer.

NOTE: If a room air conditioner is allowed to stand for an extended length of time without being run, it is possible for the Freon to become absorbed in the refrigerant oil. If this should happen there will be no cooling until the necessary working pressures have been established. The process of getting Freon out of the oil may take several hours of continuous running. Therefore, before rejecting a unit on the complaint that it will not cool, this running-in time should be allowed for. *Check this condition especially in the spring of the year.*

To check accurately the particular model room air conditioner being serviced always refer to the service notes which have been prepared specifically for that model.

Servicing the Air Flow System

It is of the utmost importance to have clean components in the air flow system and the proper quantities of air flowing through it. Restrictions from any cause will reduce the amount of refrigeration the unit is capable of producing.

Check the following points in the order given:

Dirty filter, causing loss of air flow, ventilation and cooling effect.

Dirty evaporator coil, same effect as above.

Frost or ice on evaporator due to above air stoppages.

Dirty condenser coil, causing reduction in refrigerating efficiency and resulting in high wattage (power consumption).

Fans not delivering correct air quantities, due to slow speed or dust incrustation.

The filter is usually of the expendable type and should be replaced when dirty. The encrusted metal parts should be cleaned with a bristle brush dipped in cleaning fluid. The condenser and evaporator coils should be cleaned with a brush, vacuum cleaner attachment or small air pump.

Servicing the Electrical System

The greatest source of trouble with the electrical system is not in the air conditioner itself, but in the electrical power that is supplied to it. Low line voltage is the cause of most electrical troubles.

Motors have the characteristic that the current will be high if the line voltage is low. To meet the load imposed upon it, the motor must draw more current if the voltage is low.

This increased current causes greatly increased heating of the motor windings. *This heat increase is directly proportional to the square of the increase in current.*

THE VOLTAGE AT THE AIR CONDITIONER MUST BE CHECKED UNDER LOAD AND SHOULD BE WITHIN ±10% OF THE VOLTAGE RATING OF THE UNIT.

In the event of trouble in the electrical system the voltage should be checked first. Other possible causes of trouble are as follows:

1. Short Circuits Between Turns of Motor Windings.
2. Motor Windings Grounded To Frame.
3. Open Circuits Or Short Circuits In Wiring.
4. Fan Motor Bearings Not Oiled As Required.

NOTE: Many air conditioners are provided with an overload protector which will reset automatically. If the unit has been running under extreme load conditions, the compressor may fail to re-start immediately when the switch control is turned to COOL after having been turned to any other position. If such condition occurs, turn the switch control to OFF, and wait at least two minutes before turning the unit to COOL again. This permits the refrigerant to equalize in the system and will allow the unit to start with less effort.

(continued next month)

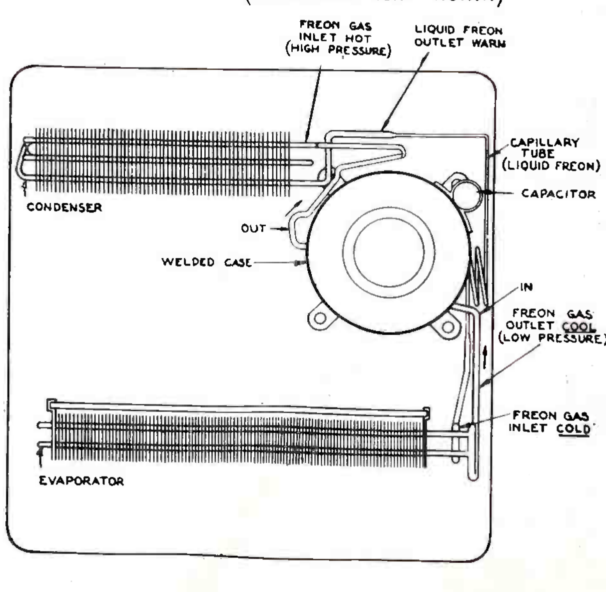


Fig. 4—Welded hermetic refrigerant system

Cross-Bar Generator

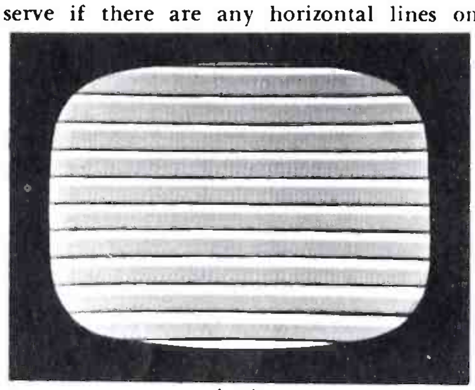
(*continued from page 1*)

vertical bars, horizontal sweep signal, or vertical sweep signal. The sweep signals are used when tapping into the receiver circuit for injection tests.

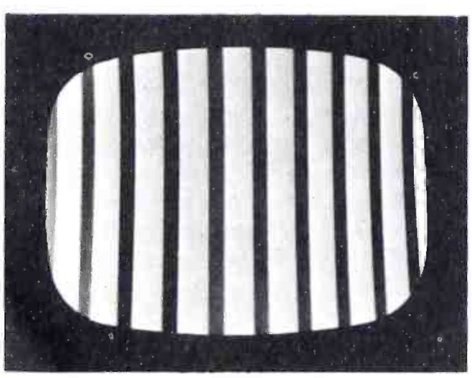
Switch *S2* connects plate voltage to *both* vertical and horizontal line oscillators, hence a cross-bar pattern is obtained consisting of both horizontal and vertical bars.

Adjustment of Oscillator Circuits

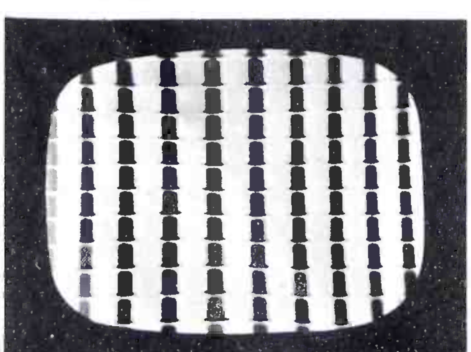
To adjust the horizontal line oscillator connect the output cable of approximately four feet of 300-ohm twin-lead to the antenna terminals of tv set, rotate the horizontal line control and listen for an audio tone. If no tone is heard at any setting of *R1*, the circuit may not be oscillating due to the interstage transformer being connected incorrectly. Try reversing either the primary or secondary winding leads. Next, observe if there are any horizontal lines on



(A)



(B)



(C)

Fig. 3. Patterns produced by cross-bar generator on a tv receiver of good vertical and horizontal linearity.

PARTS LIST

R1	25k-ohm pot. - CRL B-26, C1 taper
R2, R7, R11	22k ohms
R3	10k ohms, 2 watt
R4, R8	5k ohms, 1 watt
R5	220k ohms
R6	68k ohms
R9, R10	100k ohms
R12	50k ohms
R13, R15	10k ohms
R14, R18	470 ohms
R16	500- ohm pot. - CRL B-4, C1 taper
R17	20k ohms, 20 watt

All resistors, - 1/2 watt unless otherwise specified
k = thousand ohms

C1, C22	.002 , 600 v
C2	.03 , 400 v
C3	270μμf, 500 v
C4, C6, C7, C18, C19, C23, C24	.0015 , 500 v
C5, C8	47μμf , 500 v
C9	100μμf midget variable (air) Hammarlund (HF-100)
C10, C13, C20	100μμf, 500 v
C11, C21	.005 , 600 v
C12	.01 , 600 v
C14	20 to 275μμf trimmer
C15	5μμf , 1 kv
C16, C17	8 x 16, 450 v

All capacitors in μf unless otherwise specified

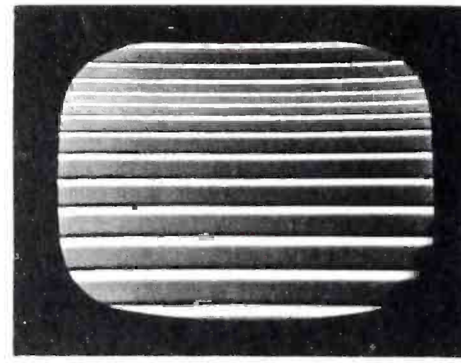
RFC1, 2	40 turns #26 enam. wire, jumble wound on 5-meg. 1/2-w resistor
RFC3	24 turns #30 enam. wire, jumble wound on 5-meg. 1/2-w resistor
RFC4	60 turns #26 enam. wire, close-wound on 3/8" form.
Choke 1	20 h, 75 ma
Osc. coil #1	2.5 mh, 4 pi choke (see text)
Osc. coil #2	16 turns #20 enam. wire, space wound (see text)
S1, S2	Toggle or any type spst
S3	2-pole, 4-position wafer type switch
T1	Interstage audio transf., plate to push-pull grids (2 to 1 ratio)
T2	Power transf. - 300-0-300 v, 5 v @ 2 amp, 6.3 v @ 2 amp.

the picture tube screen. If not, tune the carrier oscillator tuning capacitor *C9* until several dark lines appear.

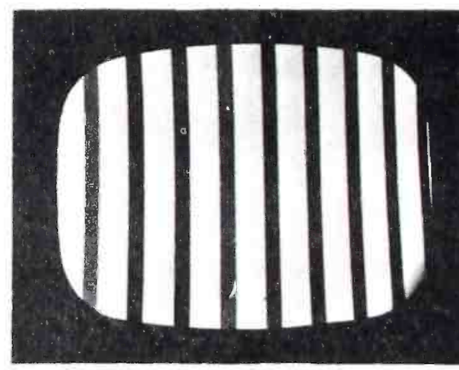
To adjust the vertical bar oscillator, tune carrier and adjust attenuator *R16* for best definition. If no vertical bars appear, adjust and balance *C14* for several bars.

Patterns Obtained. When this unit was connected to the antenna terminals of a television receiver which had good vertical and horizontal linearity, the bar patterns of Fig. 3 appeared. The pattern shown in part (A) of the figure was produced when the generator was adjusted to produce horizontal lines; that shown in part (B) was produced when the generator was adjusted to produce vertical bars; and the pattern shown at part (C) is a cross-bar pattern which results when both horizontal lines and vertical bars are used simultaneously.

When the generator was connected to a tv receiver which had poor vertical and horizontal linearity, the bar patterns of Fig. 4 appeared under the same conditions of generator adjustment as for the previous figure. Note the poor vertical linearity shown in Fig. 4(A) as evidenced by the crowding together of the horizontal lines at the top of the screen and the spreading of the lines at the bottom of the screen. Figure 4(B) shows poor horizontal linearity as evidenced by the spreading of the vertical lines at the left and the squeezing of the lines at the right. When both vertical bars and horizontal lines are used together, the pattern of Fig. 4(C) results.



(A)



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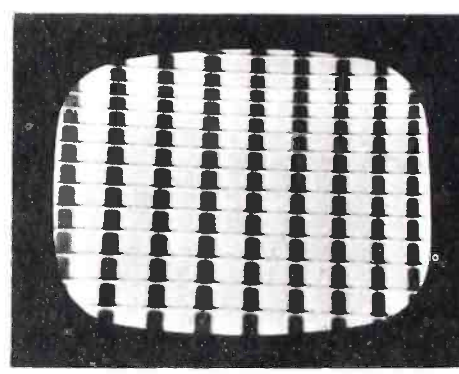

(C)

Fig. 4. Patterns produced by cross-bar generator on a tv receiver of poor linearity.

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4. *Index* indicates Substitution Group for each type.
5. *Substitution Groups* narrow choice to logical substitutions.
6. *Basing and Outline Drawings* give basing and dimensional data.

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- All necessary data given for all electromagnetically deflected types, regardless of make.
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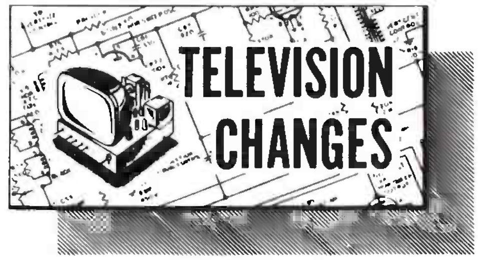

The Rider Manual pages and TEK-FILE pack which include the original data and shematics to which the following production changes apply, appear in the index on page 32 of this issue.

Page 25 of the May, 1953 issue of SUCCESSFUL SERVICING listed a Television Change for Pilot Model TV116. No such model exists. This change, and the Index of Changes, should have referred to Pilot Model TV166. It is corrected as follows:

PILOT **MODEL TV166**

The basic chassis used in the above model is the same as that used in Model TV161. For complete service information on this chassis see TV Manual, Volume 5, pages 1-12.

●

STROMBERG-CARLSON **MODEL TC19**

Service data correction.

The adjacent-channel video trap, L14 (in the plate circuit of the 2nd i-f amplifier 6BH6) should be aligned to 20.4 megacycles instead of the 21.6 megacycles originally indicated.

●

STROMBERG-CARLSON **MODEL 16 series**

Schematic diagram addition.

The peaking coil, in series with the plate-load resistors to the V8 6AC7 video amplifier, should be labeled L15 (400 microhenry, part No. 114691). This symbol is missing on the original schematic diagram.

●

TELE KING **CHASSIS TVJ**

Tube Change.

Beginning with serial number 343,559, the two 12AU7 tubes (in the V8 and V10 positions) appear in the parallel filament string in place of the 6CB6 (V3) and 6AU6 (V16) tubes. The 6CB6 and 6AU6 then replace the two 12AU7 tubes in the series filament string.

In essence then, V8—V10 and V3—V16 will replace each other in the respective series and parallel filament strings.

●

TELE KING **CHASSIS TVJ**

Fuse change.

In later production the FE-2, 3/8 amp fuse in the high-voltage circuit, has been replaced with a FE-5, 1/2 amp fuse. The fuse has also been removed from the underside of the chassis and placed in the high-voltage cage for easier accessibility.

Rider · Tek-File Index No. 10

PACKS 1-89

HOW TO USE THIS INDEX

BECAUSE OF CHANGES THAT HAVE BEEN MADE, THE NO. 10 TEK-FILE INDEX SUPERCEDES ALL OTHERS. DON'T USE THE EARLIER INDEXES.

To locate service data instantly, all you need to know is the manufacturer's name and the model or chassis number of the set.

The index is compiled alphabetically, according to manufacturer. Note the column headings at the top of each page: MODEL, PACK, PAGES.

Model numbers run in numerical sequence, starting with the smallest number under a manufacturer's name. This applies also to model numbers using letters (i.e. model AR precedes model CG). Model numbers starting with letters precede model numbers starting with numbers.

Under the column PACK, the number is the TEK-FILE Pack number.

Under the column headed PAGES, the first number indicates the Rider TV Manual in which the data originally appeared and second numbers indicate the page where the information starts.

As an example, let's look up ADMIRAL model 36X36AS. It shows that the information is in Pack No. 1, ADMIRAL. The data (8=23) starts on page 8-23.

If you remove the pages from the TEK-FILE Files and insert them in the TEK-FILE binder, refer to the PAGES only

ADMIRAL CORP

MODEL	PACK	PAGES
4H15A, 4H15B, Ch. 20A1	40-A	4=1
4H16A, 4H16B, Ch. 20A1	40-A	4=1
4H17A, 4H17B, Ch. 20A1	40-A	4=1
4H18C, 4H18CN, Ch. 20B1	40-A	4=1
4H19C, 4H19CN, Ch. 20B1	40-A	4=1
4H126A, 4H126B, Ch. 21A1	40-A	4=1
4H126C, 4H126CN, Ch. 21A1	40-A	4=1
4H137A, 4H137B, Ch. 21A1	40-A	4=1
4H145A, 4H145B, Ch. 20B1	40-A	4=1
4H145C, 4H145CN, Ch. 20B1	40-A	4=1
4H146A, 4H146B, Ch. 20B1	40-A	4=1
4H146C, Ch. 20B1	40-A	4=1
4H147A, 4H147B, Ch. 20B1	40-A	4=1
4H157A, 4H157B, Ch. 20B1	40-A	4=1
4H165A, 4H165B, Ch. 20B1	40-A	4=1
4H166A, 4H166B, Ch. 20B1	40-A	4=1
4H166C, 4H166CN, Ch. 20B1	40-A	4=1
4H167A, 4H167B, Ch. 20B1	40-A	4=1
4H167C, 4H167CN, Ch. 20B1	40-A	4=1
12X11, 12X12, Ch. 20Z1	40-B	4=38 5=8
14R12, 14R16, Ch. 20T1, Rev.	1	8=1
16M12, Ch. 21X1	57	10=29
16R11, 16R12, Ch. 21B1	1	8=23
20A1, 20B1, Ch.	40-A	4=1
20T1, 20V1, Ch., Rev.	1	8=1
20X1, Ch.	40-B	4=38
20X11, 20X12, Ch. 20X1	40-B	4=38
20X122, Ch. 20X1	40-B	4=38
20X136, Ch. 20Y1	40-B	4=38
20X145, 20X146, 20X147, Ch. 20Y1	40-B	4=38
20Y1, Ch.	40-B	4=38
20Z1, Ch.	40-B	4=38 5=8
21A1, Ch.	40-A	4=1
21B1, 21C1, 21D1, 21E1, Ch.	1	8=23
21H1, 21J1, Ch.	1	8=23
22X12, Ch. 20Z1	40-B	4=38 5=8
22X25, 22X26, 22X27, Ch. 20Z1	40-B	4=38 5=8
24A12, Ch. 20A1	40-A	4=1
24A125, Ch. 20A1	40-A	4=1
24A125AN, Ch. 20X1	40-B	4=38
24C15, 24C16, Ch. 20B1	40-A	4=1
24D1, 24E1, 24F1, 24G1, 24H1, Ch.	48	7=1
24R12, Ch. 20T1, Rev.	1	8=1
24X15, 24X15S, Ch. 20X1	40-B	4=38
24X16, 24X16S, Ch. 20X1	40-B	4=38
24X17S, Ch. 20X1	40-B	4=38
25A15, 25A16, 25A17, Ch. 21A1	40-A	4=1
26R12, Ch. 21B1	1	8=23
26R25, 26R26, Ch. 24H1	48-B	7=1
26R25A, 26R26A, Ch. 21B1	1	8=23
26R35, 26R36, 26R37, Ch. 24H1	48-B	7=1

ADMIRAL CORP. (Cont'd)

MODEL	PACK	PAGES
26R35A, 26R36A, 26R37A, Ch. 21B1	1	8=23
26X35, 26X36, 26X37, Ch. 24D1	48-B	7=1
26X45, 26X46, Ch. 24H1	48-B	7=1
26X55, 26X56, 26X57, Ch. 24D1	48-B	7=1
26X55A, 26X56A, 26X57A, Ch. 21D1	1	8=23
26X65, 26X66, 26X67, Ch. 24D1	48-B	7=1
26X65A, 26X66A, 26X67A, Ch. 21D1	1	8=23
26X75, 26X76, Ch. 24D1	48-B	7=1
26X75A, 26X76A, Ch. 21D1	1	8=23
27M12, Ch. 21X2	57	10=29
29X16, 29X17, Ch. 24F1	48-B	7=1
29X25, 29X26, 29X27, Ch. 24F1	48-B	7=1
29X25A, 29X26A, Ch. 21H1	1	8=23
30F15, 20F15A, Ch. 20B1	40-A	4=1
30F16, 30F16A, Ch. 20B1	40-A	4=1
30F17, 30F17A, Ch. 20B1	40-A	4=1
32X15, 32X16, Ch. 20Z1	40-B	4=38 5=8
32X26, 32X27, Ch. 20Z1	40-B	4=38 5=8
32X35, 32X36, Ch. 20Z1	40-B	4=38 5=8
34R15, 34R15A, 34R16, 34R16A, Ch. 20V1, Rev.	1	8=1
36R37, 36R45, 36R46, Ch. 21C1	1	8=23
36X35, 36X35A, Ch. 24E1	48-B	7=1
36X36, 36X36A, Ch. 24E1	48-B	7=1
36X36AS, 36X36S, Ch. 21E1	1	8=23
36X37, 36X37A, Ch. 24E1	48-B	7=1
37M25, 37M26, 37M27, Ch. 21Z1	57	10=29
39X16, 39X16A, 39X16B, Ch. 24G1	48-B	7=1
39X17A, 39X17B, Ch. 24G1	48-B	7=1
39X17C, Ch. 21J1	1	8=23
39X25, 39X26, Ch. 24G1	48-B	7=1
39X25A, 39X26A, Ch. 21J1	1	8=23
39X35, 39X36, Ch. 21J1	1	8=23
47M15, Ch. 21W1	57	10=14
47M15A, Ch. 21Z1	57	10=29
47M16, 47M17, Ch. 21W1	57	10=14
47M35, 47M36, 47M37, Ch. 21Z1	57	10=29
57M10, 57M11, 57M12, Ch. 21Z1A	57	10=29
57M16, 57M17, Ch. 21Z1	57	10=29
121K15, 121K16, 121K17, Ch. 21M1	57	10=14
121K15A, 121K16A, 121K17A, Ch. 22M1	57	10=1
121M10, Ch. 22M1	57	10=1
121M11, 121M12, Ch. 21M1	57	10=14
121M11A, 121M12A, Ch. 22M1	57	10=1
221K45, 221K46, 221K47, Ch. 21M1	57	10=14
221K45A, 221K46A, 221K47A, Ch. 22M1	57	10=1
320R17, Ch. 21J1	1	8=23
320R25, 320R26, Ch. 21J1	1	8=23
321F65, 321F66, 321F67, Ch. 21N1	57	10=14
321K65, 321K66, 321K67, Ch. 21N1	57	10=14
321M25, 321M26, 321M27, Ch. 21Y1	57	10=14
321M25A, 321M26A, 321M27A, Ch. 22Y1	57	10=1
421M15, 421M16, Ch. 21Y1	57	10=14
421M35, 421M36, 421M37, Ch. 22Y1	57	10=1
520M11, 520M12, Ch. 22A2A	57	10=1
520M15, 520M16, 520M17, Ch. 22A2	57	10=1
521M15, 521M16, 521M17, Ch. 21Y1	57	10=14
521M15A, 521M16A, 521M17A, Ch. 22Y1	57	10=1

AFFILIATED RETAILERS, INC. (ARTONE)

MODEL	PACK	PAGES
AR-MST-14, AR-MST-16	48	6=1
AR-14-LG, AR-14-P	1	8=1
AR-14-TR	48	6=1
AR-16-ATR	48	6=1
AR-16-CD, AR-16-CD-3CR	40-B	5=1
AR-16-CR	48	6=1
AR-16-CX	40-B	5=1
AR-16-RO, AR-16-TR	48	6=1
AR-17-3D	48	6=1
AR-17-3DG	1	8=1
AR-17-CD	48	6=1
AR-17-CDG	1	8=1
AR-17-CR	48	6=1
AR-17-CRG	1	8=1
AR-17-LG, AR-17-P	1	8=1
AR-17-RO	48	6=1
AR-17-ROG	1	8=1
AR-20-3DG, AR-20-CDG, AR-20-CRG, AR-20-TRG	1	8=1
AR-112X	48	6=10
AR-114A	48	6=1
AR-163-CR	40-B	5=1
AR-216	40-B	5=1
AR-316, AR-316-3CM	40-B	5=1
AR-816	40-B	5=1
AR-816-3CM, AR-816-3CR	40-B	5=1
AR-819, AR-819-3CM	40-B	5=1 7=1
AR-919	40-B	5=1 7=1

AIMCEE WHOLESALE CORP. (AMC)

MODEL	PACK	PAGES
117C, 117CD, 117T	57	10=1

AIR KING PRODUCTS CO., INC.

MODEL	PACK	PAGES
12C1, Ch. 700	43-A	7=1
12T1, 12T2, Ch. 700	43-A	7=1
14T1, Ch. 700-30	43-A	7=1
16C1, Ch. 700-1, 700-10, 700-90	43-A	7=1
16C2, 16C3, Ch. 700-10	43-A	7=1
16C5, Ch. 700-10, 700-90	43-A	7=1
16K1, Ch. 700-2, 700-50, 700-92	43-A	7=1
16M1, Ch. 700-10, 700-90	43-A	7=1
16T1, Ch. 700-1, 700-10	43-A	7=1
16T1B, Ch. 700-1, 700-10, 700-90	43-A	7=1
19C1, Ch. 700-40, 700-91	43-A	7=1
20C1, 20C2, Ch. 700-93	43-A	7=1
20K1, Ch. 700-95	43-A	7=1
20M1, Ch. 700-90, 700-93	43-A	7=1

AIR KING PRODUCTS CO., INC. (Cont'd)

MODEL	PACK	PAGES
700, 700-1, 700-2, 700-5, Ch.	43-A	7=1
700-10, 700-20, 700-30, 700-40, 700-50, Ch.	43-A	7=1
700-90, 700-91, 700-92, 700-93, 700-95, Ch.	43-A	7=1

AIRLINE

See MONTGOMERY WARD

AIR MARSHAL CORP.

MODEL	PACK	PAGES
B-17-T	43-A	7=1

ALLIANCE MFG. CO.

MODEL	PACK	PAGES
AB, Booster	43-B	7=1

ALLIED PURCHASING CORP. (AMBASSADOR)

MODEL	PACK	PAGES
AM17C, AM17C1M, See STARRETT Ch. 12S1	75	10=1
AM17T, AM17T1M, See STARRETT Ch. 12S1	75	10=1
AM20C, AM20T, See STARRETT Ch. 12S1	75	10=1
C1720, C2020, C2420, CD2020, See TRAD T-20E Series	54	9=1
PL17C, PL17CB, PL17CG, See STARRETT Ch. 12S1	75	10=1
PL17TG, PL17TM, PL27CD, See STARRETT Ch. 12S1	75	10=1
T1720, T2020, See TRAD T-20E Series	54	9=1
20C23P, See STARRETT Ch. 12S1	75	10=1

ANCHOR RADIO CORP.

MODEL	PACK	PAGES
ARC-101-75, ARC-101-100	37-A	7=1

ANDREA RADIO CORP.

MODEL	PACK	PAGES
Brewster	43-B	9=1
Caronia, Fleetwood	43-A	6=1
Gotham	43-B	9=1
Mayfield	43-A	6=1
Saybrook	43-A	6=1
Stratford	58	10=1
Sutton	43-A	6=1
Warwick	43-B	9=1
C-VL16, Ch. VL16, Sutton	43-A	6=1
C-VL17, Ch. VL17, Brewster	43-B	9=1
CO-VL16, Ch. VL16, Fleetwood	43-A	6=1
CO-VL19, Ch. VL19, Caronia	43-A	6=1
T-VL12, Ch. VL12, Saybrook	43-A	6=1
T-VL16, Ch. VL16, Mayfield	43-A	6=1
T-VL17, Ch. VL17, Gotham	43-B	9=1
VL12, VL16, Ch.	43-A	6=1
VL17, Ch.	43-B	9=1
VL19, Ch.	43-A	6=1
VL-20, Ch.	58	10=1
2C-VL17, Ch. VL17, Warwick	43-B	9=1
2C-VL20, Ch. VL-20, Stratford	58	10=1

ARTONE

See AFFILIATED RETAILERS, INC.
Also See MACY'S

ARVIN INDUSTRIES, INC.

MODEL	PACK	PAGES
TE272-1, TE272-2, Ch.	43-B	6=1
TE276, Ch.	43-B	6=1
TE282, Ch.	43-B	6=13
TE 286, Ch.	1	8=4
TE289, Ch.	43-B	6=10
TE-289-2, Ch.	1	8=1
TE289-3, Ch.	43-B	7=1
TE290, Ch.	43-B	7=5

ARVIN INDUSTRIES, INC. (Cont'd)

MODEL	PACK	PAGES
TE300, Ch.	43-B	9-1
TE-302, Ch.	1	8-6
TE-302-1, Ch.	1	8-6 8-9
TE315, TE315-1, TE315-2, Ch.	43-B	9-1
TE 331, Ch.	58	10-1
TE-337, Ch.	84	11-1
TE-337-2, Ch.	84	11-1
TE-337-3, Ch.	84	11-1
TE-341, Ch.	84	11-1
TE-341-2, Ch.	84	11-1
TE-341-3, Ch.	84	11-1
2120, 2121, Ch. TE289-3	43-B	7-1
2120CM, 2121TM, Ch. TE-289-2	1	8-1
2122TM, Ch. TE289	43-B	6-10
2123, Ch. TE289-3	43-B	7-1
2123TM, Ch. TE-289-2	1	8-1
2124, Ch. TE289-3	43-B	7-1
2124CCM, Ch. TE-289-2	1	8-1
2126, Ch. TE289-3	43-B	7-1
2126CM, Ch. TE-289-2	1	8-1
2160, 2161, 2162, 2164, Ch. TE290	43-B	7-5
3100TB, 3100TM, Ch. TE272-1	43-B	6-1
3101CM, Ch. TE272-1	43-B	6-1
3120CB, 3120CM, Ch. TE272-2	43-B	6-1
3121TM, Ch. TE272-2	43-B	6-1
3160CM, Ch. TE276	43-B	6-1
4080T, Ch. TE282	43-B	6-13
4162, Ch. TE 286	1	8-4
5170, Ch. TE-302	1	8-6
5170, Ch. TE-302-1	1	8-6 8-9
5171, Ch. TE-302	1	8-6
5171, Ch. TE-302-1	1	8-6 8-9
5172, Ch. TE-302	1	8-6
5172, 5173, Ch. TE-302-1	1	8-6 8-9
5204, 5206, Ch. TE300	43-B	9-1
5210, 5211, 5212, Ch. TE315, TE315-1, TE315-2	43-B	9-1
6175TM, 6179TM, Ch. TE 331	58	10-1
7210, 7212, 7214, Ch. TE-337, TE-337-2, TE-337-3, TE-341, TE-341-2, TE-341-3	84	11-1
7216, 7218, 7219, Ch. TE-337, TE-337-2, TE-337-3, TE-341, TE-341-2, TE-341-3	84	11-1

ASTORIA
See MACY'S

AUTOMATIC RADIO MFG. CO., INC.

MODEL	PACK	PAGES
TV-5217, TV-5217T	58	10-1

BELMONT
See RAYTHEON TELEV. & RADIO CORP.

BENDIX RADIO DIV.

MODEL	PACK	PAGES
Belair, Guilford	48-B	7-1
C172, Belair	48-B	7-1
OAK3	58	10-1
C182	48-B	7-1
C200, Guilford	48-B	7-1
T170	27	5-1
T171	48-B	7-1
21K3, 21KD	58	10-1
21T3, 21X3	58	10-1
2051	27	5-1
2060, 2070	27	5-1
3051	27	5-1
6001, 6003	27	5-1
6100	27	5-1
7001	27	5-1

BENRAY ELECTRONICS CORP.
(SURREY)

MODEL	PACK	PAGES
17T31, 20T31, 24T31, See VIDEO PRODUCTS 630 Series	69	10-1
621-20, 621-16, See TRAD T-20E Series	54	9-1

CADILLAC ELECTRONICS CORP.

MODEL	PACK	PAGES
F-16	2	8-1

CBS-COLUMBIA INC.
Also See AIR KING PRODUCTS CO., INC.

MODEL	PACK	PAGES
17C5B-C, 17C8-C, Ch. 700-100, 700-104	84	11-1
17C9-C, 17C10-C, Ch. 700-100, 700-104	84	11-1
17C18, 17M18, 17T18, Ch. 817	59	10-1
17K1-C, Ch. 700-110, 700-114	84	11-1
17M1-C, 17M2-C, 17M3-C, Ch. 700-100, 700-104	84	11-1
17T2-C, Ch. 700-100, 700-104	84	11-1
20C1-C, 20C2-C, Ch. 700-120	84	11-1
20C3-C, Ch. 700-145	84	11-1
20C4-C, 20C4B-C, Ch. 700-140, 700-144	84	11-1
20K1-C, Ch. 700-130, 700-134	84	11-1
20M1-C, 20M3-C, Ch. 700-140, 700-144	84	11-1
20M18, 20M28, 20T18, Ch. 820	59	10-1
20T2-C, Ch. 700-140, 700-144	84	11-1
21C11, 21C11B, Ch. 1021	84	11-22
21C21, 21C31B, 21C41, Ch. 1021	84	11-22
21T11, Ch. 1021	84	11-22
700-100, 700-104, Ch.	84	11-1
700-110, 700-114, Ch.	84	11-1
700-120, Ch.	84	11-1
700-130, 700-134, Ch.	84	11-1
700-136, Ch.	84	11-1
700-137, Ch.	84	11-1
700-140, 700-144, Ch.	84	11-1
700-145, Ch.	84	11-1
700-150, Ch.	84	11-1
817, 820, Ch.	59	10-1
1021, Ch.	84	11-22

CAPEHART-FARNSWORTH CORP.

MODEL	PACK	PAGES
Atlantan	78	11-1
Bostonian	78	11-1
Charlestown	78	11-1
Chicagoan	78	11-1
Monmouth	78	11-1
Monticello	78	11-1
Redwood	78	11-1
Saratoga	78	11-1
Ticonderoga	78	11-1
Trenton	78	11-1
William Penn	78	11-1
C-278, C-279, Ch.	27	7-1
C-281, Ch.	27	5-1
CT-27, Ch. CX-33DX	27	9-1
CT-37, CT-38, CT-39, Ch. CX-33DX	27	9-1
CT-45, Ch. CX-33DX	27	9-1
CT52, Ch. Prelim.	59	10-1
CT52, Ch., Late	78	11-1
CT57, Ch., Prelim.	59	10-1
CT57, Ch., Late	78	11-1
CT58, Ch., Late	78	11-1
CTR68, Ch., Prelim.	59	11-1
CTR68, Ch., Late	78	11-1
CX-32, Ch.	27	7-1
CX-33, Ch.	27	5-1
CX-33DX, Ch.	27	9-1
CX-36, Ch., Prelim.	59	10-1
CX-36, Ch., Late	78	11-1
1T172B, Ch. CT52, CX-36, Trenton, Late	78	11-1

CAPEHART-FARNSWORTH CORP. (Cont'd)

MODEL	PACK	PAGES
1T172M, Ch. CT52, CX-36, Prelim.	59	10-1
1T172M, Ch. CT52, CX-36, Trenton, Late	78	11-1
2C172M, Ch. CT52, CX-36, Prelim.	59	10-1
2C172M, Ch. CT52, CX-36, Monmouth, Late	78	11-1
3C212B, Ch. CT57, CX-36, Prelim.	59	10-1
3C212B, Ch. CT57, CX-36, Monticello, Late	78	11-1
3C212M, Ch. CT57, CX-36, Prelim.	59	10-1
3C212M, Ch. CT57, CX-36, Monticello, Late	78	11-1
4H212B, Ch. CT57, CX-36, Prelim.	59	10-1
4H212B, Ch. CT57, CX-36, Charlestown, Late	78	11-1
4H212M, Ch. CT57, CX-36, Prelim.	59	10-1
4H212M, Ch. CT57, CX-36, Charlestown, Late	78	11-1
5F212M, Ch. CT57, CX-36, Prelim.	59	10-1
5F212M, Ch. CT57, CX-36, Bostonian, Late	78	11-1
6F212B, Ch. CT57, CX-36, Prelim.	59	10-1
6F212M, Ch. CT57, CX-36, Chicagoan, Late	78	11-1
7F212M, Ch. CT57, CX-36, Prelim.	59	10-1
7F212M, Ch. CT57, CX-36, Redwood, Late	78	11-1
8F212B, Ch. CT57, CX-36, Prelim.	59	10-1
8F212B, Ch. CT57, CX-36, Atlantan, Late	78	11-1
9F212M, Ch. CT57, CX-36, Prelim.	59	10-1
9F212M, Ch. CT57, CX-36, William Penn, Late	78	11-1
10W212M, Ch. CTR68, CX-36, Prelim.	59	10-1
10W212M, Ch. CTR68, CX-36, Ticonderoga, Late	78	11-1
11W212M, Ch. CT58, CX-36, Saratoga, Late	78	11-1
3005-M, Ch. C-279, CX-32	27	7-1
3008-M, Ch. C-278, CX-32	27	7-1
3011-B, 3011-M, Ch. C-281, CX-33	27	5-1
3012-B, 3012-M, Ch. C-281, CX-33	27	5-1

CONRAC, INC.

MODEL	PACK	PAGES
27-M-40, 27-W-40, Ch. 40, 44	2	8-1
28-B-40, 29-P-40, Ch. 40, 44	2	8-1
30-M-40, 30-W-40, Ch. 40, 44	2	8-1
31-P-40, Ch. 40, 44	2	8-1
40, 44, Ch.	2	8-1

CORONADO
See GAMBLE-SKOGMO, INC

COVIDEO, INC.

MODEL	PACK	PAGES
T-1400	2	8-1

CROSLEY DIV.
AVCO MFG. CORP.

MODEL	PACK	PAGES
Ultratuner	78	11-9
DU-UHFP, Ch. 358, Ultratuner	78	11-9
DU-17CDB, Ch. 356-1	2	8-13
DU-17CDB, Ch. 356-3, 356-4	59	10-1

CROSLEY DIV. (Cont'd)

MODEL	PACK	PAGES
DU-17CDM, Ch. 356-1	2	8-13
DU-17CDM, Ch. 356-3, 356-4	59	10-1
DU-17CHB, Ch. 356-3, 356-4	59	10-1
DU-17CHM, Ch. 356-1	2	8-13
DU-17CHM, Ch. 356-3, 356-4	59	10-1
DU-17CHN, Ch. 356-1	2	8-13
DU-17CHN, DU-17CHN1, Ch. 356-3, 356-4	59	10-1
DU-17COB, Ch. 356-1	2	8-13
DU-17COB, DU-17COL, DU-17COLa, Ch. 356-3, 356-4	59	10-1
DU-17COM, Ch. 356-1	2	8-13
DU-17COM, Ch. 356-3, 356-4	59	10-1
DU-17PDB, DU-17PDM, Ch. 359	17	9-5
DU-17PHB, DU-17PHM, DU-17PHN, DU-17PHN1, Ch. 359	17	9-11
DU-17TOB, Ch. 356-1	2	8-13
DU-17TOB, Ch. 356-3, 356-4	59	10-1
DU-17TOL, Ch. 356-1	2	8-13
DU-17TOL, DU-17TOL1, DU-17TOL2, Ch. 356-3, 356-4	59	10-1
DU-17TOM, Ch. 356-1	2	8-13
DU-17TOM, Ch. 356-3, 356-4	59	10-1
DU-20CDM, DU-20CHB, DU-20CHM, DU-20COB, DU-20COM, Ch. 357	17	9-1
DU-20PDM, Ch. 363	17	9-17
DU-21CDM1, DU-21CDN, DU-21CHM1, Ch. 357-1	59	10-5
DU-21COB1, DU-21COL, DU-21COLB, DU-21COM1, Ch. 357-1	59	10-5
EU-17COL, EU-17COLB, Ch. 385	59	10-9
EU-17COM, Ch. 380	59	10-17
EU-17TOB, Ch. 380	59	10-17
EU-17TOLa, EU-17TOLB, Ch. 385	59	10-9
EU-17TOM, Ch. 380	59	10-17
EU-21CDB, Ch. 381	59	10-17
EU-21CDBU, UHF 391, VHF Ch. 390	78	11-1
EU-21CDM, Ch. 381	59	10-17
EU-21CDMU, UHF Ch. 391, VHF Ch. 390	78	11-1
EU-21CDN, Ch. 381	59	10-17
EU-21CDNU, UHF Ch. 391, VHF Ch. 390	78	11-1
EU-21COBa, Ch. 381	59	10-17
EU-21COBUa, UHF Ch. 391, VHF Ch. 390	78	11-1
EU-21COLd, Ch. 386	59	10-9
EU-21COLe, Ch. 387	59	10-9
EU-21COLBd, Ch. 386	59	10-9
EU-21COLBe, Ch. 387	59	10-9
EU-21COMa, Ch. 381	59	10-17
EU-21COMU-a, UHF Ch. 391, VHF Ch. 390	78	11-1
EU-21PDBU, EU-21PDMU, UHF Ch. 391, VHF Ch. 392	84	11-15
EU-21TOL, EU-21TOLB, Ch. 386	59	10-9
S11-442M1U, Ch. 331-4	2	8-18
S11-444MU, Ch. 331-4	2	8-18
S11-447MU, Ch. 321-4	2	8-24
S11-453MU, Ch. 331-4	2	8-18
S11-459MU, Ch. 321-4	2	8-24
S11-472BU, Ch. 331-4	2	8-18
S11-474BU, Ch. 331-4	2	8-18
S17-CDC1, S17-CDC3, S17-CDC4, Ch. 331-4	2	8-18
S17COC1, S17COC2, S17COC3, Ch. 331-4	2	8-18
S20-CDC1, S20-CDC2, S20-CDC3, Ch. 323-6	2	8-30
9-422M-LD	17	5-1
9-423M-LD	17	5-14

CROSLEY DIV. (Cont'd)

MODEL	PACK	PAGES
10-401	17	5-25
10-404MU, 10-404M1U	18	6-1
10-412MU	18	6-1
10-414MU	17	5-37
10-416MU, 10-416M1U	17	5-37
10-418MU	18	6-1
10-419MU	17	5-42
10-421MU	18	6-5
10-428MU	18	6-10
10-429MU	17	5-37
11-441MU, Ch. 320	18	6-15
11-442M1U, Ch. 331	18	6-27
11-443MU, Ch. 323	18	6-35
11-444MU, Ch. 331	18	6-27
11-453, Ch. 331	18	6-27
11-454MU, Ch. 323	18	6-35
11-458MU, Ch. 323	18	6-35
11-460MU, Ch. 331	18	6-27
11-461WU, Ch. 320	18	6-15
11-470BU, Ch. 331	18	6-27
11-471BU, Ch. 320	18	6-15
11-472B1U, Ch. 331	18	6-27
11-473BU, Ch. 323	18	6-35
11-474BU, Ch. 331	18	6-27
11-476BU, Ch. 325, 325-1, 325-2	18	6-21
11-483BU, Ch. 331	18	6-27
11-484MU, Ch. 323	18	6-35
17CDC1, 17CDC2, 17CDC3, 17CDC4, Ch. 331, 331-1, 331-2	2	8-1
17COC1, 17COC2, 17COC3, Ch. 331, 331-1, 331-2	2	8-1
20CDC1, 20CDC2, 20CDC3, Ch. 323-3, 323-4	2	8-7
320, Ch.	18	6-15
321-4, Ch.	2	8-24
323, Ch.	18	6-35
323-3, 323-4, Ch.	2	8-7
323-6, Ch.	2	8-30
325, 325-1, 325-2, Ch.	18	6-21
331, Ch.	18	6-27
331, 331-1, 331-2, Ch.	2	8-1
331-4, Ch.	2	8-18
356-1, Ch.	2	8-13
356-3, 356-4, Ch.	59	10-1
357, Ch.	17	9-1
357-1, Ch.	59	10-5
358, Ch.	78	11-9
359, Ch., DU-17PDB	17	9-5
359, Ch., DU-17PHB	17	9-11
363, Ch.	17	9-17
380, 381, Ch.	59	10-17
386, 387, Ch.	59	10-9
390, VHF Ch.	78	11-1
391, UHF Ch.	78	11-1
391, UHF Ch.	84	11-15
392, VHF Ch.	84	11-15

DE WALD RADIO MFG. CORP.

MODEL	PACK	PAGES
FT-200	59	10-1

ALLEN B. DUMONT LABORATORIES, INC.

MODEL	PACK	PAGES
Andover	18	7-1
Ardmore	33-B	6-1
Banbury	60	10-1
Beverly	60	10-35
Bradford	39-B	4-5
Brookville	33-B	6-1
Burlingame	33-B	6-1
Canterbury	39-B	1-31

ALLEN B. DUMONT LABORATORIES, INC. (Cont'd)

MODEL	PACK	PAGES
Carlton	18	7-1
Chatham	39-A	1-31
Clinton	60	10-35
Club 20	39-B	2-1
Colony	39-B	2-1
Devon	60	10-1
Dynasty	60	10-1
Fairfield	39-B	1-31
Flanders	60	10-1
Guilford	33-B	5-1
Hanover	33-A	5-1
Hastings	39-B	1-31
Manchu	39-B	2-1
Mansfield	39-B	4-5
Milford	60	10-35
Mt. Vernon	33-B	6-1
Newbury	60	10-1
Park Lane	18	7-1
Putnam	33-B	5-26
Revere	33-B	6-1
Ridgewood	60	10-35
Royal Sovereigh	33-A	5-1, 8-1
Rumson	39-B	1-31
Savoy	39-A	1-31
Sheffield	39-B	1-31
Shelburne	60	10-35
Sherbrooke	33-A	5-1
Sherbrooke, Late	78	11-1
Somerset	60	10-1
Stratford	39-A	1-31
Stratford	39-B	2-1
Strathmore, Sumter	18	7-1
Sussex	39-B	4-5
Tarrytown	33-B	6-1
Wakefield	60	10-35
Wellington	39-B	1-31
Westbury	39-B	2-1
Westerly	33-B	6-1
The Westminster	39-A	9-1
Westwood	39-B	1-31
Whitehall	39-B	2-1
Whitehall II	60	10-1
Whitehall Series II, Late	78	11-1
Wickford	60	10-1
Wimbledon	60	10-1
Winslow	33-A	5-1
Winthrop	39-A	1-31
RA-103, RA-103-A2, Chatham, Savoy, Stratford	39-A	1-31
RA-103C, Winthrop	39-A	1-31
RA-103-D, Canterbury, Rumson, Sheffield	39-B	1-31
RA-104-A, Hastings, Wellington	39-B	1-31
RA-105, Colony, Stratford, Westbury, Whitehall	39-B	2-1
RA-105-B, Sussex	39-B	4-5
RA-106, Club 20, Manchu	39-B	2-1
RA-108-A, Bradford, Mansfield	39-B	4-5
RA-109-A1, Winslow	33-A	5-1
RA-109-A2, Hanover	33-A	5-1
RA-109-A3, Sherbrooke	33-A	5-1
RA-109-A5, Winslow	33-A	5-1
RA-109-A6, Hanover	33-A	5-1
RA-109-A7, Sherbrooke	33-A	5-1
RA-110-A, Fairfield, Westwood	39-B	1-31
RA-111-A1, Putnam	33-B	5-26
RA-111-A2, Guilford	33-B	5-26
RA-111-A4, Putnam	33-B	5-26
RA-111-A5, Guilford	33-B	5-26
RA-112-A1, Ardmore	33-B	6-1
RA-112-A2, Westerly	33-B	6-1

ALLEN B. DUMONT LABORATORIES, INC. (Cont'd)

MODEL	PACK	PAGES
RA-112-A3, Mt. Vernon	33-B	6-1
RA-112-A4, Ardmore	33-B	6-1
RA-112-A5, Westerly	33-B	6-1
RA-112-A6, Mt. Vernon	33-B	6-1
RA-113-B1, RA-113-B2, Brookville	33-B	6-1
RA-113-B3, RA-113-B4, Revere	33-B	6-1
RA-113-B5, RA-113-B6, Brulingame	33-B	6-1
RA-113-B7, RA-113-B8, Tarrytown	33-B	6-1
RA-116A, The Westminster, Series II	39-A	9-1
RA-117-A1, Sumter	18	7-1
RA-117-A3, Carlton	18	7-1
RA-117-A5, Strathmore	18	7-1
RA-117-A6, Andover	18	7-1
RA-117-A7, Park Lane	18	7-1
RA-119A, Royal Sovereign	33-A	5-1, 8-1
RA-130A, Sherbrooke, Whitehall Series II, Late	78	11-1
RA-160-A1, Devon	60	10-1
RA-162-B1, Wickford	60	10-1
RA-162-B4, Banbury	60	10-1
RA-162-B5, Flanders	60	10-1
RA-162-B6, Wimbledon	60	10-1
RA-162-B7, Whitehall II	60	10-1
RA-162-B10, Flanders	60	10-1
RA-162-B11, Newbury	60	10-1
RA-162-B12, Somerset	60	10-1
RA-162-B13, Banbury	60	10-1
RA-162-B14, Dynasty	60	10-1
RA-162-B21 -- RA-162-B26, Banbury	60	10-1
RA-164-A1, Clinton	60	10-35
RA-165-B1, Milford	60	10-35
RA-165-B2, Beverly	60	10-35
RA-165-B3, Wakefield	60	10-35
RA-165-B4, Ridgewood	60	10-35
RA-165-B5, Shelburne	60	10-35

ELECTRONIC APPLIANCES INC.

MODEL	PACK	PAGES
101, 102, 103, 104, 105, 107, 110, 111, Series, Lincoln, See VIDEO PRODUCTS 630-K3C	69	10-1

ELECTRO-TECHNICAL INDUSTRIES (TELEKIT)

MODEL	PACK	PAGES
19C	3	8-1

EMERSON RADIO & PHONO. CORP.

MODEL	PACK	PAGES
609, Ch. 120084-B	3	8-1
614D, Ch. 120095-B	26-A	6-1
637A, Ch. 120095-B	26-A	6-1
649A, Ch. 120094A	26-A	6-5
650B, Ch. 120118B	26-A	6-11
654B, Ch. 120118B	26-A	6-11
661B, Ch. 120134-B, 120134-G	26-A	7-1
662B, 663B, Ch. 120127-B, 120128-B	26-A	7-11
665B, Ch. 120131-B	26-B	7-20
666B, Ch. 120135-B	26-B	7-28
667B, 668B, Ch. 120134-B, 120134-G	26-A	7-1
669B, Ch. 120129-B	26-B	7-36
674B, Ch. 210134-G	26-A	7-1
675B, Ch. 120129-B	26-B	7-36
676B, Ch. 120140-B, 120140-G, 120140-H	26-B	7-45
676D, Ch. 120144-B, 120144-G, 120144-H	3	8-16

EMERSON RADIO & PHONO. CORP. (Cont'd)

MODEL	PACK	PAGES
676F, Ch. 120143-B, 120143-H, similar to 681F, 686F, 687F, 696F	3	8-31
677B, 678B, Ch. 120134-B	26-A	7-1
680B, Ch. 120144-B, 120144-G, 120144-H	3	8-16
680D, 681B, Ch. 120140-B, 120140-G, 120140-H	26-B	7-45
681D, Ch. 120144-B, 120144-G, 120144-H	3	8-16
681F, Ch. 120143-B, 120143-H	3	8-31
683B, Ch. 120141-B	3	8-40
684B, 685B, Ch. 120134-B	26-A	7-1
686B, Ch. 120144-B, 120144-G, 120144-H	3	8-16
686D, Ch. 120140-B, 120140-G, 120140-H	26-B	7-45
686F, Ch. 120143-B, 120143-H	3	8-31
686L, Ch. 120142-B	3	8-46
687B, Ch. 120144-B, 120144-G, 120144-H	3	8-16
687D, Ch. 120140-B, similar to 680D, 686D	26-B	7-45
687F, Ch. 120143-B, 120143-H	3	8-31
687L, Ch. 120142-B	3	8-46
688B, 689B, 690B, Ch. 120129-B	26-B	7-36
692B, 693B, 694B, Ch. 120129-D, similar to 688B, 689B, 690B, Ch. 120129-B	26-B	7-36
696F, Ch. 120143-B, 120143-H	3	8-31
696L, Ch. 120142-B	3	8-46
697B, Ch. 120129-D, similar to 688B, 689B, 690B, Ch. 120129-B	26-B	7-36
699B, Ch. 120148-B	39-B	9-9
699D, Ch. 120160-B	60	10-1
700B, Ch. 120153-B	39-B	9-1
700D, Ch. 120158-B	50-B	9-17
700L, Ch. 120153-D	61	10-18
701B, Ch. 120153-B	39-B	9-1
701D, Ch. 120158-B	50-B	9-17
709A, Ch. 120162-A	61	10-9
711B, 712B, Ch. 120164-B	61	10-28
714B, Ch. 120153-B	61	10-18
714D, 715D, Ch. 120153-D	61	10-18
716D, Ch. 120163-D	79	11-1
717D, Ch. 120163-D	79	11-1
719D, Ch. 120163-D	79	11-1
720B, Ch. 120164-B	61	10-28
721D, Ch. 120166-D	79	11-13
722D, Ch. 120163-D	79	11-1
728D, Ch. 120166-D	79	11-13
736B, Ch. 120171-B	79	11-13
120084-B, Ch.	3	8-1
120094A, Ch.	26-A	6-5
120095-B, Ch.	26-A	6-1
120118B, Ch.	26-A	6-11
120127-B, 120128-B, Ch.	26-A	7-11
120129B, 120129D, Ch.	26-B	7-36
120131-B, Ch.	26-B	7-20
120134-B, 120134-G, Ch.	26-A	7-1
120135-B, Ch.	26-B	7-28
120140-B, 120140-G, 120140-H, Ch.	26-B	7-45
120141-B, Ch.	3	8-40
120142-B, Ch.	3	8-46
120143-B, 120143-H, Ch.	3	8-31
120144-B, 120144-G, 120144-H, Ch.	3	8-16
120148-B, Ch.	39-B	9-9
120153-B, Ch.	39-B	9-1
120153-B, Ch., Late	61	10-18
120153-D, Ch.	61	10-18
120158-B, Ch.	50-B	9-17
120160-B, Ch.	60	10-1

EMERSON RADIO & PHONO CORP (Cont'd)

MODEL	PACK	PAGES
120162-A, Ch.	61	10-9
120163-D, Ch.	79	11-1
120164-B, Ch.	61	10-28
120166-D, Ch.	79	11-13
120171-B, Ch.	79	11-13
470651, Tuner	3	8-56
470662, Tuner	3	8-63

FADA RADIO & ELECTRIC CO., INC.

MODEL	PACK	PAGES
R7C15, R7C25	4	8-1
Tuner 42.51 for all 'R' Series	4	9-1
R-1025, R-1050	32	5-1
S6C55, S6C70, S6T65	32	7-1
S7C20, S7C30	32	7-1
S7C20, S7C30, Rev.	32	9-11
S7C70, S7T65	32	7-1
S-1015, S-1020, S-1030	32	5-8
S-1055	32	5-10 7-1
S-1055X	32	7-1
S-1060, S-1065	32	5-10 7-1
S20C10, S20T20	32	9-11
7C42, 7C52, 7T32	61	10-1
20C22, 20T12, 24T10	85	11-1
721, 775T	61	10-1
42.55, 42.64, Tuners used with 'S' Series	32	9-3

THE FIRESTONE TIRE & RUBBER CO.

MODEL	PACK	PAGES
13-G-44, 13-G-45	4	8-10
13-G-51, 13-G-52	4	8-25
13-G-53, 13-G-54, Ch. 700-90, 700-96	4	8-40
13-G-55, Ch. 700-93	4	8-40
13-G-56	4	8-52
13-G-57	4	8-1
13-G-58, 13-G-59, 13-G-79, Ch. 700-96	4	8-60
13-G-107, 13-G-108, Code 105-2-700140	85	11-15
13-G-109, 13-G-109A, Codes 105-2-700100, 105-2-700104	85	11-15
13-G-110, Code 334-2-MS31C/A	61	10-1
13-G-110, Code 334-2-MS29A	79	11-1
13-G-114, 13-G-114A, Ch. 817, Code 105-2-81700	79	11-11
13-G-115, 13-G-116, Code 334-2-MS31C/A	61	10-1
13-G-117, Ch. 817, Code 105-2-81700	79	11-11
13-G-119, 13-G-120, Code 334-2-MS31C/A	61	10-1
13-G-122, Code 105-2-700140	85	11-15
105-2-700100, Code	85	11-15
105-2-700104, Code	85	11-15
105-2-700140, Code	85	11-15
105-2-81700, Code	79	11-11
334-2-MS31C/A, Code	61	10-1
334-2-MS29A, Code	79	11-1
700-90, 700-93, Ch.	4	8-40
700-96, Ch., 13-G-53, 13-G-54	4	8-40
700-96, Ch., 13-G-58, -59, -79	4	8-60
817, Ch.	79	11-11

FRANKLIN AIRLOOP CORP.

MODEL	PACK	PAGES
500-A-10, Tuner	4	8-1

FREED-EISEMANN

See FREED RADIO CORP.

FREED RADIO CORP. (FREED-EISEMANN)

MODEL	PACK	PAGES
54, 55, 56, 68, Ch. 1620C	32	5-1
101, 102, 103, 104, Ch. 1900	32	5-8

FREED RADIO CORP (Cont'd)

MODEL	PACK	PAGES
110, 111, 112, Ch. 700-120	50-B	9-1
121	50-B	9-9
700-120, Ch.	50-B	9-9
1620C, Ch.	32	5-1
1900, Ch.	32	5-8

GAMBLE-SKOGMO, INC. (CORONADO)

MODEL	PACK	PAGES
05RA4-43-8935A	31	6-1
05TV1-43-9014A, Ch. 16AY210	31	6-7
05TV2-43-8950A	31	6-17
05TV2-43-9010A	31	6-17
05TV6-43-8935A	31	6-1
15RA2-43-9105A, Ch. 16AY210	31	6-7
15TV1-43-8957A	5	8-1
15TV1-43-8958A	31	9-1
15TV1-43-9008A	5	8-9
15TV1-43-9015A, 15TV1-43-9016A	5	8-1
15TV1-43-9020A, 15TV1-43-9021A	31	9-1
15TV2-43-9101A, 15TV2-43-9102A	5	8-19
15TV2-43-9025A	5	8-28
15TV2-43-9025B	5	8-28
15TV2-43-9026A	5	8-28
15TV2-43-9026B	5	8-28
15TV4-7003U, Ch.	5	8-39
15TV4-43-8948A, 15TV4-43-8949A, Ch. 15TV4-7003U	5	8-39
16AY210, Ch.	31	6-7
25TV2-43-9022A	62	10-1
94TV2-43-8972A, 94TV2-43-8973A	32	5-1
94TV2-43-8987A	32	5-1
94TV2-43-8993A, 94TV2-43-8994A, 94TV2-43-8995A	32	5-1
94TV6-43-8953A	32	5-9

GAROD RADIO CORP.

MODEL	PACK	PAGES
12C4, 12C5; 94 Series	19	5-1
12T2, 12T3, 12T6; 94 Series	19	5-1
14C4, 94 Series	19	5-1
14CT4, 97, 98 Series	19	5-1
14T2, 14T6; 94 Series	19	5-1
16C4, 16C5, 16C6; 94 Series	19	5-1
16CT4, 16CT5; 97, 98 Series	19	5-1
16T2, 16T3; 94 Series	19	5-1
19C6, 19C7; 97, 98 Series	19	5-1
1042, 1042G Late	19	5-1
1042GU, 1042T Late	19	5-1
1043, 1043G Late	19	5-1
1043GU, 1043T Late	19	5-1
1142 Late, 1143 Late	19	5-1
1244, 1244G Late, 1244GU	19	5-1
1244T Late, 1244TX	19	5-1
1245, 1245G Late, 1245GU	19	5-1
1245T Late, 1245TX	19	5-1
1344 Late, 1345 Late	19	5-1
1348	19	5-1
1546, 1546G Late, 1546GU	19	5-1
1546T Late	19	5-1
1547, 1547G Late, 1547GU	19	5-1
1547T Late	19	5-1
1548, 1548G Late, 1548GU	19	5-1
1548T Late	19	5-1
1549, 1549G Late, 1549GU	19	5-1
1549T Late	19	5-1
1646, 1647, 1648, 1649; Late	19	5-1
1671, 97, 98 Series	19	5-15
1672, 1673, 1674, 1675; 97, 98 Series	19	5-18
1900, 97, 98 Series	19	5-1
1974, 1975; 97, 98 Series	19	5-18
2042T Late, 2043T Late	19	5-1
2546T, 2547T, 2548T, 2549T; Late	19	5-1

GENERAL ELECTRIC CO.

MODEL	PACK	PAGES
10C101, 10C102	19	5-1
10T1. 10T4, 10T5, 10T6	19	5-1
12C101. 12C102, 12C105	19	5-25
12C107, 12C108, 12C109, B Version	19	5-35
12K1	19	5-12
12T1	19	5-25
12T3, 12T4	19	5-25
12T3, 12T4, B Version	19	5-35
12T7	31	6-1
14C102, 14C103	31	6-12
14T2, 14T3	31	6-12
16C110, 16C111	31	6-35
16C113	19	7-1
16C115	31	6-35
16C116	19	7-1
16K1, 16K2	31	6-22
16T1, 16T2	31	6-35
16T3, 16T4	19	7-1
17C101, 17C102	19	7-1
17C103, 17C104, 17C105	5	8-21
17C107, 17C108, 17C109	5	8-21
17C110, 17C111	5	8-1
17C112	50-B	9-1
17C113	50-A	9-9
17C114	50-B	9-1
17C115	50-A	9-9
17C117	50-A	9-9
17C120	50-A	9-9
17T1, 17T2, 17T3	5	8-21
17T4, 17T5, 17T6	50-B	9-1
17T7	50-A	9-9
19C101	5	8-33
20C105, 20C106	63	10-39
20C150, 20C151	62	10-1
20T2, 21C200	63	10-39
21T4, 21T5	85	11-1
24C101	62	10-23
815	19	7-13

GENERAL INSTRUMENT CORP.

MODEL	PACK	PAGES
44, Tuner	35	5-1
45, Electuner	31	6-1

THE HALLICRAFTERS CO.

MODEL	PACK	PAGES
A1100D, Ch.	86	11-1
B919120, Ch.	49	9-17
C919120, Ch.	35	5-1
C1000D, Ch.	86	11-1
D1000D, Ch.	63	10-25
D919120, Ch.	28	6-1
E800D, Ch.	49	9-25
E900D, Ch.	63	10-1
F900D, Ch.	63	10-1
F1100D, Ch.	86	11-1
G900S, Ch.	49	9-67
G1100D, Ch.	86	11-1
J800D, Ch.	49	9-25
K800D, Ch.	49	9-25
K1000D, Ch.	64	10-45
L800D, Ch.	49	9-53
L900D, Ch.	49	9-37
L1000S, Ch.	64	10-59
L919120, Ch.	28	6-21
M800S, Ch.	6	8-1
M900D, Ch.	49	9-37
P800S, Ch.	49	9-67
Q1000D, Ch.	64	10-45
R900D, Ch.	49	9-37
R1000D, Ch.	64	10-45
U800S, Ch.	49	9-67
U1000D, Ch.	63	10-25
W1000D, Ch.	86	11-1
X1000D, Ch.	86	11-1
Y800D, Ch.	63	10-12
Z1000D, Run 1	86	11-1
603, 604	64	10-39
680, 681, Ch. B919120, Run 3	49	9-17

THE HALLICRAFTERS CO. (Cont'd)

MODEL	PACK	PAGES
690, Ch. B919120, Run 3	49	9-17
715, 715A, Ch. B919120, Run 3	49	9-17
716, 717, Ch. C919120	35	5-1
730, 731, Ch. C919120	35	5-1
740, 741, Ch. C919120	35	5-1
745, Ch. D919120	28	6-1
747, 748, Ch. D919120	28	6-1
750, 751, Ch. D919120	28	6-1
760, 761, Ch. D919120	28	6-1
805, 806, Ch. M800S	6	8-1
810, Ch. M800S	6	8-1
810A	28	9-1
810C, Ch. M800S	6	8-1
811	6	8-17
811, Ch. E800D, Runs 2-8	49	9-25
815	28	7-1
818	28	6-9
818, Ch. K800D, Runs 2-8	49	9-25
820, 821	6	8-17
820, 821, Ch. E800D, Runs 2-8	49	9-25
822	28	7-12
832, 833, Ch. L919120	28	6-21
860, 861	6	8-17
860, 861, Ch. E800D, Runs 2-8	49	9-25
870, 871	28	7-1
880	28	9-1
1000, Ch. W1000D, Run 1	86	11-1
1001, 1002, 1003, 1004, Ch. F1100D, Runs 1, 2	86	11-1
1005, 1006, Ch. A1100D, Runs 1, 1A, 2; G1100D, Runs 1, 2	86	11-1
1007, Ch. F1100D, Runs 1, 2	86	11-1
1008, Ch. X1000D, Runs 1, 2	86	11-1
1015, 1016, 1017, 1018, Ch. A1100D, Runs 1, 1A, 2, G1100D, Runs 1, 2	86	11-1
1019, Ch. Z1000D, Run 1	86	11-1
1025, Ch. C1000D, Run 1	86	11-1
14808, Ch. R900D, Runs 1, 2	49	9-37
14808A, Ch. D1000D, Run 1	63	10-25
14808B, Prelim.	28	9-15
14808B, Ch. U1000D, Run 1	63	10-25
17804C, Ch. L800D, Runs 1-3	49	9-53
17810C, 17810M, 17810MG, Ch. G900S, P800S, U800S, Run 1	49	9-67
17811-H, Ch. Y800D, Runs 1-3	63	10-12
17812, 17813, Ch. L800D, Runs 1-3	49	9-53
17814, Ch. F900D, Run 1	63	10-1
17815-H, Ch. L800D, Runs 1-3	49	9-53
17816, 17817, Ch. Y800D, Runs 1-3	63	10-12
17819, Ch. L800D, Runs 1-3	49	9-53
17824, 17825, Ch. L800D, Runs 1-3	49	9-53
17829, Ch. F1100D, Runs 1, 2	86	11-1
17838, Ch. L800D, Runs 1-3	49	9-53
17848, 17849, 17850, Ch. L800D, Runs 1-3	49	9-53
17860-H, 17861-H, Ch. Y800D, Runs 1-3	63	10-12
17905, Ch. L1000S, Run 1	64	10-59
20823, Ch. M900D, Run 1	49	9-37
20823B, Ch. L900D, Run 1	49	9-37
20823C, Ch. R1000D, Run 1	64	10-45
20872, Ch. G900S, P800S, U800S, Run 1	49	9-67
20882, Ch. E900D, Runs 1, 2	63	10-1
20990, 20990S, Ch. J800D	49	9-25
20994, Ch. J800D	49	9-25
21923, Ch. Q1000D, Run 1	64	10-45
21928, Ch. K1000D, Run 1	64	10-45
21940, Ch. Q1000D, Run 1	64	10-45

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MODEL	PACK	PAGES
L-10	35	5-1

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MOTOROLA INC. (Cont'd)

MODEL	PACK	PAGES
17T4E, Ch. TS-221	9	8-16
17T5A, Ch. TS-214	51-B	9-33
17T5C, Ch. TS-228	70	10-1
17T5CA, Ch. TS-214	51-B	9-33
17T5D, Ch. TS-236	9	9-9
17T5E, Ch. TS-314	51-A	9-17
17T5E, Ch. TS-314A	51-A	9-41
17T5F, Ch. TS-315	51-A	9-17
17T5F, Ch. TS-315A	51-A	9-41
17T6BD, Ch. TS-236	9	9-9
17T6BF, Ch. TS-228	70	10-1
17T6C, 17T6D, Ch. TS-236	9	9-9
17T6F, Ch. TS-228	70	10-1
17T6G, Ch. TS-314A	51-A	9-41
17T7, Ch. TS-325	70	10-13
17T7A, Ch. TS-326	70	10-13
17T8, Ch. TS-325	70	10-13
17T8A, Ch. TS-326	70	10-13
17T8B, Ch. TS-325	70	10-13
17T8BA, Ch. TS-326	70	10-13
17T9, 17T9A, 17T9E, Ch. TS-326A, TS-326B	70	10-13
17T9EF, 17T9F, Ch. TS-401	67	10-59
17T10, Ch. TS-325B	70	10-13
17T10A, Ch. TS-326A, TS-326B	70	10-13
17T10D, Ch. TS-401	67	10-59
17T11, Ch. TS-395A, TS-395A-01, TS-395A-02	87	11-19
17T11E, Ch. TS-400A, TS-400A-01	87	11-19
17T12, 17T12B, 17T12W, Ch. TS-395A, TS-395A-01, TS-395A-02	87	11-19
17T13, Ch. TS-410A, TS-410A-01, TS-410A-02	87	11-19
19K2, 19K2B, Ch. TS-101	47-B	7-58
19K2BE, 19K2E, Ch. TS-119, TS-119A	9	8-25
19K3, Ch. TS-101	47-B	7-58
19K4, 19K4B, Ch. TS-101	47-B	7-58
20F1, 20F1B, Ch. TS-119, TS-119A	9	8-25
20F2, 20F2B, Ch. TS-119B, TS-119C	9	8-25
20K1, 20K1B, 20K2, Ch. TS-119B, TS-119C	9	8-25
20K3, 20K3B, Ch. TS-119D	67	10-51
20K4, 20K4B, Ch. TS-119D	67	10-51
20K6, 20K6B, Ch. TS-307	70	10-42
20T1B, Ch. TS-119B, TS-119C	9	8-25
20T2, Ch. TS-119D	67	10-51
20T2A, Ch. TS-307	70	10-42
20T2B, Ch. TS-119D	67	10-51
20T2BA, Ch. TS-307	70	10-42
20T3, 20T3B, Ch. TS-307	70	10-42
21C1, 21C1B, Ch. TS-292, TS-292A	81	11-1
21F1, 21F1B, Ch. TS-351	70	10-13
21F2, 21F2B, Ch. TS-292, TS-292A	81	11-1
21F3, 21F3B, Ch. TS-292, TS-292A	81	11-1
21K1, 21K1B, Ch. TS-351	70	10-13
21K2, 21K2B, Ch. TS-351	70	10-13
21K3, 21K3B, 21K3W, Ch. TS-351	70	10-13
21K4, 21K4A, 21K4B, 21K4W, Ch. TS-292, TS-292A	81	11-1
21K5, 21K5B, Ch. TS-292, TS-292A	81	11-1
21K6, 21K7, Ch. TS-292, TS-292A	81	11-1
21T1, 21T1B, Ch. TS-351	70	10-13
21T2, 21T2B, Ch. TS-351	70	10-13
21T3, Ch. TS-501A, TS-501B-00, TS-501B-01, TS-501B-02	81	11-1
21T4, Ch. TS-324, TS-324A	81	11-1
21T4AC, 21T4ACE, Ch. TS-292B	81	11-1

MOTOROLA INC (Cont'd)

MODEL	PACK	PAGES
21T4EA, Ch. TS-324, TS-324A	81	11-1
21T5A, 21T5BA, Ch. TS-324, TS-324A	81	11-1

M. P. TELEVISION

MODEL	PACK	PAGES
16T503, 17T504	9	8-1

MULTIPLE TELEV. MFG. CO.

MODEL	PACK	PAGES
EC20, Ch. 630K3B	9	8-1
HFD17, HFD20, Ch. 630K3B	9	8-1
LFD17, LFD20, Ch. 630K3B	9	8-1
OF17, OF20, OF20R, Ch. 630K3B	9	8-1
630K3B, Ch.	9	8-1

MUNTZ T-V, INC.

MODEL	PACK	PAGES
M31, Ch. TV17A2	36-B	6-1
M31R, Ch. TV17A3	36-B	6-1
M32, M32R, Ch. TV17A3	36-B	6-1
M33, M34, Ch. TV17A4	36-B	6-1
M41, M42, Ch. TV17A3A	36-B	6-1
M46, M49, Ch. TV17A7	36-B	6-1
TV17A2, Ch.	36-B	6-1
TV17A3, TV17A3A, Ch.	36-B	6-1
TV17A4, TV17A7, Ch.	36-B	6-1
WG2060	51-B	9-13
17B1, 17B2, 17B3, 17B4, Ch.	51-A	9-1
17B4, Carco, Ch.	67	10-1
17B5, 17B6, Ch.	51-A	9-1
17B6, Carco 17B6, Ch.	67	10-1
1750, 1751, 1752, Ch. TV17A3A	36-B	6-1
2053, 2054, 2055, 2056, Ch. TV17A7	36-B	6-1
2053-A, 2054-A, 2055-A, Ch. 17B1, 17B2	51-A	9-1
2055-B, Ch. 17B2	51-A	9-1
2056-A, Ch. 17B1, 17B2	51-A	9-1
2158-A, 2159-A, Ch. 17B5, 17B6	51-A	9-1
2158-A, 2159-A, Ch. 17B6, Carco 17B6, Late	67	10-1
2162-A, Ch. 17B5, 17B6	51-A	9-1
2162-A, Ch. 17B6, Carco 17B6, Late	67	10-1
2457-A, 2461-A, Ch. 17B3, 17B4	51-A	9-1
2457-A, 2461-A, Ch. Carco 17B4, Late	67	10-1

NATIONAL CO., INC.

MODEL	PACK	PAGES
TV1701	67	10-1

NORELCO

See NORTH AMERICAN PHILLIPS CO., INC.

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MODEL	PACK	PAGES
The Irvington	38	6-1
The Mt. Vernon	38	6-1
PT200, Ch.	38	6-1
PT200, Ch. PT200, The Irvington	38	6-1
PT300, Ch. PT200, The Mt. Vernon	38	6-1
588A	81	11-1
1200A	81	11-1

OLYMPIC RADIO & TELEV. INC.

MODEL	PACK	PAGES
Broadmoor	44-A	6-1
Catalina	44-A	6-1
Challenger	44-A	6-1
Lancaster, Marlborough	44-B	7-1
Monte Carlo	44-A	6-1
Prince George	44-A	6-1
Riviera	44-A	6-1
Riviera Deluxe	44-A	7-1

OLYMPIC RADIO & TELEV. INC. (Cont'd)

MODEL	PACK	PAGES
Windsor	44-B	7-1
DX-214, DX-215, DX-216	44-B	4-1 5-1
DX-619, DX-620	44-B	5-1
DX-621	44-B	5-1
DX-622	44-B	5-1
DX-931, DX-932	44-B	5-1
DX-950	44-B	5-1
TG, Ch.	67	10-1
TH, Ch.	67	10-10
TK17, Ch.	87	11-1
TL20, Ch.	87	11-1
XL-210, XL-211	44-B	5-8
XL-612, XL-613	44-B	5-8
17C24, 17K31, 17K32, Ch. TG	67	10-1
17C44, Ch. TK17	87	11-1
17K41, 17K42, Ch. TK17	87	11-1
17K50, Ch. TK17	87	11-1
17T20, 17T33, Ch. TG	67	10-1
17T40, 17T48, Ch. TK17	87	11-1
20C45, Ch. TL20	87	11-1
20C52, 20C53, Ch. TL20	87	11-1
20D49, Ch. TL20	87	11-1
20K43, Ch. TL20	87	11-1
20K51, Ch. TL20	87	11-1
20T46, 20T47, Ch. TL20	87	11-1
21C28, 21D29, Ch. TH	67	10-10
21K26, 21T27, Ch. TH	67	10-10
752, Riviera	44-A	6-1
752U	44-A	6-1
753, Monte Carlo	44-A	6-1
753U	44-A	6-1
755, Challenger	44-A	6-1
755U	44-A	6-1
762, Riviera Deluxe	44-B	7-1
764, Broadmoor	44-A	6-1
764U	44-A	6-1
766, Catalina	44-A	6-1
766U, 767	44-A	6-1
769, Prince George	44-A	6-1
783	44-B	7-1
967, Windsor	44-B	7-1
968, Lancaster	44-B	7-1
970, Marlborough	44-B	7-1

PACKARD-BELL CO.

MODEL	PACK	PAGES
2001-TV, 2002-TV	44-A	5-1
2091-TV, 2092-TV	44-A	5-3
2101, 2102, Ch. 2101-2	44-B	7-1
2101-2, Ch.	44-B	7-1
2105, 2105A, Ch. 2101-2	44-B	7-1
2202-TV, 2204-TV	44-B	7-10
2111, Ch. 2111-2	52	9-15
2111-2, Ch.	52	9-15
2112, 2113, Ch. 2111-2	52	9-15
2114, Ch. 2114	52	9-15
2114, Ch.	52	9-15
2115, Ch. 2115-2	71	10-1
2115-2, Ch.	71	10-1
2116, DeLuxe, Standard, Ch. 2115-2	71	10-1
2117, DeLuxe, Standard, Ch. 2117	71	10-1
2117, Ch.	71	10-1
2118	71	10-17
2301, 2302	9	8-1
2311	52	9-1
2421, Ch. 2421-2	71	10-27
2421-2, Ch.	71	10-27
2422, DeLuxe, Standard, Ch. 2421-2	71	10-27
2423, DeLuxe, Standard, Ch. 2423-2	71	10-27
2423-2, Ch.	71	10-27
2601-TV	44-A	5-9
2602	44-A	8-14
2611	52	9-21
2612, Ch. 2115-2	71	10-11
2621, 2622, Ch. 2621-2	88	11-1

PACKARD BELL CO. (Cont'd)

MODEL	PACK	PAGES
2621-2, Ch.	88	11-1
2692-TV	44-A	5-9
2801-TV, 2801A-TV	44-A	6-1
2803	9	8-1
2811	52	9-1
2811, Late	52	9-1
2822, Ch. 2822	71	10-27
2822, Ch.	71	10-27
3021, Ch. 3021	88	11-1
3021, Ch.	88	11-1

PACIFIC MERCURY TELEV. MFG. CO.

MODEL	PACK	PAGES
150, 150-1, 150-2, Ch.	81	11-1
150-6, 150-9, 150-10, Ch.	81	11-1
150-11, 150-15, 150-21, Ch.	81	11-1
510-81, Ch.	81	11-1
2013, Ch. 150-2	81	11-1
2081, Ch. 150-2	81	11-1
2113, 2115, Ch. 150-11, 150-81	81	11-1
2116, Ch. 150-81	81	11-1
2192, Ch. 150-10	81	11-1
4120, 4220, Ch. 150, 150-2	81	11-1
4317, Ch. 150-9	81	11-1
4320, Ch. 150-2, 150-15	81	11-1
4721, Ch. 150-10	81	11-1

PATHE TELEVISION CORP.

MODEL	PACK	PAGES
TAP, Ch.	10	8-1
14-PT	10	8-6
17-N25, Ch. TAP	10	8-1
17-PC	10	8-6
17-RPC, 17-RPT, Ch. TAP	10	8-1

PHILCO CORP.

MODEL	PACK	PAGES
C-2, CP-1, Ch.	22-B	9-1
F-2, Ch.	22-B	9-1
G-1, Ch.	71	10-1
G-2, Ch.	68	10-13
G-4, Ch.	68	10-22
H-1, Ch.	82	11-1
H-4, Ch.	88	11-20
J-1, Ch.	68	10-35
RC-1 Remote Control Unit	10	8-1
RC-3, Remote Control Unit	88	11-15
33, 35, 37, 38, Ch.	22-B	9-1
42, Ch.	68	10-13
44, Ch.	68	10-22
50-T1104, Codes 121, 122	34-B	5-1 6-18
50-T1105, Codes 121, 122	34-B	5-1 6-19
50-T1106	34-B	5-1 6-19
50-T1403, Code 125	34-B	5-7 6-29
50-T1404, Codes 123, 124, 125	34-B	5-7 6-29
50-T1406, Codes 123, 124, 125	34-B	5-7 6-29
50-T1432, Code 124	34-B	5-7 6-29
50-T1443, Codes 122, 123	37-B	6-33
50-T1476, 50-T1477	37-A	6-44
50-T1476, 50-T1479	37-A	6-44
50-T1481, 50-T1482	37-A	6-44
50-T1483	22-A	7-1
50-T1484	37-A	6-44
50-T1600, Code 121	34-B	5-17
50-T1600, Codes 121, 122	22-B	7-11
50-T1630, Code 121	22-B	7-18 5-17
50-T1630, Code 122	22-B	7-18
50-T1632, 50-T1633, Code 121	34-B	5-17
50-T1632, 50-T1633, Codes 121, 122	22-B	7-11

PHILCO CORP. (Cont'd)

MODEL	PACK	PAGES
50-702, Code 122	37-B	6-9
51-PT1207, 51-PT1208	10	8-5
51-PT1234	10	8-5
51-PT1282	10	8-5
51-T1443B, 51-T1443L, 51-T1443M	22-A	7-33
51-T1443PL, 51-T1443PM, 51-T1443PW	22-A	7-41
51-T1443X, 51-T1443XL	22-A	7-33
51-T1601, 51-T1601T, 51-T1602, Codes 121, 122	22-A	7-51
51-T1604, Codes 121, 122,125	22-B	7-11
51-T1606, Codes 121,122,125	22-B	7-11
51-T1606, Codes 131, 132	22-B	7-11
51-T1634, Codes 121, 122	22-B	7-11
51-T1634, Codes 123, 124	22-A	7-51
51-T1634, Code 125	22-B	7-11
51-T1836, 51-T1836L, Code 123	10	8-14
51-T1838, Code 124	10	8-14
51-T1870, 51-T1872, Code 121	10	8-14
51-T1874, 51-T1874L, Code 121	10	8-14
51-T1875, Code 121	10	8-14
51-T1876, Code 124	10	8-14
51-T2134, 51-T2136, 51-T2138, Code 124	10	8-14
51-T2175, 51-T2176, Code 124	10	8-14
52-T1802, Ch. 33, C-2, Code 122	22-B	9-1
52-T1802, Ch. 37, C-2, Code 123	22-B	9-1
52-T1802, Ch. 71, G-1, Code 124	71	10-1
52-T1804, Ch. 33, C-2, Code 122	22-B	9-1
52-T1804, Ch. 37, C-2, Code 123	22-B	9-1
52-T1804, Ch. 71, G-1, Code 124	71	10-1
52-T1808, Ch. 33, C-2, Code 122	22-B	9-1
52-T1808, Ch. 37, C-2, Code 123	22-B	9-1
52-T1810, Ch. 33, C-2, Code 122	22-B	9-1
52-T1810, Ch. 37, C-2, Code 123	22-B	9-1
52-T1810-L, Ch. 33, C-2, Code 122	22-B	9-1
52-T1812, Ch. 33, C-2, Code 122	22-B	9-1
52-T1812, Ch. 37, C-2, Code 123	22-B	9-1
52-T1820, Ch. 37, C-2, Code 123	22-B	9-1
52-T1820, Ch. 71, G-1, Code 124	71	10-1
52-T1821, Ch. 37, C-2, Code 123	22-B	9-1
52-T1821, Ch. 71, G-1, Code 124	71	10-1
52-T1822, Ch. 71, G-1, Code 124	71	10-1
52-T1831, Ch. 33, C-2, Code 122	22-B	9-1
52-T1831, Ch. 33, C-2, Code 124	22-B	9-1
52-T1839, Ch. 33, C-2, Code 122	22-B	9-1
52-T1839, Ch. 37, C-2, Code 123	22-B	9-1
52-T1840, Ch. 33, C-2, Code 122	22-B	9-1
52-T1840, Ch. 37, C-2, Code 123	22-B	9-1
52-T1841-L, Ch. 37, C-2, Code 123	22-B	9-1
52-T1842, Ch. 33, C-2, Code 122	22-B	9-1
52-T1842, Ch. 37, C-2, Code 123	22-B	9-1

PHILCO CORP. (Cont'd)

MODEL	PACK	PAGES
52-T1842-L, Ch. 33, C-2, Code 124	22-B	9-1
52-T1842-L, Ch. 37, C-2, Code 123	22-B	9-1
52-T1844, Ch. 33, C-2, Code 122	22-B	9-1
52-T1844, Ch. 33, C-2, Code 124	22-B	9-1
52-T1844, Ch. 37, C-2, Code 123	22-B	9-1
52-T1845, Ch. 71, G-1, Code 124	71	10-1
52-T1882, Ch. 35, CP-1, Code 122	22-B	9-1
52-T1882, Ch. 38, CP-1, Code 123	22-B	9-1
52-T2106, Ch. 35, F-2, Code 122	22-B	9-1
52-T2106, Ch. 38, F-2, Code 123	22-B	9-1
52-T2108, Ch. 35, F-2, Code 122	22-B	9-1
52-T2108, Ch. 38, F-2, Code 123	22-B	9-1
52-T2110, Ch. 35, F-2, Code 122	22-B	9-1
52-T2110, Ch. 38, F-2, Code 123	22-B	9-1
52-T2120, Ch. 71, G-1, Code 124	71	10-1
52-T2122, 52-T2122-L, Ch. 71, G-1, Code 124	71	10-1
52-T2140, Ch. 35, F-2, Code 122	22-B	9-1
52-T2140, Ch. 38, F-2, Code 123	22-B	9-1
52-T2142, Ch. 35, F-2, Code 122	22-B	9-1
52-T2142, Ch. 38, F-2, Code 123	22-B	9-1
52-T2150, Ch. 71, G-1, Code 124	71	10-1
52-T2151, Ch. 71, G-1, Code 124	71	10-1
52-T2151-L, Ch. 71, G-1, Code 124	71	10-1
52-T2152, Ch. 71, G-1, Code 124	71	10-1
52-T2175, 52-T2176, Ch. 35, F-2, Code 124	22-B	9-1
52-T2175, Ch. 42, G-2, Code 125	68	10-13
52-T2252, Ch. 71, G-1, Code 124	71	10-1
52-T2275, Ch. 35, F-2, Code 122	22-B	9-1
53-T1824, Ch. 71, G-1, Code 124	71	10-1
53-T1824, Ch. 81, H-1, Code 123	82	10-1
53-T1825, Ch. 71, G-1, Code 124	71	10-1
53-T1825, Ch. 81, H-1, Code 123	82	11-1
53-T1826, Ch. 71, G-1, Code 124	71	10-1
53-T1826, Ch. 81, H-1, Code 123	82	11-1
53-T1852, Ch. 71, G-1, Code 124	71	10-1
53-T1852, 53-T1852F, 53-T1852L, Ch. 81, H-1, Code 123	82	11-1
53-T1853, 53-T1853L, Ch. 91, J-1, Code 126	68	10-35
53-T1854, 53-T1854L, Ch. 81, H-1, Code 123	82	11-1
53-T1883, Ch. 44, G-4, Code 125	68	10-22

PHILCO CORP. (Cont'd)

MODEL	PACK	PAGES
53-T1883, Ch. 84, H-4, Code 123	88	11-20
53-T1884, Ch. 84, H-4, Code 123	88	11-20
53-T1884, Ch. 44, G-4, Code 125	68	10-22
53-T1886, Ch. 44, G-4, Code 125	68	10-22
53-T1886, Ch. 84, H-4, Code 123	88	11-20
53-T1886L, Ch. 44, G-4, Code 125	68	10-22
53-T1886-L, Ch. 84, H-4, Code 123	88	11-20
53-T2124, 53-T2124L, Ch. 81, H-1, Code 123	82	11-1
53-T2125, 53-T2125L, Ch. 81, H-1, Code 123	82	11-1
53-T2126, Ch. 42, G-2, Code 125	68	10-13
53-T2126, Ch. 81, H-1, Code 123	82	11-1
53-T2127, Ch. 91, J-1, Code 126	68	10-35
53-T2152, 53-T2152L, Ch. 81, H-1, Code 123	82	11-1
53-T2183, Ch. 44, G-4, Code 125	68	10-22
53-T2183, Ch. 84, H-4, Code 123	88	11-20
53-T2226, 53-T2227, Ch. 81, H-1, Code 123	82	11-1
53-T2260, Ch. 42, G-2, Code 125	68	10-13
53-T2260, Ch. 81, H-1, Code 123	82	11-1
53-T2262, Ch. 42, G-2, Code 125	68	10-13
53-T2262, Ch. 81, H-1, Code 123	82	11-1
53-T2264, Ch. 42, G-2, Code 125	68	10-13
53-T2264, Ch. 81, H-1, Code 123	82	11-1
53-T2266, 53-T2268, Ch. 91, J-1, Code 126	68	10-35
53-T2269, 53-T2270, 53-T2271, Ch. 91, J-1, Code 126	68	10-35
53-T2272, 53-T2272L, Ch. 81, H-1, Code 123	82	11-1
53-T2273C, 53-T2273M, Ch. 91, J-1, Code 126	68	10-35
71, Ch.	71	10-1
76-4402, 76-5411, 76-5433, Series, Tuners	37-A	6-1
81, Ch.	82	11-1
84, Ch.	88	11-20
91, Ch.	68	10-35

PHILHARMONIC RADIO & TELEV. CORP.

MODEL	PACK	PAGES
C-6161, T-616	22-A	7-1
20C2B, 20CD2B	82	11-1
20T2B	82	11-1
21C2A, 21CD2A	82	11-1
111, 112	82	11-1
420	82	11-1
717T, 724	82	11-1
820	82	11-1
920, 924	82	11-1
1116	22-A	7-1
5221	82	11-1
5816	22-A	7-1
7171	82	11-1
8120	82	11-1
8820	82	11-1
9120, 9121A	82	11-1
9820, 9821	82	11-1

PILOT RADIO CORP.

MODEL	PACK	PAGES
TV-125	20	5-1
TV-127	37-B	6-1
TV-161	20	5-1

PILOT RADIO CORP. (Cont'd)

MODEL	PACK	PAGES
TV-163	20	5-1
TV-164	37-B	6-1
TV-165	20	5-1
TV-167A	37-B	6-1
TV-167B, TV-168	37-B	6-1
TV-191	37-B	6-1
TV-271, TV-273, TV-274	53	9-1
TV-293, TV-294	53	9-1

PLYMOUTH
See INTERSTATE STORES BUYING CORP.

PRECISION
See THE HERTNER ELECTRIC CO.

RADIO CORP. OF AMERICA

MODEL	PACK	PAGES
Ainsworth	72	10-64
Albury	72	10-55
Ashton	72	10-55
Bancroft	82	11-1
Belgrove	74	10-73
Bently	16-A	9-1
Brandon	74	10-73
Brett	72	10-64
Bristol	16-B	9-73
Bristol, Late	72	10-17
Brookfield	74	10-73
Caldwell	72	10-17
Calhoun	72	10-17
Clarendon	16-A	9-45
Clarendon, Late	82	11-1
Colby	68	10-1
Covington	72	10-17
Crafton	68	10-1
Donley	16-A	9-45
Donley, Late	82	11-1
Fairfield, Final	16-B	9-54
Glenside	68	10-1
Hadley	72	10-55
Hampton	16-B	9-73
Hampton, Late	72	10-17
Haywood	16-A	9-17
Highland, Final	16-B	9-54
Hillsdale	11	8-62
Hillsdale, Late	72	10-35
Kentwood	72	10-55
Lambert	74	10-73
Lansford	74	10-73
Lindale	74	10-73
Kendall	16-B	9-73
Kent, Final	16-B	9-54
Meredith	82	11-1
Modern, Final	16-B	9-54
Newport, Final	16-B	9-54
Penfield	88	11-19
Preston	16-B	9-73
Preston, Late	72	10-17
Provincial	11	8-62
Provincial, Final	16-B	9-54
Provincial	72	10-35
Regency, Final	16-B	9-54
Rockingham	16-A	9-45
Rockingham, Late	82	11-1
Rutland	10	8-31
Selfridge	82	11-1
Shelley	72	10-55
Somerville	10	8-1
Suffolk	16-A	9-45
Suffolk, Late	82	11-1
Talbot	16-B	9-31
Westland	88	11-19
Whitfield, Late	72	10-17
Winston, Final	16-B	9-54
York	11	8-62
York, Late	72	10-35
KCS31-1, Ch., S1000	20	5-48
KCS31-1, Ch., 9TW390	20	5-32
KCS34C, Ch.	34-A	5-80
		5-95

RADIO CORP. OF AMERICA (Cont'd)

MODEL	PACK	PAGES
KCS38, Ch.	34-A	5=65
KCS38C, Ch.	20	5=1
KCS40, KCS40A, Ch.	37-A	6=1
KCS40B, Ch.	46-B	7=50
KCS41-1, Ch.	20	5=16
KCS45, KCS45A, Ch.	46-A	7=1
KCS46, Ch.	46-A	7=17
KCS47, KCS47A, KCS47AT, Ch.	46-B	7=33
KCS47B, KCS47C, KCS47D, Ch.; Final	16-B	9=54
KCS47E, Ch.	16-B	9=31
KCS47F, KCS47G, Ch.; Final	16-B	9=54
KCS47GF-2, Ch.	16-A	9=17
KCS47T, Ch.	46-B	7=33
KCS48A, Ch.	10	8=31
KCS49B, Ch.	11	8=62
KCS49B, Ch., Late	72	10=35
KCS49BF, KCS49BF-2, Ch.	72	10=35
KCS49C, Ch.	11	8=62
KCS49C, Ch., Late	72	10=35
KCS49CF, KCS49CF-2, Ch.	72	10=35
KCS60A, Ch.	11	8=77
KCS61, Ch.	16-A	9=1
KCS62, Ch.	10	8=1
KCS66, Ch.	16-B	9=73
KCS66, Ch., Late	72	10=17
KCS66A, Ch.	16	9=73
KCS66A, Ch., Late	72	10=17
KCS66C, Ch.	68	10=1
KCS66D, Ch.	72	10=17
KCS68C, Ch.	16-A	9=45
KCS68C, Ch., Late	82	11=1
KCS68E, KCS68F, Ch.	82	11=1
KCS72, Ch.	72	10=55
KCS72A, Ch.	74	10=73
KCS72D-1, KCS72D-2, Ch.	88	11=19
KCS74, Ch.	72	10=64
S1000, Ch. KCS31-1	20	5=48
T100, Ch. KCS38	34-A	5-65
T120, Ch. KCS34C	34-A	5=80
T121, Ch. KCS34C	34-A	5=95
T164, Ch. KCS40	37-A	6=1
TC165, TC166, TC167, TC168, Ch. KCS40A	37-A	6=1
2T51, Ch. KCS45	46-A	7=1
2T60, Ch. KCS45A	46-A	7=1
2T81, Ch. KCS46	46-A	7=17
4T101, Ch. KCS61, Bently	16-A	9=1
4T141, Ch. KCS62, Somerville	10	8=1
6T53, 6T54, Ch. KCS47, KCS47T	46-B	7=33
6T64, 6T65, Ch. KCS47A, KCS47AT	46-B	7=33
6T71, Ch. KCS47A, KCS47AT	46-B	7=33
6T72, Ch. KCS40B	46-B	7=50
6T74, 6T75, 6T76, Ch. KCS47A, KCS47AT	46-B	7=33
7T103, Ch. KCS47B, Newport, Final	16-B	9=54
7T103B, Ch. KCS47F	16-B	9=54
7T104, Ch. KCS47B, Kent, Final	16-B	9=54
7T104B, Ch. KCS47F, Final	16-B	9=54
7T111B, Ch. KCS47GF-2, Haywood	16-A	9=17
7T112, Ch. KCS47C, Highland, Final	16-B	9=54
7T112B, Ch. KCS47G, Final	16-B	9=54
7T122, Ch. KCS47C, Fairfield, Final	16-B	9=54
7T122B, Ch. KCS47G, Final	16-B	9=54
7T123, Ch. KCS47C, Regency, Final	16-B	9=54
7T123B, Ch. KCS47G, Final	16-B	9=54
7T124, Ch. KCS47C, Modern, Final	16-B	9=54
7T125B, Ch. KCS47G, Provincial, Final	16-B	9=54
7T132, Ch. KCS47D, Winston, Final	16-B	9=54
7T143, Ch. KCS48A, Rutland	10	8=31

RADIO CORP. OF AMERICA (Cont'd)

MODEL	PACK	PAGES
9T105, Ch. KCS49B, York	11	8=62
9T105, Ch. KCS49B, KCS49BF, KCS49BF-2, York, Late	72	10=35
9T126, Ch. KCS49C, Hillsdale	11	8=62
9T126, Ch. KCS49C, KCS49CF, KCS49CF-2, Hillsdale, Late	72	10=35
9T128, Ch. KCS49C, Provincial	11	8=62
9T128, Ch. KCS49C, KCS49CF, KCS49CF-2, Provincial, Late	72	10=35
9T147, Ch. KCS60A	11	8=77
9T256, Ch. KCS38C	20	5=1
9TW309, Ch. KCS41-1	20	5=16
9TW390, Ch. KCS31-1	20	5=32
16T152, Ch. KCS47E, Talbot	16-B	9=31
17T150, Ch. KCS66C, Colby	68	10=1
17T151, Ch. KCS66C, Glenside	68	10=1
17T153, Ch. KCS66, Bristol	16-B	9=73
17T153, Ch. KCS66, Bristol, Late	72	10=17
17T154, Ch. KCS66, Whitfield, Late	72	10=17
17T155, Ch. KCS66, Preston	16-B	9=73
17T155, Ch. KCS66, Preston, Late	72	10=17
17T160, Ch. KCS66, Hampton	16-B	9=73
17T160, Ch. KCS66, Hampton, Late	72	10=17
17T162, Ch. KCS66A, Caldwell, Late	72	10=17
17T163, Ch. KCS66C, Crafton	68	10=1
17T172, Ch. KCS66A, Covington, Late	72	10=17
17T172K, Ch. KCS66D	72	10=17
17T173, Ch. KCS66A, Calhoun, Late	72	10=17
17T173K, Ch. KCS66D	72	10=17
17T174, Ch. KCS66A, Kendall	16-B	9=73
17T174K, Ch. KCS66D	72	10=17
17T200, Ch. KCS72, Shelley	72	10=55
17T201, Ch. KCS72, Hadley	72	10=55
17T202, Ch. KCS72, Kentwood	72	10=55
17T211, Ch. KCS72, Ashton	72	10=55
17T220, Ch. KCS72, Albury	72	10=55
17T250DE, Ch. KCS74, Brett	72	10=64
17T261DE, Ch. KCS74, Ainsworth	72	10=64
21T159, Ch. KCS68E, Selfridge	82	11=1
21T159DE, Ch. KCS68F, Selfridge	82	11=1
21T165, Ch. KCS68E, Meridith	82	11=1
21T174DE, Ch. KCS68F, Bancroft	82	11=1
21T176, Ch. KCS68C, Suffolk	16-A	9=45
21T176, Ch. KCS68C, Suffolk, Late	82	11=1
21T177, Ch. KCS68C, Donley	16-A	9=45
21T177, Ch. KCS68C, Donley, Late	82	11=1
21T178, Ch. KCS68C, Rockingham	16-A	9=45
21T178, Ch. KCS68C, Rockingham, Late	82	11=1
21T178DE, Ch. KCS68F, Rockingham, Late	82	11=1
21T179, Ch. KCS68C, Clarendon	16-A	9=45
21T179, Ch. KCS68C, Clarendon, Late	82	11=1
21T179DE, Ch. KCS68F, Clarendon, Late	82	11=1
21T208, Ch. KCS72A, Lambert	74	10=73
21T217, Ch. KCS72A, Brookfield	74	10=73
21T218, Ch. KCS72A, Lansford	74	10=73
21T227, Ch. KCS72A, Lindale	74	10=73
21T228, Ch. KCS72A, Brandon	74	10=73
21T229, Ch. KCS72A, Belgrove	74	10=73
21-T-242, Ch. KCS72D-1, KCS72D-2, Westland	88	11=19
21-T-244, Ch. KCS72D-1, KCS72D-2, Penfield	88	11=19

RADIO CRAFTSMEN

MODEL	PACK	PAGES
RC101	15	8=1
RC100A	38	5=1
RC201	15	8=6
RC202	74	10=1

RAYTHEON TELEV. & RADIO CORP.

MODEL	PACK	PAGES
Adams	2	8=1
Adams	83	11=21
The Belmont	27	5=1
Bermuda	83	11=21
Beverly	83	11=10
Catalina, Clayton	2	8=1
Colonial	83	11=21
Commander	58	10=1
The Console	27	5=1
Constellation	2	8=1
Essex	83	11=21
The Evanston	48-A	7=1
Glendale	83	11=10
Highland	58	10=11
Lakewood	83	11=10
Linden	58	10=1
Madrid	83	11=21
Malibu	83	11=10
The Marquis	48-A	7=1
The Mayfair	48-A	7=1
Montclair	83	11=10
The Mozart	48-A	7=1
Normandy	83	11=21
Northbrook	83	11=10
Pacer	83	11=1
Plymouth	83	11=10
Raleigh	58	10=11
The Rancho, The Revere	48-A	7=1
The Rocket	48-A	7=1
Roseland	58	10=1
The Rover	27	5=1
The Santung	48-A	7=1
Saratoga	83	11=10
The Savoy	48-A	7=1
Sensation	58	10=11
The Starlight	2	8=14
Stockholm	83	11=21
The Suburban	27	5=1
Vogue	58	10=11
Westport	83	11=10
C-1104B, Ch. 12AX27, The Console	27	5=1
C-1401, Ch. 14AX21	27	5=9
C-1602, Ch. 16AX23, 16AX25, 16AX26	27	5=21
C-1602, Series C, Ch. 16AX29	27	5=21
C-1614A, Ch. 16AY211, The Marquis	48-A	7=1
C-1614B, Ch. 16AY28, The Marquis	48-A	7=1
C-1615A, Ch. 16AY211, The Mayfair	48-A	7=1
C-1615B, Ch. 16AY28, The Mayfair	48-A	7=1
C-1618A, Ch. 16AY211, The Mozart	48-A	7=1
C-1616B, Ch. 16AY28, The Mozart	48-A	7=1
C-1714A, Ch. 17AY24, The Marquis	48-A	7=1
C-1714B, Ch. 17AY21, The Marquis	48-A	7=1
C-1715A, Ch. 17AY24, The Mayfair	48-A	7=1
C-1715B, Ch. 17AY21, The Mayfair	48-A	7=1
C-1716A, Ch. 17AY24, The Mozart	48-A	7=1
C-1716B, Ch. 17AY21, The Mozart	48-A	7=1
C-1724A, Ch. 17AY21, The Evanston	48-A	7=1

RAYTHEON TELEV. & RADIO CORP. (Cont'd)

MODEL	PACK	PAGES
C-1729A, Ch. 17AY21A, Roseland	58	10=1
C-1731A, Ch. 17AY21A, Linden	58	10=1
C-1735A, Ch. 17T1, Lakewood	83	11=10
C-1736A, Ch. 17T1, Glendale	83	11=10
C-2001A, Ch. 20AY21, Clayton	2	8=1
C-2002A, Ch. 20AY21, Catalina	2	8=1
C-2006A, Constellation	2	8=1
C-2103A, Ch. 21AY21, Raleigh	58	10=11
C-2105A, Ch. 21AY21, Highland	58	10=11
C-2108A, Ch. 21T1, Westport	83	11=10
C-2109A, Ch. 21T2, Montclair	83	11=10
C-2110A, Ch. 21T1, Malibu	83	11=10
C-2111A, Ch. 21T1, Plymouth	83	11=10
C-2112A, Ch. 21T3, Madrid	83	11=21
C-2113A, Ch. 21T3, Bermuda	83	11=21
C-2114A, Ch. 21T3, Essex	83	11=21
C-2115A, Ch. 21T3, Stockholm	83	11=21
C-2116A, Ch. 21T3, Normandy	83	11=21
C-2118A, Ch. 21T3, Colonial	83	11=21
M-1105B, Ch. 12AX27, The Suburban	27	5=1
M-1106, Ch. 12AX27, The Rover	27	5=1
M-1107, Ch. 12AX27, The Belmont	27	5=1
M-1402, M-1403, M-1404, Ch. 14AX21	27	5=9
M-1601, Ch. 16AX23, 16AX25, 16AX26	27	5=21
M-1611A, Ch. 16AY211, The Rocket	48-A	7=1
M-1611B, Ch. 16AY28, The Rocket	48-A	7=1
M-1612A, Ch. 16AY211, The Rancho	48-A	7=1
M-1612B, Ch. 16AY28, The Revere	48-A	7=1
M-1613A, Ch. 16AY211, The Revere	48-A	7=1
M-1613B, Ch. 16AY28, The Revere	48-A	7=1
M-1626, Ch. 16AY212, Pacer	83	11=1
M-1711A, Ch. 17AY24, The Rocket	48-A	7=1
M-1711B, Ch. 17AY21, The Rocket	48-A	7=1
M-1712A, Ch. 17AY24, The Rancho	48-A	7=1
M-1712B, Ch. 17AY21, The Rancho	48-A	7=1
M-1713A, Ch. 17AY24, The Revere	48-A	7=1
M-1713B, Ch. 17AY21, The Revere	48-A	7=1
M-1725A, Ch. 17AY21	48-A	7=1
M-1726A, Ch. 17AY21A, Commander	58	10=1
M-1728A, Ch. 17AY21A, Vogue	58	10=1
M-1733A, Ch. 17T1, Saratoga	83	11=10
M-1734A, Ch. 17T2, Northbrook	83	11=10
M-2101A, Ch. 21AY21, Sensation	58	10=11
M-2107A, Ch. 21T1, Beverly	83	11=10
P-301, Series B, Ch. 7DX22P	27	5=31
RC-1405, Ch. 14AX21	27	5=9
RC-1618A, Ch. 16AY211, The Savoy	48-A	7=1
RC-1618B, Ch. 16AY28, The Savoy	48-A	7=1
RC-1619A, Ch. 16AY211, The Santung	48-A	7=1
RC-1619B, Ch. 16AY28, The Santung	48-A	7=1

RAYTHEON TELEV. & RADIO CORP. (Cont'd)

REGAL ELECTRONICS CORP.

SCOTT RADIO LABS., INC.

SEARS, ROEBUCK & CO. (SILVERTONE)

SEARS, ROEBUCK & CO. (Cont'd)

SENTINEL RADIO CORP.

SHERATON TELEV. CORP.

SILVERTONE

See SEARS, ROEBUCK & CO.

SKYRIDER

SONORA RADIO & TELEV. CORP.

SPARTON RADIO-TELEVISION DIV. OF THE SPARKS-WITHINGTON CO.

SPARTON RADIO-TELEVISION (Cont'd)

MODEL	PACK	PAGES
SPARTON RADIO-TELEVISION (Cont'd)		
5107X, Ch. 26SS171, Whitney	56	9=17
5108, Ch. 26SS170D, Whitney	56	9=1
5110, Ch. 26SS170DD, Berkeley	56	9=1
5125, Ch. 26SS170DD	56	9=1
5152, 5153, 5154, Ch. 26SS170, 26SS170P	24	7=5
		8=23
		8=27
5155, 5156, 5157, Ch. 26SD170X, 26SD170XP	24	7=3
		8=2
		8=21
5158, Ch. 26SD170, 26SD170P	24	7=3
		8=2
		8=21
5162X, 5163X, Ch. 26SS171A, Gramercy	56	9=17
5165X, 5166X, Ch. 26SD171, Sheffield	56	9=22
5170, 5171, Ch. 25SD201	24	7=10
		8=14
5175X, Ch. 26SD171, Rochelle	56	9=22
5178X, Ch. 26SD171, Del Mar	56	9=22
5182, 5183, Ch. 26SD170, 26SD170P	24	7=3
		8=2
		8=21
5188, 5189, Ch. 26SD170, 26SD170P	24	7=3
		8=2
		8=21
5191, 5192, Ch. 25SD201A, Hanover	56	9=11
5220, Ch. 26SD172C, Harrison	75	10=1
5225, Ch. 26SD172C, Hastings	75	10=1
5226, Ch. 26SD172C	75	10=1
5270, Ch. 26SD172C, Roxbury	75	10=1
5271, Ch. 26SD172C	75	10=1
5272, 5273, Ch. 26SD172C, Radmoor	75	10=1
SPENCER-KENNEDY LABS., INC.		
212TV, Booster	12	8=1
SPIEGEL (AIRCASTLE)		
117H, 120H, Ch.	75	10=1
472.17XMC, 472.17XMT, Ch. 117H	75	10=1
472.20XMC, 472.20XMT, Ch. 120H	75	10=1
STANDARD COIL PRODUCTS CO. INC.		
B-51, Booster	12	8=1
STARRETT TELEVISION CORP.		
Eli Whitney	75	10=1
James Buchanan	75	10=1
James Madison	75	10=1
Patrick Henry	75	10=1
Peter Stuyvesant	75	10=1
The Riviera	75	10=1
12S1, Ch.	75	10=1
14S1, Ch.	75	10=1
15S1, Ch.	75	10=1
17BM1, Ch. 12S1, James Buchanan	75	10=1
20BM1, Ch. 15S1, Peter Stuyvesant	75	10=1
27BM1, Ch. 12S1, Patrick Henry	75	10=1
29AM1, Ch. 14S1, Peter Stuyvesant	75	10=1
30BM1, Ch. 15S1, James Madison	75	10=1
37BB1, Ch. 12S1, Eli Whitney	75	10=1
37BM1, Ch. 12S1, The Riviera	75	10=1

MODEL	PACK	PAGES
STARRETT TELEV. CORP. (Cont'd)		
39AM1, Ch. 14S1, James Madison	75	10=1
9120-A, 9120-B, 9120-C, 9120-D, 9120-E, 9120-F	24	7=1
STEWART-WARNER ELECTRIC DIV. OF STEWART-WARNER CORP.		
9121-A, 9121-B	24	7=18
9122-A	12	8=1
9125-A	56	9=19
9126-A, 9126-B	56	9=37
9127-A	56	9=42
9200-A, 9200-C, 9200-D, 9200-FA, 9200-G	12	8=20
9202-A, 9202-B	75	10=1
9202-C	12	8=37
9202-C, Late	75	10=1
9202-DA	12	8=37
9202-DA, Late	75	10=1
9202-DB	12	8=37
9202-DB, Late	75	10=1
9202-DD	12	8=37
9202-DD, Late, 9202-DDA	75	10=1
9202-E	12	8=37
9202-E, Late	75	10=1
9202-F	12	8=37
9202-F, Late, 9202-FA	75	10=1
9203-A	25	9=1
9204-A	75	10=1
STRAND TELEVISION CORP.		
32-B The Vermont, 80, 2406-C Riverdale, 2412 The Commodore, 2415-C The Cosmopolitan, 2417-C The Van Courtland, 3203-C The Regal, 3214 The Aristocrat, 3217 The Provence, 3224 The Carolinian, 3255 The Danberry, 3353 The Madison, 3356 The Roosevelt, 3357 The Jackson, 3642 The Scarsdale, 3644L The Crestwood, 3645 The Yorktowne, 4000 The New Yorker, 4000 Ch. L, See VIDEO PRODUCTS 630-K3C, 630-DX, 630-FM	69	10=1
STROMBERG-CARLSON CO.		
Brighton	76	10=1
Cavalier, Futura	23	9=1
Invader	76	10=8
Mandarin	76	10=1
Pan American	76	10=8
Panatomic	76	10=8
24C, 24CM, Ch. 112126	23	7=1
24RP, 24 Series, Ch. 112119	23	7=1
24RPM, 24 Series, Ch. 112119	23	7=1
119CDM, 119CM, Ch. 112107	23	7=9
119M5A, 119M5D, 119M5G, 119M5I, 119M5M, 119M5R, Ch. 112114	23	7=9
119RPM, 119RPM2, Ch. 112114	23	7=9
317RPM, Ch. 112120	15	8=1
317TM, Ch. 112121	15	8=1
321CD2M, 321CD2O, 321 Series, Ch. 112127, Futura	23	9=1
321CF, 321C2M, Ch. 112127, Cavalier	23	9=1
417C5M, 417C5O, 417 Series	76	10=1
417C5-Dec, 417 Series, Mandarin	76	10=1
417TX, 417 Series, Brighton	76	10=1
421CDM, 421 Series, Pan American	76	10=8
421CM, 421 Series, Invader	76	10=8
421TX, 421 Series, Panatomic	76	10=8
112107, Ch.	23	7=9

MODEL	PACK	PAGES
STROMBERG-CARLSON CO. (Cont'd)		
112114, Ch.	23	7=9
112119, Ch.	23	7=1
112120, 112121, Ch.	15	8=1
112126, Ch.	23	7=1
112127, Ch.	23	9=1
SUPREMACY See MACY'S		
SURREY See BENRAY ELECTRONICS CORP.		
SYLVANIA ELECTRIC PRODUCTS INC.		
1-197-2, Ch. 1-227	13	8=53
1-227, Ch.	13	8=53
1-231, Ch.	13	8=105
1-245-2, Ch. 1-227	13	8=53
1-247-1, Ch. 1-231	13	8=105
1-260, 1-261, Ch.	23	7=1
1-329, Ch.	13	8=64
1-356(CO5), Ch.	13	8=160
1-366, Ch.	23	7=1
1-366(CO8), Ch.	13	8=140
1-366-66, Ch.	23	7=1
1-381, Ch.	13	8=64
1-387, Ch.	13	8=83
1-387(CO7), Ch.	13	8=118
1-387-1, Ch., 22M-1	13	8=118
1-387-1, Ch., 25M	25	9=15
1-437, Ch.	23	7=24
1-437-1, Ch.	25	9=1
		9=41
1-437-2, 1-437-3, Ch.	69	10=39
1-441, Ch.	23	7=1
		8=99
1-441(CO2), Ch.	13	8=140
1-442, Ch.	23	7=24
1-502-1, Ch.	25	9=31
1-502-2, 1-502-3, Ch.	76	10=1
1-502-5, Ch.	76	10=1
1-507-1, Ch.	76	10=22
1-507-2, Ch.	76	10=22
22B-11, Ch. 1-507-1	76	10=22
22M, Ch. 1-387(CO7)	13	8=118
22M-1, Ch. 1-387-1	13	8=118
22M-11, Ch. 1-507-1	76	10=22
22M-11A, 22M-11B, Ch. 1-507-2	76	10=22
23B, Ch. 1-387-1	13	8=118
23B-11, Ch. 1-507-1	76	10=22
23M, Ch. 1-387-1	13	8=118
23M-11, Ch. 1-507-1	76	10=22
24M-1, Ch. 1-387-1	13	8=118
25M, Ch. 1-387-1	25	9=15
71M, Ch. 1-441(CO2)	13	8=140
71M-1, 72B-1, Ch. 1-502-1	25	9=31
72B-11, Ch. 1-502-3	76	10=1
72M, Ch. 1-366	23	7=1
72M, Ch. 1-366(CO8)	13	8=140
72M-1, Ch. 1-502-1	25	9=31
72M-2, Ch. 1-437-3	69	10=39
72M-11, Ch. 1-502-3	76	10=1
72M-11A, 72M-11B, Ch. 1-502-5	76	10=1
73B, Ch. 1-366(CO8)	13	8=140
73B-5, Ch. 1-437-3	69	10=39
73B-11, Ch. 1-502-3	76	10=1
73M, Ch. 1-366	23	7=1
73M, Ch. 1-366(CO8)	13	8=140
73M-1, 73M-2, Ch. 1-502-2	76	10=1
73M-3, 73M-5, 73M-6, Ch. 1-437-3	69	10=39
73M-11, Ch. 1-502-3	76	10=1
74B-1, Ch. 1-437-1	25	9=41
74B-2, Ch. 1-437-2	69	10=39
74M, Ch. 1-356(CO5)	13	8=160
74M-1, Ch. 1-437-1	25	9=41
74M-2, 74M-3, Ch. 1-437-2	69	10=39
75B, 75M, Ch. 1-437-1	25	9=1
1110X, Ch. 1-329	13	8=64
1210X, Ch. 1-381	13	8=64

MODEL	PACK	PAGES
SYLVANIA ELECTRIC PRODUCTS INC. (Cont'd)		
2221M, Ch. 1-387	13	8=83
4120M, 4130B, Ch. 1-260, 1-261	23	7=1
4130E, Ch. 1-260	23	7=1
4130M, 4130W, Ch. 1-260, 1-261	23	7=1
6110X, Ch. 1-261	23	7=1
6120B, 6120M, 6120W, Ch. 1-260, 1-261	23	7=1
6130B, 6130M, 6130W, Ch. 1-260, 1-261	23	7=1
7110X, Ch. 1-366	23	7=1
7110XB, Ch. 1-441	23	7=1
		8=99
7110XF, Ch. 1-366-66	23	7=1
7110XFA, Ch. 1-442	23	7=24
7111M, Ch. 1-441	23	7=1
		8=99
7111MA, Ch. 1-366	23	7=1
7120B, 7120M, 7120W, Ch. 1-366	23	7=1
7120BF, 7120MF, Ch. 1-366-66	23	7=1
7120MFA, Ch. 1-442	23	7=24
7120WF, Ch. 1-366-66	23	7=1
7130, 7130M, 7130W, Ch. 1-366	23	7=1
7130BF, 7130MF, Ch. 1-366-66	23	7=1
7130MFA, Ch. 1-442	23	7=24
7130WF, Ch. 1-366-66	23	7=1
7140MA, 7140WA, Ch. 1-437	23	7=24
TECH-MASTER PRODUCTS CO. (VIDEOLA)		
17U-A, Ch.	14	8=1
630D19, 630S10	69	10=1
1930 Final, 1930D	69	10=1
2430, 2431C, 2431P	69	10=1
5116, Ch. 17U-A	14	8=1
TELE KING CORP.		
K-21, K-21B, K-22, Ch. TVJ	41-A	9=1
K-71, K-72, K-72B, Ch. TVJ	41-A	9=1
K-73L, K-74, Ch. TVJ	41-A	9=1
KC-21, KC-21B, Ch. TVJ	41-A	9=1
KC-71, KC-71B, Ch. TVJ	41-A	9=1
KD-21M, KD-22B, Ch. TVJ	41-A	9=1
KD-71, KD-72B, Ch. TVJ	41-A	9=1
TVG, Ch.	41-B	7=1
TVJ, Ch.	41-A	9=1
172LO, 172M, Ch. TVG	41-B	7=1
174LO, 174M, Ch. TVG	41-B	7=1
202LO, 202M, Ch. TVG	41-B	7=1
203, 205, Ch. TVG	41-B	7=1
916, 916CAF, Ch. TVG	41-B	7=1
919, 919CAF, Ch. TVG	41-B	7=1
1014, 1016, Ch. TVG	41-B	7=1
TELEKIT See ELECTRO-TECHNICAL INDUSTRIES		
TELEQUIP RADIO CO.		
C517, C517B, Ch. 5050, 5050A	14	8=1
C617, C617B, Ch. 5050, 5050A	14	8=1
C720, C720B, Ch. 5050, 5050A	14	8=1
C820, C820B, Ch. 5050, 5050A	14	8=1
T417, T417B, T620, Ch. 5050, 5050A	14	8=1
12TR	41-B	6=1
14T, 14TR	41-B	6=1
16T, 16TR	41-B	6=1
19T, 19TR	41-B	6=1
5050, 5050A, Ch.	14	8=1
TELE-TONE RADIO CORP.		
TAA, TAB, Ch.	41-A	6=9
TAG, Ch.	41-A	6=18
		7=4
TAJ, Ch.	41-A	6=18

TELE-TONE RADIO CORP (Cont'd)

TELEVISION EQUIPMENT CORP.

TRAD TELEVISION CORP.

TRANS-VUE CORP.

TRAV-LER RADIO CORP.

TRUETONE

See WESTERN AUTO SUPPLY CO.

VIDAIRE TELEVISION CO.

VIDEOLA

See TECH-MASTER PRODUCTS CO.

VIDEO PRODUCTS CORP.

JOHN WANAMAKER

JOHN WANAMAKER (Cont'd)

WESTERN AUTO SUPPLY CO. (TRUETONE)

WESTINGHOUSE ELECTRIC CORP.

WESTINGHOUSE ELECTRIC CORP. (Cont'd)

WESTINGHOUSE ELECTRIC CORP. (Cont'd)

ZENITH RADIO CORP.

MODEL	PACK	PAGES
ZENITH RADIO CORP. (Cont'd)		
G2951, Ch. 29G20, Stratosphere	42-B	3=1
G2951R, Ch. 29G20, Stratosphere	42-B	3=1
G2952R, Ch. 29G20, St. Regis	42-B	3=1
H-2029R, H 2030E, H-2030R, Ch. 20H20	15	8=1
H-2041R, Ch. 20H20	15	8=1
H-2052R, H-2053R, Ch. 20H20	15	8=1
H2226E, Ch. 22H20	42-A	6=1
H2226R, Ch. 22H20, Warton	42-A	6=1
H2226RQ, Ch. 22H20	42-A	6=1
H2227E, Ch. 22H20, Garland	42-A	6=1
H2227EQ, Ch. 22H20	42-A	6=1
H2227R, Ch. 22H20, Walpole	42-A	6=1
H2227RQ, Ch. 22H20	42-A	6=1
H2250R, Ch. 22H20, Lowell	42-A	6=1
H2250RQ, Ch. 22H20	42-A	6=1
H2255E, Ch. 22H20, Morley	42-A	6=1
H2255EQ, Ch. 22H20	42-A	6=1
H2328E, Ch. 23H22	42-A	6=1
H2328EZ, Ch. 23H22Z	42-A	6=1
H2328R, Ch. 23H22, Walton	42-A	6=1
H2328RQ, Ch. 23H22	42-A	6=1
H2328RQZ, H2328RZ, Ch. 23H22Z	42-A	6=1
H2329R, Ch. 23H22, Burton	42-A	6=1
H2329RQ, Ch. 23H22	42-A	6=1
H2329RZ, Ch. 23H22Z	42-A	6=1
H2352R, Ch. 23H22, Mansfield	42-A	6=1
H2352RQ, Ch. 23H22	42-A	6=1
H2352RQZ, H2352RZ, Ch. 23H22Z	42-A	6=1
H2353E, Ch. 23H22, Meredith	42-A	6=1
H2353EQ, Ch. 23H22	42-A	6=1
H2353EQZ, H2353EZ, Ch. 23H22Z	42-A	6=1
H2437E, Ch. 24H20, Fielding	42-A	6=1
H2437EQ, Ch. 24H20	42-A	6=1
H2437R, Ch. 24H20, Irving	42-A	6=1
H2437RQ, Ch. 24H20	42-A	6=1
H2438R, Ch. 24H20, Aldrich	42-A	6=1
H2438RQ, Ch. 24H20,	42-A	6=1
H2439R, Ch. 24H20, Coleridge	42-A	6=1
H2445R, Ch. 24H21, Tennyson	42-A	6=1
H2445RQ, Ch. 24H21	42-A	6=1
H2447R, Ch. 24H21, Byron	42-A	6=1
H2447RQ, Ch. 24H21	42-A	6=1
H2449E, Ch. 24H20, Churchill	42-A	6=1
H-2868R, Ch. 20H20	15	8=1
H-3074R, Ch. 20H20	15	8=1
H3267, Ch. 24H20, Hawthorne	42-A	6=1
H3267R, H3267RQ, Ch. 24H20	42-A	6=1
H3469E, Ch. 24H20, Wordsworth	42-A	6=1
H3469EQ, Ch. 24H20	42-A	6=1
H3475R, Ch. 24H20, Kilmer	42-A	6=1
H3475RQ, Ch. 24H20	42-A	6=1
H3477R, Ch. 24H21, Thackeray	42-A	6=1
H3477RQ, Ch. 24H21	42-A	6=1
H3478E, Ch. 24H21, Shelley	42-A	6=1
H3478EQ, Ch. 24H21	42-A	6=1
J2026R, Ch. 20J22, Hawthorne	21	9=1
J2027E, Ch. 20J21, Barrett	21	9=1
J2027R, Ch. 20J21	21	9=1
J2029E, J2029R, Ch. 20J21, Markham	21	9=1
J2030E, Ch. 20J21	21	9=1
J2030R, Ch. 20J21, Fielding	21	9=1
J2040E, Ch. 20J21, Conrad	21	9=1

MODEL	PACK	PAGES
ZENITH RADIO CORP (Cont'd)		
J2042R, Ch. 20J21, Galsworthy	21	9=1
J2043R, Ch. 20J21, Wordsworth	21	9=1
J2044E, Ch. 20J21	21	9=1
J2044R, Ch. 20J21, Walton	21	9=1
J2051E, Ch. 20J22, Coleridge	21	9=1
J2053R, Ch. 20J22, Chesterton	21	9=1
J2054R, Ch. 20J22, Thackeray	21	9=1
J2055R, Ch. 20J22, Carlyle	21	9=1
J2126R, Ch. 21J21	21	9=1
J2127E, J2127R, Ch. 21J20	21	9=1
J2129E, J2129R, Ch. 21J20	21	9=1
J2130E, J2130R, Ch. 21J20	21	9=1
J2140E, J2142R, J2143R, Ch. 21J20	21	9=1
J2151E, J2153R, J2154R, J2144E, J2144R, Ch. 21J20	21	9=1
J2155R, Ch. 21J21	21	9=1
J2868R, Ch. 20J21, Kipling	21	9=1
J2968R, Ch. 21J20	21	9=1
J3069E, Ch. 20J21, Barrie	21	9=1
J3169E, Ch. 21J20	21	9=1
K1812E, K1812R, Ch. 19K22	77	10=1
K1815E, K1815R, Ch. 19K20	77	10=1
K1820E, K1820R, Ch. 19K20	77	10=1
K1846E, K1846R, Ch. 19K20	77	10=1
K1850E, K1850R, K1880R, Ch. 19K20	77	10=1
K2229R, Ch. 19K23	77	10=1
K2230E, K2230R, Ch. 21K20	77	10=1
K2240E, K2240R, Ch. 21K20	77	10=1
K2258R, Ch. 19K23	77	10=1
K2260R, K2263E, Ch. 21K20	77	10=1
K2266, K2266R, Ch. 21K20	77	10=1
K2267E, K2268R, Ch. 21K20	77	10=1
K2270H, K2270R, Ch. 21K20	77	10=1
K2286R, K2288E, Ch. 19K23	77	10=1
K2290R, K2291E, Ch. 21K20	77	10=1
19K20, 19K22, 19K23, Ch.	77	10=1
20H20, Ch.	15	8=1
20J21, 20J22, 21J20, 21J21, Ch.	21	9=1
21K20, Ch.	77	10=1
22H20, 23H22, 23H22Z, Ch.	42-A	6=1
24H20, 24H21, Ch.	42-A	6=1
27F20, Ch.	42-B	3=1
27T965R, Ch. 27F20, Broadmoor	42-B	3=1
28F20, Ch.	42-B	3=1
28F21, Ch.	42-B	3=1
28F22, Ch.	42-B	3=1
28F23, Ch.	42-B	3=1
28F25, Ch.	42-B	3=1
28T925E, Ch. 28F22, Biltmore	42-B	3=1
28T925R, Ch. 28F22, Mayflower	42-B	3=1
28T926E, Ch. 28F25, Saratoga	42-B	3=1
28T926R, Ch. 28F25, Claridge	42-B	3=1
28T960E, Ch. 28F20, Waldorf	42-B	3=1
28T960K, Ch. 28F20, Derby	42-B	3=1
28T961E, Ch. 28F21, Wilshire	42-B	3=1
28T962R, Ch. 28F20, Warwick	42-B	3=1
28T963R, Ch. 28F21, Newport	42-B	3=1
28T964R, Ch. 28F23, Stratoshpere	42-B	3=1
29G20, Ch.	42-B	3=1
37T996RLP, Ch. 28F23, Sovereign	42-B	3=1
37T998RLP, Ch. 28F20, Gotham	42-B	3=1
42T999RLP, Ch. 28F23, Marlborough	42-B	3=1

ADDITIONS and CORRECTIONS RIDER'S TV MANUAL 11

Here are more data that will keep your RIDER'S DEPENDABLE REPLACEMENT PARTS LISTING published in TV Volume 11 up to date.

Set Mfr.	Set Mfr.'s Original Part No.	
FIXED CAPACITORS		
Motorola	21K38951	Add NPO-CN-1-4mmf to Aerovox column.
"	"	Add Z009 to Cornell-Dubilier column.
"	21K710903	Add N150-HVD4-47mmf to Aerovox column.
"	21K470329	Add N150-CN-1-30mmf to Aerovox column.
"	21R115641	Add N750-CN-1-56mmf to Aerovox column.
Sylvania	166-0043P	Add 5TCC-Q43J to Sprague column.
ELECTROLYTIC CAPACITORS		
Crosley	154098	Add B078 to Cornell-Dubilier column.
"	154099	Add D109 to Cornell-Dubilier column.
"	154103	Add BR550 to Cornell-Dubilier column.
"	154104	Add BR105 to Cornell-Dubilier column.
Hoffman	4238	Add PRS150/4 to Aerovox column.
"	"	Add BBR2-50T to Cornell-Dubilier column.
"	"	Add TC302 to Mallory column.
"	4239	Add PRS25/25 to Aerovox column.
"	"	Add BR255A to Cornell-Dubilier column.
"	"	Add TC36 to Mallory column.
Majestic	C-5.421-7	Add AFH4-67 to Aerovox column.
"	"	Add D052 to Cornell-Dubilier column.
"	"	Add TVL-4763 to Sprague column.
Montgomery Ward	45X395	Add AFH3-142* to Aerovox column and *Parallel Sections to Remarks column.
"	"	Add C109 to Cornell-Dubilier column.
"	"	Add FP 375 to Mallory column.
"	"	Add TVL-3722** to Sprague column and **Omit 20mf Section to Remarks column.
"	45X399	Add AFH3-137 to Aerovox column.
"	"	Add C097 to Cornell-Dubilier column.
"	"	Add FP 366 to Mallory column.
"	"	Add TVL-3682 to Sprague column.
"	45X401	Add PRS25/100 to Aerovox column.
"	"	Add BRH251A to Cornell-Dubilier column.
"	"	Add TC 250 to Mallory column.
"	"	Add TVA-1207 to Sprague column.
Packard-Bell	24048	Add AFH3-43 to Aerovox column.
"	"	Add C034 to Cornell-Dubilier column.
"	"	Add FP376.8 to Mallory column.
"	24049	Add AFH2-103 to Aerovox column.
"	"	Add C105 to Cornell-Dubilier column.
"	"	Add FP277-CE6* to Mallory column and *CE6=Insulating Sleeve to Remarks column.
Philco	30-2584-6	Add AFH4-13* to Aerovox column and *Parallel 20 & 10 mf Sections to Remarks column.
Sears, Roebuck	A20135	Add BRD1145A & BR1045A to Cornell-Dubilier column.
Stromberg-Carlson	111012	Add PRS50/50 to Aerovox column.
"	"	Add BR505 to Cornell-Dubilier column.
"	"	Add TC39 to Mallory column.
"	111093	Add PRS150/4 to Aerovox column.
"	"	Add TVA-1301 to Sprague column.

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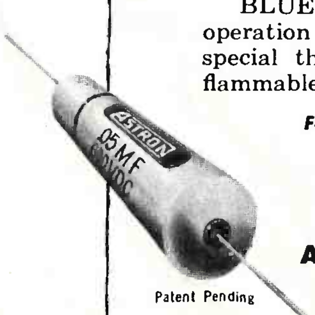

Patent Pending

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†Trade Mark Safety Margin capacitors for every radio, television and electronic use.

Replacement Parts In TV Receivers

Part 2 - Transformers (Continued)

by John F. Rider

This is the eighth in a series of articles on "Replacement Parts in TV Receivers."

Common usage has lead to the acceptance of the words "power transformer" to mean the device which is a part of the power supply of the conventional a-c receiver, and performs the function of supplying the plate voltage for the rectifiers and the filament voltage for the rectifier heater, and for the heaters (or filaments) of the tubes in the receiver. This is not a contradiction of the previous use of the name as a general category, and the plate-filament transformer as one of the types within this category. Rather it is an attempt to fall in line with practical identification instead of using the strictly technical approach.

In Fig. 1 is shown a schematic symbolization of a conventional low voltage power supply as used in a TV receiver, inclusive of three extra filament windings, F sec. 2, 3, and 4, as sources of heater voltage for the

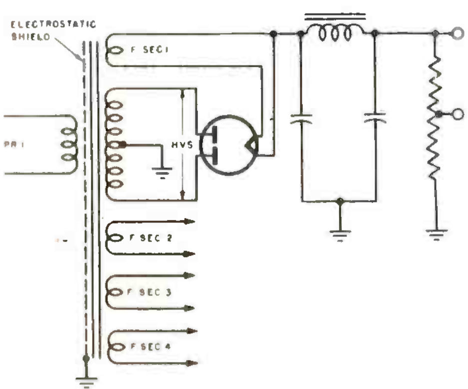


Fig. 1—Schematic symbolization of a conventional low voltage power supply as used in a TV receiver.

tubes in the receiver. The rectifier system is full-wave, hence the high-voltage winding HVS is center-tapped. The filament windings F sec. 1, 2, 3, and 4 are without center-tap because they are intended to supply heater voltages to cathode type tubes, with the exception of the power supply rectifier.

The transformer shown in Fig. 1 is a typical example. Variations from this particular organization of windings are plentiful; some transformers have fewer filament windings, but occasionally as many as five will be found. Those transformers which are intended for half-wave rectifiers use high-voltage windings without center-taps; however the presence of a center-tap is no limitation inasmuch as it does not have to be used. Hence the center-tapped transformer is suitable for use in the half-wave rectifier system, as well as the full-wave system, bearing in mind of course that the output voltage between one extreme terminal of the high-voltage winding and the center-tap amounts to half the voltage output available between the two extreme terminals.

Still another example of winding organization on a typical power transformer which may be found in television receiver power supplies is shown in Fig. 2. The presence of only two filament windings, in addition to the supply for the power supply rectifiers, instead of the three illustrated in Fig. 1, is deliberate to show a variation. A more significant difference however is found in the high-voltage winding. In this instance the high-voltage winding has five terminals; the center-tap, CT, is common to a high-voltage winding terminating in A-B, and for the medium voltage winding terminating in D-E. These two pairs of terminals feed two separate full-wave rectifying systems, each of which has its own individual filter system, thus a single power transformer serves two separate power supplies.

The specific organization of windings on a power transformer is determined by the requirements of the system which uses it. Some receivers may be designed for the kind of transformer illustrated in Fig. 2, whereas others, which are in the majority, require units like those shown in Fig. 1. Obviously the single voltage center-tapped type is not suitable for use where the multi-voltage variety is required, whereas the latter is usable where the former is required, provided that: (1) the voltage and current constants are correct, (2) the required number of filament windings are available, (3) the physical and test specification requirements are satisfied, and (4) the design of the transformer relative to electrostatic and electromagnetic shielding conforms with the need.

Obviously the suitability of a power transformer as a replacement for original receiver equipment is controlled by a number of factors. All of them influence the final selection; and, while every one may not seem

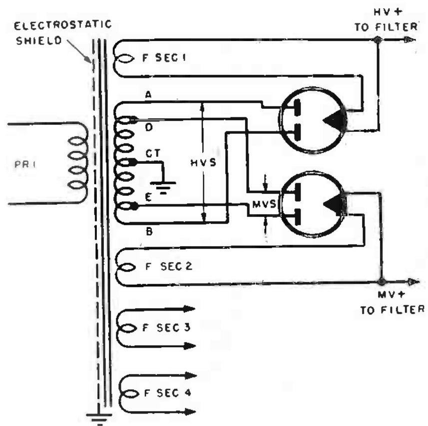


Fig. 2—Another example of winding organization on a typical power transformer which may be found in a receiver power supply.

equally important, none of these factors can be disregarded if convenience of use, ease of application, and the desired electrical performance are to be achieved.

Factors That Control Power Transformer Selection

As mentioned above, there are several factors which give rise in one way or another to at least two general sub-groups of power transformers. The distinction is based on the physical features of the component. Figure 3 shows three types of power transformers that differ in physical features. Each of these may duplicate the electrical capabilities of the others, both as to electrical constants and organization of the windings, yet is not a suitable replacement for the other.

Physical Features

For example Fig. 3A shows the outline of a typical power transformer that is intended for "through-chassis" mounting. An opening is provided in the chassis, and the bottom half of the transformer extends into the underside of the receiver chassis, the transformer being fastened to the chassis by means of bolts which also hold the trans-

(continued on page 29)

TELL-A-FAULT Symptom Sheet

REDUCED PICTURE WIDTH

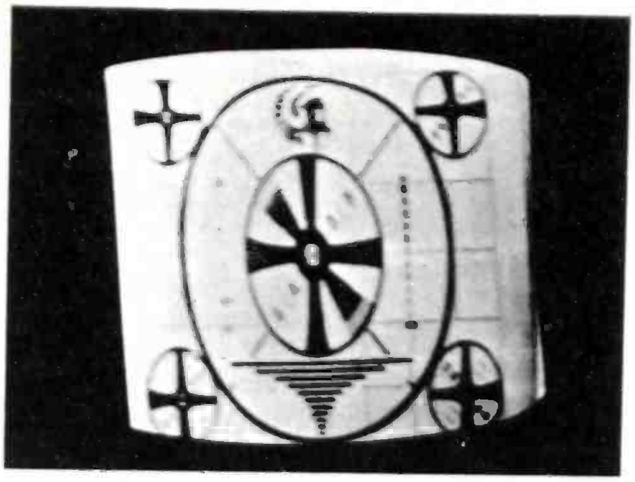
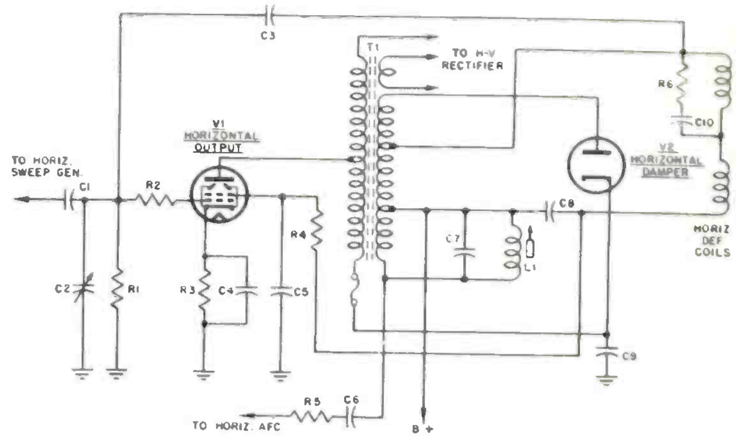


FIG. 1

(NOTE: Refer to CIRCUIT GUIDE IV-3 for identification of components.)

A faulty picture-tube pattern is shown in Fig. 1 in which the width of the pattern has been reduced. In addition, poor picture focus and decreased brightness were in evidence.



NORMAL

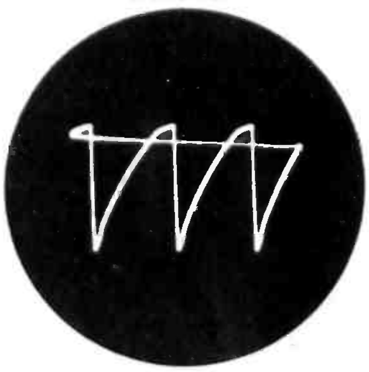


FIG. 2

The waveform at the horizontal-sweep generator was normal. With the scope connected to the grid of the horizontal-output tube *(V1)*, the normal waveform shown in Fig. 2 appeared with F=H/3. However, the P-P value of the voltage was about 10% below normal, while the d-c voltage was only about 2/3 of the proper negative value.

NORMAL

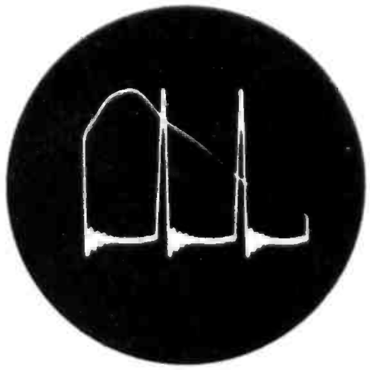


FIG. 3

The waveform at the plate of *V1*, taken through a capacitive-divider probe, was also normal as shown in Fig. 3. But the P-P amplitude was about 40% below normal, while the d-c voltage at this point was only about ¾ of the normal value.

NORMAL

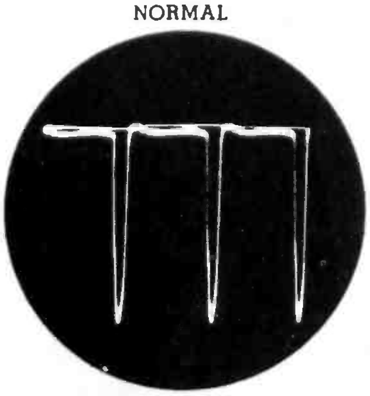


FIG. 4

The scope was then connected to the plate of the damper tube *(V2)*, at which point the waveform shown in Fig. 4 appeared (F=H/3). This waveform had a normal appearance but its P-P amplitude was only ½ of the normal value.

NORMAL

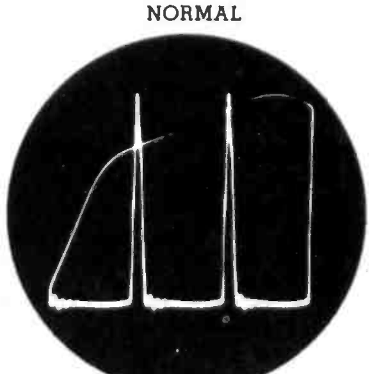


FIG. 5

The waveform at the junction of *C6* and the bottom end of the horizontal-output transformer secondary winding also appeared normal (see Fig. 5, F=H/3). The P-P amplitude was only 1/3 of the normal value however.

The receiver fault which produced the above effects was a defective capacitor C7. This capacitor, which is shunted across the width coil *(L1)*, was found to have high leakage.

Mismatched Television Components

Part 2 - Deflection Yoke (Horizontal Windings)

by Sidney C. Silver

This is the third and last of a series of articles on Mismatched TV Components.

The Third Case: Deflection Angle Changed

Once again the original yoke was restored and the receiver readjusted for a normal picture and otherwise normal operation, waveforms and voltages being checked to confirm this condition. It was then decided to investigate another criterion critical in the choice of a proper replacement for a defective yoke. A yoke was accordingly sought out whose vertical and horizontal inductance ratings met the requirements of the circuit, but whose designed deflection angle differed from that of the 70-degree unit originally used. Such a one could not be found, in this case, but a 53-degree yoke was on hand

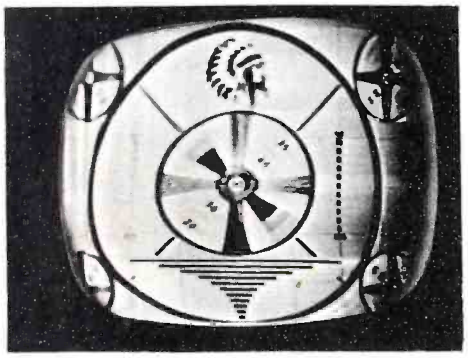


Fig. 1. Pattern produced by yoke with wrong deflection angle.

whose inductance ratings exactly matched those of the first substitution mentioned in this series of tests. In other words, a standard of performance was still available in that performance with the 53-degree yoke could be compared—not with the performance of the original part—but with the operation of the yoke discussed as *The First Case: Yoke Inductance Reduced* in the preceding portion of this article (see last month's issue of SUCCESSFUL SERVICING).

That yoke, like this one, had a horizontal winding whose inductance was 9 millihenries. The deterioration in performance with the first replacement yoke now becomes the standard of comparison. Changes in appearance of the picture-tube pattern, in waveforms, and in voltage and current readings in this third case must be checked against changes that occurred with the first substitution.

As before, the substitute yoke was placed in operation, and conditions were observed both before and after readjustment of the preset controls. Readjustment of these controls had little effect on appearance of picture and waveforms or on voltage and current readings. The following had to be reset, and then with only partially successful restoration of acceptable operation: width, horizontal linearity, height, vertical linearity, focus, brightness, vertical centering, horizontal centering, horizontal drive, and ion trap. Under any condition of adjustment, the following symptoms were clearly evident: There was considerable ringing at the left-hand side of the raster; neck shadow was marked at more than one point; there was a substantial loss of width; vertical and horizontal nonlinearity were apparent; brightness was decreased; and acceptable focus could not be obtained under any combination of adjustments. The pat-

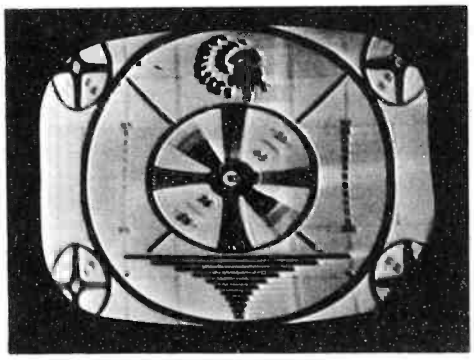


Fig. 2. Pattern obtained with comparison yoke (deflection angle correct).

tern in Fig. 1 illustrates the receiver's performance. Note that the symptoms are far more severe than those observed for the first substitution (see Fig. 2), where a yoke having the correct deflection angle of 70 degrees was used.

Similar changes were noted with respect to waveforms and meter readings. The voltage pulse at the plate of the horizontal output tube is shown in Fig. 3. The comparison pulse shown in Fig. 4 was taken under the same conditions when the first substitution was in place. In Fig. 3, the undamped oscillations during the horizontal portion of the trace continue over the full span of the trace, instead of dying out toward the right as occurs in Fig. 4. In addition, these oscillations are of greater relative amplitude. This corresponds to the ringing at the left-hand portion of the raster. Also observe the change in shape of the flyback portion of the pulse. P-P amplitude of the pulse is now 2,700 volts as compared to 3,500.

Although the change in the shape of the current sawtooth observed in the horizontal windings of the yoke were not as severe, they were clearly evident. There was a slight drop in amplitude, and the shape, which was still recognizable as a sawtooth, showed irregular curvature.

With the original yoke in place, second-anode voltage was at the rated value of 15 kv. With the first, 9-millihenry, 70-degree, substitution it fell to 12.8 kv. With the 9-millihenry, 53-degree substitution it fell further to 10.6 kv. Current at the plate of the output tube, normally about 95 ma, had risen to 110 ma with the first replacement. In this case, it rose still further to 120 ma. Plate voltage (boosted B-plus) fell from a normal value of 360 volts to 310 volts when the first substitution was attempted. In this instance it fell to 250 volts. There was a corresponding drop in the overall d-c power-supply output.

The evidence is here. There was a considerable amount of overall effect on operation that had to be attributed exclusively to the fact that a 53-degree yoke was used in place of a 70-degree component.

Overall Considerations

What conclusions can be drawn, at this point, concerning allowable degrees and types of mismatch with respect to yokes in general? Such conclusions are studiously avoided here for the simple reason that no *general* statements are workable. In the la-

(continued on page 31)

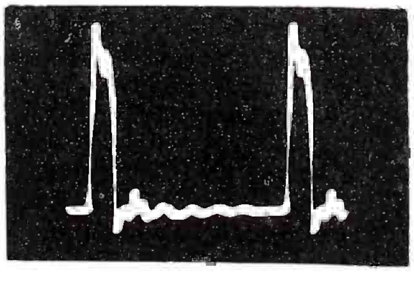


Fig. 3. Voltage waveform, plate of the horizontal-output tube: incorrect deflection angle in yoke.

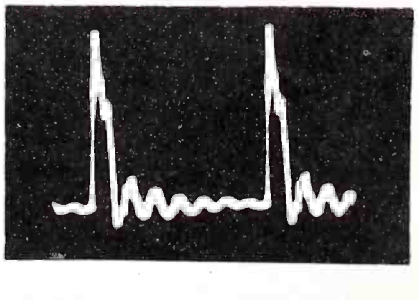


Fig. 4. Voltage waveform, plate of the horizontal-output tube: correct deflection angle in yoke.

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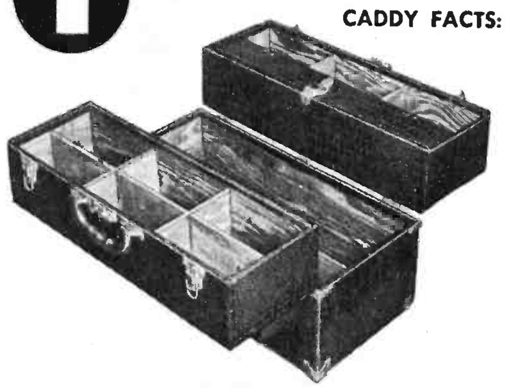

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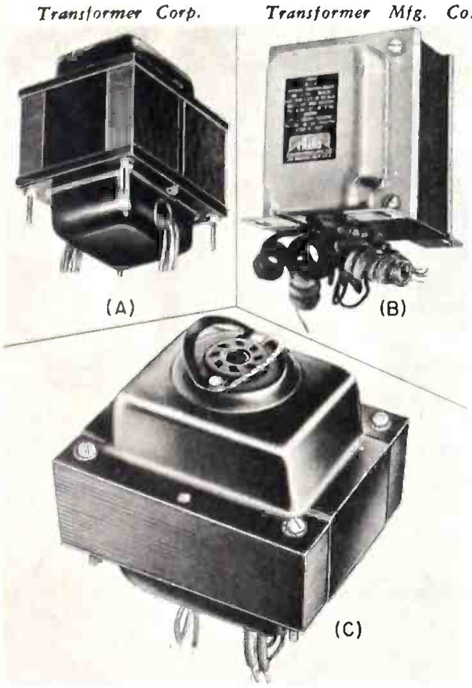
REPLACEMENT PARTS, ETC.

(Continued from page 25)

former laminations in place. Bearing in mind the limited space that usually prevails, and also that the usual location of the power transformer is at one corner of the chassis, it stands to reason that with the hole already cut in the chassis, the physical dimensions of the transformer must conform pretty much to the space provided.

(A) Courtesy Standard Transformer Corp. *(B) Courtesy Triad Transformer Mfg. Co.*



(C) Courtesy Merit Coil and Transformer Corp.

Fig. 3—Three types of power transformers that differ in physical features

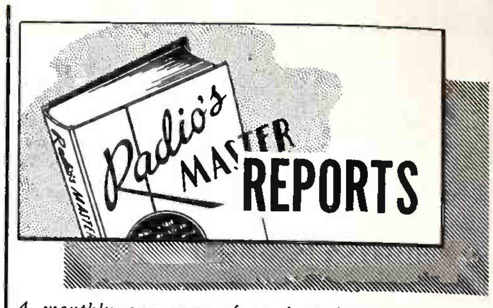
A little latitude is usually available in all three dimensions, but not too much. If the shell passes through the hole provided for it very readily, there is a little play left in the event that the mounting bolts are slightly farther apart than the holes provided for them, but if the shell is too large to fit in the hole provided, making the hole larger by filing may not be the answer, because sufficient room may not be available. Moreover, this type of fabrication should not be expected of the service technician because neither he nor the public should pay for the time required to accomplish this adaptation. Where room exists and it may be necessary to drill two new holes for the mounting bolts, this labor is not too much.

Neglecting for the moment the matter of fabrication to make a power transformer fit the space, it is obvious that where a "through-chassis" type is needed no other physical variety will do. In this connection we hasten to comment on a special version of this kind of transformer; the type which already mounts the rectifier tube socket, and the connections to the plates and heater terminals are made internally inside the shell. This special kind is illustrated in Fig. 3C.

An "above-chassis" type of power transformer is illustrated in Fig. 3B. This is a typical unit, but does not necessarily reflect the multitude of shapes which are encountered. Regardless of this variable, this kind of transformer offers a little more leeway in mounting than does the "through-chassis." Since the transformer is mounted on top of the chassis, the bottom surface area is not as rigidly bounded by space limitations, though limits do exist. On occasion it will be found that very little extra room is available because other components surround the power transformer. This is especially true in the case of some rectifier sockets which are so located as to prevent locating a transformer with a larger base area than the original, without having one side of the transformer extend slightly beyond the edge of the chassis. This causes no harm, provided that the amount that protrudes does not prevent proper positioning of the chassis in the cabinet.

Recognizing the limits which exist in height, width, and depth dimensions for an "above-chassis" mounted power transformer, conformance to shape is not the most important detail; conformance with physical space requirements set by the original component is the pertinent requirement. Of course it is assumed that all electrical details are satisfied. But even here it is necessary to pay heed to another physical feature of "above-chassis" mounted power transformers. This is the location of the opening through which the transformer leads leave the shell. Usually they are located on the bottom of the transformer case, or on the side, but wherever the opening may be for these wires, it is necessary to bear in mind that they must pass through the chassis for junction with the components located underneath.

As it happens, a certain amount of standardization does exist in the base dimensions or mounting hole dimensions for power transformers used in TV receivers. These are 3" x 3¾", but are subject to variations depending on the design of the receiver and the space provided for the power transformer.



A monthly summary of product developments and price changes supplied by RADIO'S MASTER, the Industry's Official Buying Guide, available through local parts distributors.

COMMENT: This month has seen the largest number of manufacturers reporting product changes in their lines. Over the last few months, as noted in previous columns, Antenna, Sound and Audio, Test Equipment and Tube Manufacturers have been the most active of the product groups.

New Items

AMERICAN PHENOLIC—Added Model 114-058 Corner Reflector at $7.50 dealer net.
AMPEX ELECTRIC—Added Audio Magnetic Tape Duplicator; Series 350 Audio Magnetic Tape Reproducers; Series 450 Audio Magnetic Tape Reproducers.
BEAM INSTRUMENTS—Added Tannoy "Westminster" Wall Type Enclosure; Tannoy "Parliament" Corner Type Enclosure. (Mahogany cabinet at $125.00 dealer net; Blonde cabinet at $130.00 dealer net.)
BERLANT ASSOCIATES—Added Model 1503-D Dual Track Recorder at $345.00 professional user net; Model 1503-S Single Track Recorder at $345.00 professional user net.
CBS-HYTRON—Added Receiving Tubes 5AW4 at $2.65 list; 6T4 at $3.70 list; TV Picture Tubes 21AP4; 21MP4; 21WP4; 24TP4; 27RP4; Transmitting Tube 6216 at $3.50 dealer net.
CLEAR BEAM—Added Model TY-M Ty Match at $4.95 list.
CORNELL-DUBILIER—Added Model UW-2 UHF TV Antenna at $3.57 dealer net; Model UAK-3 Stacking Bars at $0.57 dealer net; Model S-6 "Superior" Conical at $3.48 dealer net.
DUMONT—Added TV Picture Tubes 17KP4 at $28.00 dealer net; 21YP4 at $41.00 dealer net; 21ZP4A at $39.50 dealer net; 24CP4 at $61.00 dealer net; 24CP4A at $75.75 dealer net.
FRETCO—Added Fretaray with UHF at $23.97 dealer net; UHF Adaptor Kit at $2.25 dealer net; Conicals Model BXF8 at $3.67 dealer net; Model BXFH8 at $3.50 dealer net; Stacking Bars (pair) at $0.66 dealer net; Elements (each) at $0.24 dealer net.
GENERAL ELECTRIC — Added Receiving Tube 6BZ27 at $3.35 list.
KENWOOD ENGINEERING—Added Model 5C-SS Chimney Mount at $2.98 dealer net.
LITTELFUSE—Added No. 313.175 at $0.25 list to their 3AG Slo-Blo Fuse Series.
LOUIS BROS.—Added Model 470FM Folded Dipole FM Antenna at $4.17 dealer net; Model 515 Sloping Wall Speaker Baffle for 15" Speaker at $6.75 dealer net; Model 715 Corner Wall Speaker Baffle for 15" Speaker at $9.30 dealer net.
OLIN INDUSTRIES—Added Model D Leakproof Battery for Portable Receivers at $0.0975 dealer net.
PERMOFLUX CORP. — Added Headset Adapter Model BMA-1 at $2.25 professional net price.
PILOT RADIO—Added TV Remote Chassis Model TV-524 at $399.50 dealer net (less picture tube); Model TV-527 at $399.50 dealer net (less picture tube); UHF Converter Model CV-602 at $37.13 dealer net.
PORCELAIN PRODUCTS—Added Guy Wire Anchor Insulators No. 1929; No. 1933.
QUAM-NICHOLS—Added new series of Intercom Speakers and new series of Outdoor Theater Speakers.
RCA—Added Transistors No. 2N32 at $15.40 dealer net; 2N33 at $23.00 dealer net; No. 2N34 at $13.40 dealer net; No. 2N35 at $18.40 dealer net; Alignment Tool No. 7800 at $1.50 dealer net.
RADIO RECEPTOR—Added Model C1709-C UHF Converter at $36.60 dealer net; No. 6QS4 Selenium Rectifier at $2.38 dealer net.
RAYTHEON—Added Receiving Tubes 1AG4 at $2.80 list; 1AH4 at $2.80 list; 1AJ5 at $2.75 list; 1V6 at $3.15 list.
RECOTON—Added new series of Diamond Replacement Needles.
SIMPSON ELECTRIC—Added Model 1000 Plate Conductance Tube Tester at $135.00 dealer net.
TURNER CO.—Added Model ADA-95D Dynamic Microphone at $21.00 dealer net.

(continued on page 32)

Mismatched Television Components

(continued from page 27)

boratory, some receivers have been shown to be fairly tolerant to mismatches; others appear to be more critical. Furthermore, it is impossible to say that any one type of receiver or type of circuit is generally broad or critical with respect to variations in component values. The same receiver that will tolerate some mismatch in the yoke will be highly critical with respect to a linearity coil, width coil, or transformer. No simple pattern emerges. A receiver that seems to accept a broad range of values elsewhere will suddenly become very choosy about the yoke.

Although the theoretical possibility always exists, it is not practical to go to the elaborate lengths required to predict, *for each individual circuit,* what the limits are that separate the allowable mismatch from the forbidden one. The integration of any horizonal-output circuit, with respect to its directly associated components as well as with respect to the rest of the receiver is far too complex.

Hidden Hazards

In the early portion of this article, which appeared last month, the statement was made that an incorrect replacement which seems to work out can be more dangerous than one which is obviously incorrect. Consider the facts. An unworkable replacement must be rejected at once. It doesn't get much of a chance to damage the set. But what happens when, through a series of adjustments—or misadjustments, a poorly chosen yoke can be made to operate with apparent success?

In any circuit, maximum efficiency and maximum transfer of energy is achieved only when all components are matched to each other. Wherever mismatch occurs, the circuit has to work more to produce less. In every case of a mismatched yoke, for example, plate current through the horizontal output tube has gone well beyond 100 ma. Yet the tube types used in this application in the large majority of receivers are rated for 100 ma maximum plate current. Because of the demands made on the horizontal output stage, it is customary to drive these tubes at or near the maximum (90-100 ma). Any change in the carefully balanced chain of components is likely to drive these tubes to the point where they will break down early and often. The flyback transformer, under these same conditions, is also likely to saturate and break down. These events are not likely to take place at once. They are more likely to occur in the form of call-backs, by which time the service technician has taken for granted the acceptability of the poor replacement and sees no connection between it and the immediate difficulty at hand.

A misadjustment of an ion trap, also done to produce apparently acceptable performance after a mismatch has been introduced, is likely to produce gradual but serious damage to the picture tube.

Secondary Effects

Innumerable troubles may arise, in the long run, which seem to have no connection with the horizontal-output circuit. The vertical-output tube in many receivers obtains its d-c voltage from the boosted B-plus supply. As has been shown in this series, this poorly regulated source can be drastically affected by a mismatched *horizontal* winding in the yoke. How long does a service technician sweat over an insoluble vertical-sweep trouble before it occurs to him to investigate operation of the horizontal-output circuit?

The three output tubes in the average tv receiver (vertical, horizontal, and audio) account for more than half the drain on the regular d-c power supply. The horizontal-output tube itself will account for half or more of this drain in a large number of sets. The series of tests shows that a mismatched yoke can be ultimately responsible for a drop of 20 percent or more in d-c supply voltage. If this fact, of itself, does not account for widespread impairment in performance, a normal slight drop in line voltage in association with it will almost inevitably have that effect.

Suppose that the receiver's keyed-agc circuit drives its keying pulse from the horizontal-output circuit, or that the horizontal-oscillator-control circuit obtains its comparison pulse from this source, as is usually the case. Poor horizontal stability or improper agc action become possibilities.

The drop in d-c supply voltage, already mentioned, can produce strange results in terms of the ensuing change in the balance of control and operating voltages. Consider the video i-f amplifiers, for example. A change in loading on these can alter i-f bandwidth. It can also influence sensitivity to signals or to noise.

What Can Be Done?

There is no intention here to give the impression that a slight mismatch in the case of replacement of any inductive component will, in all instances, result in the immediate and complete destruction of the receiver involved. Sometimes there will be serious results; sometimes there will not. However, there is no easy way of knowing in advance. The long-range solution is prevention rather than cure. The best preventive technique is the use of a replacement that is known to be acceptable.

Normally the service shop does not provide the laboratory facilities (Q meters, bridges, etc.) or allow the time required to screen out a replacement from random parts. This is so even where the critical values of

(continued on page 32)

Radio's Master Reports

(*Continued from page 30*)

TV DEVELOPMENT CORP.—Added new series of TV Guy Wire; new series of UHF Tubular Twin-Lead.
UNIVERSITY LOUDSPEAKERS — Added several new High-Fidelity Corner Enclosures for 12" Speakers.
UTAH RADIO PRODUCTS—Added a number of new Wall Baffles.
VIDAIRE ELECTRONICS — Added Model TM-1 UHF-VHF Tenna-Match at $3.15 dealer net; Model FT-100 Wave Trap Meter at $14.95 dealer net.
VIDEO INDUSTRIES—Added UHF Antennas No. 201 at $3.60 dealer net; No. 202 at $5.79 dealer net; No. 103 Stacked at $7.50 dealer net.
WEBSTER ELECTRIC—Added Model FX Replacement Cartridge at $5.10 dealer net; Model SS464 Portable Sound System at $50.25 dealer net.

Discontinued Items

BAKER MFG.—Discontinued TV Towers Models 10AM, 12AM.
BERLANT ASSOCIATES—Discontinued Model 503 Console Tray for mounting Basic Recorder; Model 702 Console Cabinet.
DUMONT—Discontinued TV Picture Tube 30BP4.
ELECTROVOX—Discontinued No. W-8A Replacement Needle for Webster Electric.
PRECISION APPARATUS—Discontinued Model 10-15PM Deluxe Tube and Battery Merchandiser.
RADIO APPARATUS CORP.—Discontinued AM Receivers Model AR-2; Model AR-3; FM Receiver Model M-101; Squelch Adapter Model MS-119.
RADIO CITY PRODUCTS — Discontinued Model 453 Master Multitester; Model 448A All Coverage Deluxe Multitester.
RCA—Discontinued Electron Tube 715-C.
RADIO RECEPTOR—Germanium Diode No. 1N82 has been discontinued.
RECOTON—Discontinued Variable Reluctance Pickups No. 155C, 155X, 165X, 175X; Acoustic Tone Arms No. 51, 61.
RIDER, JOHN F.—Discontinued No. 113 "Servicing by Means of Resistance Measurement"; No. 117 "Servicing Superheterodynes"; No. 129 "The Business Helper".
STEELMAN PHONOGRAPH & RADIO—Discontinued Model 3D3 Del Three-Speed Portable Phonograph.
SYLVANIA—Discontinued Receiving Tube 6N6G; Special Purpose Tube 5763; TV Picture Tubes 24CP4; 24VP4; 27EP4; 27GP4; 27LP4.
UNITED TRANSFORMER — Discontinued Model LS-15 Low Impedance to Grid Transformer; Model CG-303 Commercial Grade Plate Transformer.

Price Decreases

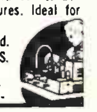
AKRO-MILS—Decreased prices on Jiffy Cabinets Model J-16 to $6.95 dealer net; Model J-24 to $9.95 dealer net.
CBS-HYTRON—Decreased prices on three 21"; one 24"; one 27" TV Picture Tubes.
CLEVELAND ELECTRONICS—Decreased price on Model 88 UHF Television Antenna to $4.77 dealer net.
CREST LABS.—Decreased prices on Voltage Booster Model LVB "Jr" to $4.05 dealer net; Cathode Ray Tube Rejuvenators Model 51 to $2.17 dealer net; Model B to $2.03 dealer net; Model C to $1.87 dealer net; Model D to $2.03 dealer net.
EBY SALES—Decreased price on No. 49-9-H Yoke Extension Harness to $1.35 dealer net.
GENERAL ELECTRIC—Decreased price on Industrial and Transmitting Type Tube GL-1B35A to $11.10 user price.
HICKOK ELECTRICAL INSTRUMENT—Decreased price on Model PR-15 R.F. Crystal Probe to $7.59 dealer net.
JFD—Decreased price on Model UHF-400 Corner Reflector to $8.97 dealer net.
RCA—Decreased prices on TV Picture Tube 27MP4 to $107.00 dealer net; Electron Tubes 5675 to $15.20 user price; 5690 to $11.25 user price.
RAM ELECTRONICS—Decreased prices on Horizontal Output Transformers No. X078 to $5.40 dealer net; No. X079 to $5.40 dealer net.
SPECIAL PRODUCTS—Decreased price on Model STAB Battery Operated Signal Tracer to $10.95 dealer net.
SYLVANIA—Decreased prices on TV Picture Tubes 27EP4 to $107.00 dealer net; 27LP4 to $107.00 dealer net; Sub-Miniature Tube 5899 to $12.30 dealer net; Microwave Crystal Diode 1N25 to $5.75 dealer net.
UNIVERSITY LOUDSPEAKERS — Decreased price on Model SA-HF Breakdown-Proof Driver Unit to $21.00 dealer net.
VIDEO INDUSTRIES—Decreased price on Five Element Yagi for Channel Six to $5.25 dealer net.

Price Increases

CBS-HYTRON—Increased prices on Receiving Tube 6BK5 to $2.55 list; TV Picture Tube 7JP4 to $21.50 dealer net.
CHICAGO INDUSTRIAL INSTRUMENT—Low Resistance Test Lead Model 1048 increased to $0.90 dealer net.
GENERAL ELECTRIC—Increased prices on Receiving Tubes 6V3 to $3.55 list; 6V6 to $3.40 list.
RCA—Increased prices on TV Picture Tube 3KP4 to $17.50 dealer net; Electron Tubes 5691 to $9.50 user price; 5692 to $9.75 user price; 5693 to $7.75 user price.
SPECIAL PRODUCTS—Increased price on Model 309 Phonograph Amplifier-Preamplifier to $18.90 dealer net.
SYLVANIA—Increased price on Sub-Miniature Tube 5896 to $8.25 dealer net.
VIDEO INDUSTRIES—Increased price on Model 103 Fan Antenna to $3.45 dealer net.
WESTINGHOUSE—Increased prices on TV Picture Tubes 17HP4/17RP4 to $38.25 list; 17LP4 to $38.25 list.

VACATION NOTICE

During the two weeks from July 27 to August 9 the staff of John F. Rider will be on vacation. This will not affect our readers in any way, though we may be a little late in answering your letters. On August 10 we'll be going full blast again to give you the best service possible.



INDEX OF CHANGES

Model No.	Manual From	Page To	Tek-File Pack
Pilot Model TV166	5-1	5-12	---
Stromberg Carlson Model TC19	5-1	5- 7	---
Stromberg Carlson Model 16 Series	5-1	5- 8	---
Tele King Chassis TVJ	9-1	9-16	41

Mismatched Components

(*continued from page 31*)

the original part and of its circuits are known. There is too little standardization of such components to allow guesswork. A prepared list of checked and dependable substitutions offers the needed margin of safety. Even where direct replacement recommendations cannot be made on the basis of available parts, the inclusion of critical values in the list provides a starting point. In any case where a questionable substitution is made, a careful sequence of checks for the shape and amplitude of waveforms, and for changes in voltages and current, should be conducted. These checks, with the replacement data and the manufacturer's service data for reference, will guard against the hidden hazards that are at least as important as the obvious defects.

SUCCESSFUL SERVICING

starts with

Your Parts Distributor

METROPOLITAN
NEW YORK — NEW JERSEY
edition
AUGUST 1953

in this issue . . .

This Program Is Needed

The editorial in this issue of SUCCESSFUL SERVICING describes a joint effort between a parts distributor and more than 350 television service facilities in the San Francisco Bay Area. We visited San Francisco in July and found the popularity of the program to be very high. Bearing in mind the importance of the independent TV service facility to the welfare of the parts distributing industry, it seems only natural that electronic parts distributors in other localities of the United States should become interested in initiating similar means of promotng the TV servicing industry.

Not only does this plan elevate the standing of the servicing industry in the eyes of the public, but it is to be remembered that the greater the activity of the service shop, the greater the sale of merchandise by parts distributors.

Equally important is that phase of the Qualified TV Service Dealer Program which results in the education of the public to appreciate the problems of servicing. This is done by the weekly television broadcasts. It is extremely important because it effects the income of the servicing industry.

The equivalent of the Qualified TV Service Dealer plan is required in all centers of population being served by television stations. When will it start in the New York area?

JOHN F. RIDER

John F. Rider Publisher, Inc. • 480 Canal St., N. Y. 13, N. Y. • Parts Distributor Representative, William J. Marcus

Sweep Generator Operation

Development of sweep, phasing and blanking

J. Richard Johnson

(This material was excerpted from Chapter 4 of the forthcoming Rider book "How To Use Signal and Sweep Generators" by J. Richard Johnson)

Types of Sweep Generators

Sweep signal generators are those which provide frequency modulation of the r-f carrier signal, so that they may be used for sweep analysis of a response curve of a radio or TV receiver or other device.

Sweep signal generators can be roughly divided into three classes — (1) those with a rather limited sweep range (up to 1 mc) designed primarily for f-m receiver alignment, (2) those designed for TV receiver alignment (sweep up to 15 mc or so) and (3) special laboratory devices with greater sweep ranges.

Although some sweep generators of type (1) have been available, they are now in the minority in practical use. This is because those of type (2) nearly always have sweep-width controls which will allow adjustment of the sweep width to a low enough value to provide for f-m receiver alignment, as well as provide for the greater sweep width necessary for TV alignment. Type (3) generators are special laboratory equipment and not of as great an interest in the field as those of type (2). Accordingly, it is type (2) which we will be concerned with mainly.

Use of Reactance Tube For Frequency Sweep

The reactance tube is one of the main methods used for providing frequency modulation in sweep generators. Let us review briefly how a reactance tube works. The reactance tube produces artificially, by electronic means, the effect of capacitance or inductance. More important, it provides the means of varying the value of that capacitance or inductance by variation of a d-c control voltage applied. If the effective capacitance or inductance produced by the reactance tube is made to form an appreciable part of the capacitance or inductance of the tuned circuit of an oscillator, the frequency of that oscillator's signal can be made to vary by the variation of a d-c control voltage applied to the reactance tube. If the d-c control voltage is made to alternate (that is, become low-frequency alternating current) the oscillator frequency also alternates and thus becomes a "sweep" frequency. This is the method used in some sweep generators to provide the desired frequency sweep.

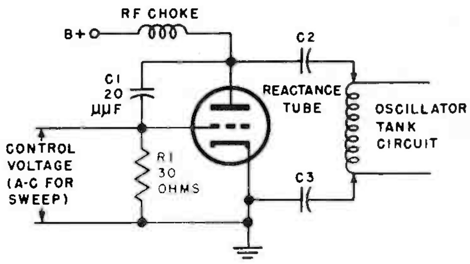


Fig. 1. Typical reactance-tube circuit as used in a sweep generator.

A typical reactance tube circuit is shown in Fig. 1. The operation is as follows:

1. R-f is coupled to the plate and cathode of the reactance tube from the oscillator tank through *C2* and *C3*.

2. This causes the reactance tube plate-cathode circuit to act as a load across the oscillator tank. The current drawn through this load depends upon the value of the grid bias, which in this case is the control voltage across *R1*.

3. Also across the oscillator tank circuit is the series combination *C1-R1*. This series circuit is designed so that the reactance of *C1* is much greater than the resistance of *R1*. The current through this circuit is therefore leading the oscillator voltage applied by nearly 90 degrees. This current through *R1* produces a voltage drop which is also nearly 90 degrees ahead of the oscillator voltage. This *R1* voltage is applied to the grid of the tube and there it acts to control the current in the plate circuit. The plate current variations are in phase with the grid voltage variations. Since the latter are almost 90 degrees *leading* with respect to the r-f voltage applied from the oscillator, the plate current is also almost 90 degrees leading with respect to the oscillator r-f voltage.

The result of all this is that, looking from the oscillator toward the reactance tube, the oscillator sees a load which draws current that leads the applied voltage by nearly 90 degrees. Since this is exactly what would happen if a capacitor were connected in place of a reactance tube, the oscillator does not distinguish it from a capacitor, and its frequency is controlled accordingly.

The larger the capacitance, the greater r-f current it will draw from the oscillator; in the same way, the more positive (or less negative) is the control voltage on the reactance tube, the more current the tube draws. Thus the more positive the control voltage, the larger will be the capacitance exhibited by the reactance tube; the more negative the control voltage, the less the capacitance.

Now if the control voltage is made to vary rapidly back and forth, we produce the same effect as though we were rapidly rotating a variable capacitor across the oscillator tank circuit. This effect causes the oscillator to change frequency rapidly in accordance with the control voltage changes. In other words, the oscillator frequency "sweeps" back and forth.

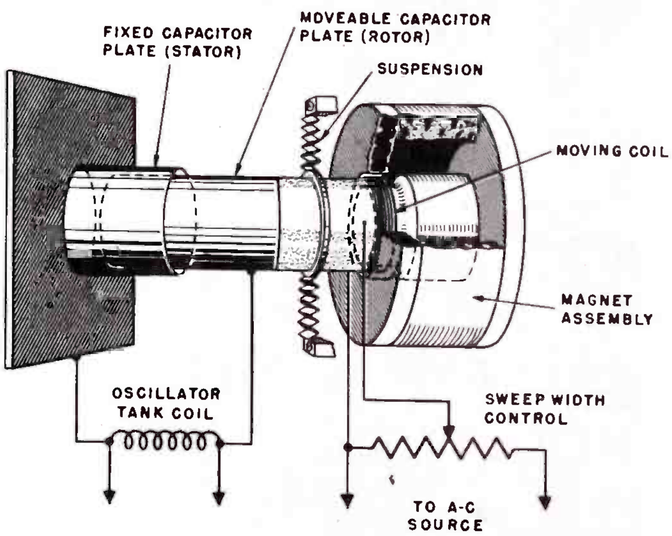
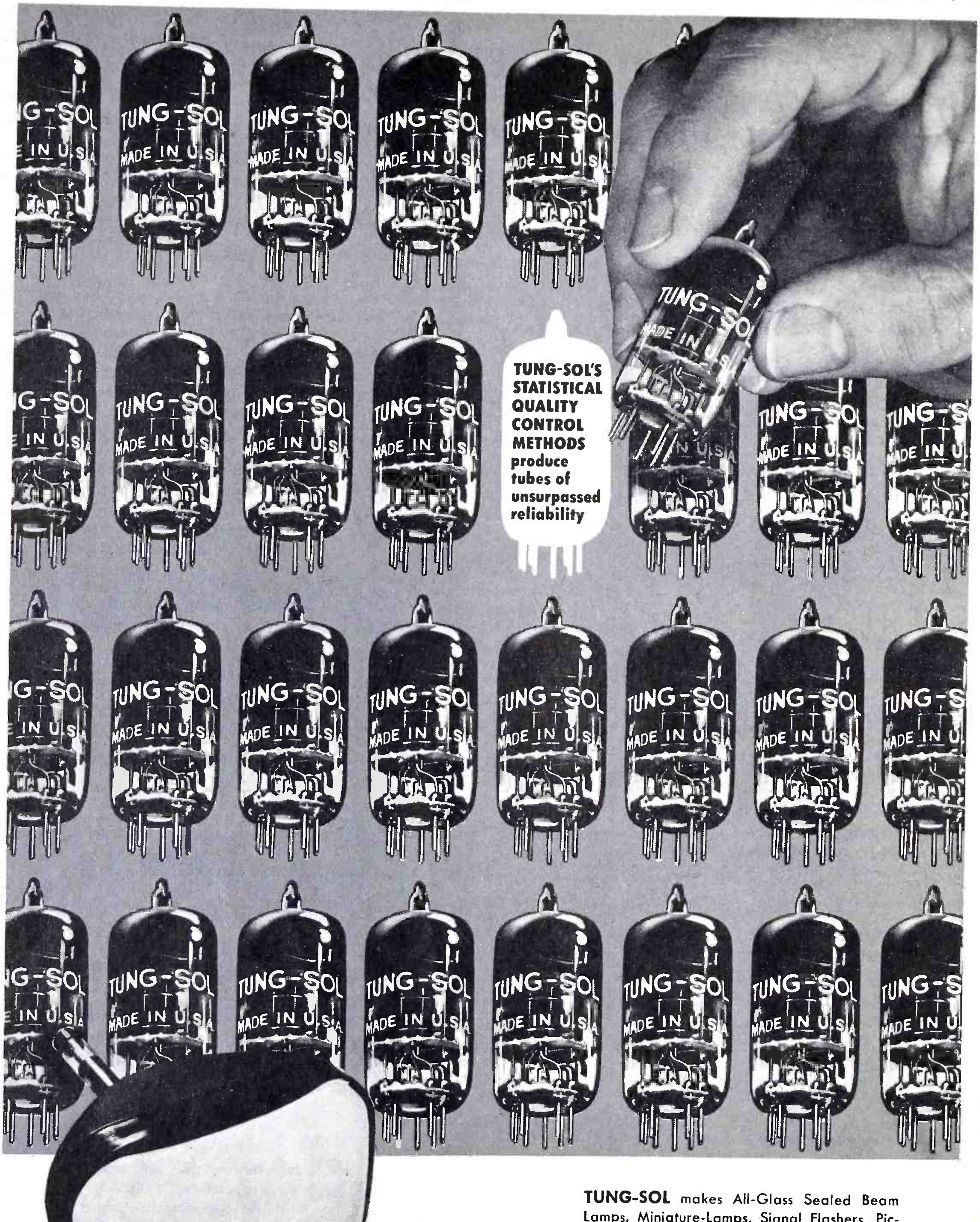


Fig. 2. A vibrating capacitor as used to produce frequency sweep.

In sweep generators of the reactance tube type, a small voltage derived from the power line is applied as control voltage. This voltage is ordinaraily 60 cps a-c sine wave, and thus causes the oscillator frequency to vary sinusoidally.

In sweep generators, the sweep width is controlled by variation of the a-c control

(continued on page 23)



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A house organ of John F. Rider Publisher, Inc., dedicated to the financial and technical advancement of electronic maintenance personnel

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RETMA MEMBER

Curtain Time

There has come into being in the San Francisco area a movement known as the GMP Qualified TV Service Dealers program. GMP stands for the George M. Popkey Co., a parts distributor in San Francisco. This organization, which fathered the program, is guiding its efforts.

In the main it is a cooperative effort among TV service dealers who have pledged themselves to abide by a set of conditions which are aimed to satisfy the jobber's needs for TV service. But it goes far beyond just living by a code of ethics.

One of its aims is to answer a difficult question asked by the public: "How do I recognize a good service shop?" The GMP organization checks the qualifications and equipment of the organization which wishes to join the group. Identification is by a distinctive label (shown in picture on page 14). It appears on the truck (s) of the service organization and identification cards carried by the technicians.

Advertising showing the group label and the names of the participating members of the group appears in local newspapers, and in the local TV Review Magazine which circulates among the public in the San Francisco Bay area. The advertising is cooperative — the service facilities make their contributions on a monthly basis and these monies are matched by the Popkey organization.

The Popkey Co. sponsors a TV program on KPIX every Wednesday night. It is a news analysis by the foremost news commentator in that area, William Winter. The commercial on this program attempts to do two things — to make the organization's distinctive label known to the public; also to educate the public to better understand the TV receiver servicing problem — to better appreciate the requirements of service — to realize that it is a technical business — that failures will occur in receivers despite claims made to the contrary in receiver advertising — that repeat calls are not necessarily due to the failure of the part recently replaced.

Just a few weeks ago, a program of cooperation was completed between this qualified TV service dealer group and a nationwide credit-card service. This is aimed to make it convenient for the service dealers in the group to extend credit to the public, yet get their money immediately. The credit-card organization receives a copy of the invoice, pays the service dealer immediately and then collects the money from the public later.

The GMP qualified service dealer program is about the best thing we have yet seen for the betterment of the TV service industry. This is proven by the fact that both large and small organizations are in it and working hand in hand. Every problem which may arise in such an effort has not yet been encountered, but it's a certainty that it will be solved. At the moment a grievance committee is in the process of formation, its purpose being to process properly any complaints if they arise from the public relative to any member of the group.

A program of this type should exist in every city and state of the nation. It is something which the TV service industry needs. It obviates the necessity for licensing. It will give the TV servicing industry stature in the eyes of the public. The unified effort of a group like this will kill off the opportunist — the fly-by-night operator — the kidnapper of a receiver who demands ransom from the public before he returns the receiver.

We must commend the George M. Popkey organization for its courage and foresight. Our sincere hope is that, somehow, the other parts distributors in the San Francisco area can see their way clear to participate in the program. If the same ideas take hold elsewhere in the nation, it would be grand if the sponsors of the program were a council of parts distributors in each locality — in this way avoiding any possibility of conflict among distributors in an area. It is to be remembered that every inch of progress made by the independent servicing group is important to the continued progress of the parts distributing industry.

Color TV

Enthusiasm for color TV seems to be growing quite rapidly. We have had occasion to visit different parts of the nation during the past few months and concerns actively engaged in the television receiver manufacturing industry are leaning toward color, although they realize that its spread across the nation will take some time.

We have said it before, and we say it again — the independent TV servicing industry is capable of handling color TV if it applies itself to the job of learning how. From where we sit, the transition from radio receivers to black and white TV was much more difficult than from black and white TV to color. . . . This does not make the color TV receiver a simple gadget. It is a far cry from a simple receiver, but it is not so complicated that the details concerning its operation and repair cannot be digested by servicing industry personnel.

The situation which bothers us most is the ability of the servicing industry to cope with color TV when it hits the market. It must be ready to do a good job if it is going to discourage the participation in servicing by all of the other agencies which have a stake in the receivers which get into the hands of the public.

Our Slogan For the Year

Mr. TV Receiver Manufacturer — make the bottom of the chassis of table model TV receivers accessible. . . . Make the bottom of the cabinet removable. . . . You'll get better service.

Set Distributor TV Servicing

TV servicing by set distributors in centers of population in different parts of the country is severe competition for the independent TV service shop. It can be discouraged by the demonstration of comparable skill and knowledge by the servicing industry. But to do this, the service technician *must know as much about the receiver as the distributor's service personnel.* . . . He must work with the same information which the set distributor has in his possession — the data which the receiver manufacturer prepared. Not abridged information — but the complete data. . . . This is the only way in which the independent TV service shop can match the experience of the factory-trained service specialist — the accumulation of hints and kinks and cures which the set distributors have in their files. . . .

Some information is better than nothing — but incomplete information will never compete successfully with all the facts! Only with the complete information on hand can the TV service technician do the kind of a service job which will assure his continuance in business.

John F. Rider

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the Raytheon tv *service saver*

by John F. Rider

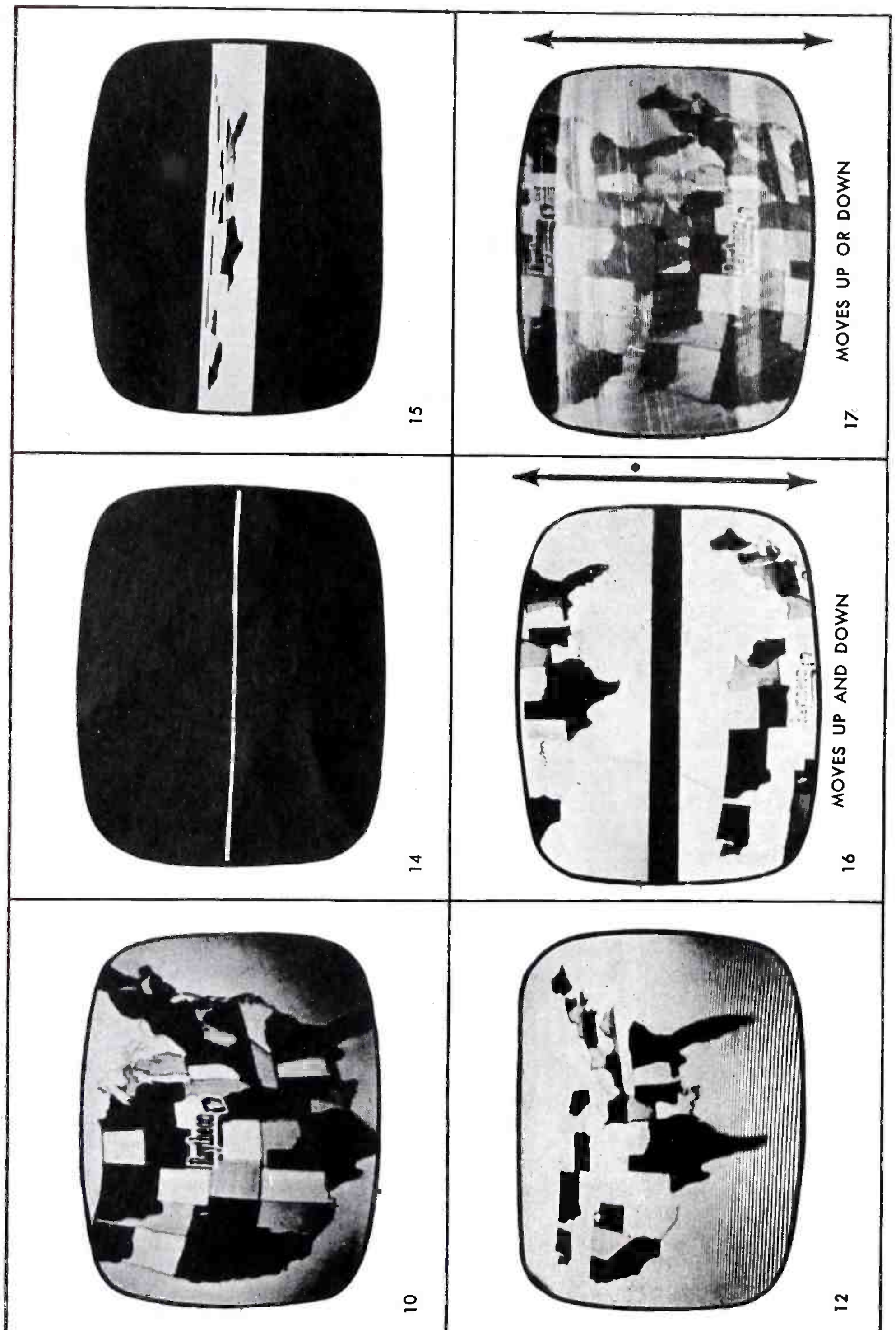

Fig. 1. Sample portion of the "Owner's Guide."

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When a car owner drives his automobile into a service station for repair it is customary for him, or her, to describe to the car inspector the type of trouble which seemingly exists in the automobile. Sometimes the descriptions are very adequate and correct, and so give the inspector an excellent clue as to what corrective remedies are required. The average car owner is very far from being a car mechanic, but fortunately for the 40 odd million car owners it is not too difficult a task to describe at least some of the symptoms of what is wrong.

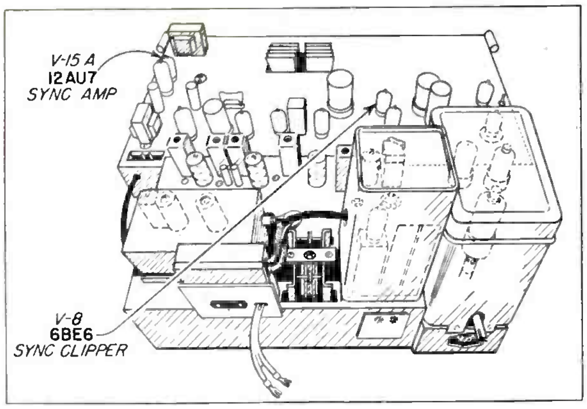
We present in these pages an idea conceived by Raytheon TV and, to the best of our knowledge, by Mr. Carroll Hoshour, Director of Sales Engineering. In many respects, it is not too much unlike the situation in the automobile business as described. As we see this idea, it seems to possess tremendous possibilities which may make the life of the service technician easier and which in the long run can improve the relationship between the public and the servicing industry tremendously.

All indications point to servicing TV receivers in the home as the standard procedure. Statistics covered by the writer lead to the conclusion that even at this early date between 80 and 90% of service calls are completed in the home. Generally, upon receiving a call, the service facility attempts to establish certain facts concerning the receiver in question. The information covered may determine the data needed for reference instructions to the service technician on the probability of the trouble and possibly the replacement parts which may be needed.

Advance Diagnoses Made Possible

Unfortunately the customer, not being overly familiar with terminology which is properly descriptive, oftentimes finds it very difficult to describe the character of the

(Continued on page 19)

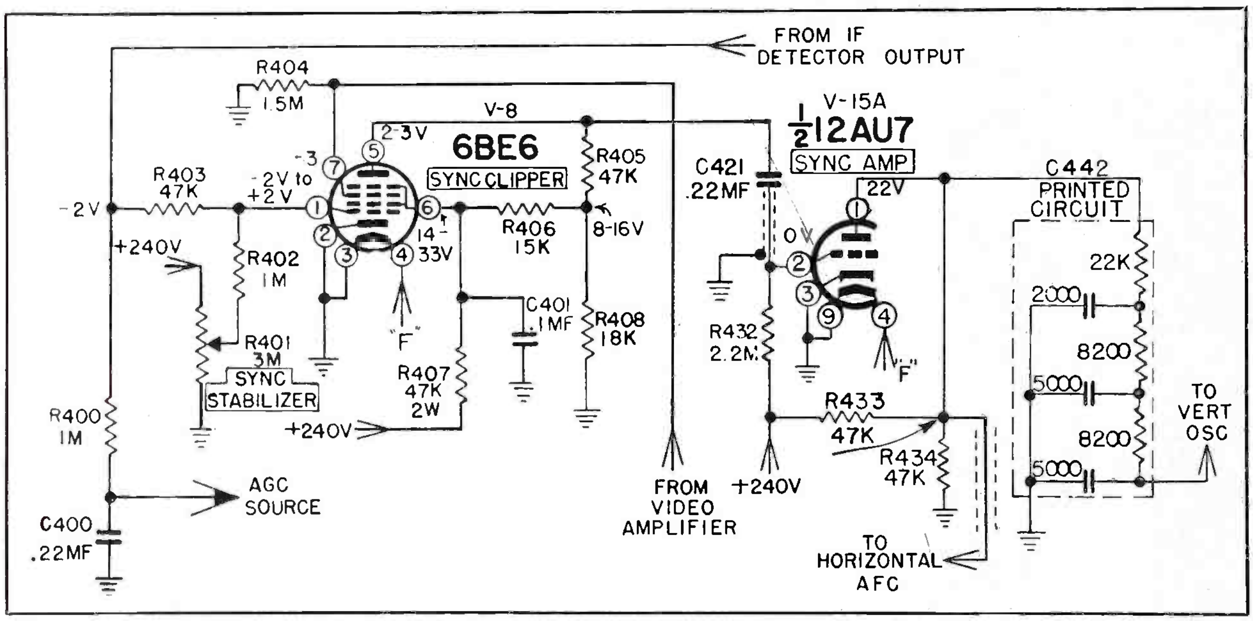


Sync Stabilizer:

The control varies the operational characteristics of the sync clipper stage to obtain the optimum operation point for the least effect of noise interrupting synchronization. The control should be adjusted for a steady picture.

REPLACEMENT PARTS

Ref. No.	Part No.	Description
R401	10B-17318	Sync Stabilizer control—3 meg
C442	17A-22376	Printed circuit



SYNC CLIPPER AND AMPLIFIER SCHEMATIC

POOR VERTICAL SYNC

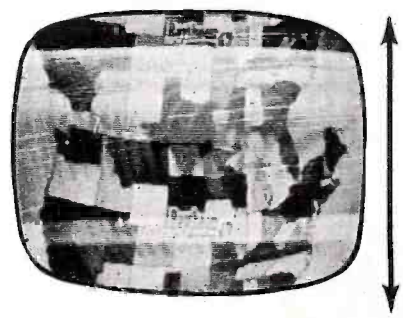
Poor vertical sync is generally caused by improper adjustment of the vertical hold control or a defect in the oscillator, sync amplifier or sync clipper circuits.

CHECK:

R437	Vertical Hold Control Adjustment
R401	Sync Stabilizer Control Adjustment
V-15	Vertical Blocking Oscillator and Sync Amplifier (12AU7)
V-8	Sync Clipper (6BE6)
C422	Intergrating network
R435-436-437-438	Vertical Hold Control Resistors
C423	Coupling Capacitor
T402	Oscillator Transformer

NOTE: A poor vertical sync condition may possibly be due to a defect in the RF, IF or video amplifier stages. This may be quickly checked by observing the blanking bar as illustrated in condition 16. If the detail in the blanking bar is not blacker than the blackest portion of the picture an overloading condition exists. Refer to overloading, condition number 33.

16



17

13

Fig. 2. Sample page from the technician's "Service Saver."

for the new 12 volt auto circuit

RADIART announces its 6300 series... an addition to the full line of

Seal-Vent RED SEAL VIBRATORS

Faster Starting

The exclusive RADIART design permits the briefest possible "Warm-up" period, thereby making the RADIART vibrators practically instantaneous starting. This added feature means greater performance.

Longer Life

There's more for your money in every RADIART vibrator-they last longer! Precision manufacture, using only the finest materials, assures long lasting, trouble-free performance.

Complete Replacement Line

RADIART has a CORRECT replacement vibrator for every original equipment vibrator. 12 Radiart vibrator types serve over 89% of all popular replacements. NOW..THE NEW 6300 SERIES IS READY FOR THE NEW '53 car MODELS with radios having 12 volt circuits.

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Sealed at the factory to prevent the formation of an insulating film on the points while the vibrator is on the shelf... the sealed vent automatically opens when put in use to allow the vibrator to "breathe".

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Refrigeration Fundamentals And Service Procedure For Air Conditioning Units (Con,t)

Prepared by the Commercial Service Section
of the RCA Service Co., Inc.

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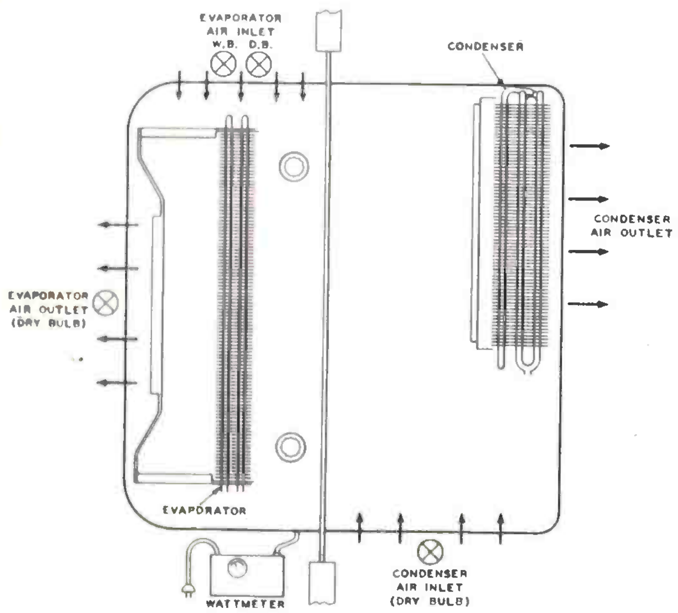

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Read the temperatures when the lowest wet-bulb temperature is obtained. The wet-bulb thermometer will not maintain a minimum reading for very long, since the wick dries quickly. The wick must be wet when the reading is taken. The bulb end of all thermometers must be in the center of the air stream in which they are suspended. Refer to Fig. 5 for thermometer placement.

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If for any reason the thermometer cannot be located at the unit, it may be placed outside the nearest window in the same wall.

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Description of Performance Table. Performance tables have been prepared to aid in determining whether the air conditioners are producing a maximum amount of cooling with normal current consumption for the existing operating conditions.

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EXAMPLE: Assume that the following temperature readings have been taken:

(continued on page 27)


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RANGES:
20,000 OHMS PER VOLT DC
1,000 OHMS PER VOLT AC
VOLTS, AC AND DC: 2.5, 10, 50, 250, 1,000, 5,000
OUTPUT: 2.5, 10, 50, 250, 1,000
MILLIAMPERES, DC: 10, 100, 500
MICROAMPERES, DC: 100
AMPERES, DC: 10
DECIBELS (5 RANGES): −12 TO +55 DB
OHMS: 0-2000 (12 OHMS CENTER), 0-200,000 (1,200 OHMS CENTER), 0-20 MEGOHMS (120,000 OHMS CENTER)
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"	"	Add "Silver mica" to Remarks column.
Du Mont	030100010	Change 030100010 to 03100010 in Part No. column.
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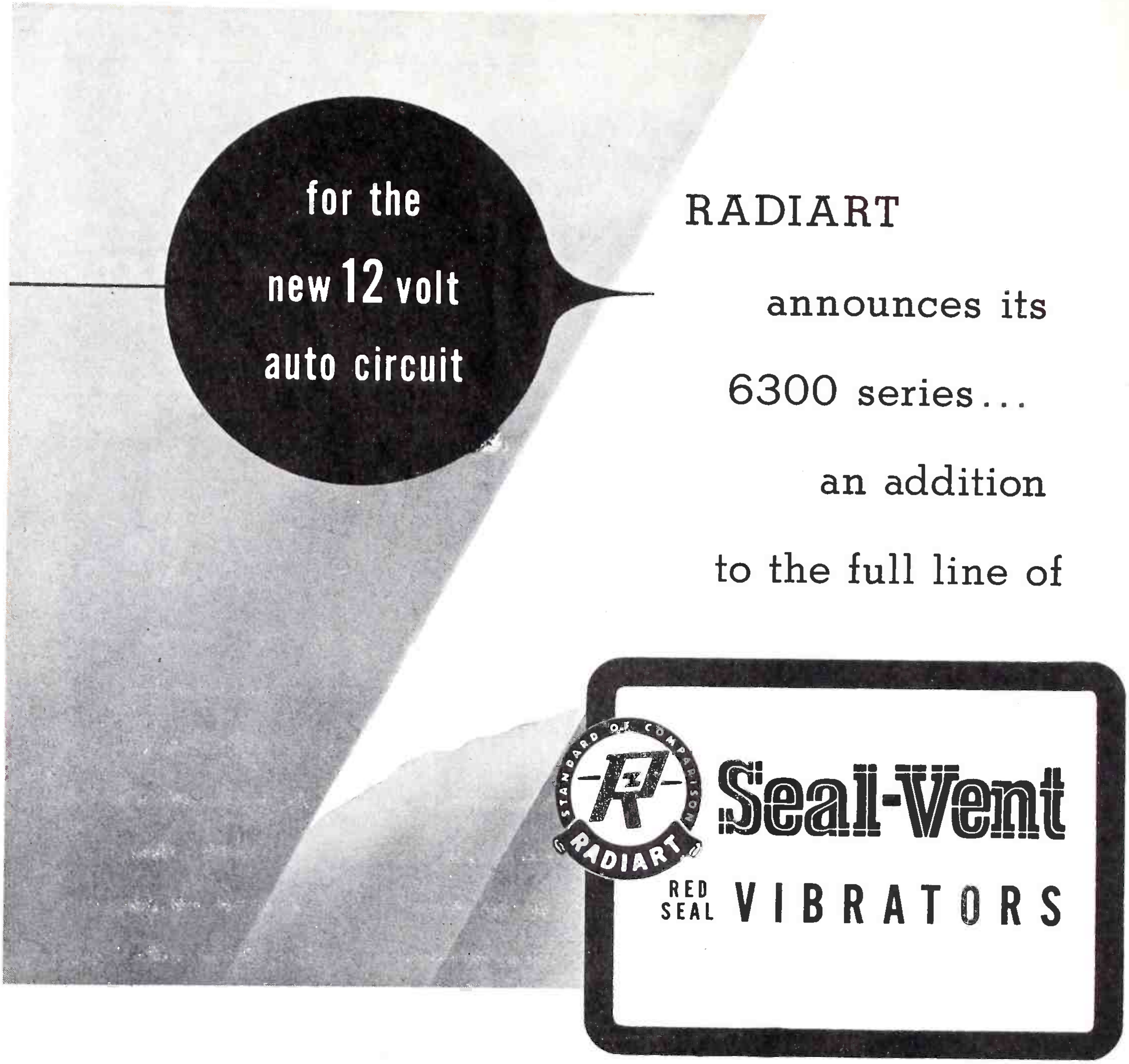

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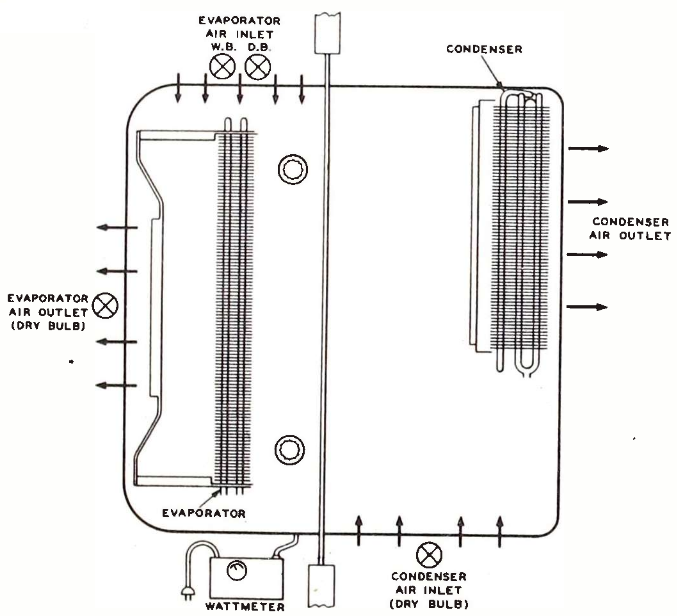

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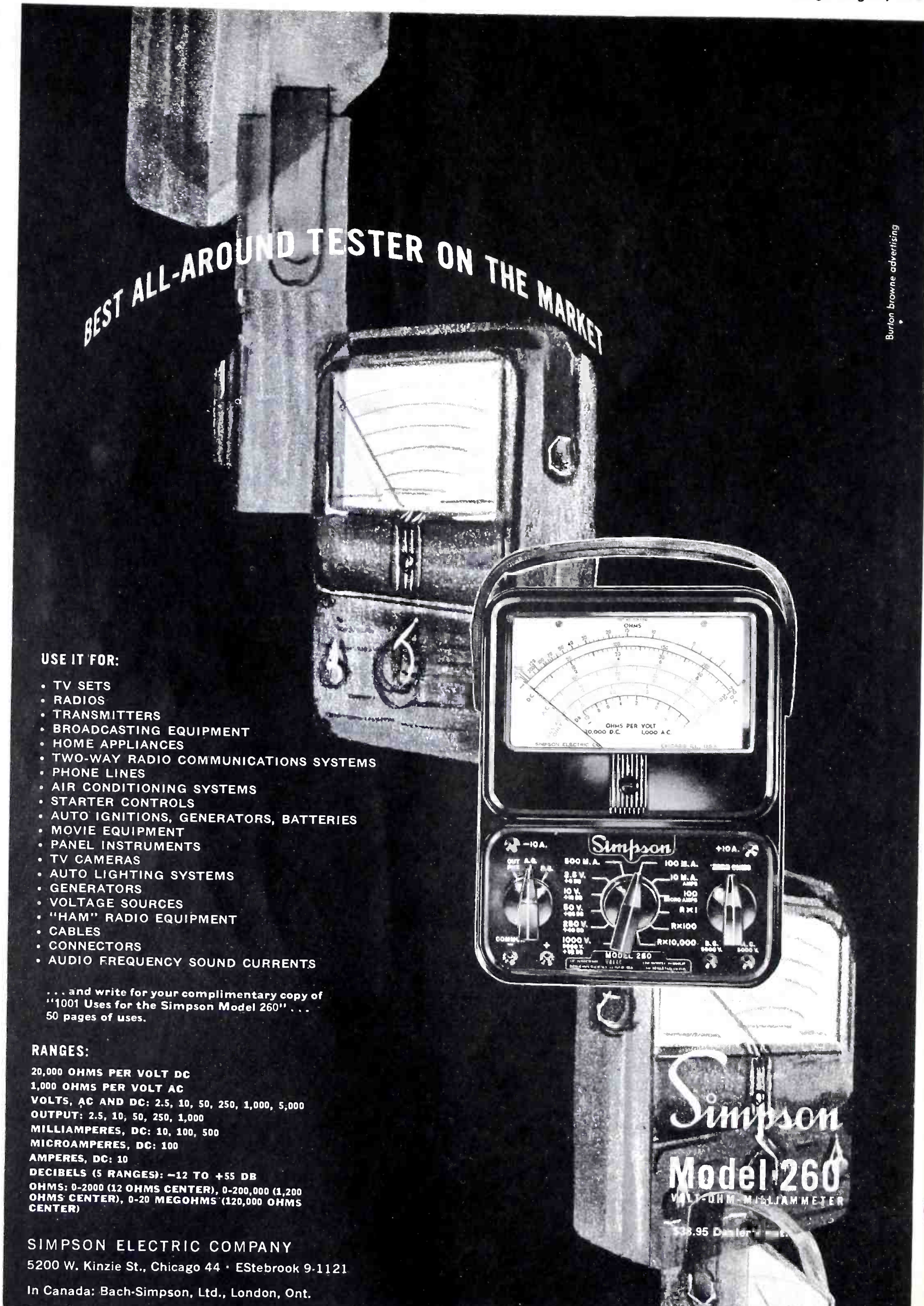
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Carry An Extra High-Voltage Supply

by Phil Weiss

The best indication of how a tv set is performing is the picture on the screen together with sound. However, when a set has insufficient high voltage to show any light on the screen, the serviceman is immediately deprived of his most important source of information.

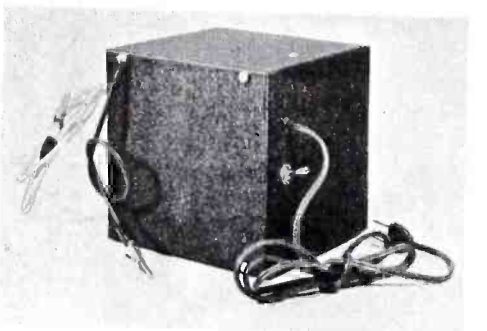


Fig. 1. The completed accessory supply.

If he decides to pull the set into the shop, he needs more information before he can give the customer a reasonable estimate of what it will cost to repair it. And many customers demand such an estimate before they will permit their set to be removed. Much helpful information can be obtained on the spot by using an auxiliary high-voltage supply to produce a raster on the screen. By examining the raster so produced the technician can often answer these important questions:

1. Is the trouble in the picture tube or deflection yoke? If not, the whole picture tube assembly can often be left in the cabinet, removing only the chassis.
2. Is there some additional trouble besides the obvious one of no high voltage, for example, poor video, or poor sync? If so the customer had better be told about it before the set is removed.

The auxiliary supply is built in a 6" x 6" x 6" utility box, as shown in Fig. 1. The schematic diagram of the unit appears in Fig. 2. The ground strap is clipped to the tv chassis and the high-voltage lead is clipped to the picture tube anode (from which the receiver's high-voltage lead had previously been disconnected). The same procedure is used when the tv chassis is ungrounded since there is always enough leakage to pass the small current required by the picture tube anode. Severe shock hazard is avoided by the use of a 100,000-ohm wire-wound resistor, in series with each lead, as shown in the schematic diagram.

When the tv set and the extra high-voltage supply are both turned on, the picture tube receives about 16,000 volts. Usually a raster will appear, unless the tube is bad, or is not receiving correct voltages at its socket. It is sometimes necessary to turn down the brightness control to avoid burning the face of the tube when this is done, especially when the yoke is shorted. Sometimes the raster will not focus properly, if the extra voltage supply is either too high or too low for the set. But in general, it works very well.

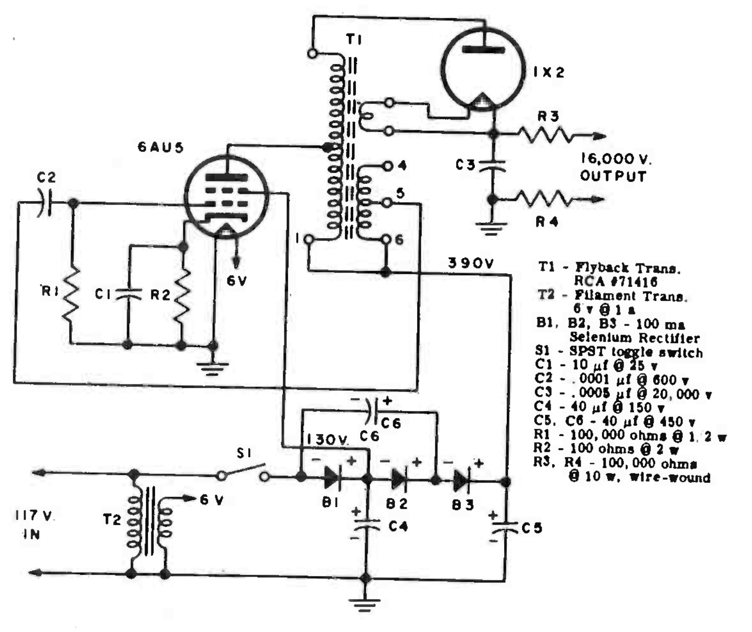


Fig. 2. Schematic of the extra high-voltage supply.

Nearly any flyback transformer could be used, provided it has a separate yoke winding

(*continued on page 30*)

Additional literature on each of the products described in these columns may be obtained from SUCCESSFUL SERVICING. See the coupon in column three.

New Battery Eliminator and Charger

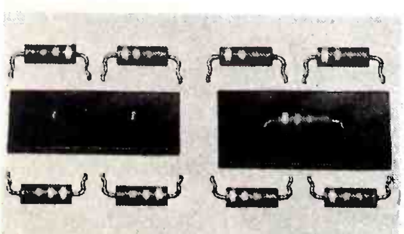
A new Battery Eliminator and Charger kit for combined 6-volt and 12-volt use has been developed and added to the EICO line by Electronic Instrument Co., Inc. This instrument, the new Model 1050, is available in kit or wired form.

Item 1.

The Model 1050 is designed for use as a Battery Eliminator in the servicing and demonstrating of both 6-volt and 12-volt operated auto radios, marine and aircraft equipment, and for charging both 6-volt and the new 12-volt storage batteries. Rated above normal needs in these applications and fully protected against overloads, the instrument incorporates such features as continuously variable output voltage, separate voltmeter and ammeter, safe and easy operation. It may be used in other applications requiring a low-voltage d-c power supply.

Snap-in Resistors for Printed Wiring

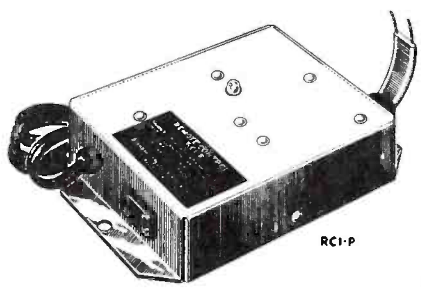
In keeping with latest printed wiring techniques, the Electronic Components Division of the Stackpole Carbon Company has announced that its standard ½-watt fixed composition resistors are now available with specially formed and trimmed leads. This new feature greatly facilitates the handling of resistors when assembling components on the standard 0.062″ printed wiring base. The hot tin dipped leads are cut and formed for a tight "spring fit" and extend through the printed circuit base just far enough for easy soldering. Resistors snap into place. No additional operation need be made for proper assembly.



Item 2.

Remote Control Unit for TV Boosters

Blonder-Tongue Laboratories announces a new 2-piece remote control unit for the operation of TV boosters, uhf converters, or distribution units from the on-off switch of the television receiver. This unit will operate with any Blonder-Tongue auxiliary equipment of this type.



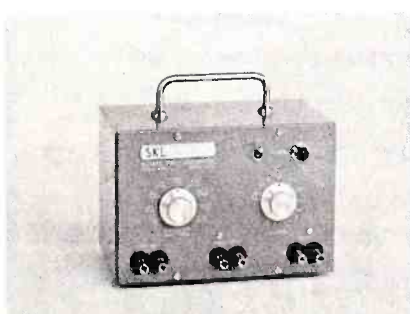
Item 3.

The power control section of this device, Model RC-1, plugs into any 117-volt a-c outlet and receives the TV set line cord. It contains a thermo relay, an indicator light, and fuses. The remote portion at the unit to be controlled feeds a-c power and accepts TV signals. For outdoor installations, the remote section may be mounted in a Blonder-Tongue weatherproof housing along with the booster or other unit.

A single, heavy-duty 300-ohm line is used between the two parts to carry a-c power out and TV signals back at the same time. Both sides of this slave circuit are fuse-protected according to the Electrical Code of the National Board of Fire Underwriters.

Square-Wave Generator

The new SKL Model 504 Square-Wave Generator, manufactured by Spencer-Kennedy Laboratories, Inc., produces square-wave voltages without tilt or overshoot. The extremely short rise time (less than 30 milli-microseconds) makes the generator useful for testing the response of audio, i-f, r-f, and video-amplifier circuits.

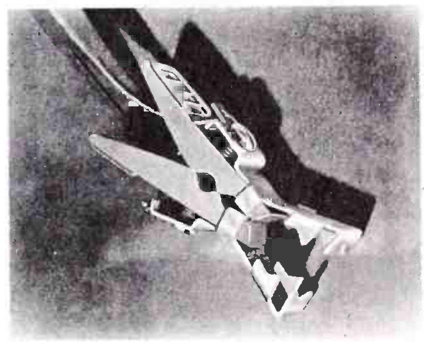


Item 4.

The calibrated voltage output is continuously variable from 0 to 11 volts. A synchronizing pulse output is provided on the front panel to permit triggering of an oscilloscope or similar network. Another front-panel terminal pair allows the generator to be synchronized with an external voltage source.

The Model 504 has a frequency switch with nine positions. The first step permits operation at any frequency as determined by an external capacitor. The remaining positions provide frequencies from 0.5 cycles to 500 kc in decade steps. This provides a convenient source of time bases from one second to one microsecond.

The SKL Model 504 Square-Wave Generator and its self-contained regulated power supply are mounted in a compact, lightweight aluminum cabinet suitable for bench use.



Item 5.

Improved Antenna Clip

Industrial Television, Inc., announces that initial deliveries are now being made to jobber accounts of its newest Tenna Clip.

The new Tenna Clip incorporates the design improvements of the two-year period since its original development. Provision is made for either screw terminal or solder connection with strain relief.

To obtain additional literature on any of the items described in this section encircle the number of the product (number appears under picture) on the coupon below, cut the coupon out and mail it to SUCCESSFUL SERVICING, 480 Canal Street, New York 13, N. Y.

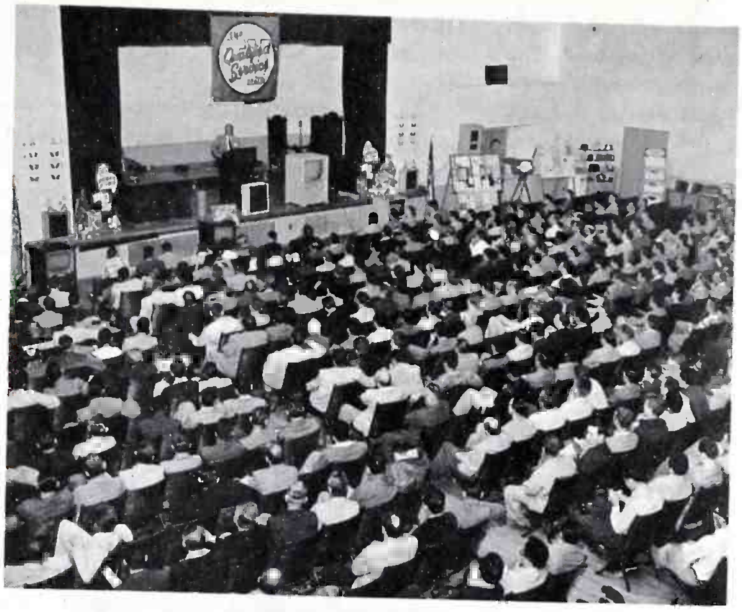
Cut Here

SUCCESSFUL SERVICING
480 Canal Street, New York 13, N. Y.

Please send me additional literature on the items circled below appearing in the NEW PRODUCTS column of the November, 1952 issue of **SUCCESSFUL SERVICING:**

1 2 3
4 5

Name..........
Address..........
City.......... **Zone**.......... **State**..........
Company..........



Mr. Rider addresses a meeting of the GMP Qualified Service Dealers. *(See story on page 5.)*

RCA Announces Prefab I-F Strip

THE TELEVISION INDUSTRY'S first ready-to-use prealigned i-f amplifier—complete with electron tubes and printed circuit components—was announced recently by the Tube Department of the RCA Victor Division, Radio Corporation of America.

The unique assembly, now in mass production, is designed to help TV set manufacturers pare production time, eliminate assembly and alignment operations, and provide efficient amplifier operation, according to R. T. Orth, vice president in charge of the tube department.

Intermediate-frequency (i-f) amplifiers, essential to every home TV set, are now constructed and aligned by individual set manufacturers, he pointed out. Such operations are exacting and time-consuming because amplifier tubes, circuits, and wires must be assembled on the TV chassis, positioned to assure efficient operation, and then connected and soldered manually. The new amplifier is a finished "package," ready for attachment to the chassis.

The unit became commercially practical with the successful application of a special photo-etch "printing" process for the production of wiring patterns as well as component coils, Mr. Orth explained. Accordingly, all hand-wiring operations are eliminated. In effect, the amplifier is mass-produced from a series of film negatives covering the wiring panel and the individual printed components.

The unit is a 3-stage, 40-mc assembly, designed for intercarrier receivers having picture and sound i-f carriers at 45.75 and 41.25 mc respectively.

COMING IN OCTOBER
RIDER TV 12
WITH REPLACEMENT PARTS

Latest RIDER TEK-FILE Packs with Replacement Parts Listings Available at your jobber at the end of August!

- Pack 90. Sparton, Spiegel, Stewart-Warner, Stromberg-Carlson
- Pack 91. Starrett, Sylvania, Teletone, Western Auto
- Pack 92. Aimcee, Arvin, Western Auto, Westinghouse
- Pack 93. Cadillac, Emerson, Fada, Gamble Skogmo
- Pack 94. Hallicrafters, Jewel, Magnavox, Majestic, Mitchell
- Pack 95. Montgomery Ward, Motorola, Philco, Philhormonic

For the individual models included in these Packs, refer to the TEK-FILE INDEX that will appear in the September 1953 issue. Consult your RIDER distributor or write to us directly.

the crystal phonograph cartridge

(continued from page 1)

it to normalcy. It is too late to merely add moisture then, because the crystal structure itself has warped.

In climates where the temperature and relative humidity are extremely high, crystal cartridges have a tendency to take on excessive moisture. A simple *desiccator,* such as is shown in Fig. 4 may be used as an aid in controlling this hydration. The desiccant may be either calcium chloride or silicagel. If the crystal cartridge, when not in use, is stored in the desiccator, the excess moisture will be removed from the crystal element, thus helping to prolong the useful life of the cartridge.

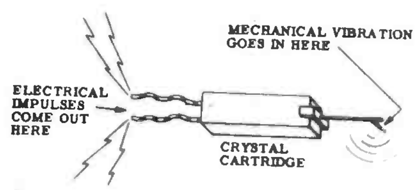


Fig. 3. Operation of the crystal cartridge.

In this case the desiccant must be changed periodically, as it becomes saturated with moisture. To determine whether the desiccant has reached its saturation point, a piece of paper toweling may be moistened and inserted in the desiccator. This should completely dry out within approximately 1½ hours. If it does not dry, it may be assumed that the desiccant has become saturated and should, therefore, be replaced.

Soldering to Cartridge Terminals

When leads are required to be soldered to the cartridge terminals during installation or service, the soldering iron should not be applied for a longer time than necessary to make a solid joint. Terminals are well tinned during manufacture and if leads are also well tinned before connection is made, it is only necessary that the soldering iron be applied to the joint long enough to flow the solder. Remember the metal ribbon leads to the crystal conduct heat very well, and the usual soldering iron temperature is well over 120 degrees F. Give the crystal element a chance, before it is even connected to the phonograph.

Replacement of Cartridge

To an experienced serviceman replacement of a crystal phonograph cartridge is a fairly routine procedure. Charts are available, listing replacement cartridge specifications, identifying the frequency response, output voltage, physical mounting, needle pressure—everything required to show which cartridge may be used to replace which. From stock, or if necessary from the shelves of dealers, the required replacement is obtained, connected, mounted, and the job is done. The serviceman gets his fair labor charge, and he's sold a cartridge. The customer has a speedy repair with an exact replacement.

On the other hand, lest the serviceman consider opening the crystal cartridge and attempting an internal repair of the element itself—remember the eternal soldering caution? It's even worse inside. Consider:

1. A crystal element consists of a chemical salt. (If you get the chance, give one a lick with your tongue. *Salty,* isn't it?) No binder but the normal crystalline structure holds the fragile element into a single piece. In handling and assembly this frail salt is easily broken. You break a crystal in assembly, and there's your profit on the floor in chips.

2. Crystals are especially treated at the factory to protect them from adverse climatic conditions, requiring specially controlled storage facilities. The crystal elements themselves are not stocked. They are assembled as received. The complete cartridge is stocked as a sealed unit. Should the service shop desire to stock crystal elements, without temperature and humidity controls, the loss from deterioration of crystals would prove prohibitive.

3. The crystal pickup cartridge assembly appears to be a simple mechanism. In operation it is truly simple. However, fine tolerances with special instruments and individual company techniques make each cartridge a precise problem in basic construction. Even if you could match the company assembly, would it pay?

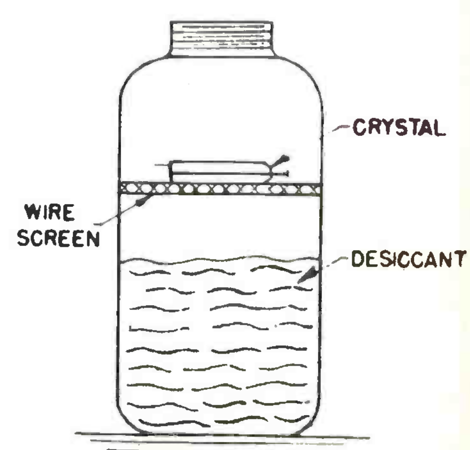


Fig. 4. Using a desiccant to dry out a crystal.

4. Finally, even if you did complete the assembly, could you tell how the repaired unit stacked up against the factory product? Few servicemen have access to the test equipment necessary to properly test pickup cartridges. And there's no dealer return of opened, "repaired" cartridge units.

(continued on page 30)

"Part Number for Part Number"

Many different activities make up the cost of running a business. In the operations of an electronic parts distributor one of the cost items is the research which is necessary in the parts distributor's store to determine the replacement part which is needed by the service technician when he does not tell the counterman the set manufacturer's part number for the original part used in the receiver.

Every parts distributor is ready and willing to serve the television servicing industry at all times. It is a daily practice for countermen to check lists which identify suitable replacement parts. It must, however, be recognized that at best this is a time consuming operation for both the man behind the counter and for the person in front of the counter who wants the part. The parts distributor is always ready to do checking of this kind because he is selling the part and satisfying the customer.

There is, however, one point which warrants more than just casual attention in this situation. It is the possible saving of the service technician's time by a slight modification of the request that he makes to the distributor's counterman. Instead of asking for a contrast control for a TV receiver of a certain model, it would be very much better if he asked for that part by the original equipment part number.

Very few service technicians, if any, attempt to service a television receiver without having service data on hand. While this type of information is available in assorted varieties, seldom does it lack a list of the receiver manufacturers' parts numbers for the components which are used in the receiver. Therefore, the information which would save everyone time in procurement of a suitable replacement part, if it exists, is readily available. It is simply a matter of using the information. Not only does this save time but it is a much more business-like method of procurement. It may not mean too much if just an occasional replacement part is purchased over an extended period of time, but every service shop which is worth its salt has occasion to procure many replacement parts.

As regards to transformers, chokes, and capacitors of all kinds, it is by far the best way of getting the proper part from the parts distributor. Frequently the parts list shows changes in part numbers for specific chassis and models. A request for a part by functional name may lead to the purchase of a part which is not intended for the particular chassis in question. However, if the replacement part is based on part number for part number reference, not only is time saved for everyone, but the possibility of error is minimized.

JOHN F. RIDER

TELEVISION CHANGES

The Rider Manual pages and TEK-FILE pack which include the original data and shematics to which the following production changes apply, appear in the index on page 32 of this issue.

FIRESTONE

MODELS 13-G-110, -115, -116, -119, -120

Power transformers in later production.

The power transformer part No. 53X324 has been replaced in later production by part No. 53X331. This later power transformer has the rectifier tube (V20, a 5U4G) and socket mounted on the top cover. The schematic symbol remains T10.

STROMBERG-CARLSON

MODEL 16 series

Service data revisions.

The following changes have been made in the 16 series receivers:

Capacitor changes

1. C40 becomes part No. 110040 instead of part No. 110037 when it is mounted so as to be accessible from the rear of the chassis, as on all 16 series receivers.
2. C49 should be part No. 110286 instead of part No. 110280.

Resistor changes

1. R63 is 330,000 ohms instead of 33,000 ohms as originally indicated. The part number is correct as originally given, and is 149198.
2. R72 (from brightness control potentiometer to ground) becomes 18,000 ohms, ½ watt, part No. 28173 instead of 27,000 ohms, part No. 28174.
3. R85 should be 68 ohms, 2 watts, part No. 149069 instead of 220 ohms, part No. 149072.

TELE KING CHASSIS TVJ

Capacitor changes.

C217 (0.01-μf, 1000-volt capacitor, part No. CP-10-11) which originally went to pin 4 of V6 (a 25L6 GT-G, audio output) has been grounded.

C218 (a .005-μf capacitor) is added in parallel with C217 near the audio-output transformer.

STROMBERG-CARLSON

MODEL 17 series

Resistor deletions.

The following resistors have been deleted in the chassis of later production.

1. R18, the 120-ohm resistor in the grid circuit of the V8 video amplifier, has been removed.
2. R37, the 4.7-megohm resistor in the V6 horizontal phase-detector circuit, has been removed.
3. R69, the 1,000-ohm resistor in series with the screen supply to the picture tube, has been removed.

TELE KING CHASSIS TVJ

Starting with chassis serial number 297,925, all TVJ chassis incorporate the following changes: (These later production chassis are also stamped with the letter "D," denoting that the changes have been made.)

Peaking coils:

L4 (peaking coil part No. LP11, wound on an 18k-ohm resistor and schematically located between V3 and V4) is changed to part No. LP17, wound on a 10-k resistor.

L7 (peaking coil part No. LP13, wound on an 18k-ohm resistor and schematically located between V4 and the brightness control) is changed to part No. LP-18, wound on a 12k-ohm resistor.

Resistors:

R118 (8.2-k, ½-w resistor, part No. RC-822-2, schematically located under L4) is changed to 6.8 k, 2 w.

R125 (5.6-k, 2-w resistor, part No. 562-8, schematically located near L7) is changed to 6.2 k, 2 w.

MECK CHASSIS 9034

All 9034 chassis with the suffix "M" incorporate a three tube tuner, part No. TT-10002B.

(continued on page 32)

COMING

TV TROUBLESHOOTING AND REPAIR GUIDE BOOK

Volume II

Volume I in this series has been a *best seller* in the TV servicing text book field almost since the day it appeared in 1952. It is with a great deal of pleasure that we announce Volume II now being typeset and to be published within two months.

"Bob" Middleton is one of those rare authors who possesses the faculty of understanding his reader and who is a firm believer in the value of practical information. He is one of those individuals who, when writing a book, feels that it is his responsibility to *do the work* first and then describe and illustrate his findings. Writing and illustrating a book in this fashion delivers to the reader the kind of information that he will need as the answer to the daily servicing problems he encounters.

Volume II of the Middleton TV TROUBLESHOOTING GUIDE BOOK series is *not* a repetition or duplication or a revision of Volume I. *It picks up where Volume I of the series left off.* For example, troubleshooting in front ends of receivers was not covered in Volume I. It is Chapter 1 in Volume II and is a very substantial chapter at that. It is tremendous in its contents and discusses and illustrates a great many problems which TV service technicians have encountered and for which they never had the answers. The kinds of troubles which may be encountered in the video i-f system, video system, sound i-f system and horizontal-sweep system are myriad. Many of these were treated in Volume I, but as each day passes in the life of a TV service technician new and different kinds of difficulties appear. A great many of these which were not covered in Volume I are clearly diagnosed and illustrated in Volume II.

The many tens of thousands of purchasers and users of Volume I will find Volume II an even better book. More than 500 oscillograms were taken by the author to illustrate his points. We say without reservations that there never has been a book like this one for use by TV service technicians, students of TV servicing, and others who have an interest in the subject.

The format of Volume II will be exactly the same as Volume I and the price will be only $3.90. The book will be 8½ by 11 in size and will contain a cumulative index covering Volumes I and II. Watch for publication date announcement in September *Successful Servicing.*

Raytheon Service Saver

(*Continued from page 6*)

image which appears on the picture tube when trouble exists. The result can easily be a wrong evaluation of the fault. This may lead to a wrong estimate of time required to correct it, the cost for the repair, the information given to the technician for guidance, etc.

This Raytheon program solves not only these problems, but very many more, among which is one that is extremely important and which we shall deal with separately later. Raytheon is placing in the hands of each buyer of one of their TV receivers a booklet titled "TV Owner's Guide" wherein are contained about 40 different picture-tube patterns representative of a wide variety of troubles which may occur in the receiver. A reduced reproduction of one of these pages is shown in Fig. 1. Each picture bears a number. At the same time Raytheon releases to the servicing industry another service booklet pertaining to the same receivers. In this booklet appear the same picture-tube traces as are to be found in the "TV Owner's Guide" and they are identified by exactly the same numbers as appear in the "TV Owner's Guide."

The service technician's booklet, however, contains additional information. A sample page from this booklet appears in Fig. 2. Each of the picture-tube patterns is correlated with a sectionalized schematic of that portion of the receiver which contains the trouble responsible for the picture. In addition, a list of possible faults in that section is included in the technician's guide.

How the Plan Works

The operation of the plan is very simple. With the "TV Owner's Guide" in his possession, the receiver owner furnishes the service facility he has called with a clue to what may be wrong in the receiver by referring to that sample picture-tube illustration which most closely resembles what he sees on the picture tube itself. The only description required is the number which contains the illustration in the "TV Owner's Guide." The service facility having on hand the "Service Saver" service guide checks the reference illustration by number. He immediately sees the portion of the circuit involved, and the components which are suspect. From this point on he has the general idea of what work has to be done when he gets to the home and what components, if any, he must carry as possible replacement requirements.

Another item of great interest in this "TV Owner's Guide" is that this is not a "fix it yourself" book. The receiver owner is not given any troubleshooting information. Moreover, he is told that no matter how well a receiver is made some troubles will eventually develop and that the repair of these troubles requires the service of a competent TV technician. In other words, the TV technician is being sold to the public.

Consumer Education and Call-Backs

The above points are important of course, but there is one point in this whole program which we consider to be of tremendous value. Heretofore, the servicing industry has faced a problem stemming from the lack of technical knowledge on the part of the TV receiver owning public. This has been the problem of convincing the public that the repair of one fault can be followed legitimately by the appearance of a new defect within a week, a day or an hour after a repair. This difficulty has plagued the servicing industry no end. For years, the servicing industry has been unable to explain this situation.

We believe that the widespread use of a plan of this type by all receiver manufac-

(*Continued on page 20*)

TV Replacement Parts Series

The continuation of the TV Replacement Parts series of articles will be picked up in September. The space originally allotted for it has been used for this article, which is considered of greater immediate importance.

Raytheon Service Saver

(Continued from page 19)

turers will be of tremendous value in making the public recognize the difference between troubles which may develop in television receivers. Having called a service facility to correct those troubles which may be responsible for picture symptom 19, whatever they may be, and having had the fault corrected, the appearance of some other fault shortly thereafter may cause a symptom described by picture 32. Inasmuch as the public associates different faults with the different pictures contained in their "TV Owner's Guide," they will readily understand that something else has gone wrong.

Without any trouble-symptom pictures to guide them in the past, the public did find it difficult to distinguish one type of picture-tube image from another. All faulty pictures due to trouble in the receiver looked alike. Hence, the individual not versed in technical details naturally would assume that the two different bad pictures stemmed from the same fault. There is no attempt in the "TV Owner's Guide" to state what is wrong when a certain type of picture appears on the screen, but since each is distinctive from the other and since the set owner has identified two different pictures on two different occasions, it is reasonable to assume that he will recognize them as being due to different causes.

An Important Step Forward

It has always been our contention that the manufacturer of the receiver is the one who knows his product best and that information which will lead to the most effective repair and the most rapid diagnosis of troubles can be produced best by the organization that engineered and manufactured the receivers. What we show here is a vivid example of this situation. This information is not general, it relates specifically to a single Raytheon Chassis, the 21T8. We are given to understand that subsequent chassis will be treated in similar fashion, this information being complementary to the regular service manuals prepared by them.

We realize that many TV receiver manufacturers have produced creditable literature for use by the service technician and for guidance to the receiver only. Notwithstanding all of this, wedding the public to the TV service technician as Raytheon has done in this program is something which warrants serious consideration by all.

It is understandable that every problem extant in television servicing is not answered by the idea we have described. Neither is it presented as the panacea for all ills, but there is no doubt about it being an excellent idea with tremendous potential.

DUMONT UNVEILS HIGH POWER UHF TRANSMITTER

TOP QUALITY, ultra-high frequency (uhf) television pictures broadcast from Easton, Pa., 70 miles from New York City, were witnessed recently at the Empire State Building on a standard vhf/uhf television receiver using only a 2-bay bowtie antenna and reflector. This antenna was mounted inside a window of a room on the 82nd floor of the building.

The TV pictures were shown by Allen B. Du Mont Laboratories, Inc., to demonstrate the unusually wide signal coverage provided by a new Du Mont 5-kilowatt ultra-high frequency television transmitter. The new transmitter, first of its kind, is owned by WGLV, Easton TV station. It was put into regular commercial operation for the first time over Channel 57 on August 14. The 5-kilowatt transmitter feeds a specially designed transmitting antenna having a power gain of 20 so that an effective radiated power of 100 kilowatts is produced.

In addition to the long-distance coverage, good local coverage is obtained by the new uhf station. Evidence of this strong local coverage was provided in a report based on engineering tests already undertaken in the Lehigh Valley over an area covering 95% of the population which WGLV will serve. The report shows that the new transmitter furnishes very good noise-free coverage in the area which includes the cities of Easton, Bethlehem and Allentown, Pa., and Philipsburg, N. J.

An interesting feature of the demonstration was that some of the uhf television pictures witnessed at the Empire State Building were originally transmitted from New York to Easton on very-high frequencies (vhf). They were originally telecast by WABD, key station of the Du Mont Television Network, from the transmitting tower on top of the building. The signals were picked up at Pattenburg, N. J. and sent by microwave relay equipment to the Easton station, where they were rebroadcast as uhf signals. These uhf signals were then picked up directly at the Empire State Building and displayed. Other portions of the programs originated in Easton.

As evidence of the high quality of the uhf signals being received, Du Mont engineers placed a monitor, showing the original picture, alongside the uhf receiver showing the picture received from WGLV. In addition, a third receiver was tuned to the local vhf channel for an off-the-air picture. Viewers watched all receivers simultaneously in order to compare the pictures. Aside from a slight loss in high-frequency detail in the uhf picture, the quality of the picture was remarkably similar to the vhf signal that was being received locally. This was so despite the fact that the signal had traveled a total of about 140 miles, one-half of which distance was being covered by uhf transmission from station WGLV.

TV SUPPLEMENTARY SHEET NO. 4

MODEL & CHASSIS	PART #	CATALOG #	FUNCTION	DESCRIPTION	LIST PRICE
KAYE-HALBERT					
012	M-106-A	AG-83-S KSS-3	Height	2 Meg. Ω carbon	$1.25
	M-106-A	AG-83-S KSS-3	Vert. Hold	2 Meg. Ω carbon	$1.25
CHASSIS 243	M-110	AG-19-S KSS-3	Vert. Lin.	5000 Ω carbon	$1.25
	M-116	RTV-293	Contrast/ Vol./Sw.	2000/500K Ω Conc. Dual carbon--SPST	$3.70
	M-120	AG-58-S KSS-3	Bright.	500K Ω carbon	$1.25
114DX	M-106-A	AG-83-S KSS-3	Height	2 Meg. Ω carbon	$1.25
	M-106-A	AG-83-S KSS-3	Vert. Hold	2 Meg. Ω carbon	$1.25
CHASSIS DX253	M-110	AG-19-S KSS-3	Vert. Lin.	5000 Ω carbon	$1.25
	M-112	RTV-319	Focus	2250 Ω 4W-W.W.	$1.85
	M-116	RTV-293	Contrast/ Vol./Sw.	2000/500K Ω Conc. Dual carbon--SPST	$3.70
	M-120	AG-58-S KSS-3	Bright.	500K Ω carbon	$1.25
	M-128	A10-25K KSS-3	Hor. Drive	25K Ω 4W-W.W.	$2.20
	M-130	A10-400 KSS-3	Width	350 Ω 4W-W.W.	$1.85
MAJECTIC					
20FP88 20FP89	C-8.206-6	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	C-8.219-5	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	C-8.221	A43-2500 FKS-1/4	Focus	2250 Ω 2W-W.W.	$1.25
	C-8.229-7	AG-46-Z RS-2	Hor. Hold	50K Ω carbon	$1.25
	C-8.229-8	AG-63-Z RS-2	Vert. Hold	1 Meg. Ω carbon	$1.25
	C-8.229-9	AG-49-S RS-2	Bright.	100K Ω carbon	$1.25
	C-8.230-1	RTV-323	Contrast/ Vol./Sw.	1500/1 Meg. Conc. Dual carbon--SPST	$4.30
MERCURY					
2013 2113 2115 2401 4120 4220 4317 4320	PMA-48016	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	PMB-48014-1	AG-44-S RS-2	Hor. Drive	50K Ω carbon	$1.25
	PMB-48014-2	AG-49-S FKS-1/4	Bright.	100K Ω carbon	$1.25
	PMB-48014-3	AG-55-S FKS-1/4	Noise Bal.	250K Ω carbon	$1.25
	PMB-48014-5	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	PMB-48014-7	AG-61-S RS-2	Vert. Hold	1 Meg. Ω carbon	$1.25
	PMB-48015	RTV-247	Contrast/ Vol./Sw.	750/500K Ω Conc. Dual carbon--SPST	$3.70
MIRRORTONE					
20PC	VC-12120B	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25

MODEL & CHASSIS	PART #	CATALOG #	FUNCTION	DESCRIPTION	LIST PRICE
	VC-12121C	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	VC-12127B	RTV-297	Contrast/ Vol./Sw.	750 Tap 500/250K Ω Conc. Dual carbon SPST	$4.30
	VC-12131C	AG-44-S KSS-3	Hor. Hold	50K Ω carbon	$1.25
	VC-12132C	AG-83-S KSS-3	Vert. Hold	1.5 Meg. carbon	$1.25
MOTOROLA					
14P2 14P2U	1X711613	Order From MFR.	Hor. Cent.	50 Ω 1 W-W.W.	
	18A702441	AG-85-S RS-2	Bright.	5 Meg. Ω carbon	$1.25
CHASSIS TS-275	18A702443	AG-85-S RS-2	Height	5 Meg. Ω carbon	$1.25
	18A702444	RTV-343	Contrast/ Vol./Sw.	2500 Tap 2000/1 Meg. Tap 300K Ω Conc. Dual carbon--SPST	$4.90
	18A702468	AG-49-S RS-2	Hor. Hold	100K Ω carbon	$1.25
	18A702475	AG-8-S RS-2	Vert. Lin.	750 Ω carbon	$1.25
	18A711225	AG-61-S KSS-3	Focus	1 Meg. Ω carbon	$1.25
	18A711999	AG-61-S RS-2	Tone	1 Meg. Ω carbon	$1.25
	18K711278	Order From MFR.	Vert. Hold	850K Ω carbon	
21F1,B 21K1,B 21K2,B 21T1,B 21T2,B	1X711613	Order From MFR.	Hor. Cent.	50 Ω 1W-W.W.	
	18A702441	AG-85-S RS-2	Bright.	5 Meg. Ω carbon	$1.25
	18A702443	AG-85-S RS-2	Height	5 Meg. Ω carbon	$1.25
	18A702468	AG-49-S RS-2	Hor. Hold	100K Ω carbon	$1.25
CHASSIS TS-351,A	18A702475	AG-8-S RS-2	Vert Lin	750 Ω carbon	$1.25
	18A711225	AG-61-S KSS-3	Focus	1 Meg. Ω carbon	$1.25
*RADIO CHASSIS HS-316	18A711999	AG-61-S RS-2	Tone	1 Meg. Ω carbon	$1.25
	18K702864	RTV-344	Contrast/ Vol./Sw.	2500 Tap 2000/1 Meg. Tap 300K Ω Conc. Dual carbon--SPST	$4.90
	18K711278	Order From MFR.	Vert. Hold	850K Ω carbon	
	18A600974	AT-115 KSS-3 SWA	Vol./Sw.	2 Meg. Tap 500K Ω carbon--SPST	$1.85 .60
	18K77399	AG-61-S KSS-3	Tone	1 Meg. Ω carbon	$1.25

Form No. 751838010-5M-11/52

Sweep Generator Operation

(continued from page 3)

voltage applied to the reactance tube. The oscillator whose frequency is being swept is usually operated at a rather high frequency (the values in Fig. 1 are for an oscillator at 40 mc) so that a given percentage of frequency deviation can produce as high as possible a sweep in megacycles. For constant sweep width with varying output center frequency, and for reasons of stability, the oscillator which is thus frequency modulated is usually kept at a fixed center frequency, while variable output center frequencies are obtained by *heterodyning* with another, unmodulated, variable frequency oscillator.

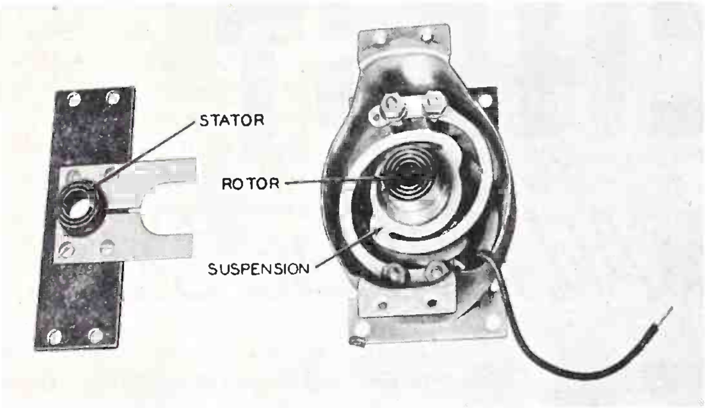


Fig. 3. One example of a vibrating capacitor.

Use of Vibrating Capacitor for Frequency Sweep

The second method for obtaining frequency sweep is a mechanical method, usually employing a vibrating capacitor. This is a development from an older method, in which the shaft of a variable capacitor was made to rotate rapidly, causing the capacitance to change rapidly from minimum to maximum and back again in a regular periodic manner. This capacitor, connected in an oscillator tank circuit, caused the frequency of the oscillator to sweep back and forth in the desired manner.

The more modern method frequently utilizes a capacitor whose plates can move closer or further apart. The spacing between them is varied by means of an electromagnet connected to an a-c power-line voltage. The idea is shown in Fig. 2. In most cases the capacitor plates are cylindrical, as shown, with one moving inside the other. One plate is fixed in position, while the other is kept in motion by a coil-and-magnet arrangement (similar to the voice coil and magnet assembly of a loudspeaker), actuated from an a-c voltage source. A springy suspension of some kind keeps the armature in its static position. As the moveable plate moves out of the stator, the capacitance becomes less; as it moves into it, the capacitance becomes greater. Since the voltage applied to the moving coil is alternating rapidly, the capacitor rotor plate is moved rapidly back and forth, thus rapidly varying the capacitance. As shown, the capacitor plates are connected across the oscillator tank coil. The rapid variations in capacitance cause rapid variations in oscillator frequency, and the desired sweeping action is accomplished. Frequently the stator is made in two sections so that a split-stator capacitor is formed.

The distance the moving assembly travels back and forth depends upon how much voltage is applied to the moving coil. The amount of capacitance variation and thus the sweep width depends upon the distance through which the assembly moves. Consequently, the sweep width depends upon the voltage applied to the moving coil. This is the principle used in controlling sweep width in generators using modulation of this type. As shown in the figure, the sweep-width control is one which varies the voltage applied to the actuating coil.

A typical vibrating capacitor is illustrated in Fig. 3. Note that, to increase the capacitance and its variation, several coaxial plates are used in the capacitor. In this case, the rotor plates are grounded through the centering spider, and the split stator plates are insulated above ground by the insulating material at the top.

(Note: The type of electromechanical driving mechanism described above is also sometimes used to move a copper or aluminum disc toward and away from a coil which forms the inductance of the swept oscillator. As the disc is moved closer to the coil, the inductance is reduced and the oscillator frequency is raised. As the disc is moved away from the coil, the inductance is increased and the oscillator frequency is lowered. When a.c. is applied to the coil in the driving mechanism, the disc moves alternately back and forth and thereby causes the oscillator frequency to vary in step.)

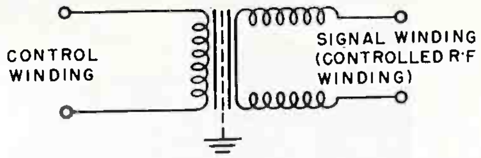


Fig. 4. Schematic, controllable inductor.

Use of Controllable Inductors for Frequency Sweep

Still another method of producing frequency sweep is by the use of a controllable inductor such as the Increductor[1]. This is a special type of saturable inductor which operates at radio frequencies. In a saturable inductor, the effective inductance of a winding on an iron core is caused to decrease if the core is partially saturated with flux produced by current flowing in another winding.

The schematic diagram of a controllable inductor is shown in Fig. 4. Note the use of the two windings—the *control winding,* to which the changing current is applied which produces the flux that partially saturates the core, and the *signal winding,* whose inductance is caused to change because of the changing flux in the core. This flux, as it approaches core saturation, reduces the permeability of the core and thus results in a reduction of effective inductance. The two windings are separated by an electrostatic shield, and are so arranged that practically no electromagnetic coupling exists between them. The entire unit is usually supplied

[1]Trademark of C.G.S. Laboratories Inc.

Fig. 5. One example of a controllable inductor.

(continued on page 25)

Sweep Generator Operation

(continued from page 23)

in a hermetically sealed can, which may be mounted in any position. The appearance of one such typical unit is shown in Fig. 5.

In normal operation in a sweep generator, an alternating current at the line frequency is applied to the control winding. This causes the inductance of the signal winding to vary over a considerable range. By using the signal winding as all or part of the inductance of an L-C tuned circuit of an oscillator, the oscillator frequency is made to vary back and forth at the line-frequency rate about a center r-f frequency. In this manner, a frequency sweep is produced.

Phasing

When a sweep generator is being used to produce a response curve on an oscilloscope screen, the sweeping action of the generator frequency and the sweeping action of the oscilloscope beam horizontally should be synchronized not only in frequency but also in phase. If the phase relation is not properly adjusted, then one end of the oscilloscope horizontal trace does not correspond to the lowest frequency swept through by the generator, and the other end does not correspond to the highest frequency, as should be the case. This is illustrated in Fig. 6. In this figure, it is assumed that a sweep generator is sweeping between 20 and 30 mc, and that it is being used to depict a response curve on an oscilloscope screen. To make the explanation clearer, the forward and return traces are shown separately (return trace below the forward trace) although in practice they usually coincide.

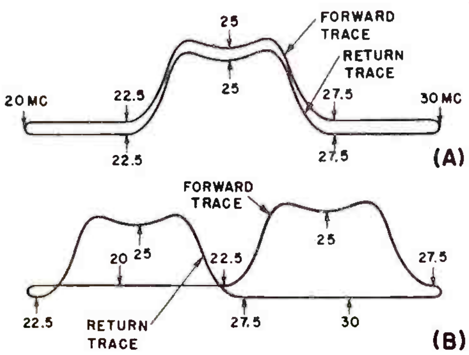


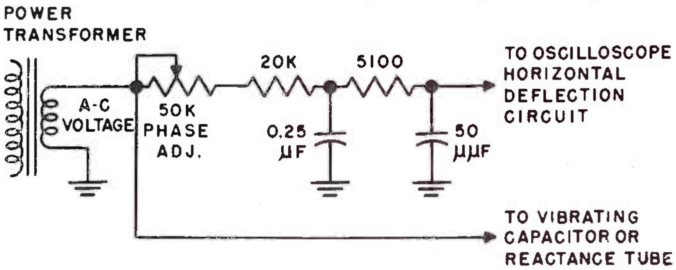
Fig. 6. Proper and improper sweep-generator phasing.

At (A) the phasing is properly adjusted, so the response curves swept during the forward and return traces coincide. The forward trace sweeps through the frequency range from 20 to 30 mc, while the return trace sweeps in reverse order, from 30 to 20 mc. Thus when phasing is proper, each point along the horizontal axis represents the same frequency for both the forward and return traces.

At (B) is shown what happens if the phasing is not correct. The sweep generator is starting from its low frequency extreme (20 mc) *after* the oscilloscope beam has started its forward sweep; by the time the sweep generator reaches 30 mc, the oscilloscope beam has completed its forward sweep and started its return sweep. The result is that the forward and return response curves do not occur at the same point along the horizontal axis and are staggered as shown at (B).

traces are shown separated vertically in the figure for clarity but coincide in practice) and the region *under* the traces is blank. Sometimes it is desirable to remove the return trace of the response curve by eliminating the generator r-f signal during the return-trace period. The oscilloscope beam then returns without vertical deflection, and forms a *base line* for the response curve in the forward direction. This process is known as *blanking* and a circuit to effect this is provided on many sweep generators.

Fig. 7. A phase-adjusting circuit, schematically shown.



The phase relation between the sweep generator signal and the oscilloscope sweep is adjusted by a circuit between the generator and the oscilloscope deflection plates. This phase adjusting circuit may be in the generator or in the oscilloscope, or sometimes there is one in each unit. A common method of obtaining sweep voltage for the oscilloscope and adjusting its phase in the sweep generator is shown in Fig. 7. The a-c voltage for both the vibrating capacitor in the sweep generator and the deflection circuit of the oscilloscope are obtained from a low-voltage secondary winding of the power transformer in the sweep generator. The voltage is applied directly to the vibrating capacitor, but through the network shown to the oscilloscope horizontal input circuit. The relative phase between the two outputs depends upon the adjustment of the 50k-ohm phase adjuster, which varies the amount of resistance in the circuit with the .25-μf capacitor.

Blanking

As shown in Fig. 6 there are actually two traces visible in ordinary sweep alignment or response curve observation. One is the forward trace, as the oscilloscope beam sweeps from left to right, and the other is the return trace, when the beam returns from the right to the left. If the phasing is properly adjusted, as shown at (A) of Fig. 6, the response curve traces coincide (the

A typical blanking circuit is shown in Fig. 8. Here the blanking tube is normally held cut-off by the bias developed across the large (10 meg) bias resistor. Under these conditions the sweep oscillator operates normally. During the positive alternations of the input a.c., the blanking tube conducts.

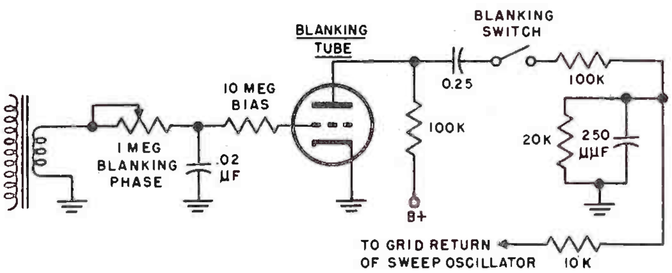


Fig. 8. Schematic of a typical blanking circuit.

It therefore operates to place a high negative bias voltage on the oscillator tube so the oscillator stops oscillating and the sweep-generator signal is absent. The blanking-phase control forms a phasing circuit with the .02-μf capacitor so that the phase of the blanking voltage may be adjusted to stop operation of the sweep oscillator during exactly the proper time (while the sweep generator produces the reverse sweep and the scope retrace occurs). Examples of response curves with base lines produced by the blanking facility of the sweep generator are shown in Fig. 9.

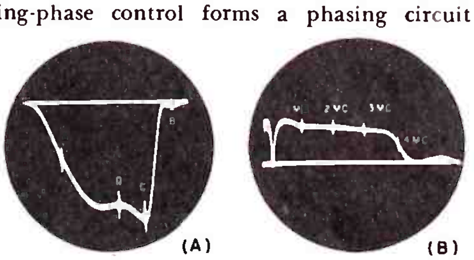


Fig. 9. Response curves showing baselines produced by blanking.

Refrigeration Fundamentals etc.

(continued from page 9)

Condenser-air inlet, dry-bulb temperature 95°F.
Evaporator-air inlet, wet-bulb temperature 67°F.
Evaporator-air inlet, dry-bulb temperature 76°F.
Evaporator-air outlet, dry-bulb temperature 54°F.
(Evaporator dry bulb difference = 22°)
Total power consumption of unit, 855 watts.

1. Referring to the table, find 95° in column headed "Condenser Inlet Temperature (D.B.)."
2. In column headed "Evaporator Inlet Temperature (W.B.)" and in the "95" horizontal group find 67°.
3. Follow to the right from the 67° value, and find the figures 20-23 in the column marked "Evaporator Inlet and Outlet Temperature Difference (D. B.)."
4. The wattage reading may be found in in the fourth column and should be 810 to 900.

A REPRESENTATIVE ROOM AIR CONDITIONER

Condenser Inlet Temp. (Dry Bulb) °F	Evaporator Inlet Temp. (Wet Bulb) °F	Evap. Inlet & Outlet Air Temp. Diff. (Dry Bulb) °F	Total Watts
110	79	10 — 13	850 — 950
	75	14 — 17	880 — 980
	71	17 — 20	900 — 1000
	67	19 — 21	900 — 1000
	63	19 — 21	900 — 1000
100	79	11 — 14	795 — 875
	75	15 — 18	820 — 910
	71	18 — 21	840 — 930
	67	20 — 23	850 — 940
	63	21 — 24	840 — 930
95	79	11 — 14	755 — 845
	75	15 — 18	790 — 880
	71	18 — 21	810 — 900
	67	20 — 23	810 — 900
	63	22 — 25	810 — 900
	59	23 — 26	800 — 890
90	79	11 — 14	765 — 855
	75	15 — 18	760 — 850
	71	19 — 21	780 — 870
	67	21 — 24	790 — 870
	63	23 — 26	785 — 865
	59	24 — 27	770 — 860
80	71	19 — 21	720 — 800
	67	21 — 24	735 — 815
	63	24 — 27	725 — 805
	59	26 — 29	715 — 795
75	71	19 — 21	690 — 770
	67	22 — 25	700 — 780
	63	25 — 28	695 — 775
	59	27 — 30	690 — 770
70	67	22 — 25	675 — 745
	63	25 — 28	670 — 740
	59	28 — 31	665 — 735
	57	31 — 33	660 — 730

This data shows that if the evaporator is reducing the temperature of the air passing through it at least 20°, and not more than 23° the unit is operating normally for the existing conditions. The 20° dry-bulb temperature difference is the minimum value allowed for these conditions.

If the evaporator cooling is greater than the maximum temperature difference (23°), check for the following troubles:

1. Clogged or dirty filter.
2. Evaporator fan motor turning too slowly.
3. Frost or ice on evaporator.

If the evaporator cooling is less than the minimum temperature difference (20°), check for the following troubles:

1. Low line voltage.
2. Air leakage from normal path (leaking seals, damper door not tight, etc.).
3. Dirty condenser.

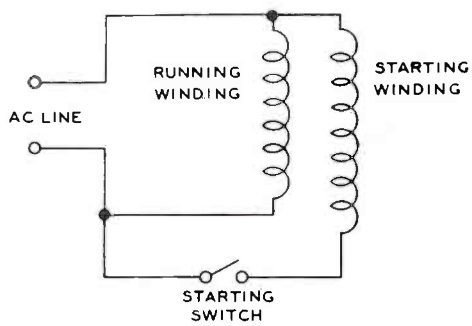


Fig. 6. Split-phase motor.

If the wattage and temperature readings are within the limits given in the table, the air conditioner may be considered to be operating normally.

Complaints of insufficient cooling may result from the use of a unit of insufficient capacity to meet the cooling load imposed upon it.

A careful performance test should always be made before considering unsatisfactory performance to be the result of a defect in the sealed refrigerant system.

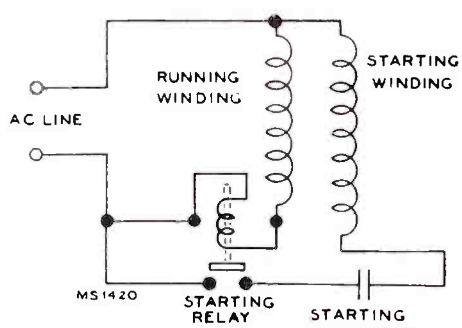


Fig. 7. Capacitor-start motor.

Electric Motors

It is advisable, at this time, to describe the several types of motors used in room air conditioners and why each type is used.

The common split-phase induction motor (Fig. 6), found on washing machines and large fans, is relatively efficient, has medium starting torque and the current required is not excessive in sizes under one-half horsepower.

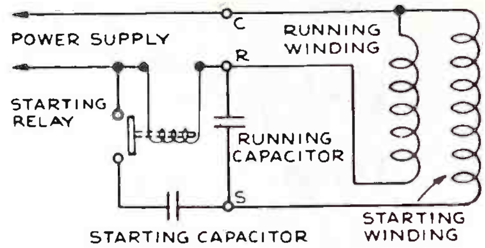


Fig. 8. Capacitor-start-run motor.

Compressors require a motor with a greater starting torque and for this reason a capacitor-start split-phase motor is used. (Fig. 7). Being hermetically sealed and surrounded by the refrigerant, all starting switches must be outside the compressor shell. In the larger size units the running current becomes quite heavy. Underwriters Laboratories now require that the total running current be less than 15 amperes. To meet this limitation, larger size conditioners utilize what is known as a running capacitor in addition to the starting capacitor. (See Fig. 8.)

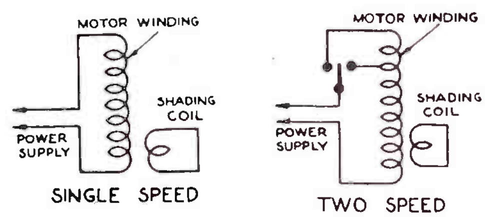


Fig. 9. Shaded-pole motors.

The so-called "shaded-pole" motors are seldom made in sizes greater than one-eighth horsepower. They do not require any starting switch but have low starting torque and are suitable for use only on small fans and other light duty applicators. (See Fig. 9.)

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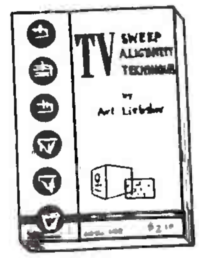

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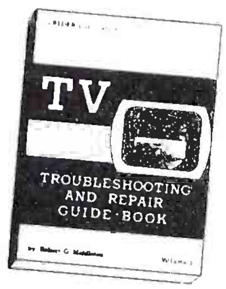

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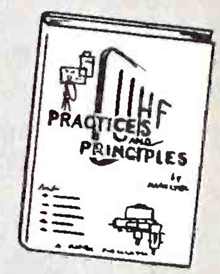

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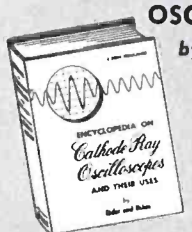

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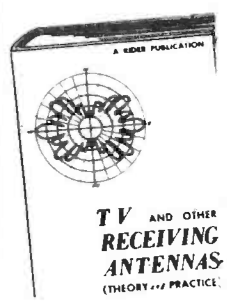

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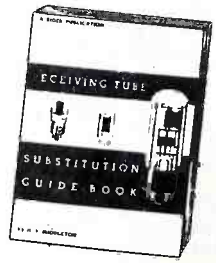

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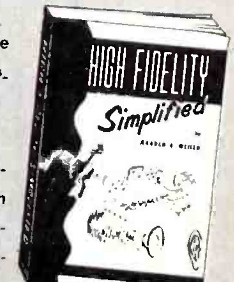

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COMMENT: For the second month in succession, more manufacturers have reported product changes than for any other previous month. The most active product classification continues to be the Sound and Audio group, with a total of 44 manufacturers reporting changes.

New Items

ALTEC LANSING — Added Model TI-401 Signal Generator at $340.00 dealer net; Model TI-402 Intermodulation Analyzer at $450.00 dealer net.
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Q-LINE MFG. — Added new series of 5 element and 10 element Yagi Antennas.
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WORKMAN TV — Added Model FR2 Filament Resistor Kit at $1.44 dealer net.

Discontinued Items

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FAIRCHILD RECORDING — Model 201-B Three-Way Turret Head discontinued.
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Price Decreases

HICKOK ELECTRICAL — Decreased price on Model 600A Portable Dynamic Mutual Conductance to $164.00 dealer net.
KENWOOD ENGINEERING — Decreased price on Model 5C-SS One Piece Chimney Mount to $2.84 dealer net.
LEWIS & KAUFMAN — Decreased price on Rectifier 705A to $17.93 dealer net.
RADELCO MFG. — Model VT-3A Indoor Antenna decreased to $2.07 dealer net.
RAYTHEON — Decreased price on CK722 Junction Type Transistor to $4.50 dealer net.
SYLVANIA — Decreased prices on Microwave Crystal Diodes 1N23B to $4.30 dealer net; 1N23BM to $12.95 dealer net; Germanium Crystal Diode 1N56 to $1.05 dealer net.

Price Increases

EITEL-MCCULLOUGH — Increased prices on Vacuum Tubes 35TG to $16.00 dealer net; 866A to $2.10 dealer net.
GONSET — Model 3026 Standard Gonset Communicator increased to $209.50 dealer net.
SYLVANIA — Increased price on Receiving Tube 6BK5 to $2.55 list.
TALK-A-PHONE — Increased price on Model LM-5 Master Station for 5 Sub-Stations to $34.80 dealer net.
UNIVERSITY LOUDSPEAKERS — Model PH Reflex Loudspeaker Projector increased to $18.60 dealer net.
NOTE: *CENTRALAB*: On Radio's Master page L-7, through error, Switch No. 1483 is shown as complete with mounting bracket and hardware. This is not so. Bracket and mounting hardware are furnished with kit No. P-300 listing at $1.50.

the crystal phono. cartridge

(continued from page 16)

"Improving" the Situation

Now, for another service failing. The well-intentioned serviceman, finding it necessary to replace a bad cartridge, decides to win customer approval by improving the performance of the equipment by replacing the original faulty cartridge with a more recently developed model. The output voltage of the original cartridge was approximately 2.5 volts at 1,000 cps. The cut-off frequency of the cartridge then might have been 4,000 cps, with a husky needle pressure of 2¾ ounces. The customer had been satisfied, but now simply requested replacement and return of the apparatus.

Good-hearted-Joe thumbing through the catalogue instead picks out a cartridge with an output voltage of 1 volt, a needle pressure of 1 ounce, and a greatly extended frequency range, cutting off at almost 10,000 cps. The customer, impressed by the description, waits the two weeks for delivery, finally arriving to find the unit installed.

Of course, the pickup arm had to be counterbalanced for one ounce needle pressure. This caused considerable trouble with the record changer trip mechanism, since it was designed to operate at the greater needle pressure required by the original cartridge. A decided loss in output resulted, of course, since the new cartridge was designed with decreased output voltage. The audio amplifier, never designed for extra power or wide response, didn't even notice the highs, and didn't have enough gain to make up the loss of input in the first place, consequently giving very weak output. As if that weren't enough, the maximum volume setting to get even weak output accented needle scratch and increased audio distortion. P.S. The new model also cost more. (Question—how much is Joe's profit?)

Every story should have a moral. Okay, here it is: A serviceman's business is to restore the faulty unit to its original condition.

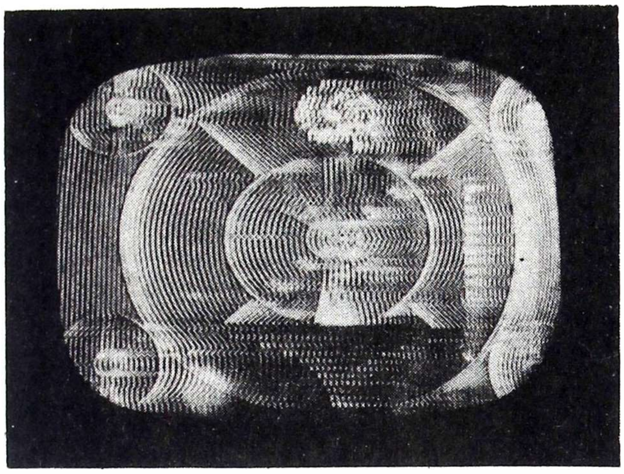
Carry an Extra-Hi Voltage etc.

(continued from page 12)

for feedback. There is nothing critical about the placement of parts, but reasonable care should be used to insulate the high-voltage. A stand-by switch is used instead of an on-off switch to facilitate testing without waiting for the filament to heat each time. No pilot light was included because the squeal of the transformer can be heard when the power is on.

TELL-A-FAULT Symptom Sheet

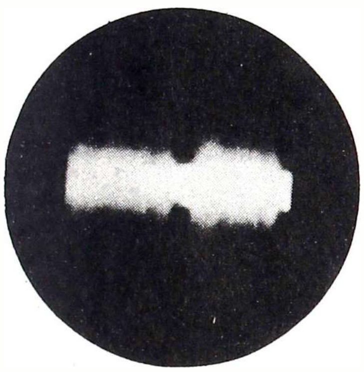
NEGATIVE PICTURE



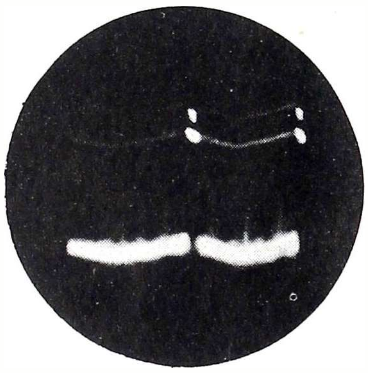
1

(NOTE: Refer to CIRCUIT GUIDE III-2 for identification of components.)

In addition to black-and-white reversal, as shown in Fig. 1, smear and marked ringing of video information were noted on the picture tube in this defective receiver. Manipulation of the brightness and contrast controls had little effect in changing this condition. Reception of audio intelligence in this split-sound receiver was unaffected by the fault.



2-A

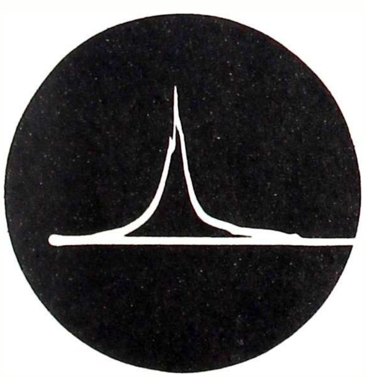


3-N

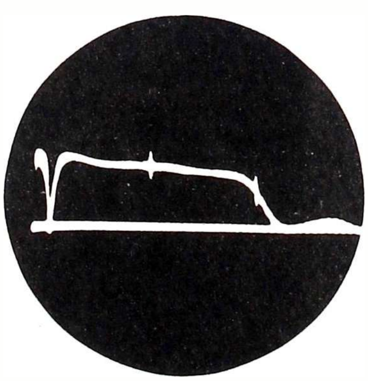
A check at the output of the video detector disclosed a normal video-signal waveform; but at the input electrode of the picture tube (grid, in this case), this display was highly distorted and of abnormally high P-P amplitude. This is shown in Fig. 2, as observed with a direct probe at F=V/2.

Working back from the picture tube into the two-stage video amplifier, similarly distorted video waveforms were noted up to and including the grid of 2nd-video amplifier *V2*. At the plate of 1st-video amplifier *V1*, however, the normal display of Fig. 3 was noted. Except for changes in waveform polarity and P-P value, the waveform in the 2nd video amplifier and at the grid of the picture tube resembles Fig. 3 during normal operation.

A check of operating voltages and resistance-to-ground readings in the peaking and coupling network between the plate of video amplifier *V1* and the grid of video amplifier *V2* disclosed the following: There was a considerable drop from normal value of resistance from the *V1* plate.



4-A



5-N

Examination of components in the plate network of 1st video amplifier V1 revealed a short in wiring. The lead going from the bottom connection of load resistor R4 to the B+ divider was making direct contact with the junction of peaking coil L3 and resistor R6. This effectively short-circuits R6.

Effects of this change in loading on video-amplifier response may be studied by a comparison of Figs. 4 and 5. The two-stage response curve, as obtained while the fault existed, is shown in Fig. 4. There is excessive response in the region of 2 mc, causing ringing and overload, but there is poor response over the remainder of the band. After repair, with the same setting of the contrast control, the normal curve of Fig. 5 was obtained. The markers appear at 2 and 4 mc.

Television Changes

(Continued from page 17)

STROMBERG-CARLSON

MODEL 16 series

Chassis differences between the 16C (console) and the 16T (table) models.

The differences between the C and T models are as follows:

C62, across the audio-output transformer primary:

In 16C is .0047 μf, 600 volts, part No. 110553

In 16T is .01 μf, 600 volts, part No. 110555

C123, across terminals No. 1 and No. 2 of the horizontal-output transformer:

In 16C is 7,500 $\mu\mu$f, 500 volts, part No. 110287

In 16T is 3,900 $\mu\mu$f, 500 volts, part No. 110272

Picture tubes:

In the 16C is the round 16GP4, part No. 162089

In the 16T is a rectangular 16RP4, 16KP4, or 16TP4, part No. 162091

Additional rectangular tube types may also be used in some receivers so that it is advisable to replace a defective picture tube in a receiver with one of the same type wherever possible. (The 162091 part number refers to all rectangular tube types, thus the type as well as part number must be used in ordering.) However, rectangular tubes of the types listed above can be interchanged by proper choice of focus coils with no other mechanical changes required. All the above tube types take focus coil part No. 114683, except the 16KP4 which must take focus coil part No. 114687.

To obtain a satisfactory range of control on the focus potentiometer with the use of the focus coils mentioned above, the R85 resistor, in series with the focus potentiometer, should be 68 ohms, 2 watts (part No. 149069) rather than the 220-ohm, 2-watt resistor originally specified. If the 68-ohm resistor is not in a receiver being serviced, another 220-ohm resistor can be bridged across the existing 220-ohm resistor to obtain a proper focus range. Receivers are now being produced with the lower value resistance in this R85 position.

ALUMINIZED PIX TUBES IN UPSWING

THE GENERAL ELECTRIC COMPANY announced today that it will increase production of its aluminized TV picture tubes by fifty percent when a retooling project, now under way at its Buffalo and Syracuse plants, is completed.

Almost three-quarters of this company's picture-tube production then will be in the aluminized type, according to J. Milton Lang, general manager of the organization's tube department.

The aluminized tubes feature a metallic reflective coating on the rear of the viewing screen. Mr. Lang states that this increases light output considerably and also improves picture contrast.

Tubes of this type are used initially in TV receivers made by GE, and by many other receiver manufacturers in addition. They are also stocked by distributors throughout the country for replacement use in receivers in which they were not originally incorporated. The increase in production was made necessary by an increase in demand, both as initial equipment and for replacement use.

The retooling project is part of an overall expansion on the part of GE in the electronic-tube field. This company is expanding warehouse facilities in Chicago, Los Angeles, and Clifton, N. J.

INDEX OF CHANGES

Model No.	Manual Page From	To	Tek-File Pack
Firestone Models 13-G-110, -115, -116, -119, -120	10-1	10-10	61
Meck Chassis 9034	10-1	10-13	66
Stromberg Carlson Model 16 Series	5-8	5-12	—
Model 17 Series	6-5	6-10	—
	7-21	7-22	—
Tele King Chassis TVJ	9-1	9-16	41

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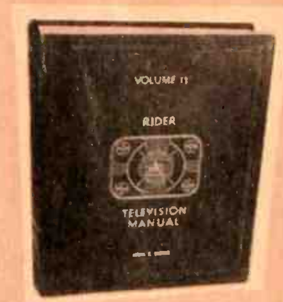

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