

ELECTRONIC TECHNICIAN

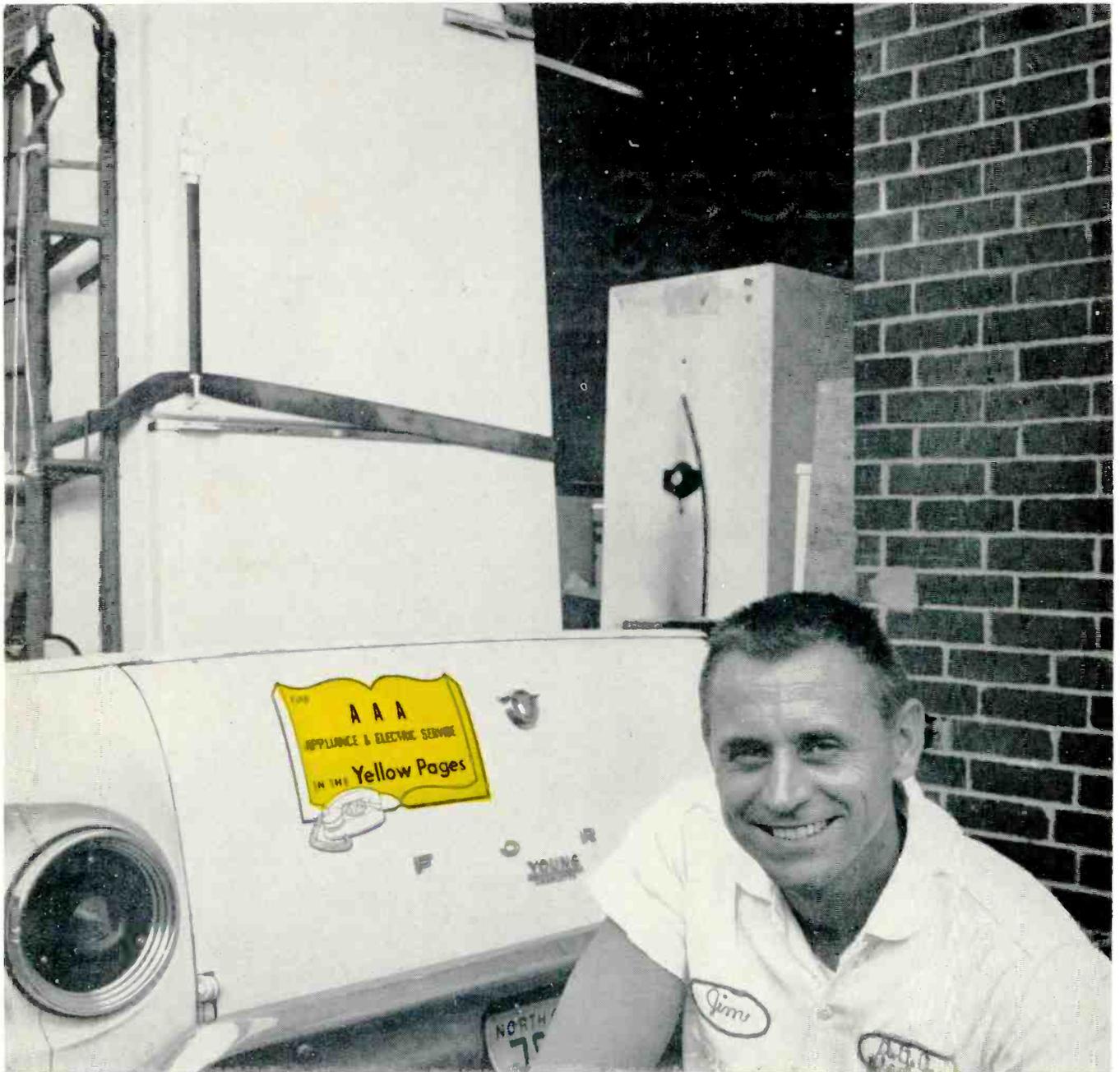
WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION



DECEMBER 1964



Business Practices / Improving Color Reception / Customer Relations



"Our Yellow Pages ad brought us a \$250 a month commercial account," says James F. Rorie, AAA Appliance & Electric Service, Charlotte, North Carolina. "It's the only advertising we do . . . and we've had great success with it. Fact is, the response to our Yellow Pages advertising has been overwhelming. People see our ad and remember us. We can trace a good portion of our business increase to Yellow Pages; it's largely responsible for the good business we enjoy today — and that's the truth of it."

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A-A-A

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F2 Radio Dispatched Trucks
For Quick Pick-Up & Delivery

523-8731

... for more details, circle 11 on post card

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR SIX NEW SETS

Schematic No

ADMIRAL	890	GENERAL ELECTRIC	889
Color TV Chassis		TV Chassis AA	
D11, 1D11, 2D11, 3D11 and 4D11		MAGNAVOX	892
AIRLINE	888	TV Chassis 47 Series	
TV Model WG-2785A		ZENITH	893
DUMONT	891	TV Chassis 14M20	
Color TV Chassis			
120699 and 120722			

GROUP
148

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR SIX NEW SETS

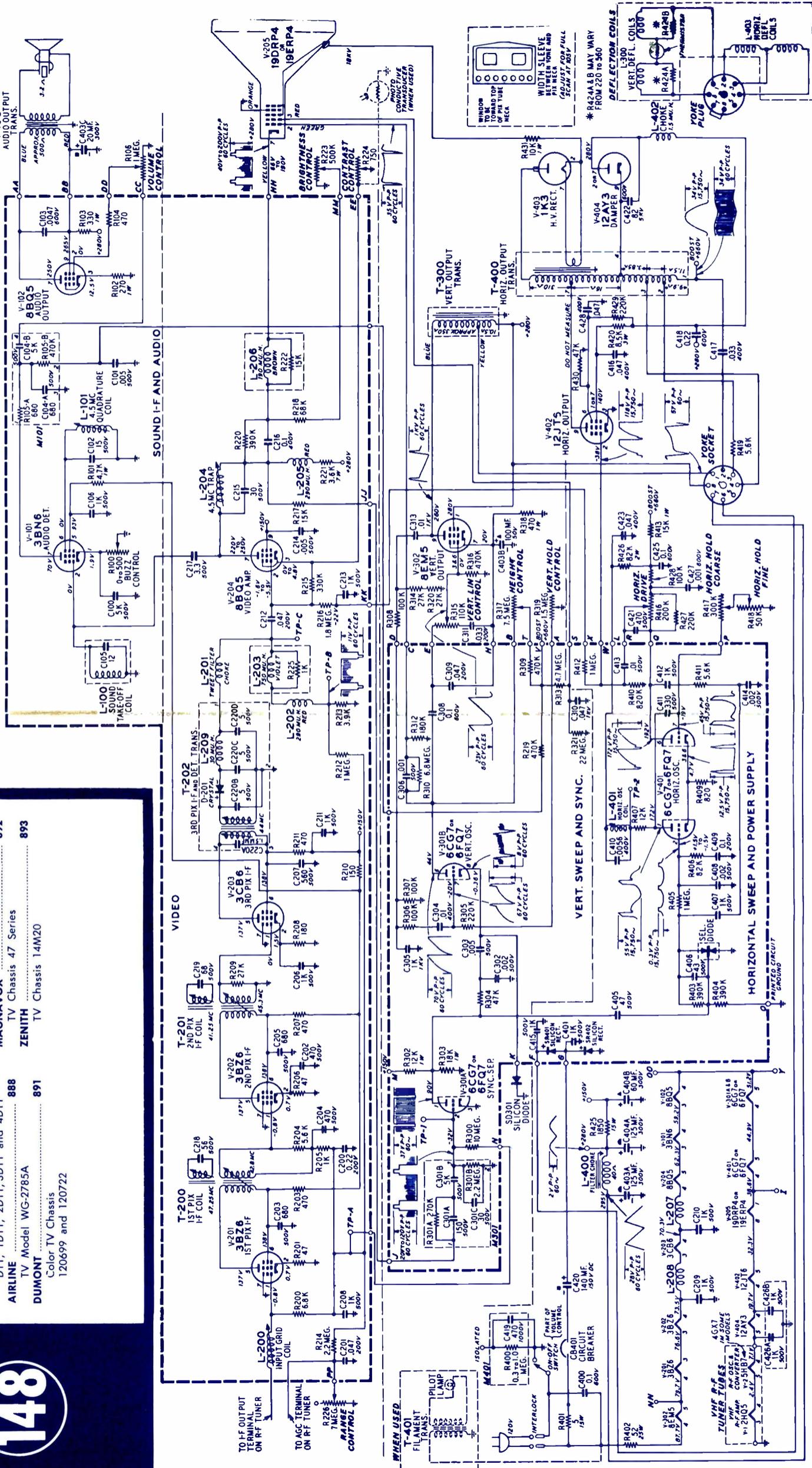
DC SOCKET VOLTAGES

All DC socket voltages shown on the schematic are measured with a high impedance VTVM and under zero signal conditions.

December 1964

AIRLINE
TV Model
WG-2785A

888



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889

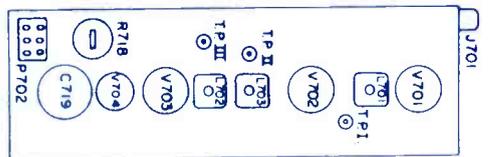
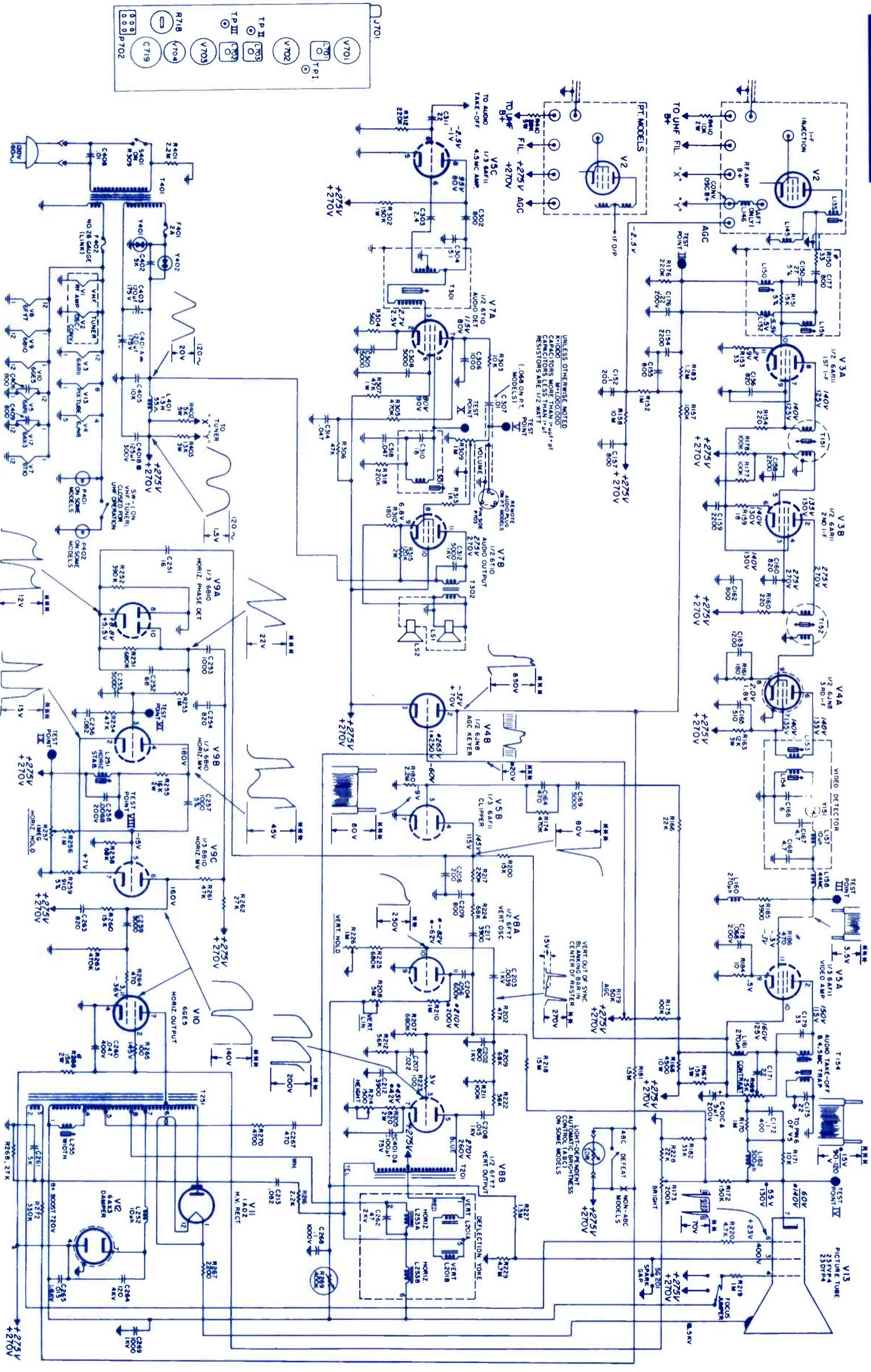
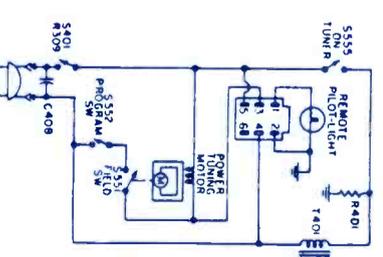
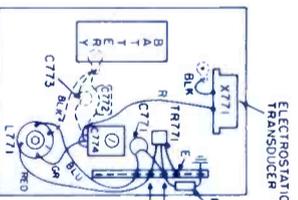
GENERAL ELECTRIC TV Chassis AA

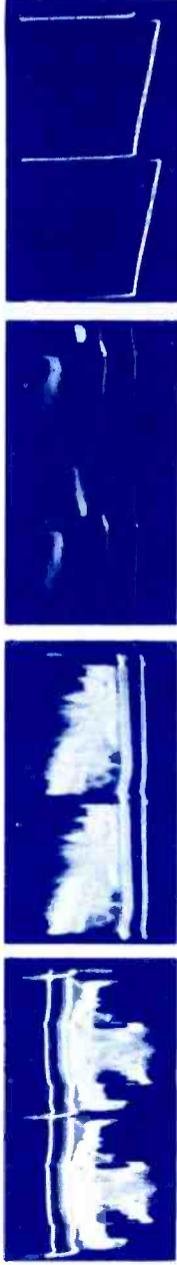
ELECTRONIC TECHNICIAN TEKTRAX

COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR SIX NEW SETS

December 1964

- 1. ALL VOLTAGE MEASUREMENTS MADE WITH A VTVM WITH RESISTANCE RANGE SET FOR NORMAL OPERATION. MEASUREMENTS MAY DEVIATE $\pm 10\%$ AT 120V AC LINE VOLTAGE.
- 2. WHERE ON-SIGNAL AND OFF-SIGNAL MEASUREMENTS WANTED, VOLTAGES ARE SHOWN ON OFF-SIGNAL VOLTAGE APPLAINS IN 1/2 LINES OVER OFF-SIGNAL ON-SIGNAL VOLTAGES & WAVE SHAPES TAKEN WITH A NOISE FREE SIGNAL PRODUCING -2.5 TO -3.5 VOLTS AGC AT VHF TUNER.
- 3. OFF-SIGNAL VOLTAGES TAKEN WITH ANTENNA DISCONNECTED & ANTENNA TERMINALS SHORTED TOGETHER ON UNUSED CHANNEL.
- 4. INDICATES VARIATION WITH CONTROL SETTING.
- 5. INDICATES SCOPE SYNCHED AT 1/2 VERT FREQ.
- 6. INDICATES SCOPE SYNCHED AT 1/2 HORIZ FREQ.





ELECTRONIC TECHNICIAN

TEKFAK

890

1—Pin 4 of Picture Tube. 100 Volts, Vert. Contrast and Brightness $\frac{3}{4}$ Turn CW.

2—Pin 2 of 2nd Video V205. 7 Volts, Vert. Negative Sync.

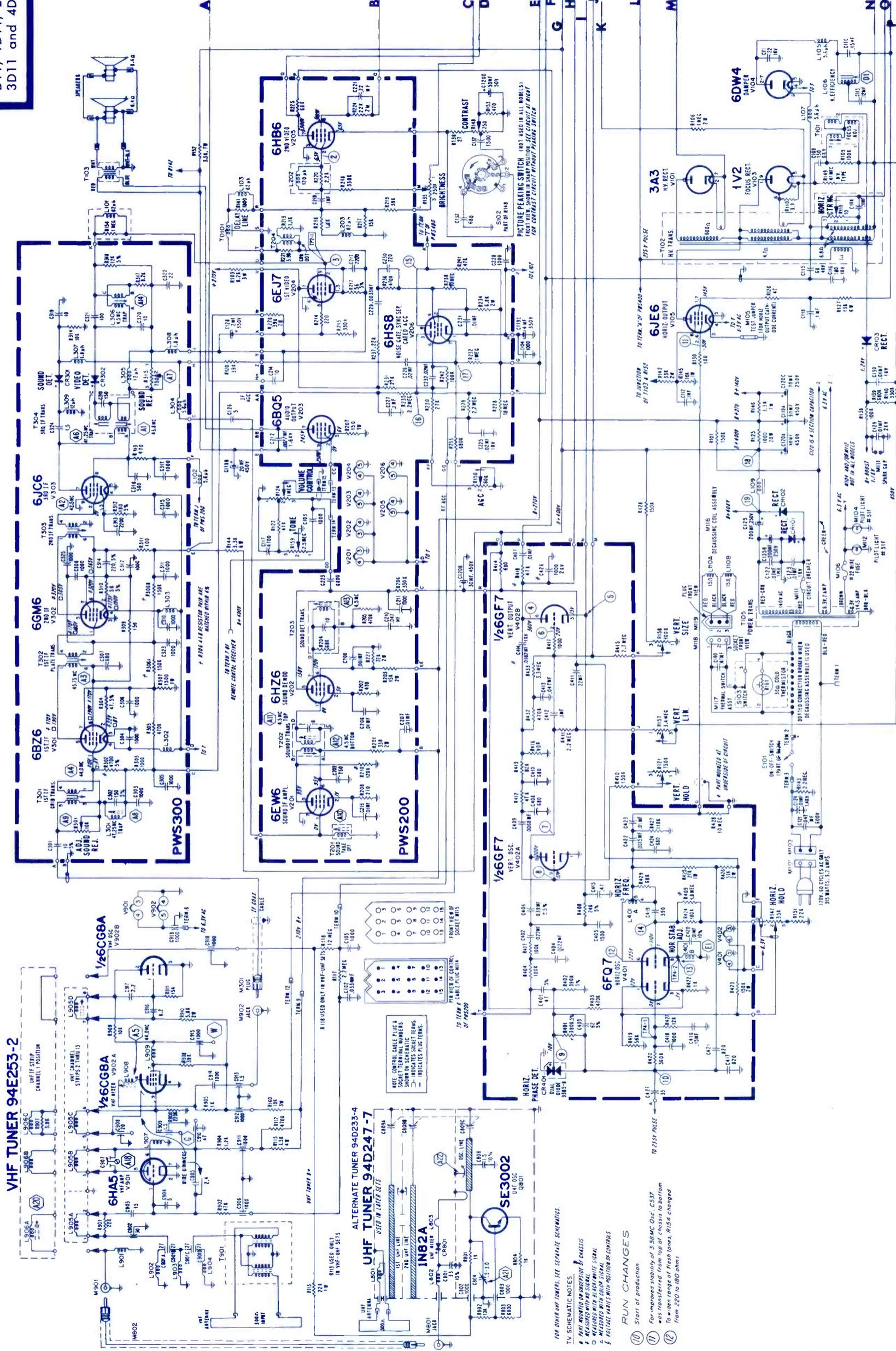
3—Pin 2 of 1st Video V204. 10 Volts, Vert. Negative Sync.

4—Pin 6 of Vert. Output V402B. 1,080 Volts, Vert.

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR SIX NEW SETS

ADMIRAL
TV Chassis
D11, 1D11, 2D11,
3D11 and 4D11

December 1964



FOR OTHER VHF TUNERS, SEE SEPARATE SCHEMATICS
TV SCHEMATIC NOTES:
* PART MOUNTED UNDER PICTURE TUBE
* MEASURED WITH COLOR SIGNAL
* MEASURED WITH COLOR SIGNAL
* VOLTAGE VALUES WITH POSITION IN CONTRAST

RUN CHANGES
Start of production
For improved stability of 3.58MC OSC. CS37 was transferred from top of chassis to bottom
To save range of fresh tones, R154 changed from 250 to 100 ohms

ELECTRONIC TECHNICIAN TEKFAK

891

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR SIX NEW SETS

DUMONT
Color TV Chassis
120699 and
120722

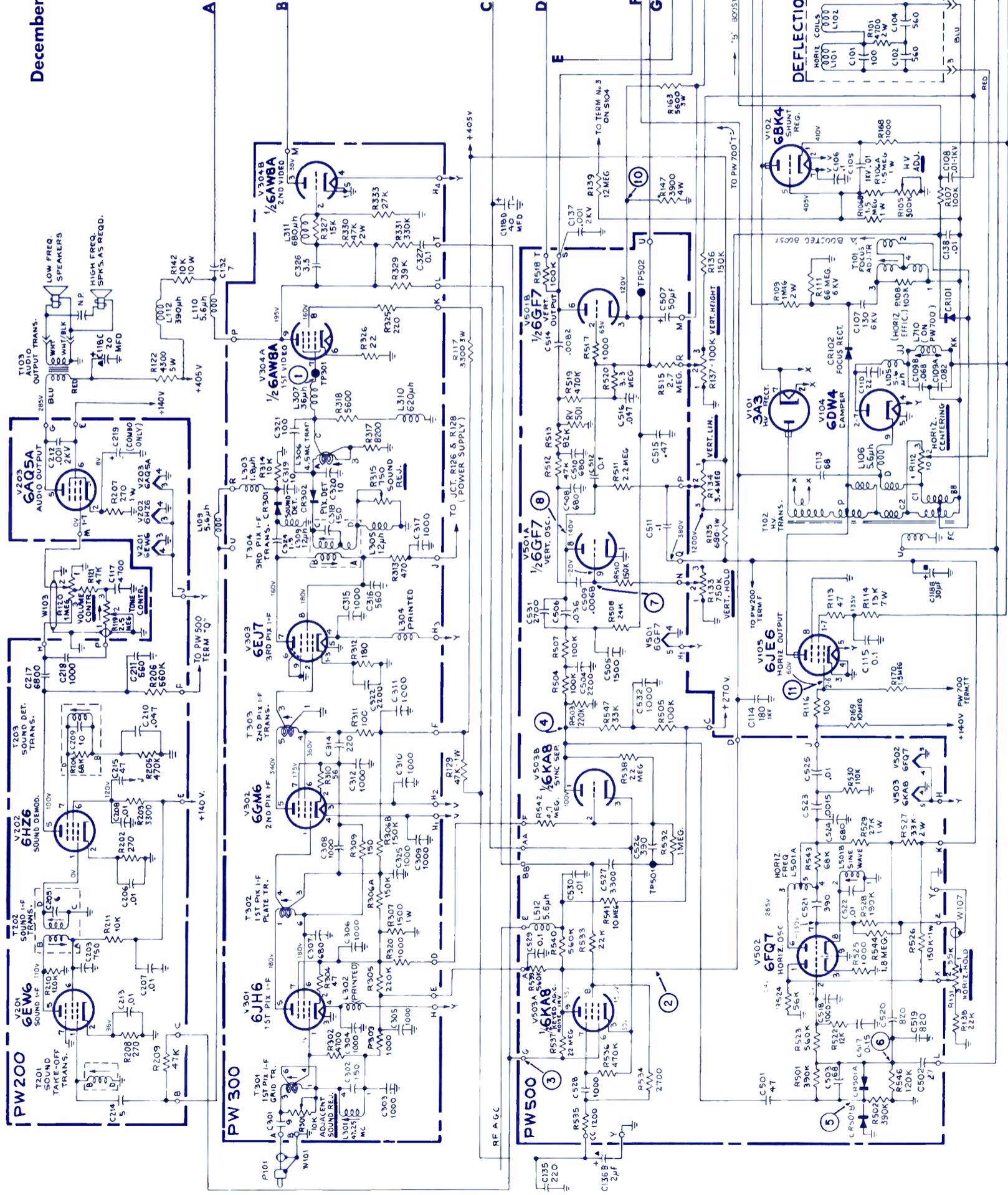
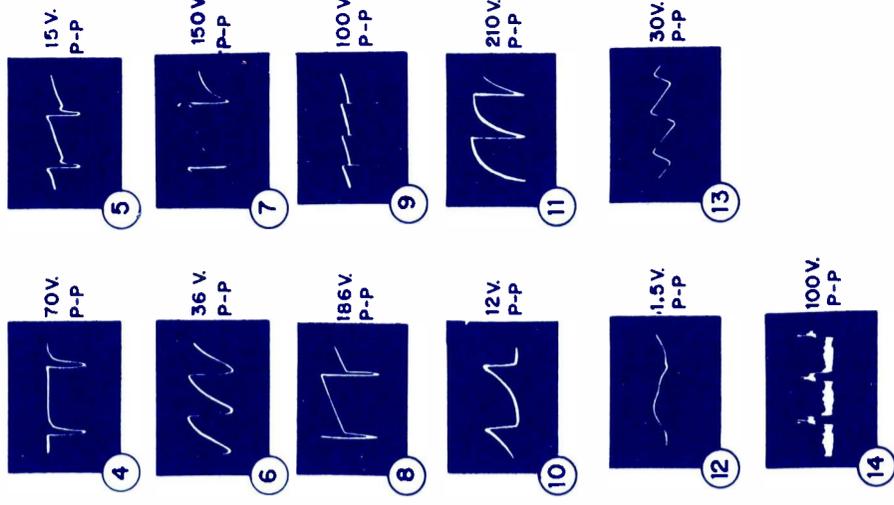
December 1964

BALLOONS ①, ②, ETC.,
SHOWN ON SCHEMATIC
INDICATE POINTS OF
OBSERVATION OF THE
WAVEFORMS.

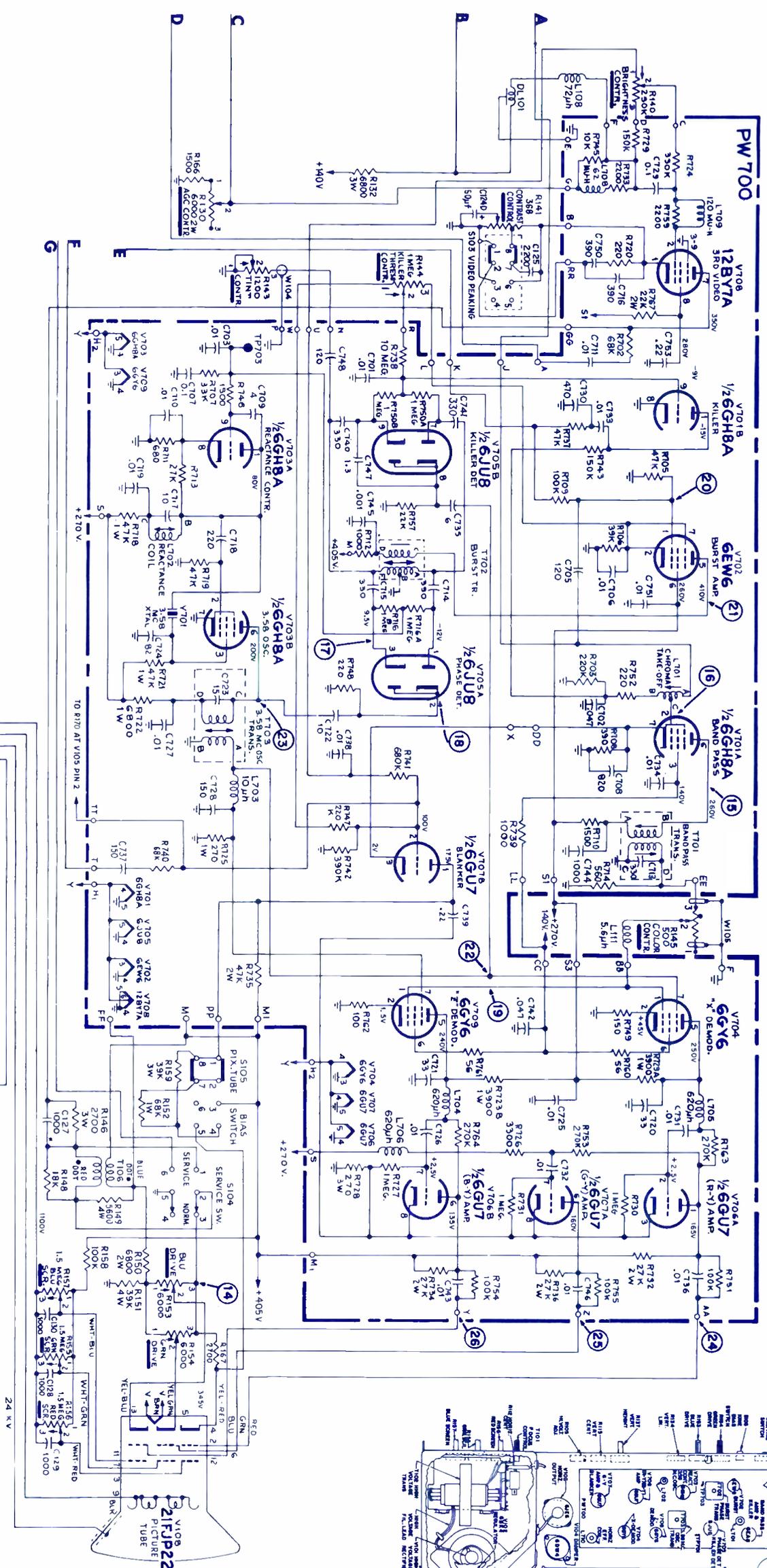
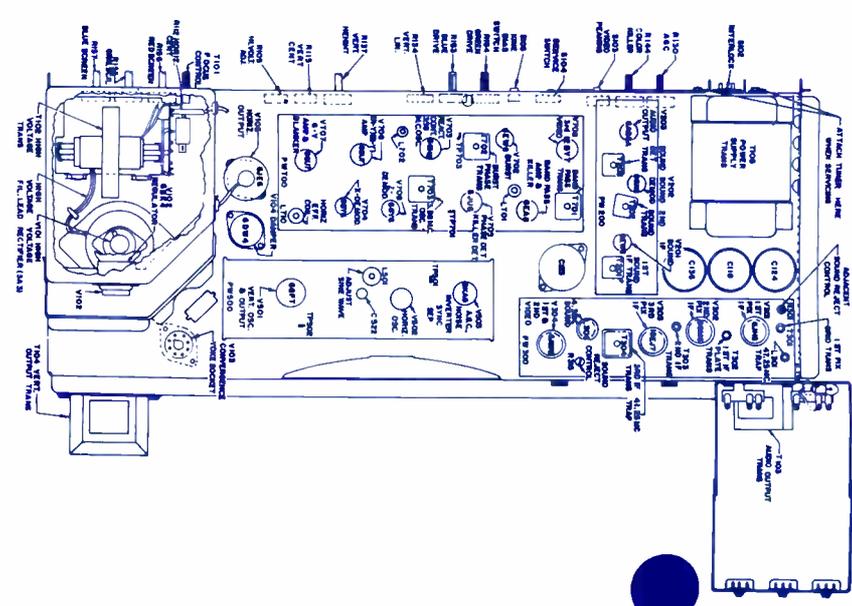
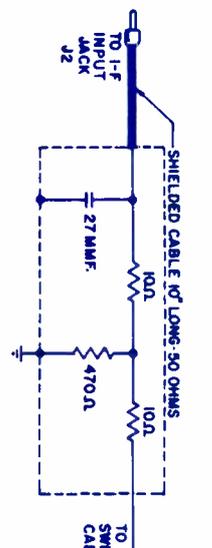
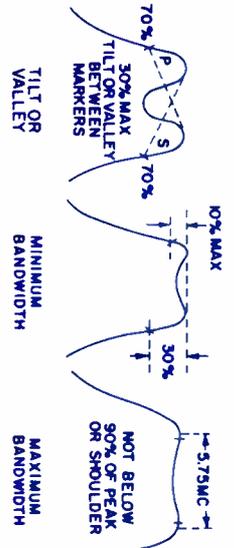
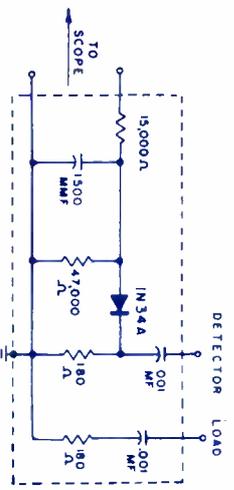
3.0V.
P-P

750V.
P-P

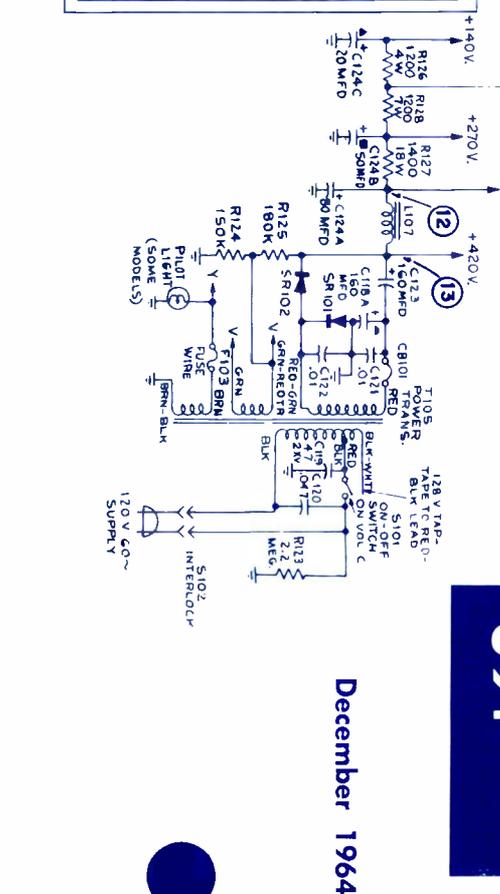
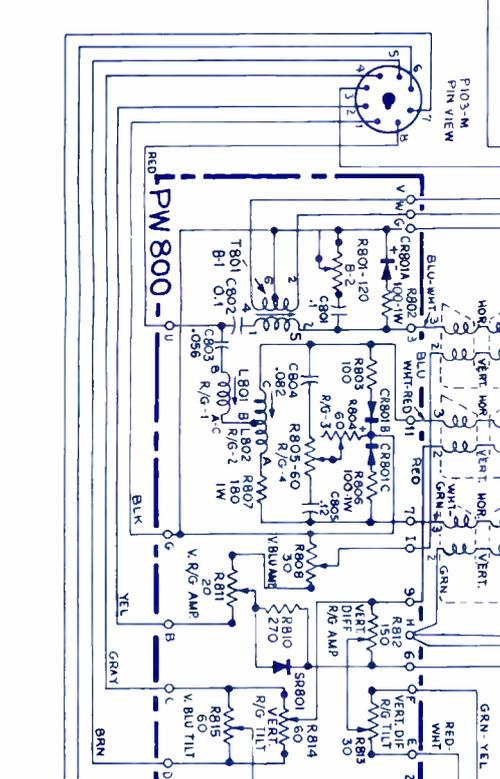
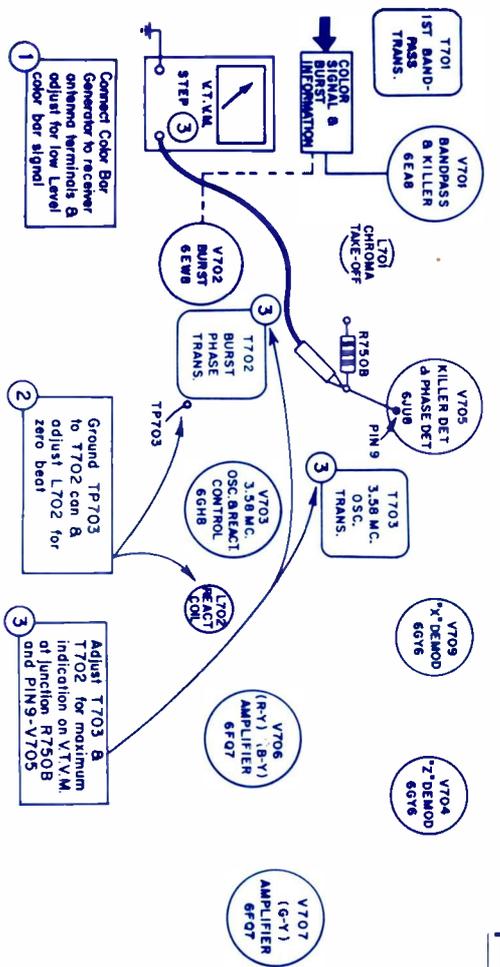
20V.
P-P



More Data on Reverse Side



More Data on Reverse Side



DUMONT
Color TV Chassis
120699 and 120722

ELECTRONIC TECHNICIAN

TEKFAX

891

December 1964

ELECTRONIC TECHNICIAN

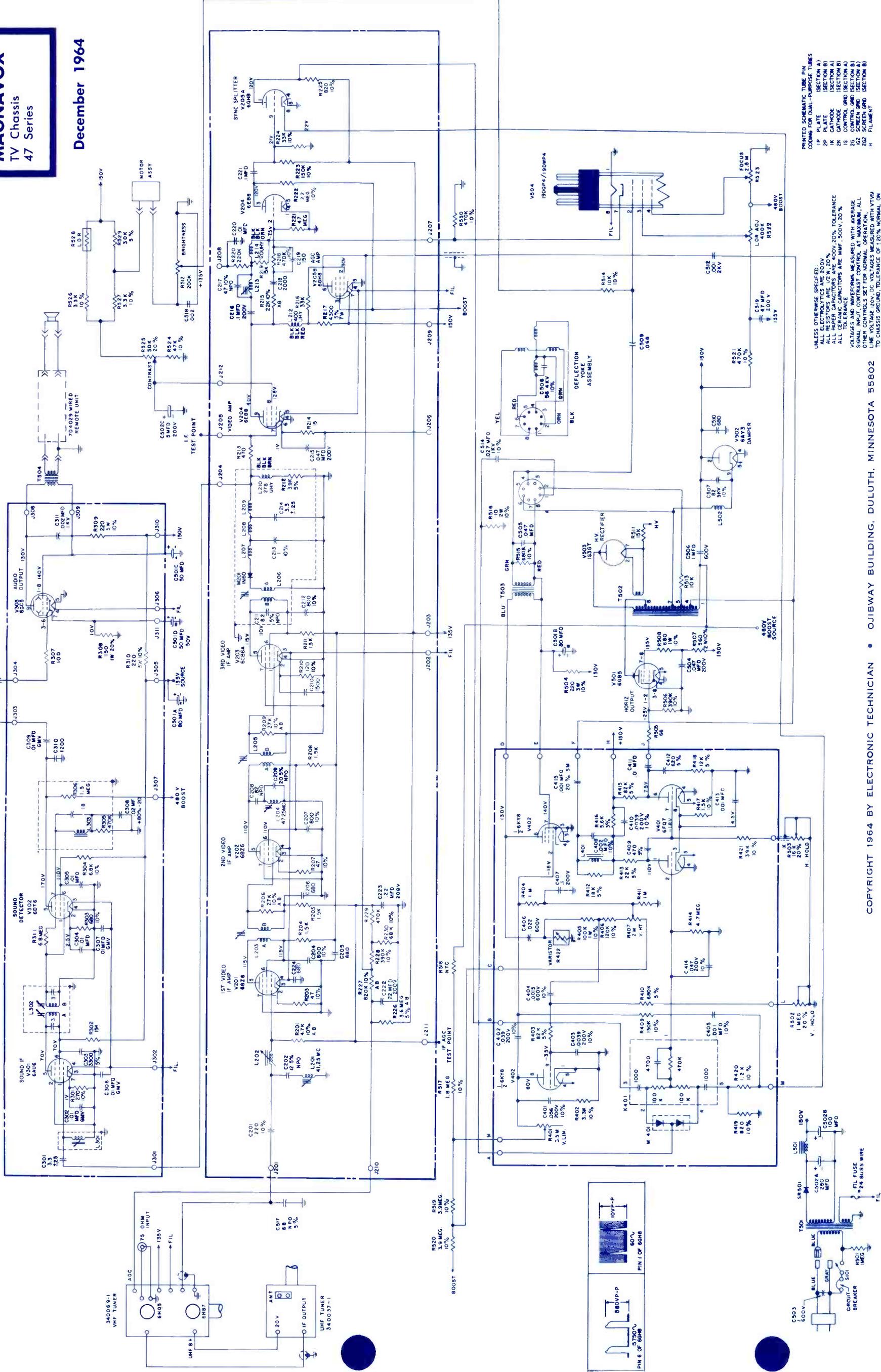
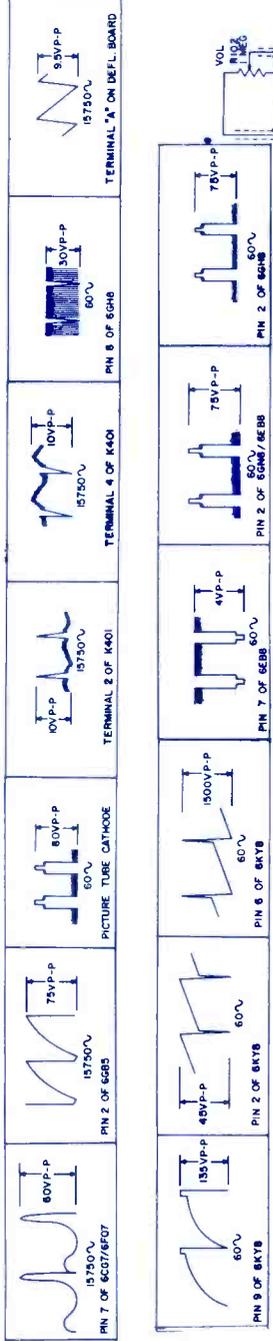
TEKFAK

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR SIX NEW SETS

892

MAGNAVOX
TV Chassis
47 Series

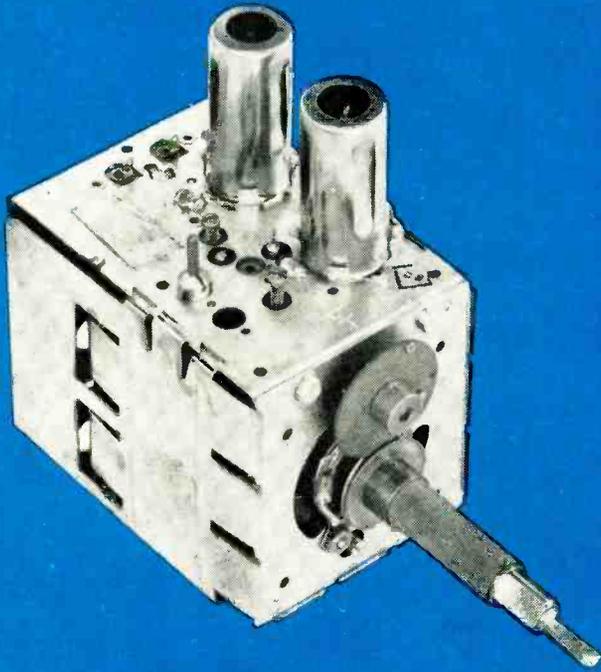
December 1964



PRINTED SCHEMATIC TUBE PIN
COUING FOR DUAL-PURPOSE TUBES
1P PLATE (SECTION A)
2P CATHODE (SECTION B)
3K CATHODE (SECTION B)
4K CATHODE (SECTION B)
5G CONTROL GRID (SECTION B)
6G SCREEN GRID (SECTION B)
7H FILAMENT

UNLESS OTHERWISE SPECIFIED:
ALL RESISTORS ARE 1/2 W, 20%
ALL PAPER CAPACITORS ARE 400V, 20% TOLERANCE
ALL CERAMIC CAPACITORS ARE MMF, 500V, 20%
VOLTAGES AND WAVEFORMS MEASURED WITH AVERAGE
SIGNAL INPUT, CONTRAST CONTROL AT MAXIMUM, ALL
OTHER CONTROLS SET FOR NORMAL OPERATION. ALL
LINE VOLTAGE 200V, DC VOLTAGES MEASURED WITH VVM ON
LINE VOLTAGE SOURCE, TOLERANCE OF ±20% NORMAL ON
ALL READINGS

TUNER REPAIRS



\$9.50

FOR COMPLETE OVERHAUL

**Includes ALL parts (except tubes)
ALL labor on ALL makes**

**24-HOUR SERVICE with
FULL YEAR WARRANTY**

Sarkes Tarzian, Inc., largest manufacturer of TV and FM tuners, maintains two completely-equipped Service Centers to serve YOU. Both centers are staffed by well-trained technicians in this specialized field and are assisted by engineering personnel to assure you of FAST, DEPENDABLE service.

Ⓢ Tarzian-made tuners—identified by this stamping—received one day will be repaired and shipped out the next. A little more time may be required on other makes. Every channel is checked and re-aligned per manufacturer's specifications, not just the channels which might exist in any given area.

You get a 12-month guarantee against defective workmanship and parts failure due to normal usage. Cost to you is only \$9.50 and \$15 for UV combinations, including all labor and parts except tubes. No additional costs. No hidden charges. All tuners repaired on approved, open accounts. You pay shipping. Replacements on tuners beyond practical repair are available at low cost.

When inquiring about service on other than Tarzian-made tuners, always send TV make, chassis and Model number. Check with your local distributor for Sarkes Tarzian replacement tuners, parts, or repair service. Or, use the address nearest you for fast factory repair service.



SARKES TARZIAN, INC.

TUNER SERVICE DIVISION

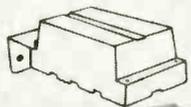
See your distributor, or use the address nearest you

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Bloomington, Indiana
Tel: 332-6055

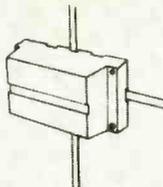
10654 Magnolia Blvd.,
North Hollywood, Calif.
Tel: 769-2720

Manufacturers of Tuners . . . Semiconductors . . . Air Trimmers . . . FM Radios . . . AM-FM Radios . . . Audio Tape . . . Broadcast Equipment

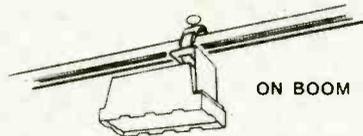
MOUNTS 5 WAYS



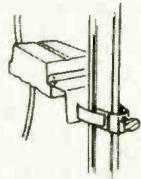
ON OUTSIDE OF HOUSE



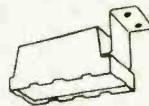
INSIDE OF HOUSE



ON BOOM



ON MAST



UNDER EAVE



Never before couplers like these! New Winegard Super Color Couplers ...the 2 most efficient TV-FM 2 and 4 set Couplers ever built!

- Constant Isolation between sets . . . 22db minimum across all channels (2-13 and FM)
- Lowest Loss of Any Coupler . . . -3.2db maximum
- Best Impedance Match from Antenna to Coupler and Set to Coupler
- Allow Best Possible Reception on Color or Black & White Sets

There is a wide difference in the performance of TV-FM couplers. And now, with the new Winegard 2-set and 4-set Super Color Couplers, there is a greater difference than ever.

For example, no resistors are used for isolation of outputs. No resonant coils are used in the circuit. Instead, our research labs have developed an entirely *new coupler circuit* using three high frequency, ferrite core transformers in a unique "Balanced Bridge" circuit.

What does this do to performance? Well, for one thing, the 2-set Super Coupler provides an isolation figure of 22db minimum across *all* channels (2-13 and FM). Until now, the minimum isolation between sets with 2-set couplers was about 10db or 3 times, and was not constant on all channels. With the new Super Color Couplers, it's 12.8 times—*four times better* than the previous best. In fact, isolation is so good, you can put a dead short across one set of output terminals without affecting the set connected to other output.

LOSS is another key factor in measuring the performance of a coupler. The lowest possible theoretical loss in a 2-set coupler is -3db but no coupler on the market had ever approached this ideal. Now, with Winegard's new 2-set Super Coupler (CC200), the MAXIMUM loss is -3.2, nearly perfect and by far the best on the market.

One more very important factor—IMPEDANCE. There are two impedance matches to consider . . . "Forward" from coupler to antenna, and "Backward" from set to coupler. A perfect coupler would have a VSWR of 1.1:1 on both matches. Some couplers have good match one way but, until now, no coupler ever had a good match both ways. Winegard Super Couplers have a near perfect VSWR of 1.2:1 both *forward and backward* . . . and on all channels. This far exceeds other couplers on the market.

What does all this mean to your customers? Most important, it means that the Super Coupler will not spoil picture resolution by adding smear or halos. *The Super Coupler is especially recommended for color installations* where preservation of picture quality is even more critical than on black & white.

What besides performance? Construction and price. The new Winegard Super Color Couplers have a unique 5-way mount, sleek new weather-proof coupler housing, pre-notched transmission line outlets, 1/4" slotted Hex terminal screws and no-strip terminal connections . . . the price is only \$4.50 for the CC200 which includes the special inside-outside mount.

Try the new Winegard Super Couplers now and *see* the difference. Ask your distributor for a 6 pack dispenser. Try them on your next six installations. If they aren't the finest you've ever used, take them back for a *full refund*.

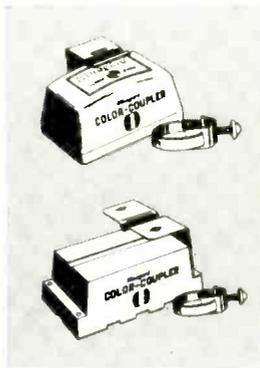
CC200 — For VHF and FM Specifications as above.
List \$4.50 includes 5-way mounting bracket and strap.

CC400 — For VHF, UHF and FM (replaces LT-43).

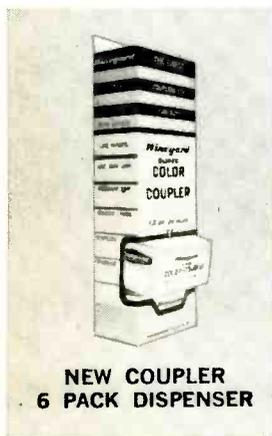
Max. loss -6.23DB (A theoretical loss for perfect 4 way coupler would be -6.0DB); Isolation 12DB min; Response $\pm 1/4$ DB per 6MC; VSWR: Input 1.15:1; Output 1.4:1 Max; Bandpass 20MC-1000MC; Impedance: Input 300ohm, Output 300ohm. List \$5.50 including 5-way mount and strap.

Winegard's Famous CC23 Color Coupler
Finest VHF/FM color coupler on the market next to our new Super Color Couplers. List Price \$3.95.

Winegard All New CVU-2 UHF-VHF Coupler Efficiently transfers UHF and VHF signals from antennas to sets. Serves as coupler or splitter for channels 2-83 (UHF-VHF). List \$3.95.



	UHF	VHF/FM
Splitter loss	3.5db	4.3db
Isolation	20 db	12 db
VSWR	1.4:1	2:1



NEW COUPLER
6 PACK DISPENSER



Winegard Co.

ANTENNA SYSTEMS

3019-0 Kirkwood, Burlington, Iowa

--- for more details circle 42 on post card

ELECTRONIC TECHNICIAN

DECEMBER 1964
VOL. 80 NO. 6

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

COVER:

Color TV set sales continue to rise throughout the nation in thousands of small, medium and large-operation sales-service organizations.

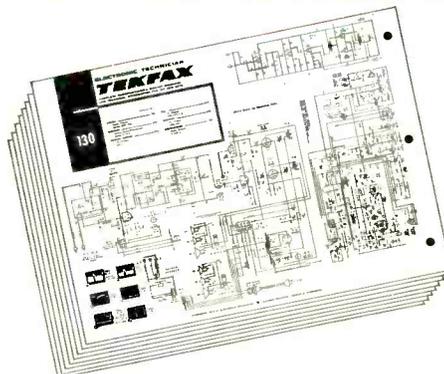
FEATURES:

Basic Business Practices For Independent Service-Dealers	39
<i>Marvin Tepper tells why many TV-radio service-dealers fail to make the grade in business</i>	
What You'll Find in 1965 TV Sets Part II	41
<i>Some innovations in new sets that improve operation and simplify servicing</i>	
What's 'Public Relations?'	45
<i>This article reveals a sure way to boost your business</i>	
Improving Color TV Reception	46
<i>Lon Cantor shows why you have to install better antennas for color TV reception</i>	
Your Records Can Save Your Business	49
<i>How to use your books to monitor your operations and avoid financial difficulties</i>	
Visual Symptoms Will Tell You Part I	51
<i>Jay Shane reveals importance of visual symptoms in diagnosing subject</i>	
Choosing and Using Audio Oscillators Part III	53
<i>Art Walters continues his in-depth article on this important subject</i>	
1964 Article Index	62
<i>An alphabetically arranged listing of the articles and features that appeared in ELECTRONIC TECHNICIAN during 1964.</i>	

DEPARTMENTS

Letters to the Editor	22	Shop Hints	58
Editors' Memo	26	'Tough Dogs'	60
Sync on Business	30	New Products	75
Technical Digest	32	Advertisers Index	82

TEKFAX . . . 16 PAGES OF THE LATEST SCHEMATICS



ADMIRAL: TV Chassis D11, 1D11, 2D11, 3D11, and 4D11

AIRLINE: TV Model WG-2785A

DUMONT: Color TV Chassis 120699 and 120722

GENERAL ELECTRIC: TV Chassis AA

MAGNAVOX: TV Chassis 47 Series

ZENITH: TV Chassis 14M20

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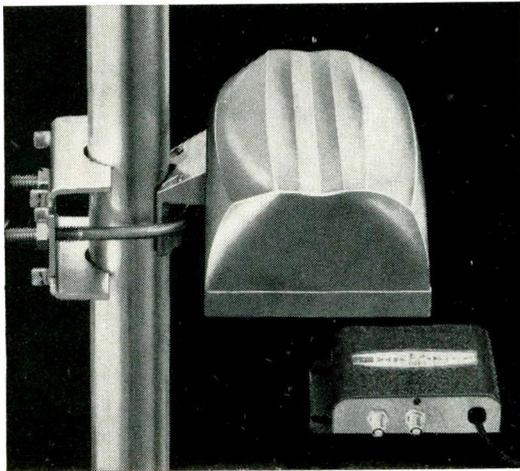
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"A professional quality TV system priced for the home?"



"Try this!"

"I understand that professional TV systems use 75 ohm coax."

"That's right. Because coax minimizes interference and ghosting."

"How's that?"

"It's shielded—doesn't pick up noise. Also, it's unaffected by changing weather conditions. With 300 ohm twinlead, moisture can play havoc with the signal."

"So, that's it."

"What's more, you can feed coax thru all types of surfaces, even near metal, without interfering with performance."

"I'd like to have a system with TV outlets all over the house—bedrooms, kitchen and patio."

"The new two-transistor Blonder-Tongue Vamp 2-75 is easy to install and it can deliver sharp, clear pictures to as many as 8 TV outlets."

"Sounds real professional. What about the cost?"

"The rugged, weatherproof amplifier with remote power supply lists for only \$44.95."

"I'm on my way to my dealer."

(This message was paid for out of the gross profits of BLONDER-TONGUE, 9 Alling St., Newark 2, N.J.)



- - - for more details circle 17 on post card

LETTERS TO THE EDITOR

A Well-Worn 'Tool'

I have been a subscriber to your publication for some time now and consider it as valuable as any of my tools or test equipment . . . I have been trying, without success, to obtain an instruction book for a Solar capacitor analyzer, EXAM-ETER Model CE. I would be willing to purchase, or borrow, a copy. Would return the book.

SY SHEARD

Ottawa, Ont., Canada

Wants More On EOs

I want to compliment Mr. Joe Hayes on the "Electronic Organ Principles" article which appeared in your October 1964 issue. The mention of forthcoming articles on this subject sounds interesting and profitable.

JAMES JIROVSKY

Hooper, Nebraska

Likes Realistic Art

The two technicians your artist invented for the September 1964 ELECTRONIC TECHNICIAN cover look like first class amateurs. The one climbing the roof ladder looks like he's scared to death crawling on all-fours. The ladder leading to the roof is too short and too far away from the roof ladder. And the antenna attached to the chimney must have been installed by a do-it-yourselfer without any knowledge of safety factors and I have yet to see an antenna mast bend in three or four places like the one in the picture. Outside of that, I think ET is the best magazine on the market. I compliment you on publishing such an educational and informative magazine.

NICK ROSCO

Farrell, Pa.

• *That's a 20-ga mast that got worked over by an East Coast hurricane.—Ed.*

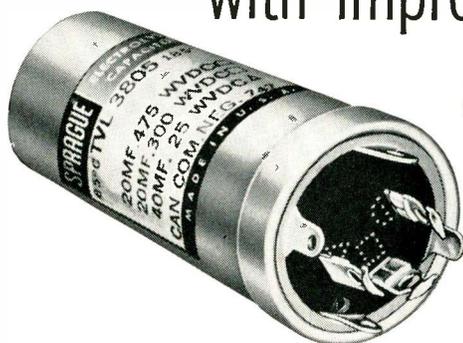
Technician Certification

I am seriously interested in certification for engineering technicians . . . Please send full information . . . I want to thank ELECTRONIC TECHNICIAN for the many fine

WHY bother with makeshift twist-prong capacitor replacements ?

When you substitute capacitor sizes and ratings, you leave yourself wide open for criticism of your work . . . you risk your reputation . . . you stand to lose customers. It just doesn't pay to use makeshifts when it's so easy to get the exact replacement from your Sprague distributor!

Get the right SIZE,
right RATING every time
with improved

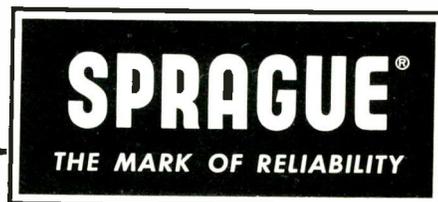


SPRAGUE TWIST-LOK[®] CAPACITORS!

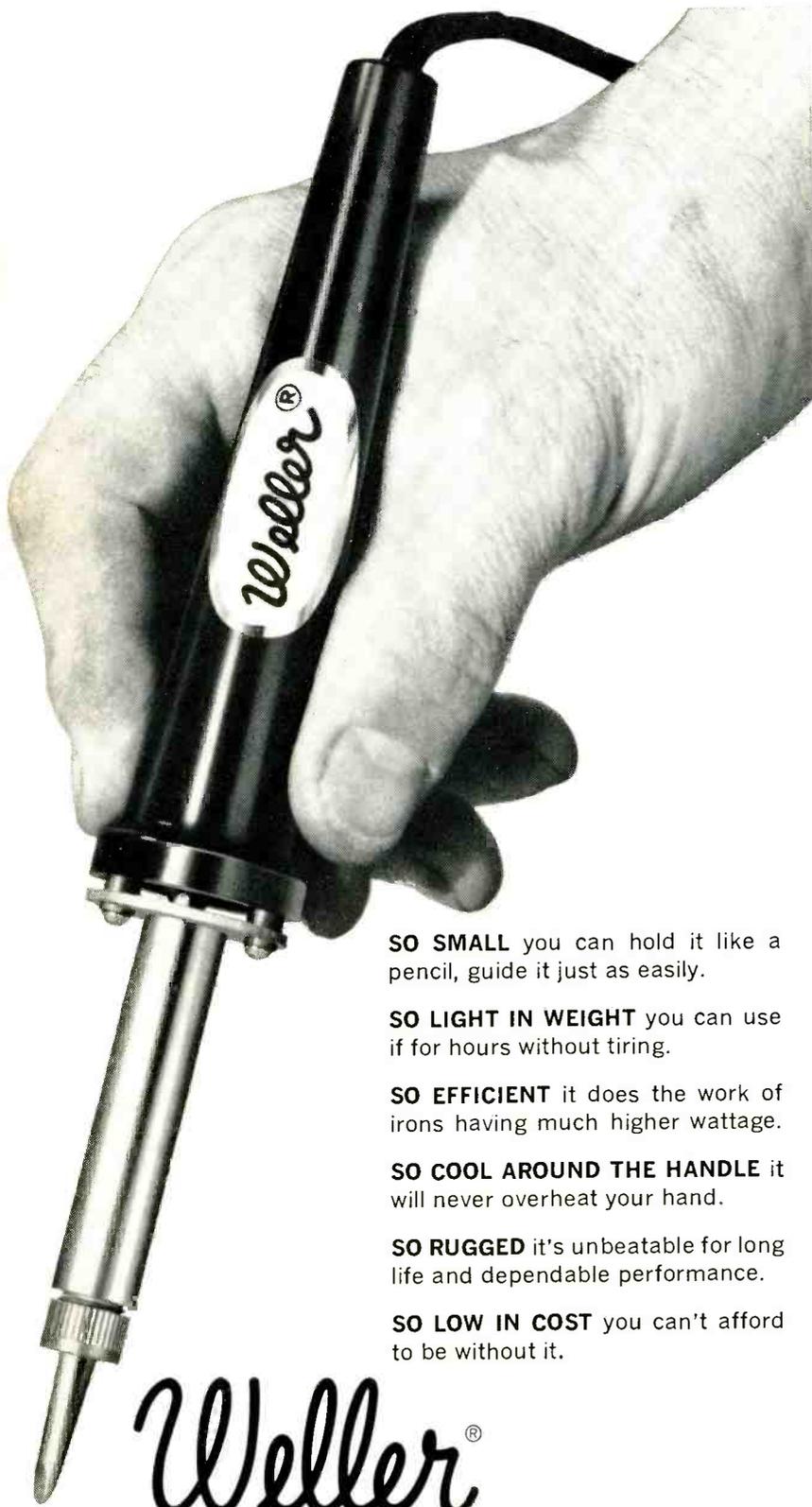
1,863 different capacitors to choose from!

The industry's most complete selection of twist-prong capacitors, bar none. Greater reliability, too. Exclusive Sprague cover design provides a leak-proof seal which permits capacitors to withstand higher ripple currents.

GET YOUR COPY of Sprague's comprehensive Electrolytic Capacitor Replacement Manual K-107 from your Sprague Distributor, or write Sprague Products Co., 65 Marshall St., North Adams, Massachusetts.



WORLD'S LARGEST MANUFACTURER OF CAPACITORS



SO SMALL you can hold it like a pencil, guide it just as easily.

SO LIGHT IN WEIGHT you can use it for hours without tiring.

SO EFFICIENT it does the work of irons having much higher wattage.

SO COOL AROUND THE HANDLE it will never overheat your hand.

SO RUGGED it's unbeatable for long life and dependable performance.

SO LOW IN COST you can't afford to be without it.

Weller[®]

"Pencil" Soldering Iron

A 25-watt, 115-volt iron that's ideal for miniature-type soldering.

Complete with tip and cord set. Screwdriver-shaped tips available in three sizes. Model W-PS. **\$5.20** list.

Buy Weller "Pencil" Soldering Irons at your Electronic Parts Distributor.

WELLER ELECTRIC CORP., 601 Stone's Crossing Rd., Easton, Pa.

--- for more details circle 40 on post card

LETTERS TO THE EDITOR

articles and to say you deserve a lot of credit for carrying one like this . . .

WILLIAM G. PORTER
North Warren, Pa.

At this writing we have received more than 600 letters in response to this article and they are still coming in! — Ed.

I have been a TV service technician for 10 years and am interested in engineering technician certification . . .

W. W. ADKISON
Yale, Okla.

I read your article on Certification of Engineering Technicians and like the idea very much . . . Since retiring from the Navy I've worked as an electronics technician in the missile field . . .

FRANK S. THOMAS
So. Daytona, Fla.

. . . I enjoy ELECTRONIC TECHNICIAN Magazine very much . . . Please send further information about engineering technician certification . . .

KENNETH BLAUVELT
Erie, Penn.

Please send me more information on certifying engineering technicians. I am a registered professional engineer . . . and believe some of the men here could qualify . . .

J. L. OBERHOLZER, SUPT.
Relay & Communications Div.
Honolulu, Hawaii

We Scooped 'Em!

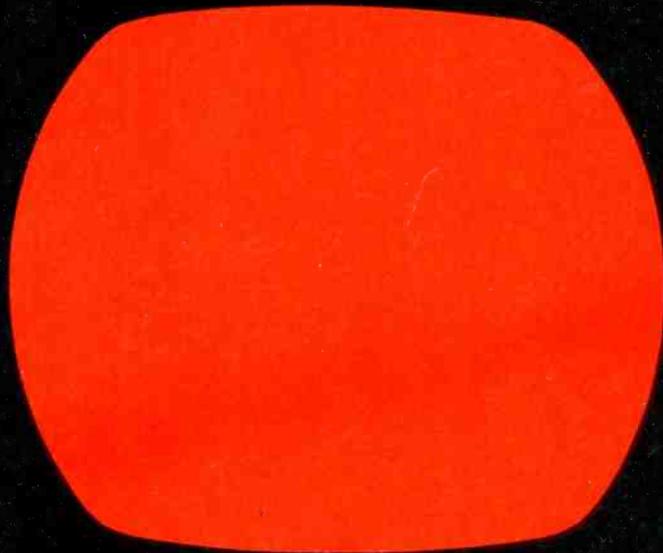
You scooped the entire TV-radio magazine field with your "Compacktrons — Condensed Specifications" in the May 1964 edition. Congratulations and thanks for some useful information. I have been a subscriber since about 1945, when ET was known as "Retailing."

HORACE D. WESTBROOKS
Griffin, Ga.

you get **PRODUCT PLUS** *from your Sylvania Distributor*

Suddenly

**COLOR TV
HAS A NEW
RED STANDARD**



Sylvania's new EUROPIUM RED.

New COLOR BRIGHT 85 picture tube brings more natural color to television and increases monochrome brightness 43%.*

The startling news in the television industry is Sylvania's new picture tube, and its new, truer red phosphor.

EUROPIUM RED, developed at GT&E Laboratories, is the brightest red known to the industry. And, to match it, now the full brightness of blue and green is used. The result is a color picture tube that gives the entire television industry a boost.

Because the COLOR BRIGHT 85 tube is *really* bright, dealers can demonstrate color TV effectively in normally lighted showrooms. As the set's brightness is adjusted, the colors remain true—not shifting to unnatural tones in the highlights of the picture.

Another thing, black and white performance is far better than you've ever seen before in a color tube. Be-

sides the increased brightness, there's improved contrast in a sharp, vivid picture.

The new, exciting COLOR BRIGHT 85 picture tube is a product plus from Sylvania for the entire color television industry, and particularly for dealers. In color, as in black and white, you know it's good business to handle the Sylvania line.

SYLVANIA
SUBSIDIARY OF
GENERAL TELEPHONE & ELECTRONICS **GT&E**

NEW CAPABILITIES IN: ELECTRONIC TUBES • SEMICONDUCTORS • MICROWAVE DEVICES • SPECIAL COMPONENTS • DISPLAY DEVICES

*Tests show the COLOR BRIGHT 85 tube is 43% brighter, on the average, than standard color picture tubes.



Be a wise owl!

How to save time, increase profit with Admiral antennas!



Simplified for easier installation . . . priced for bigger profits! All Admiral antenna kits are designed to help you increase outdoor antenna sales and installations. New "All-Snap" assembly overcomes customer complaints of slow installation and high cost.

Each kit is prepacked in its own carton with all the necessary hardware. There's nothing more to buy! No need to have extra hardware lying around your shop—or in your service vehicle.

You can sell every antenna need with conical, in-line, yagi, uhf, and new parabolic styles. Many are available with gold anodizing for custom installations.

And the remarkable Admiral price gives you bigger profits from the expanding antenna market.

Call your Admiral Distributor today . . . start saving installation time, pocketing new profits tomorrow.

Be wise . . . standardize on

Admiral "ALL-SNAP" ASSEMBLY ANTENNAS

Always Precision Crafted Quality

--- for more details circle 10 on post card

EDITORS' MEMO

Through the Looking Glass

We recently took a long look at ELECTRONIC TECHNICIAN readers through a reader inquiry. Four thousand questionnaires were mailed to subscribers throughout the country. The giant six-page folder had more than 80 questions.

What do you think this confidential "revealer" told us after the last data processor button was pushed?

Among other important things, it shows that you are loyal to proven brand name products. And other information you gave indicates that you strongly influence the millions who buy TVs, radios and Hi Fi equipment; audio communications, regular 2-way, CB and marine electronics equipment.

We have said for years that your recommendation is a prime factor influencing the ups and downs of various consumer product sales figures.

Your answers contained in previous questionnaires, your thousands of frank letters about everything from technician licensing to associations to printed-circuit and hand-wired TVs have revealed your independent views.

You are servicing close to 65,000,000 TV sets — B/W and color; 200 million radios — portable, home and auto; other millions of Hi Fi sets — packages and components — including 39 million phonographs; more millions of two-way communications radios — including over two million citizens band transceivers.

We feel certain that the mass of consumer electronics owners — buyers of replacements and additional equipment — will come to you in even greater numbers in 1965 to ask for your technical help, advice and recommendations.

We know that you can and will continue, as you have in the past, to serve these customers fairly and with technical skills you have accumulated after many years of study and experience. And we also know that you can use your powerful influence to make your world a better and more pleasant place to live.

designed and
produced to the
highest standard
of excellence...

NORTRONICS

laminated core, all-metal face heads are now available for more than 500 different tape recorders! Nortronics complete replacement line includes:



miniature heads for use with compact audio-visual equipment



record, play and erase heads for use with home and professional tape recorders



multi-channel heads for use with video tape machines

Find out how you can increase your sales and service business! Write for your FREE copy of Nortronics Tape Head Replacement Guide.

Nortronics

8133 Tenth Ave. N., Minneapolis, Minn. 55427

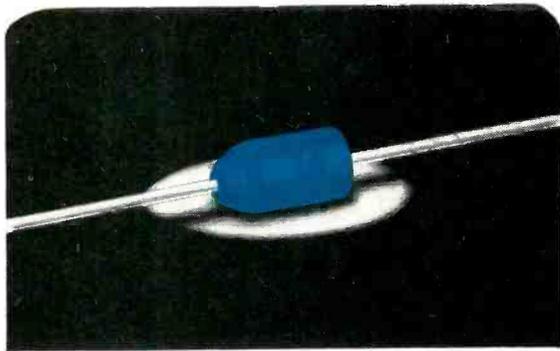
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Tips for Technicians

Mallory Distributor Products Company
A division of P. R. Mallory & Co. Inc.
Indianapolis, Indiana 46206

New Kind of Zener Diode



A zener diode, as you're probably aware, is a special kind of semiconductor which has excellent voltage regulating characteristics. It's the solid-state successor to the gas discharge tube. It acts like a rectifier diode, blocking current in the reverse direction, until the "zener voltage" is reached—then it starts to conduct with a capital C. The zener diode can carry appreciable current continuously. So this makes it a fine regulating device. You can use it in power supplies where you need highly accurate output. Or you can use it in clipper or clamper circuits, by biasing the diode negative.

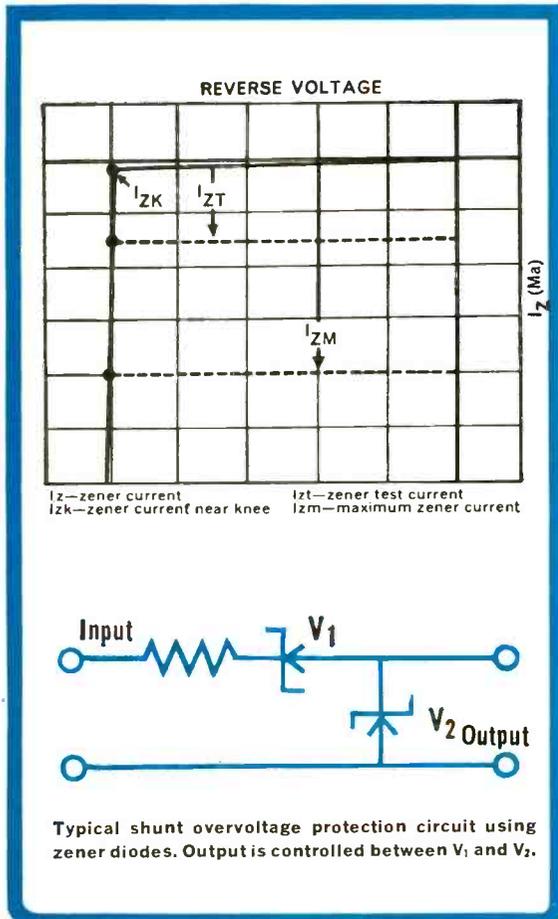
The big news in zener diodes is that you can now get them from Mallory at a price which makes them practical for service work, experimentation, or commercial circuitry. The news-maker is the new Mallory Type ZA molded-case diode. Its electrical properties and reliability record are comparable to those of military grade units. In fact, we use the same silicon cell in the ZA as in the zener diodes we make for military requirements. But the price is only about *half* that of hermetically sealed diodes.

The ZA is rated 1 watt at 25°C. If you install it in a hot spot, you can use it at ambients up to 100°C, derating linearly to 0.5 watt. Voltage ratings go from 6.8 to 200 volts, in small increments so that you can get exactly the regulating voltage you need. Standard tolerances are 20%, 10% and 5%.

You'll like the cold-case design of the ZA. No need for insulating sleeves when you squeeze it into tight layouts. It's so small—only 3/8" long by 0.220" in diameter—that it fits practically anywhere.

Your Mallory distributor has the Type ZA in a range of ratings. He also stocks Mallory silicon rectifiers . . . including handy packaged doubler, bridge and center-tap circuits. See him soon!

... for more details circle 28 on post card



**Installing
UHF converters
can cost you money**

OR

**you can install
Standard Kollsman**

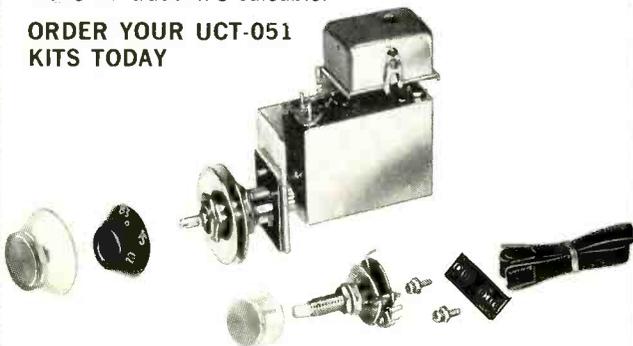
Do you realize that a high percentage of converters being sold today **don't** meet minimum F.C.C. requirements? It's a fact.

It's also a fact that Standard Kollsman converters fall well within F.C.C. minimum requirements—and are among the few which do. This is one reason why we're the number one seller in Los Angeles, Chicago, Boston, or wherever UHF is on the air.

Here's how to convert 45 minutes into solid profit. Install a Standard Kollsman Transistor UHF Converter. That's all the time it takes. It's the built-in, all-channel converter that gives any set a sought after custom look. **And, only Standard Kollsman gives a full year warranty.**

Best performance. Fits all consoles, table models, and most portables. Compact size: 5½" long, 1½" wide, 4½" high; weight: 1¼ lbs. Easy tuning high-ratio ball bearing drive. Service-free tuning element. For both series or parallel filament sets. Quick and easy way to make TV trade-in's saleable.

**ORDER YOUR UCT-051
KITS TODAY**



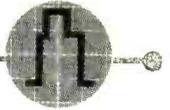
WORLD'S LARGEST MANUFACTURER OF TELEVISION TUNERS



Standard Kollsman
INDUSTRIES INC.
2085 NORTH HAWTHORNE AVE., MELROSE PARK, ILLINOIS

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SYNC ON BUSINESS



The growing need for electronic technicians has prompted Pratt Institute's School of Continuing Professional Studies to inaugurate a special program in Electronics Technology. A total of four courses will be given over a period of two years, one each semester. Further information may be obtained by contacting Edward D. Shanken, Assistant Dean, School of Continuing Professional Studies, Pratt Institute, Brooklyn, New York City 11205.

Precision instrument calibration can now be studied at the Los Angeles Trade-Technical College. A new two-year day school training program covers the subject. Students will learn to calibrate, repair, adjust and clean instruments.



Glo-Bar thermistor replacements are made by GC Electronics for Magnavox, RCA and Zenith color sets. The GC thermistor part is No. 25-908-S, at your regular parts distributor.

A transistorized stereo adapter by Delco can be plugged into the 1965 Chevrolet AM/FM radios with no modification to the radio receiver. Adapters can be installed either as a factory option or later by a service-dealer.

New indoor TV antennas for VHF and UHF are announced by RCA. Called "Stratoscope," they feature multi-position selector switches for "juggling" ghosts and interference.

A tape recorder service manual for the Viking model 88 is now available on request from the factory at a cost of \$1.

What TV viewers think of telecast programs was the theme of a contest sponsored by "tinyvision" TV set-maker, Sony. Six nubin-sized sets were given away

1P1139
Full-Line Merchandiser.
Only 11½" wide



1P1161
Revolving Rack.
Only 11" in diameter



1P1160
For transistor types.
Only 11½" wide



VS3200
"Top Six" Sampler.
Only 8½" wide



Give 'em
an
inch...

and they'll
take
a foot

but
ONLY
a foot...

and really
put it
to work.



Counter space is money. That's why these RCA Radio Battery Counter Merchandisers are designed to pack maximum selling power into a few inches.

With RCA Batteries you have the brand name people associate with radio . . . a name that's immediately recognized and respected by the buying public. It's the brand that's nationally advertised over network TV on Walt Disney's "Wonderful World of Color" to over 30 million viewers.*

Remember — the radio battery market is big . . . over 65 million transistor radios now in use. And YOU can capitalize on it! Improve your profit picture today—with a modest stocking order of RCA Radio Batteries.

Call your Authorized RCA Battery Distributor. Or contact: RCA Electronic Components and Devices, Harrison, N. J.



*Estimate of average viewing audience per show for the Fall season based on Nielson National Television Index.



The Most Trusted Name in Electronics



New stick-on wiring system eliminates mechanical fasteners

New "Scotchflex" Brand Flat Cable System lets you install low-voltage hookups anywhere in seconds. Applies like tape to tile, concrete, brick, paneling, any surface. No stripping necessary . . . sharp "U" shaped prongs in the connectors pierce the insulation and establish firm contact with each of the round wire conductors. "Scotchflex" Cable saves installation time and provides better looking wiring on intercoms, call systems, hi-fi, and other low voltage systems. For details, write: 3M Co., St. Paul, Minn. 55119.

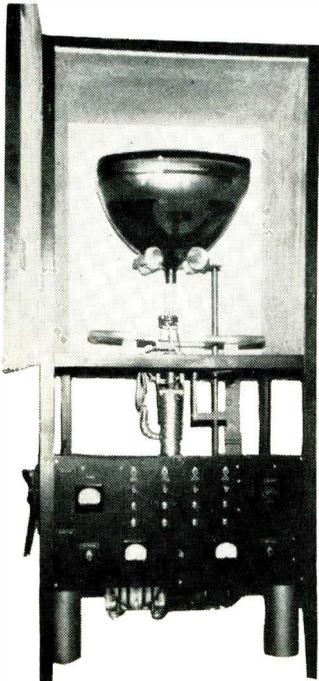
3M Electrical Products Division
MINNESOTA MINING & MANUFACTURING CO.

"SCOTCHFLEX" IS A REGISTERED TRADEMARK OF 3M CO.

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Me...? Rebuild Color Tubes???

Why Not!



Windsor Equipment
Handles Color & Bonded-Face As Well As
Black-and-White Tubes.

So What?

Rebuilding with Windsor is a **QUALITY PROCESS . . . and PROFITABLE !!!**

Rebuild Color Tubes for a Cost of \$11.75 each
... You Sell them for???

Windsor Equipment pays for itself in a few months.

Financing Available
Free Training at our Plant

Write for our Booklet "The Open Door to TV Profits"

WINDSOR ELECTRONICS, INC.

Equipment Division
999 N. Main St., Glen Ellyn, Illinois

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|| SYNC ON BUSINESS ||

free to writers of the best letters. More than 10,000 viewers expressed opinions. Most viewers complained about loud commercials, summer reruns and violence. News, sports and not-too-old movies ranked high in viewers' favor.

• • •

A hand cleaner, called "Wilclean," can be used effectively with or without water. Container fits in the caddy for hand cleaning after doing antenna work and eliminates bothering the housewife when going indoors to adjust set. Must be easy on the hands because it is said to contain both lanolin and hexachlorophene. At your distributor.

• • •

A dealer-aid promotion features full-page advertising with dealer listing in local UHF markets. Also makes available free brochures, mail pieces, window streamers, complete UHF technical guides, etc. Called "DAD" (Dealer Aid Division), it's sponsored by Gavin Instruments.

• • •

Automatic telephone answering has taken another step into the Space Age. Outercom Electronics, makers of "outercall" automatic answering phones, have added



"Outerkey," a tiny device that makes your automatic phone "spill" its messages when you call in at a distance from another phone.

• • •

A phonograph needle merchandiser features five popular stereo sapphires on an attractive point-of-sale counter card. It's by Jensen Industries and at your jobber.

• • •

Hi Fi information kits are available to Sherwood Hi Fi dealers for promoting "first-equipment" sales or for experienced audiophile up-grading sales. Said to be conservatively valued at \$1, kits are available from Sherwood at 25¢.

NEW . . . JUST \$119.50 FOR A COMPLETE COLOR BAR GENERATOR WITH EXCLUSIVE SECO STABILITY!

- 15-second warmup for your convenience
- Day-long performance without variation
- Simple sync control—just vertical and horizontal hold
- Work-a-day ruggedness—crystal controlled in heavy metal case

JUST IN TIME FOR THE BIG BOOM IN COLOR TV!

Cash in on the bigger volume coming from the new lower cost color TV's. Here are two color bar generators built to take the toughest use in truck or shop. Fast hookup—just clip on two antenna leads. Foolproof crystal controlled color bars. Fast warm up. Highly stable, after just 15 seconds and all day long—speeds work in home or at bench. Factory set to Channel 3 and can be tuned to Channels 2 or 4. Steel case. See your electronic supply dealer or write for information.



MODEL 990

MODEL 980

MODEL 980 does everything you need to set up a color TV set

- **KEYED COLOR BARS** for aligning and trouble shooting color circuitry—10 standard bars.
- **DOT PATTERN** for DC or static convergence—54 dots.
- **CROSSHATCH** for dynamic convergence, overscan and linearity adjustments—6 horizontal bars, 9 vertical bars.
- **VERTICAL BARS** for adjusting dynamic horizontal convergence controls—9 vertical bars.
- **HORIZONTAL BARS** for adjusting dynamic vertical convergence controls—6 horizontal bars.

ONLY \$119.50 net

MODEL 990 gives you all the deluxe features!

- **ALL** the tests of the Model 980—with these extra advantages—
- **COLOR GUN KILLER** to actuate any combination of guns.
- **RAINBOW COLOR PATTERN** to supplement keyed color bar tests.
- **VARIABLE DOT PATTERN** with 54 or 144 dots of adjustable size.
- **VARIABLE CROSSHATCH** with 6 or 16 horizontal bars.
- **VARIABLE HORIZONTAL BARS** with 6 or 18 lines.
- **GREY RASTER** for tests required on older sets.

ONLY \$149.50 net



SECO also manufactures a full line of tube testers

SECO ELECTRONICS, INC.

1211 S. CLOVER DRIVE • MINNEAPOLIS, MINNESOTA 55420
A DIVISION OF DI-ACRO CORPORATION

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TECHNICAL DIGEST

WESTINGHOUSE

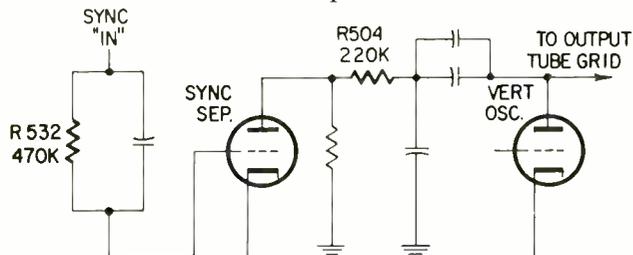
Early production of the 12 in. portable (chassis V-2478) may show a 600 kc beat pattern on a number of channels if the 2nd IF tube (4EJ7) is replaced. To correct this, an RF choke, Westinghouse number 230V065H-01, should be added between pin 5 of the 4EH7 and pin 4 of the 4EJ7 tubes. This change can be made easily from the top of the board by cutting the 2 in. blue filament wire between the two tubes and soldering the RF choke in its place.

Chassis with a choke already added can be identified by a small red mark on the bottom of the chassis, on the right side front. The back cover must be removed to locate the identification mark.

If receivers show the 6-kc beat, check for the choke. If none is present, add the choke as described.

RCA

The vertical circuit in this chassis provides a stabilized picture size by using a VDR in the grid circuit of the vertical output tube. The values of



R532 and R504 are different from those used in prior circuitry. These changes result in improved vertical synchronization and optimize the lock-in characteristics of the color chassis.

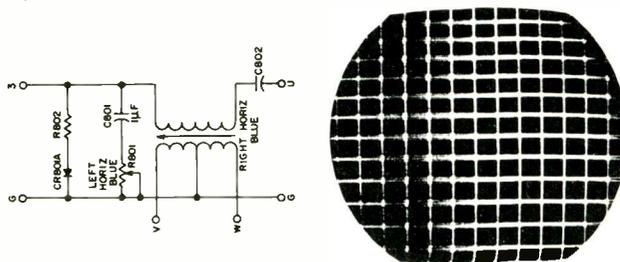
ZENITH

Two corrector magnets are used in all 23 in. models to obtain straight, sharply focused sweep lines across the face of the CRT. The magnets are mounted on the deflection coil support bracket. Adjustment is made by bending the flexible arms sideways and up and down. Correct adjustment has been made at the factory and readjustment should not be required unless the brackets have been accidentally bent out of position. If this occurs, proceed as follows: With the vertical and horizontal size controls, reduce the size of the picture to a point where the four corners and sides are visible. (In some receivers it is not possible to reduce the picture sufficiently to see all sides and it may be necessary to shift the picture with the centering control to view one side at a time.) Bend

the corrector magnet arms until the corners become right angles and the top of the raster is parallel with the bottom and the left side is parallel with the right side. After adjustment, the picture should be restored to normal size. Note: Misadjustment of the corrector magnets may cause pincushioning, barreling, keystone-ing, poor linearity, etc.

PHILCO

Open capacitor C801 will cause the blue left horizontal convergence control to be inoperative. The



set cannot then be completely converged by the right blue horizontal control. Replacement of the defective capacitor corrects the fault.

MAGNAVOX

The horizontal hold circuit on this chassis was designed to provide sync pull-in of 1½ bars to reduce the possibility of color phase shift with adjustment of horizontal hold. The pull-in range can be increased to approximately three bars by removing resistor R529 (120K) in the horizontal oscillator circuit. This resistor is located on the deflection board to the right of the horizontal oscillator tube as you view the chassis from the rear. It is not necessary to remove the chassis from the cabinet to remove the resistor.

GENERAL ELECTRIC

The G-E Transistorized VHF Tuner ET86X229 uses three silicon NPN transistors, one S1059 as RF amplifier and two S1060's as mixer and oscillator.

Thirteen channel strips contain the RF, interstage and oscillator coils for each of the 12 VHF channels and one for the UHF40-50 Mc IF channel. These strips are mounted in a turret type configuration and continuity of circuitry is maintained by the strips contacting nickel alloy stator blades. The stator blades are returned to the appropriate points on an etched circuit board. All other components with the exception of the fine tuning coil are mounted on this etched board which is rigidly held in place by the tuner body. A removable shield which clips to the tuner

16 YEARS AND STILL UP TO DATE

all sockets
conveniently
grouped

checks all
radio & TV
types

sensitivity &
shorts tests
between
elements



angle view
zig-zag
roll chart

fast
pushbutton
sequence
switching

line
voltage
indicator
control

*** FREE**

**NEW TUBE TEST DATA ISSUED REGULARLY -
KEEPS YOU CURRENT BETWEEN ROLL CHARTS**

JACKSON MODEL 648S DYNAMIC TUBE TESTER

Developed over 16 years ago to give the servicemen a tube tester that could be kept up to date without fear of it becoming obsolete in a few short months. A tube tester that was fast and easy to use, while being able to check all radio and TV type tubes. The results are a tube tester that is more profitable. There are over 30,000 servicemen to prove this.

DEALER NET **\$169⁹⁵**

DON'T BE FOOLED BY INADEQUATE PICTURE TUBE TESTERS



Now a picture tube tester - booster with features wanted most by the TV servicemen. Color keyed - push button operated for ease and speed. Designed to make more accurate tests than any other tester now in existence. Completely versatile for all black and white or color picture tubes. Oh yes! we keep you up to date.

DEALER NET **\$119⁹⁵**

**See These Testers At Your Franchised Distributor
and Ask Him About a Trade-In Deal**

"Service Engineered Electronic Test Equipment"



The Jackson Electrical Instrument Company Dayton, Ohio

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**ZENITH QUALITY
"ROYALTY CREST" CIRCUIT TUBES**

Complete line of more than 875 top-quality types for maximum performance and dependability.

**ZENITH QUALITY "STEREO PROFESSIONAL"
and "STEREO PRECISION" RECORD CHANGERS**
with Micro-Touch® 2G Tone Arm with "Free Floating" cartridge. World's
finest automatic record changer for the audiophile.



ZENITH QUALITY TELEVISION PICTURE TUBES
The industry's broadest line of replacement picture tubes.



**ZENITH POSITIVE QUALITY CONTROL
TRANSISTOR RADIO BATTERIES**
Featuring "Transistor Blend" Electrolyte.



Zenith Color replacement tubes contain used material which, prior to re-use, is carefully inspected to meet our high quality standards. The electron gun is new.



Zenith replacement tubes are made only from new parts and materials except for the glass envelope in some tubes which, prior to re-use, is inspected and tested to the same standards as a new envelope.

**CHOOSE *ZENITH* for
in REPLACEMENT PARTS**

Now Zenith is your *number-one* source of supply with a full line of replacement parts and accessories, built to famous Zenith quality standards.

Wherever you are located, there's a Zenith Distributor near you, who can supply you quickly with whatever you need on a day-to-day basis.

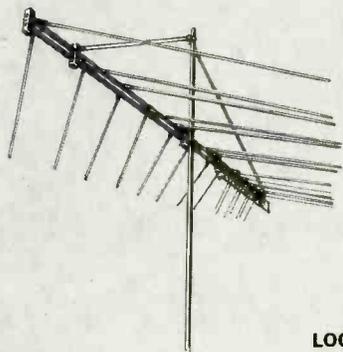
Zenith  *The quality goes in before the name goes on*

Specifications subject to change without notice.

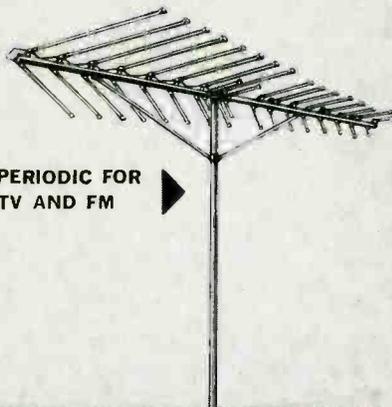
FOR MORE INFORMATION, SEE YOUR LOCAL ZENITH DISTRIBUTOR OR CLIP AND MAIL COUPON: ▶▶▶

NEW! ZENITH QUALITY OUTDOOR ANTENNAS

A complete line featuring...

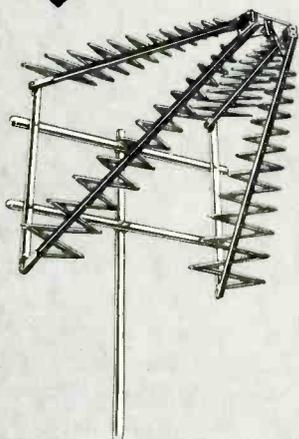


◀ **LOG-PERIODIC FOR ALL CHANNEL
COLOR AND B/W TV,
FM AND FM STEREO**



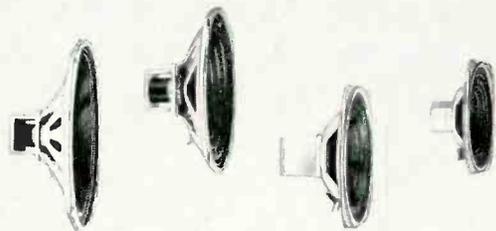
**LOG-PERIODIC FOR
VHF TV AND FM** ▶

**PLANAR HELICAL LOG-PERIODIC
FOR UHF TV** ▼



**NEW!
ZENITH QUALITY HEAVY-DUTY
ANTENNA ROTORS**

Manual or Automatic
... can turn up to 150-
lb. antenna in a com-
plete circle in only 45
seconds.



**NEW! ZENITH QUALITY HIGH-EFFICIENCY
UNIVERSAL LOUD-SPEAKERS**

32 popular sizes for practically any purpose. Built to Zenith's famous original equipment standards.

NEW! NOW ZENITH HAS QUALITY WIRE AND CABLE

Built to highest standards for every installation application.



NEW! LOW-LOSS 300 OHM UHF CABLE

Finest for all installations—in hanks of 65 ft., 100 ft. and reels of 1000 ft.



NEW! VHF 300 OHM TRANSMISSION LINE

Covered with special ultraviolet protective polyethylene—15-year warranty! In hanks of 65 ft., 100 ft. and reels of 1000 ft.



COAXIAL CABLE—RG 59/U ultra-flexible, low-loss foam poly in vinyl packets of black, white, silver, gray and beige colors. In hanks of 50 ft. and reels of 250 ft., and 1000 ft.



ROTOR CABLE—

4/C Polarized Parallel—8/C Color Coded Round—5/C Polarized Parallel—in hanks of 65 ft., 100 ft. and reels of 1000 ft.



MICROPHONE CABLE—1/C Foam Type Low Capacitance, spiral shielded. In reels of 250 ft.



SPEAKER CABLE—

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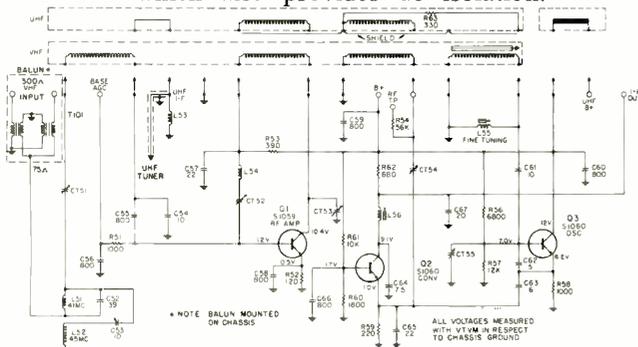
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body completes the shielding of the unit and provides access to the turret and circuit board.

Input impedance is 75Ω connected through a balun to the antenna. The power supply input is + 12 at about 15 ma maximum.

The RF signal from the antenna is fed directly to the highpass filter consisting of L51, C52, L52, and C53. L51 and L52 are mutually coupled and tuned to 41 Mc and 45 Mc, respectively. This filter provides attenuation of frequencies in the IF band.

The (ch 2-13) RF coil is tuned by trimmer CT51 and the resonant circuit completed by C54 and Q1 base. The RF signal is coupled to the base of Q1 thru C55 which also provides dc isolation.



An AGC voltage of positive polarity is supplied to the base of Q1 through the isolation resistor R51 and filtered by C56. R53 is the collector load resistor.

Stabilization of Q1 is maintained by the bias derived from the voltage drop across R52. C58 provides the RF by-pass. Neutralization of Q1 is accomplished by feeding back the signal present at the junction of C57 and R53 to the base through L54 and trimmer CT52.

The primary of the interstage coil (ch 2-13) in the collector circuit of Q1 is tuned by trimmer CT53 and inductively coupled to the secondary coil (ch 2-13) in the emitter circuit of the mixer transistor, Q2.

The secondary coil is tuned by trimmer CT54 and fed to the emitter of Q2. Stabilization of Q2 is maintained by the bias developed across R59. C65 provides the RF by-pass and is also a portion of the capacitor divider required for the oscillator injection voltage. R60 and R61 constitute a voltage divider to provide base bias to Q2 with C66 as the RF by-pass at this point. R62 is the collector load resistor and C59 the RF by-pass capacitor. L56 and C64 in the collector circuit of Q2 and C67 constitute the resonant circuit to provide the 40-50 Mc IF output.

Transistor Q3 is used in a modified colpitts circuit to provide oscillator injection voltage to the mixer stage. The oscillator tank coil (ch 2-13) is tuned by trimmer CT55 and shunted by L55 which contains an adjustable core to provide fine tuning. Each of the 12 VHF channels can be coarse-tuned by the brass screws mounted on the individual coil strips.

The tank coil is shunted by C61, C62, C63, and C65. The base of Q3 is connected to the junction of C61 and C62. The emitter is connected to the junction of C62 and C63 and returned to ground through the stabilizer resistor R58. The AC return for the collector is provided by C60, C65, and C63.

The oscillator injection voltage is fed to the mixer from the junction of the capacitor divider C63 and C65. Q3 base bias is supplied from the junction point of divider R56 and R57.

The channel one or UHF strip, when switched to its operating position, converts the RF and mixer transistors to a two stage 40-50 Mc amplifier. The output (40-50 Mc) of a separately mounted UHF tuner is applied across L53 and coupled to Q1 base through C55. L53 provides the dc return path for the UHF tuner.

The two coils on the UHF strip are mutually coupled and tuned to provide maximum bandpass from 41.25 Mc to 45.75 Mc. The circuit of Q3 becomes non-oscillatory because of the damping resistor R63. A shorting bar which is mounted on the turret provides the switching mechanism for supplying B+ to the UHF tuner. The grounded shield mounted on the channel one strip prevents interaction between the low channels and channels 12 and 13.

Season's Greetings

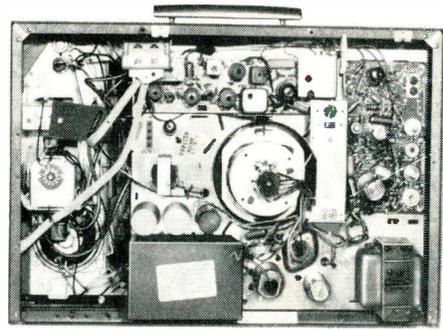
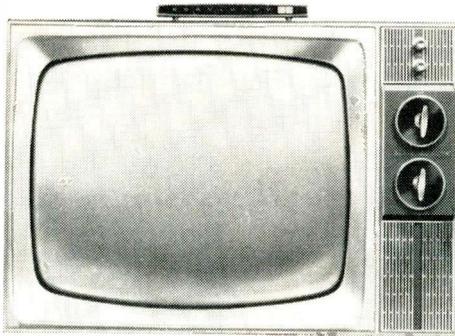
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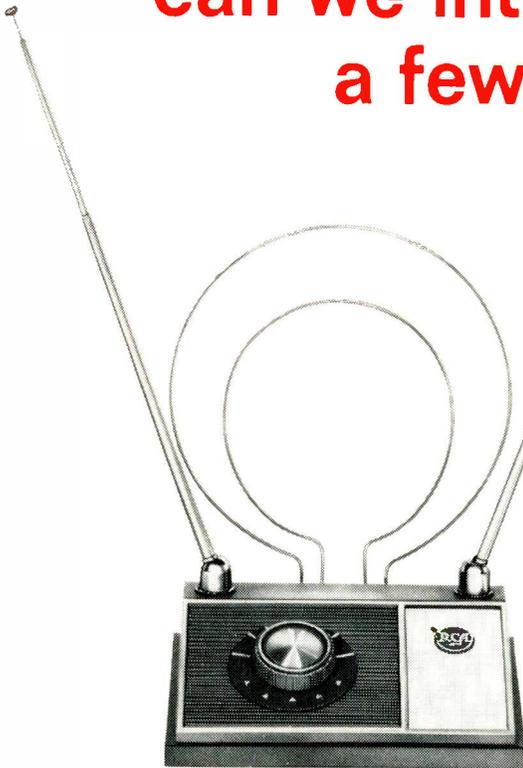
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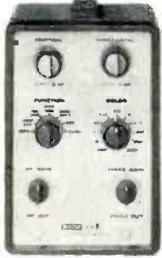
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Basic Business Practices For Independent Service-Dealers

by Marvin Tepper

Too many shops go on the rocks
because their owners fail
to evaluate overhead, properly select
a good business location or
neglect to maintain accurate records

■ According to information from the U.S. Department of Commerce and from other sources, the turnover of independent TV-radio service-dealers is constant and at a high rate. The number who leave, or more appropriately, are driven from the business, is needlessly high. A certain percentage of dropouts is normal. These are generally the technically incompetent, but too high a percentage is caused by a lack of understanding of basic business practices. Your chances for a successful business and increased profits will be improved if you learn something about these basic principles and set about to practice them diligently.

The basic rules of business are paramount:

1. Don't cheat your customers — give them true value for their money.
2. Don't cheat yourself — make a fair profit for your labor and equipment investment.

Overhead

Making a fair profit means more than merely getting paid for the time you spend on a TV, radio, Hi Fi or other repair. Many technicians forget that pickup and delivery time and a profit on their stock and equipment investment must be included in overhead.

Failure to take all overhead factors into account is probably the major cause for business failures. Overhead has been figured to be approximately 60

Business Practices . . .

percent of the value of labor. If you consider your labor is worth \$3.75 an hour, for instance, the total charge per hour for labor should actually be \$6. The small things that go to make up overhead are numerous. The main items are rent, electricity, salaries, telephone, etc. The lesser known costs include depreciation — ultimate replacement of test equipment, service car or truck, and worn or lost tools. Other costs include record keeping and accounting, taxes, instrument maintenance, car or truck maintenance, gasoline, fuel for heating if not included in rent, advertising, insurance, etc. Other overhead considerations are holidays, sick pay and vacation where salary must be paid when no work is being performed.

Store Location

A recent tendency has been for service shops to move out of congested, hard-to-park-in downtown areas, out to the main highways leading in and out of the city. These out-of-town locations must have ample parking facilities, and for auto radio repairs, must be out of the weather. The type of location required will be determined by whether or not the business includes sales of new merchandise as well as service. A high traffic volume is required for sales and service; a more remote location may be suitable for service alone, or the service operation can be from a garage or home basement. The rent for a store will of course be determined by its location and size.

Records

Keeping accurate and complete records is a must, even if they are in a notebook instead of fancy journals. With proper records, you will know whether you are making a profit or losing money, and how much. Keep in mind that a salary alone is not enough for a self-operating repair business. Service-technician owners are entitled to a profit on inventory and equipment capital investments. Records will show whether this goal is being achieved, and to what extent.

Records of consumer repairs are also important. They help to determine over a period of time whether charges are correct or too low. They are also protection against customers' convenient memory lapses. A common complaint is that the repair was made "only six weeks ago," yet your records will frequently prove that the repair was made six months ago.

Another convenient form of record keeping is to

pay all bills by check. A petty cash fund is used for paying small bills. A cancelled check is useful as a receipt. Paying by check reduces record keeping effort to a minimum.

Advertising

Advertising is a problem that must be solved by each business. In some locations — like those operated from a home, for example — business will lean heavily on what is still the most important of all forms of advertising, "word of mouth." Other forms of advertising are also necessary. These include business cards, letterheads, store front name display, etc. Some advertising methods depend on the size of the business. These include: direct mail, match book covers, calendars, TV and radio spots. Another good form of advertising is a reasonable guarantee that you stand behind your work.

The back of each piece of equipment you repair should have an easily readable sticker with your name, address and phone number on it.

If your store is located in a small city or town with local newspapers, one good form of advertising is a small but consistent ad. By making a long-term agreement with the newspaper, special cost-saving rates can be obtained. Be sure to change the ad frequently or readers will begin to take the ad for granted. A neat-looking car or truck, prominently displaying the name of your firm, is another form of advertising.

Store fronts also figure in advertising. For stores that do only servicing, the problem can be a bit more difficult. Sizable window displays are available, however, from various manufacturers, particularly tube and battery manufacturers. Some of these displays can be used to attract attention. They may include dummy tube cartons, display boards, electric signs, electric clocks, decals and outdoor illuminated signs. Since a faded window display is worse than none at all, be sure to change the display regularly — and keep the display clean.

Buying

When buying replacement parts for future repairs it is desirable to take advantage of discounts given for early payment of bills. This is usually 2 percent. This figure may seem insignificant, yet a small business may well average \$50 a week for parts. On a 52 week basis this is \$2600 a year — 2 percent of which is \$52 — an amount no one can ignore because it represents free parts for more than a week.

Be cautious when purchasing parts. Buy only what is actually required as determined by the volume and type of business being done. Parts that gather dust on the shelves over a long period are useless and represent a loss of money. When bargains in parts are offered, be sure they are needed parts to be used in repairs. A bargain that can't be used is no bargain.

There's no need for service technicians to tell themselves they're not good businessmen. If they can learn the intricacies of electronics they can certainly learn the basics of business — which boils down to simply using common sense. ■

WHAT YOU'LL FIND IN



TV SETS

Part II

Some innovations improve operation and simplify service adjustments

■ Last month we gave a few details on important circuitry in 1965 TV sets. A number of other new set innovations are being covered here.

Magnavox

The **45 series color chassis** employs a total of 26 tubes, including the CRT. A transformer power supply uses two silicon rectifiers in a full wave circuit. Several features which aid in adjustment and servicing are included. The CRT screen grids, drive and bias controls, the service switch and height and linearity controls are all grouped together on a "video control board." The service switch has three positions, normal, service and purity. In the service and purity positions the IF supply voltage is removed so that no signal will be present on the CRT during white tracking or purity adjustments.

Dynamic convergence controls are grouped on the convergence panel to correspond to the area that each control affects. Controls are numbered one through twelve to show the correct adjustment sequence and each control has an arrow indicating the crosshatch pattern section to be observed while adjusting.

The **convergence board assembly** (Fig. 1) mounts in an opening in the front cabinet bottom. By removing two screws the assembly can be dropped out and held while adjusting and observing the screen from the front (Fig. 2).

An **instant-on circuit** is featured on a number of 45 Series models (Fig. 3). The circuit applies a reduced filament voltage to the tubes when the set is off so that warmup time is kept short. Filament potential is lowered to about 3 v by a series choke in the power transformer primary. A large portion of the line voltage (about 100 vac) appears across the choke while a lower voltage is applied to the power transformer primary.

A switch, ganged with the main power switch, is connected in series with the secondary winding to prevent development of B+ when the receiver is off. A defeat switch, located along the back edge of the

cabinet, opens the choke circuit so the receiver can be turned off completely.

More test points have been added to the PC boards to facilitate servicing. The 6JE6 horizontal output tube cathode has been brought out through the rear apron and soldered to a chassis terminal. A 0-250 ma meter can be placed in series with it and the horizontal efficiency coil can be adjusted for minimum cathode current.

The **regulator tube cathode** has also been made accessible. It is brought to a special terminal on the chroma board. By placing a low-range VTVM between the terminal and the 405 vdc supply (which is also present on the board), the drop across the 100 Ω cathode resistor can be measured. The reading in ma is equivalent to the voltage reading.

A **sepia switch** (Fig. 4) is incorporated in all sets having the instant-on circuit. This feature allows customers to view black-and-white programs in sepia tones similar to those produced by the sepia glass on monochrome receivers. The sepia switch must be in the OFF position when color temperature adjustments are made.

Motorola

The **BTS-908 color receiver** uses a 27-tube horizontal chassis with a 23 in. rectangular color CRT. It is handwired, has a power transformer and silicon rectifiers, solder-well terminals, inter-carrier sound, noise gate, sinewave horizontal oscillator and shunt-connected high voltage regulator. With the exception of the tuner input cable, all connections to the chassis are plug-in to allow easy sub-chassis removal for test or repair. The tuner cable is plug-in, but spot soldered to insure a good electrical ground connection.

Pincushion corrector circuits are an innovation in the BTS-908. When a raster is projected on the nearly flat CRT faceplate, its shape becomes slightly distorted. The distance from the deflection center to the corners of the CRT is greater than the distance from deflection center to any other part of the face-

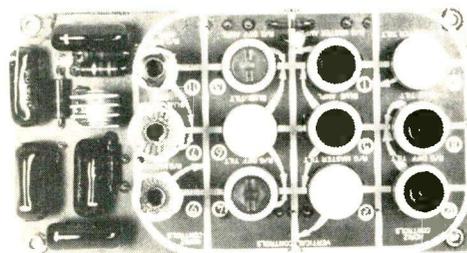


Fig. 1 — Convergence control panel for Magnavox Series 45 color chassis.

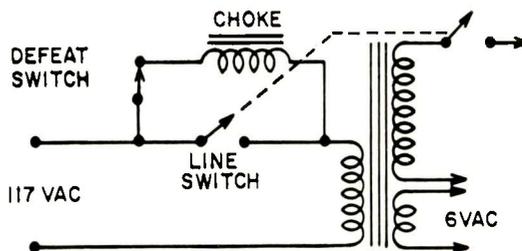


Fig. 3—Magnavox instant-on circuit.

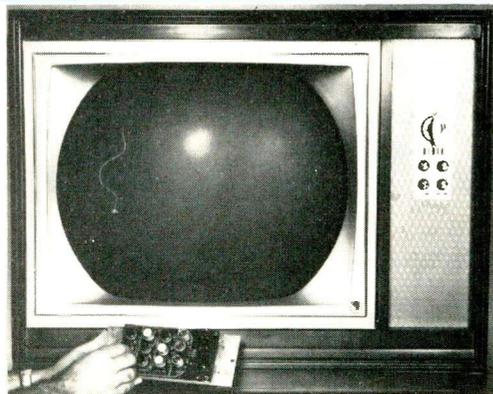


Fig. 2—Convergence adjustments are made from the set's front.



PHILCO PORTABLE

The 3 in. TV set shown here was recently announced by Philco. The self-contained TV weighs a little more than 5 lb. It has its own stand for table-top or lap viewing or it can be slung from the neck on a strap for stand-up viewing. The TV is not yet in production, although the manufacturer said it is possible to make the unit using existing materials. Philco is bringing out a fully-transistorized, battery-operated 9 in. set and a tube type 12 in. set during this model year.

plate. The greater distance to the corners causes the raster to become larger at the corner (Fig. 5).

The pincushion error causes the corner squares to be larger in area than the center squares. The amount of pincushion error will increase as the tube deflection angle is increased.

In a black-and-white CRT, this raster distortion is corrected by a yoke having a distorted field or by placing permanent magnets in a position to correct the geometric distortion. This is not possible in a color CRT because the three electron beams would not be acted on equally by a non-uniform field and it would not be possible to converge the three rasters.

The color yoke is designed for as uniform a field as possible. Power from an external source is then fed into its windings to correct the error. In this manner, convergence is not affected by the pincushion error or by measures to correct it. A simplified circuit for correcting the vertical pincushion error is shown in Fig. 6.

Unfiltered boost voltage which is parabolic at a horizontal rate, is fed into transformer T1, connected in series with the vertical yoke. Capacitor C1 is tuned to bring T1 secondary to resonance at the horizontal parabolic rate, causing maximum energy from transformer T1 primary to be coupled into the secondary. The parabolic voltage fed into the vertical yoke will add and subtract from the vertical field at a horizontal rate and cause the raster to become straight at the top and bottom of the CRT screen (Fig. 6).

Notice that the correction required at the top of the screen is exactly opposite to the correction re-

quired at the bottom and half-way between these two points the required correction is zero.

The parabolic voltage is fed into each end of T1's center tapped primary. Since these two voltages are fed into opposite ends of the winding, their action will be in opposition and will have the effect of being 180 deg out of phase.

The voltage fed to one end of the primary has a tube connected to amplify the signal. A sawtooth voltage developed from the vertical sweep system is fed to the control grid to adjust tube gain in time with vertical sweep. This voltage causes the tube to have maximum gain at the beginning of trace and zero gain at the end of trace.

For the first few lines of a vertical field, T1 will receive two signals, A and B. Signal B is approximately twice as strong as signal A because of the tube gain and since the two signals have opposite actions, signal A will cancel out a portion of signal B. The portion of B signal that remains will correct the pincushion error at the top of the screen. At the center of vertical sweep where pincushion correction is not needed, the voltage on the tube's control grid has become less positive, reducing the tube gain to a point where signals A and B are equal. Being equal and opposite in action, the two signals cancel, providing zero correction at the center of vertical sweep. At the bottom of the vertical trace, the saw voltage on the tube grid is negative and turns the tube off, leaving signal A to correct the pincushion error at the bottom of the screen.

This arrangement will provide maximum correc-

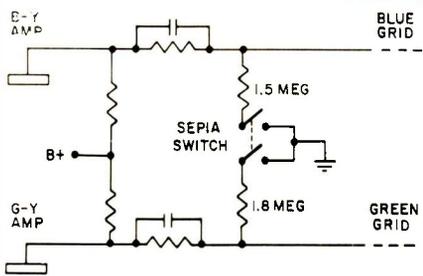


Fig. 4—This circuit allows black and white pictures to be viewed in sepia tones on series 45 Magnavox color TVs.

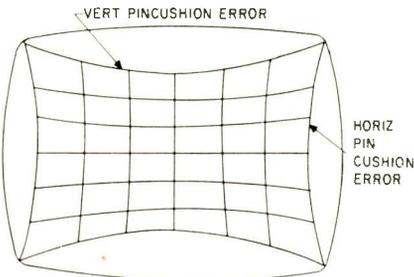


Fig. 5—Pincushion raster distortion.

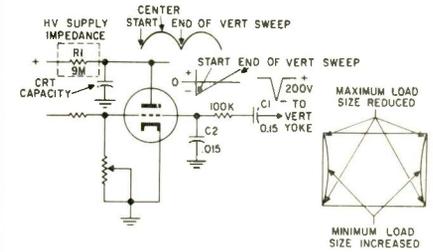


Fig. 7 — Motorola's horizontal pincushion corrector circuit.

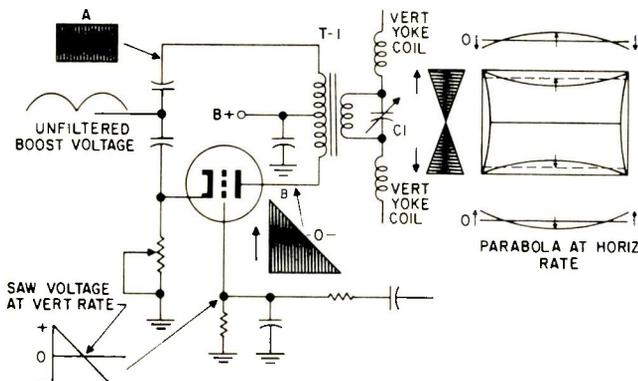


Fig. 6—Vertical pincushion corrector circuit in Motorola's BTS-908 color chassis.

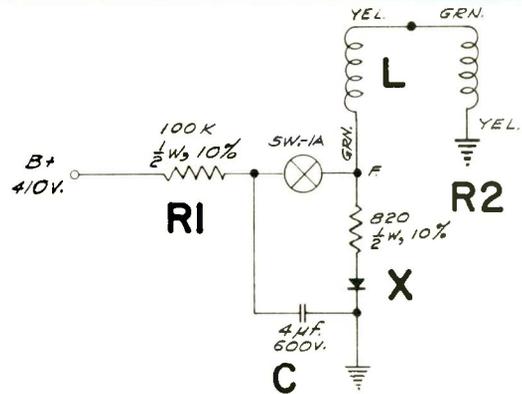


Fig. 8—Schematic of automatic degaussing circuit in 1965 Packard-Bell color TV.

tion in one direction at the top of the screen, maximum correction in the other direction at the bottom of the screen and zero correction at center.

Two controls are available to adjust the vertical pincushion corrector circuit. The transformer in the plate of the tube is adjusted to make the raster straight at the bottom of the screen. The tube cathode control is then adjusted until the raster is straight at the top of the screen.

The pincushion error viewed on each side of the CRT screen is corrected by adjusting the load

on the horizontal sweep system at the vertical rate. The load is varied by varying the current through the high voltage regulator tube with a saw voltage developed from the vertical yoke. The load on the horizontal sweep system is maximum at the start and finish of the vertical sweep, and minimum halfway between these two points. The uneven load will cause the horizontal sweep width to vary and correct the pincushion error on the screen sides. A simplified circuit is shown in Fig. 7.

A 200 v negative going pulse is taken from the

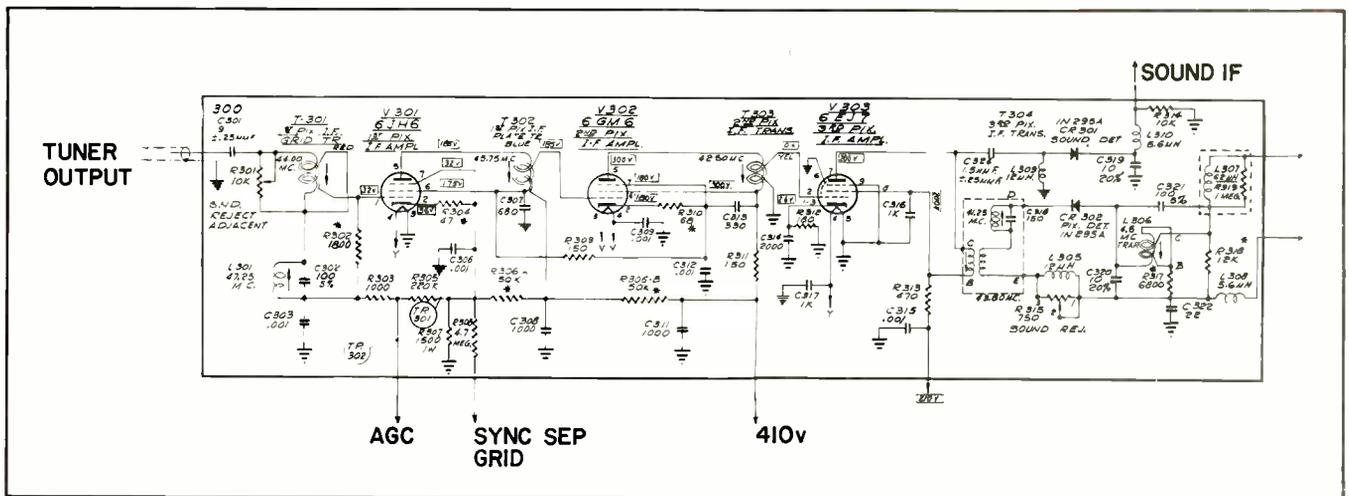


Fig. 9—Schematic of video IF strip in Packard Bell 98C8 color chassis.

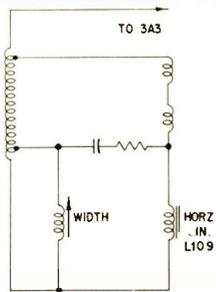


Fig. 10—Circuit showing horizontal linearity coil in RCA KCS 136x chassis.

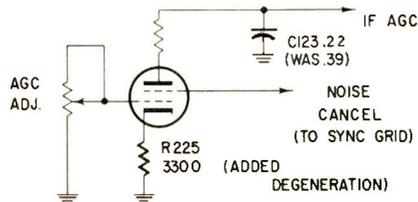


Fig. 11—Noise cancellation circuit used in RCA KCS 151 chassis.

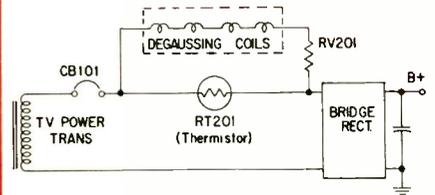


Fig. 12—Schematic of automatic degaussing circuit employed in 1965 RCA color TV.

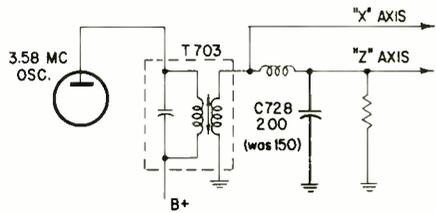


Fig. 13—Increased value of C728 results in greater displacement of "X" and "Z" axes in RCA CTC 16 color chassis.

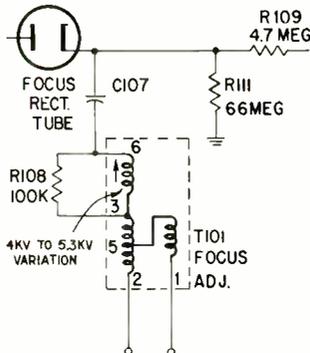


Fig. 14—RCA CTC 16 focus circuitry.

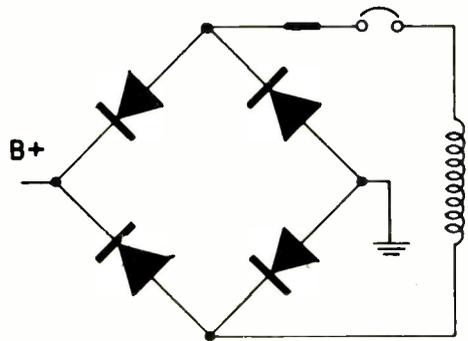


Fig. 15—Bridge rectifier circuit used in 1965 RCA color TV.

vertical yoke and integrated into a sawtooth voltage by R1 and C1 and fed to the high voltage regulator control grid.

At the start of a vertical field, the regulator grid has a negative voltage, causing the regulator current to decrease. The current decrease causes the high voltage supply to increase. The voltage increase takes place gradually because the CRT capacity requires time to charge to the new value through the high voltage supply impedance (approximately 9 MΩ). At the center of the vertical sweep, the CRT capacity has charged and the current from the supply has decreased. The sweep system has less load and the sweep width increases. Past the center of the vertical sweep, the saw voltage on the regulator is drawing maximum current causing minimum sweep width. At the beginning and end of each vertical scan, the

horizontal sweep is reduced and at the center of the vertical scan, the horizontal sweep is expanded. This is shown in Fig. 7 to be the desired correction to eliminate pincushion error.

It might appear that the increase in high voltage at the middle of the vertical scan would reduce rather than increase the horizontal scan but the decrease in loading causes a substantial increase in horizontal size while the increased high voltage causes only a small reduction in size. This circuit does not require field adjustment.

Packard Bell

The automatic degaussing circuit used in these chassis is shown in Fig. 8. SW1A is normally open, so capacitor C charges to 410 v. When the switch

Continued on page 80

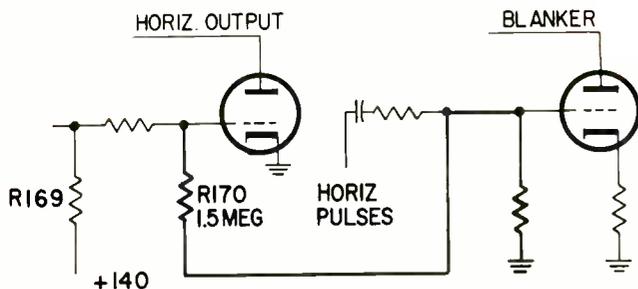


Fig. 16—Interconnection between blanker tube grid and horizontal output tube grid provides voltage limiting in RCA CTC 16.

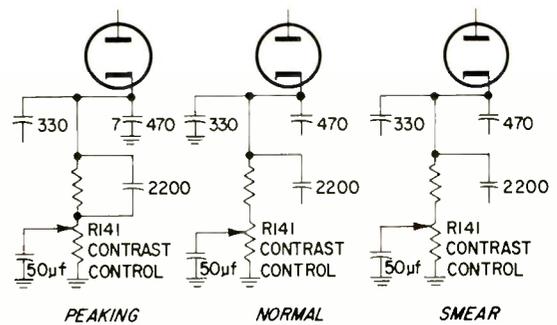


Fig. 17—Peaking switch circuitry in RCA color chassis.



WHAT'S 'PUBLIC RELATIONS?'

Keep your customer relations lamp
burning and watch your business
volume soar to new high levels

■ Some service-dealers and technicians still believe that "public relations" (more specifically, customer relations), is a mysterious, exotic form of ointment, concocted by modern "snake doctors" who work in posh offices high above canyoned streets in New York, Chicago and Los Angeles. No idea could be so quaint or so obsolete.

Well, then, what are customer relations?

Customer Relations

Customer relations definitions are as numerous as "PR" experts. But let's face it. Your customers and prospects are just as human as you are. They're interested in doing business with the *best* service-dealer in the neighborhood; they want to get what they pay for, and they want what they want when they want it — within limits that seldom pose insurmountable problems. Because of this, you are forced to work hard to polish your image by various methods. And the methods are normally pinpointed in a carefully-thought-out customer relations program.

In the area where you work and live — as far as you and your business is concerned — customer relations means "putting your organization's best foot

forward" at all times and under all circumstances. It means treating your customers in precisely the same way that you want to be treated yourself. It's no more mysterious than that.

This means that you cannot separate public relations from your over-all business and service policies. Customer relations is a bright-colored thread that's interwoven throughout the total fabric of any successful service-dealer operation. In a foundering business, the tint of the yarn is drab and dull.

Let's take a close look at only one facet of customer relations and see how it can be practiced instead of preached.

Courtesy

Many public relations experts have indicated that *courtesy* rates high as a customer relations ingredient in a successful sales and service business. Yet, in some areas — in both large and small cities — courtesy is in a state of obsolescence.

Courtesy is an accomplishment that varies in degree with the particular individuals who practice it, their natural talents and how hard they work at it. Because courtesy is habit forming, almost anyone can become addicted. In advanced stages of courtesy, all addicts become keenly perceptive, genuinely sympathetic, warm and thoroughly sincere. In fact, courtesy has become the radiant public image of a few "tough" (and wealthy) businessmen.

One service-dealer on his way up, for example, has built a solid, thriving business by establishing a highly developed customer relations policy. Neither he nor any of his seven technicians would think of leaving a customer's home, after completing a house call or antenna installation, without uttering a final, smiling, "Thank you for calling us."

This same courtesy is extended to everyone who telephones by the person who answers the shop phone.

Every customer or prospect who comes into the shop, looks around, asks questions and departs without generating business, is thanked for coming in. Many of these return later to do business.

This service-dealer has seen to it that every employee in his business has developed the habit of being courteous at all times and under all conditions.

And he and his employees are thoroughly indoctrinated with the idea that it never pays to "argue" with a customer — even one they may be losing through no fault of theirs. They know that one "enemy" can, by word-of-mouth, negate thousands of dollars worth of otherwise effective advertising. The theory here is simple: "If you can't keep 'em as satisfied customers, then lose 'em as 'neutralized' friends." And the theory pays off in practical cash!

The sooner you begin to understand the real meaning of customer relations — the quicker you clean your public relations lamp, light it and keep it burning — the sooner you'll begin to solve the major problems that now confront you.

Make no bones about it — the amount of business you have at any given time will be proportional to the quality of your customer relations. And what your customers think of you and your work will be a measure of the quality of your customer relations. ■

Improving **COLOR** TV Reception

by *Lon Cantor*
Jerrold Electronics

Sell-up on antenna installations for the rainbow hues

■ Nineteen-sixty-four has been a banner year for color TV. The public has finally overcome its suspicion of color TV. Most people seriously consider color today when buying a new TV console. Moreover, color programing is on the rise. It appears likely that a very high percentage of your customers will own color TV sets within the next few years.

Color TV represents an excellent profit potential for TV service-dealers and technicians. The awe of black and white TV has vanished. The time has gone when technicians were called to adjust vertical hold controls. Do-it-yourselfers replace tubes (including picture tubes), clean tuners, and make adjustments with abandon. Not all of these do-it-yourself efforts are successful, but technicians lose revenue. Further, when you do make a house call, some customers complain about the high cost of tubes and other parts.

Color TV is a different story, however. It's still very much an unknown quantity to most people. They tend to think of color TV as extremely complex and beyond their ken. They've paid more for the set and are afraid to perform do-it-yourself operations. For this

reason, they are willing to pay for your time.

Thus, the well prepared technician will enjoy an increase in business through color TV.

Antennas

Remember the early days of black and white TV? One lucrative aspect of the early TV boom was antenna sales and installation. And antennas will play an important part in your color TV revenue.

What's the difference between a color TV antenna and a mono-

chrome TV antenna? Theoretically, none. After all, the same frequencies are involved. Let's look at a typical color TV channel — say channel 2 (see Fig. 1). Channel 2 covers the frequency spectrum from 54 to 60 Mc. The picture carrier is at 55.25 Mc, 1.25 Mc away from the lower edge of channel 2; the sound carrier is 59.75 Mc, 1.25 Mc from the top edge of channel 2. The color subcarrier is right between the two, at 58.83 Mc.

The antenna used for receiving

Fig. 1 (right)—Channel 2 carrier frequencies.

Fig. 3 (bottom left, page 47) — Response of a typical black-and-white TV antenna. Variations in response for channels 2, 6, 7, 8 and 13 would be too great for good color reception.

Fig. 4 (bottom right, page 47) — Response of one antenna made specifically for color TV reception.

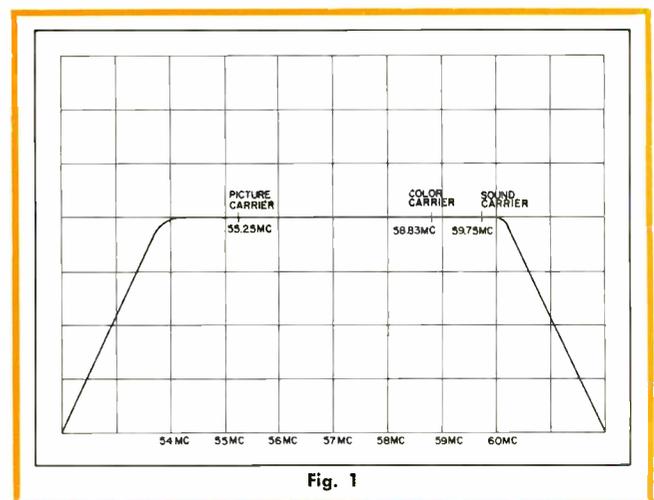


Fig. 1

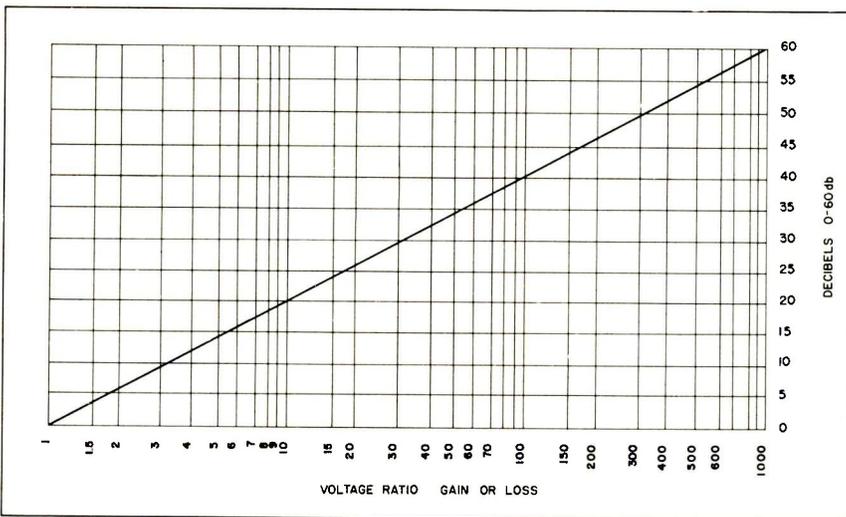


Fig. 2—Decibels to voltage ratio conversion graph.

color on channel 2 should have a reasonably flat frequency response, especially at the frequencies near the color subcarrier. For monochrome reception, attenuation at any point on the response curve will cause some loss of picture detail. This detail loss is seldom observed by the viewer but attenuation around the color subcarrier frequencies could cause improper color rendition or even loss of color.

The color information is phase dependent and any mismatch between the antenna and the TV set can cause phase distortion of the color carrying signal, resulting in poor color response.

The gain of an antenna is also extremely important and as the color subcarrier is relatively weak compared to the picture carrier, an-

tenna gain in the 58.83 Mc region will tend to accentuate color signals.

For these reasons, antennas commonly used for black and white TV are not suitable for color. Most indoor "rabbit ears" are very badly mismatched. And the familiar VHF outdoor "conical type" antenna may not be much better.

As mentioned previously, the critical requirements of color TV make your services more necessary. People who were able to get satisfactory monochrome reception with a "rabbit ear" may have to use an outdoor antenna for color. And those who put up with "snowy" or "ghostly" black and white pictures from defective or poorly installed outdoor antennas will be asking you for help to get good color pictures.

To meet the needs of monochrome TV, antenna manufacturers have concentrated primarily on gain. In general, the more gain an antenna provides, the more effectively it can pick up distant TV channels. Free space transmission loss characteristics of channel 2 are shown in the table below. Although losses increase with frequency, other channels show essentially the same characteristics.

When the distance from the transmitter is doubled, this chart shows the loss increases by 6 db. For example, free space transmission loss is 78 db at 2 miles, compared with 84 db at four miles (84 db — 78 db = 6db). Also, between 30 miles (101 db) and 60 miles (107 db) the loss increases by 6 db. Antenna gain is also expressed in decibels (db). A standard dipole is generally used as a reference for determining antenna gain. In other words, an antenna with 8 db gain will actually provide 8 db more signal than a standard dipole.

CHANNEL 2 FREE SPACE TRANSMISSION LOSS	
DISTANCE FROM TRANSMITTER	LOSS
2 miles	78 db
3	82 db
4	84 db
5	86 db
6	88 db
7	89 db
8	90 db
9	91 db
10	92 db
20	98 db
30	101 db
40	104 db
50	106 db
60	107 db

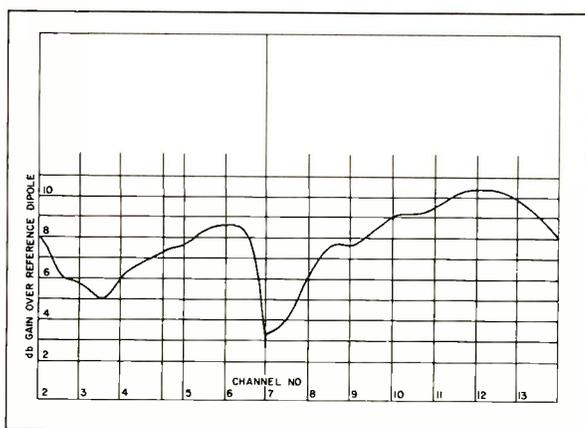


Fig. 3

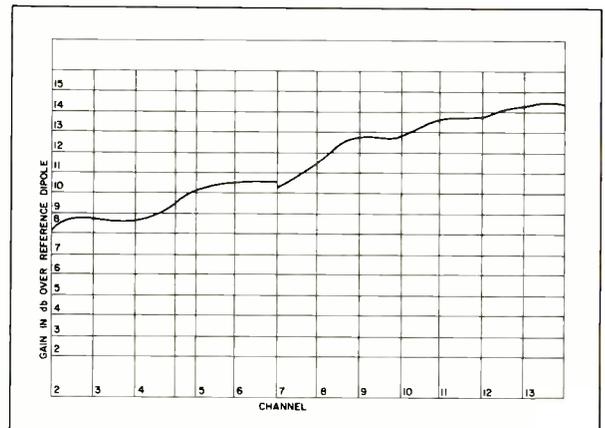
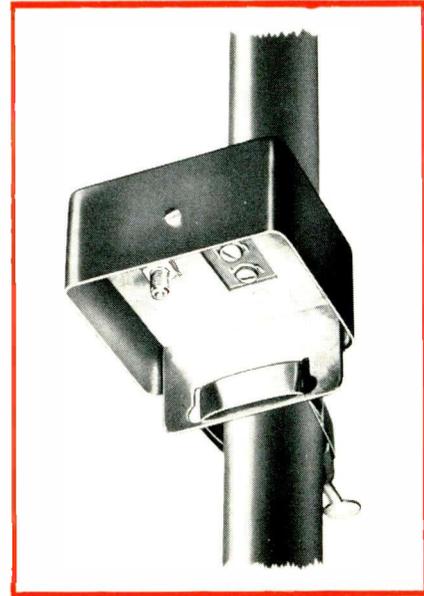


Fig. 4



While used for black and white TV for years, this type antenna is not generally recommended for color.



Mast-mounted balun for matching 300 ohm antenna to 75 ohm coaxial downlead.

The relationship between decibels and voltage times is shown in Fig 2. For example, 6 db = 2 times voltage. Therefore, if a standard dipole will pick up $1000\mu\text{v}$ at a given location, an antenna with 6 db gain will pick up $2,000\mu\text{v}$.

Perhaps more significant, since doubling the distance from the transmitter increases signal loss only 6 db, an antenna with 6 db gain will pull in as much signal at 40 miles as a dipole will pull in at 20 miles. Of course, all this is theoretical. Actually, signal propagation is affected by many things other than free space transmission loss, including especially terrain, atmospheric conditions, height of the transmitter and curvature of the earth. Nevertheless gain is an important factor.

The trouble is that many antennas designed for black and white reception stress gain to the detriment of other characteristics. Many high gain antennas are poorly matched. More typically, high gain antennas are often frequency sensitive.

The frequency response of an antenna designed essentially for highest gain at specific channels, is shown in Fig. 3. The fact that channel 12's gain is higher than channel 13's is no more important to color than it is to black and white. What is important is the ex-

treme slope within the spectrum of this individual channel. It would be virtually impossible to get good color reception on channel 6 with this antenna.

Response of an antenna designed especially for color reception is shown in Fig. 4. It is designed with a relatively flat frequency response and flatness of impedance. Gain considerations were not allowed to over-ride the characteristics so important to good color reception.

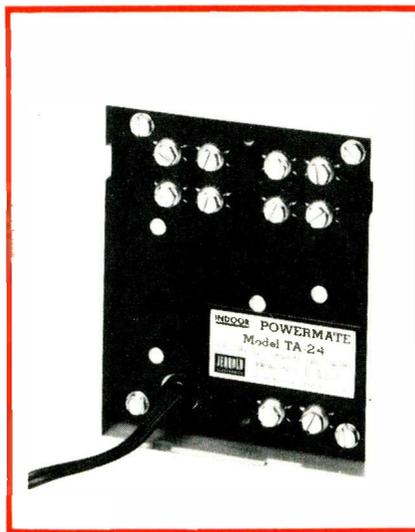
Lead-In

Average-type 300 Ω flat twin-lead has been most frequently used

for monochrome TV. It is easily affected by external conditions including proximity to metal and other objects. It picks up TV and other signals directly. Its loss increases considerably when it is wet or dirty. The cheaper lead-in ribbons are not even 300 Ω — spacing frequently results in impedances as low as 200 Ω . Many technicians are beginning to use higher quality twin lead — especially the encapsulated foam-filled type.

Good color antennas cost more than those that are adequate for black and white reception. This

Continued on page 78



Amplified couplers can provide stronger, well-isolated TV signals to as many as four TV sets.



Indoor matching transformer for 75/300 ohm TV set.



Your Records Can Save Your Business

Accurate, comprehensive books can help you avoid financial troubles if you know how to use them

■ Service-dealers and technicians who have remained in business for any length of time have kept some kind of records. But just keeping records won't help much unless you keep them accurately, fully and, what is even more important, *use them properly* to keep your business on an even keel.

Statistics from the U. S. Bureau of Census indicate year after year that "failure to use existing records properly" is a frequent cause of small business failure. Just maintaining your books doesn't help you diagnose your business problems. You have to put those records to work for you.

And it's vital that you have pertinent information while it is still current. A doctor who accurately diagnoses his patients' illnesses only after they are dead would not be popular, and neither will you be with your associates and family if you learn what's taking place in your business only *after* it has already happened.

A number of "measurements" can be made from information contained in accurate, complete book records. And this information may well be used to prevent you from joining that business legion which disappears annually in the economic jungle.

Basic Information

Let's take your book information and break it down into (1) the number of call-backs or complaints you receive; (2) number of individual service calls, bench jobs, antenna installations, sales transactions and total service and sales volume; (3) accounts receivable and overdue accounts; (4) monthly service and sales; (5) profit percentages; (6) beginning and closing inventory values and total cost of goods sold; (7) bad debts; (8) current assets and liabilities; and (9) net yearly income plus net assets at the beginning of the year.

With this basic information you can compare your records with other information to determine trends

Your Records...

or spot deviations. You can use any or all of three comparisons: Prior periods (last month, year to date, same month last year), to see where you're heading; budget figures calculated earlier, to see if you're meeting goals; and industry statistics, to determine how your operation stacks up against others.

1. **Volume of call-backs.** If your call-back figure is increasing, or is already too high — compared with any of the three indexes mentioned previously — a number of things may be wrong with your operation and should be corrected immediately.

You may be "pushing" yourself or your technicians to make more calls than they or you can handle properly. A more thorough check of the equipment may be needed on house calls. Perhaps more time should be spent explaining the condition of the equipment to the customer to avoid unpaid call-backs.

Maybe your benchman isn't doing the job properly. Perhaps you need to check the sets closer and "cook" them longer before returning them to the owner's home. And it's possible you're doing too many "minimum" repair jobs.

If too many accessories are being returned, perhaps you are high pressuring your customers or your jobber is selling you "reject" or damaged goods. Let up on sales pressure and set up a quality control system for incoming shipments.

2. **Average value of each house call, bench job, antenna installation and sales transactions.** If any of these items show a drop by comparison with a given index, check up and find out why. Here again you may be "rushing" the house jobs and actually leaving a few bad tubes in the sets when they should be replaced. And once again, you may be doing too many "minimum" bench jobs which can get you into all kinds of trouble.

If your antenna installation values have dropped or remain steady, you could be missing an opportunity to "sell-up" on antenna installations because of increased UHF and color activity. If your product sales are down, dress up your battery display counter, your indoor antenna display or push your radio and TV sales a little harder. Because your major overhead items remain relatively stable, the more you increase sales the more you actually cut expenses. And when you're selling up on antennas by supplying boosters, rotors, etc., in effect you're cutting overhead expenses even more.

3. **Overdue accounts as a percentage of all accounts receivable.** If overdue accounts as a percentage of all accounts receivable start to creep up suddenly, you're being too liberal with credit. Tighten up your credit requirements.

4. **The number of each day's service calls, bench jobs, antenna installations or sales transactions that**

appear in accounts receivable. (Divide the total monthly transactions by the number of working days; that gives average per day. Then divide that into accounts receivable.) If too high, your collection procedures aren't working too well. Get after your negligent customers and whittle this down quickly or you may find a substantial portion of your profits going to a collection agency soon.

5. **Gross profit percentages.** Two things can cause declines here. First, your total service and sales volume may be off in comparison with fixed overhead expenses. Second, you may be paying too much for your products, or not charging your customers enough. You may need better prices from suppliers, or you may need to cut internal costs or both. If you're not charging your customers enough, of course, you have to raise prices.

6. **Inventory turnover.** Divide the cost of goods sold, (or used in repair) by the average of opening and closing inventories. A decreasing figure can result from inefficient buying policies, deteriorated repair and replacement policies (too many minimum bench and house-call jobs), or misdirected selling practices. Inefficient buying in a given product area results in that product's contributing a lower-than-normal share of profit. If you're not careful, too, you may get stuck with unsalable or unusable items if prices drop as a result of competition or improved manufacturing operations.

7. **Bad debts as a percentage of total sales.** If you do not check this periodically, it may creep up to a point where your financial position is precarious. You may then find it necessary to turn over all bad debts to a lawyer or collection agency so you can salvage something.

8. **Working capital ratio.** (Current liabilities divided into current assets, then expressed as a ratio.) For example, with current liabilities of \$2000, and current assets of \$5000, your ratio is 2.5 to 1. Traditionally, a 2:1 ratio has been considered healthy by banks lending money, but the situation varies from area to area. A ratio less than 1.5:1 means that you may soon have difficulty meeting payment demands from your suppliers.

9. **Return on investment.** (Net income for the year expressed as a percentage of net assets.) Compare your figure with returns you could get from other types of investment — government-guaranteed bonds, for example — as well as with other service-dealer operations. For your answer to be meaningful, make necessary adjustments. If, for instance, you pay yourself a salary of \$6000 a year but it would cost \$7500 to hire a service manager, subtract the additional \$1500 from net profit before making your calculation. Follow the same type of procedure with any special allowance (car, expense account, etc.) which you allow yourself, but to which a service manager wouldn't normally be entitled.

If you use these nine measurements regularly, you will have sufficient information about your organization's financial health to ward off crippling financial crises. ■

Change the coupling capacitor, C2 shown in Fig. 1, and it won't hurt a bit to check C3 as well as the "hot and cold" values of all resistors in the circuit. If there's the least bit of doubt, change them. Resistors under the constant strain of high B+ on one end and a low B- at the other, do change in value and this can be critical here.

Replace the horizontal amplifier cathode and screen resistors and the bypass capacitors. All these components may have drifted out of tolerance or have some thermal deterioration.

Alignment

Alignment is not difficult, but each step, as outlined here, must be taken in turn.

First: If the receiver has a "frequency lock" padder (somebody may have discovered that loosening it helped correct the trouble), it must be tightened clockwise, then loosened *one and a half* turns. This is critical to alignment. Likewise, if a drive padder is used, check to see if it's been tightened. If it has, loosen it a half turn. If a drive line appears on the screen, ignore it until after alignment. Follow manufacturer's alignment instructions.

Second: Don't guess. Use a scope. You must see the "heel and toe" (Fig. 1), to know if they're even. When they *are*, the oscillator is at optimum anti-hunt condition.

Third: Connect the scope to the junction of C1 and R1 (Fig. 1), and a ground point close by. If you don't have a capacitor probe, place a small capacitor, 10 to 22 pf, in series with the direct probe to prevent capacitive circuit loading. If the receiver has an isolation pigtail protruding from the chassis, probe isolation is not necessary.

Fourth: Adjust the waveshaping coil until the "heel and toe" looks like the waveform shown in Fig. 1. At this point, keep the picture in sync. If the receiver has a "fine hold" control on front and you've reached its limit, adjust the frequency coil. Turn the "fine hold" control back and forth while putting the finishing touches to the waveshaping adjustment — until the control no longer affects the waveform.

Fifth: Disconnect the scope and make final ad-

justment to the frequency coil, turning the "fine hold" until a blanking bar starts to drift in from the left side of the picture, or until the oscillator drops out of sync at both extremes of the "fine hold." Check the drive. Readjust the padder as needed to get full sweep with no drive line. Recheck for the blanking bar drift or drop-out at both ends of the control.

Sixth: Receivers without a "fine hold" control must rely on the frequency coil adjustment for sync. Here you switch from channel to channel, adjusting the frequency coil until the picture maintains sync. Let the set run for awhile and switch channels again. If the blanking bar wants to move onto the screen, a quarter turn or so of the frequency coil should stop it.

Some manufacturers indicate that they desire the waveform to be just a little uneven — "toe" a trifle higher than the "heel." Unless this is specified under alignment instructions, do it exactly as outlined here and as shown in Fig. 1.

Modified Circuitry

As shown in Fig. 2, one manufacturer has come out with a modification of this old reliable circuit. Instead of the "stabilizer" coils being in the plate circuit, they've been inserted in the oscillator cathode. One coil is tapped, with coupling back to the grid making this a variation of the Hartley oscillator.

The core of one coil is fixed, while the other is adjustable for waveshaping. Frequency is changed with a "hold" control connected to the grid in a manner that sync can be plucked off the cathode of the AFC tube as well as changing the bias of the oscillator. Another version of this circuit may have one end of the control tied to ground, thereby changing only the grid bias.

Instead of having a "heel and toe" wave shape, Fig. 2 shows a low amplitude sine wave with a vertical spike riding the leading edge. (It's similar to the spike riding the output of a vertical integrator in many sets.) This same waveform, somewhat suppressed, appears on the grid, while a sawtooth is at the plate.

Servicing and alignment procedures for this oscillator are the same as for the synchroguide. Since the frequency coil is fixed, no adjustment can be made at this point. This is done with the control.

Most of the receivers employing this oscillator will be equipped with a vernier ball-bearing type control, giving very fine adjustment.

Since the rear cover of the control is the bearing race, the control is often insulated from ground: It would be good practice to watch for metal objects coming in contact with the control. For example, a set came into the shop recently with "no picture." It was found that a bobby pin had been dropped into the set, becoming lodged against the control and a chassis bracket, shorting the cathode of the AFC and the grid of the oscillator to ground.

Because no sliding contact exists in these controls, replacement is rare. If, on turning the control, the picture is "watery," a good quality contact cleaner will frequently do the trick. ■

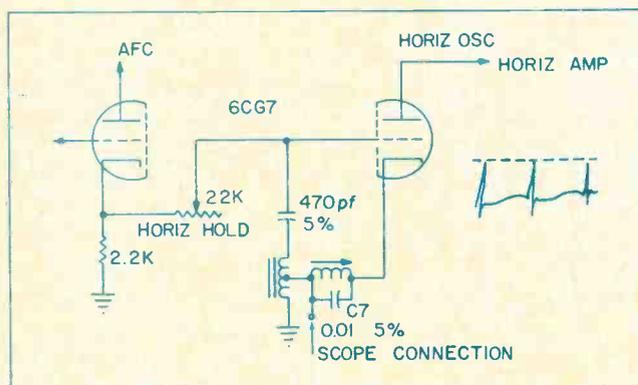
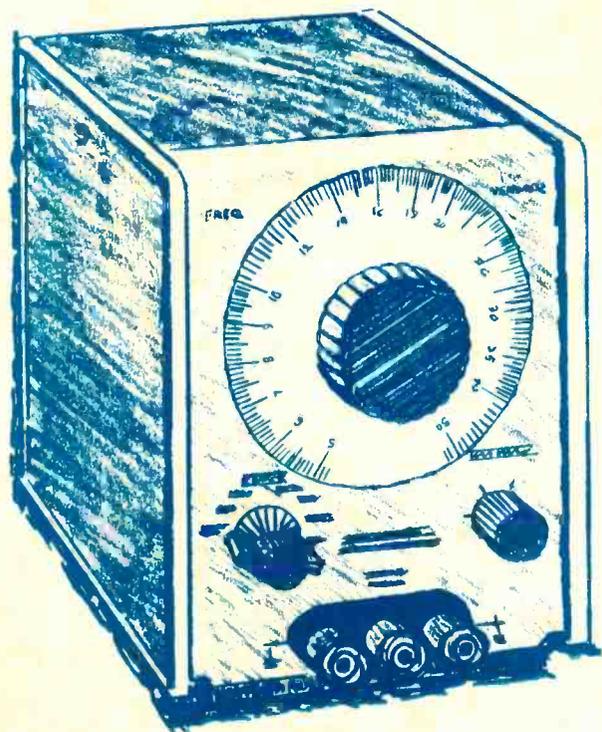


Fig. 2—Modified synchroguide horizontal oscillator circuit.



Choosing and Using Audio Oscillators

by Arthur M. Walters

Hewlett-Packard Co.

Prevent extraneous ground-loop signals from entering measurements when driving sensitive input circuits with low-level signals

■ When driving sensitive input circuits with low-level oscillator signals especially, some precautions are needed to prevent extraneous signals from entering the measurements. Noise and hum may be picked up by unshielded inter-connections, especially when the conductors are at high impedance. But the most common problem is hum, and its most common source is ground loops.

A ground loop is formed wherever two parallel paths, each closed at each end, exist for ground between two circuits. This situation often arises when a ground connection is made at both ends of a line interconnecting an oscillator with the tested instrument. Usually another ground path exists between the two through the ac power line or the power line safety ground. When this path is linked at both ends to signal terminals, a closed loop is formed. Currents at power line frequency circulate through these paths. They arise from capacitive and inductive coupling in and around transformers, and elsewhere; they develop voltages across the low resistance of wire interconnection. Their current level may be considerable, so their voltage can be comparable with the lowest voltages encountered in signal circuits.

When these currents are allowed to circulate through a line which also carries test signals, they add together and an unwanted hum appears. The usual solution is to float one end of each interconnection, grounding at the other end only. When three or more

chassis are interconnected, extra care must be taken to assure that signal-carrying lines do not form closed loop ground paths with other ground lines.

Practical Work

To get practical, meaningful information when using audio oscillators, a number of factors must be considered. Let's take a simple case to demonstrate.

A high quality consumer-type power amplifier is shown in Fig. 1, together with an audio oscillator and ac voltmeter. The amplifier is to be tested for sensitivity. The practical question to be answered is, "what should be the output voltage capability of the preamplifier we need to drive this amplifier?"

First, we need to consider the amplifier's specifications which are:

Continuous power output of 30 w.

Frequency response at full power output — ± 0.1 db, 20 to 20,000 cps.

Input: single-ended, 250,000 Ω .

Tone controls: none.

Maximum distortion @ 400 cps @ rated output: less than 0.5 percent.

If the preamplifier is not to limit the power capability of the sound system, it must put out at least enough voltage, substantially undistorted, to drive the amplifier to full output. So we find the input voltage which will produce 30 w at the power amplifier's output. In the real case we may reasonably expect

The antenna that challenges

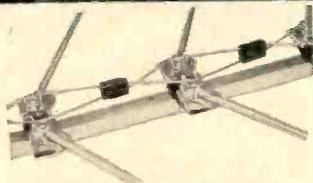
NEW Swept Element

"COLOR-VE"

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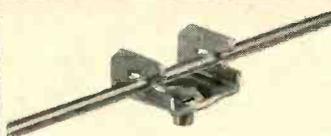
Finco's Color Ve-Log challenges all competition on color or black and white reception and stands behind this challenge with a "Guarantee of Supremacy". ■ The swept element design assures the finest in brilliant color and sharply defined black and white television reception — as well as superb FM monaural and stereo quality. ■ FINCO precision-engineered features make these advanced-design antennas indispensable to good home sight-and-sound systems. And, of course, they carry the famous unconditional guarantee from the leading manufacturer in the field — FINCO. ■ Promote the Color Ve-Log Antennas with pride, sell them with confidence, and profit handsomely.



One-piece cross-over drive line assembly has no joints between adjacent driven elements. Eliminates loose connections, shorts, broken drive line sections. Polystyrene snap-lock spacers, with center 'air insulator' space.



Elements are made of triple thick aluminum to stand up in severe weather. Die stamped bracket fastened with tough, thick-gauge rivet holds proportional length sleeve reinforcing shell into which element fits.



First from Finco and exclusive — double contact between drive line and driven element bracket assembly for perfect drive-line support and electrical continuity. Positive, vibration-free, non-corrosive contact.



Boom reinforcing back up brackets at elements add triple strength to the riveted assembly, mounted on a rigid, non-crushable 1" heavy duty square boom. Boom rolled square from 1 1/4" diameter round aluminum for increased strength.

Write for color brochure #20-307, Dept. 110.

all competition!

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 9 driven elements
 1 parasitic element
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Featuring Finco's Exclusive Gold Corodizing



Finco's boom-mast bracket, rust-proofed by zinc plate-gold di-chromate dip process, is the finest available. It has positioned cleats to assure sag-free positive direction of the antenna. Locks tight. Can't tilt. Antenna stays in proper position at all times.



High impact polystyrene insulators are reinforced with strong aluminum shields. This gives quadruple strength in supporting triple-thick snap-in elements. Lifetime assembly with fitted aluminum cup to hold oversize aluminum rivet.



VL-5
 5 element VHF-FM
 5 driven elements
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VL-7
 7 element VHF-FM
 7 driven elements
 List price \$23.95



VL-15
 15 element VHF-FM
 9 driven elements
 6 parasitic elements
 List price \$46.95



VL-18
 18 element VHF-FM
 9 driven elements
 9 parasitic elements
 List price \$54.50

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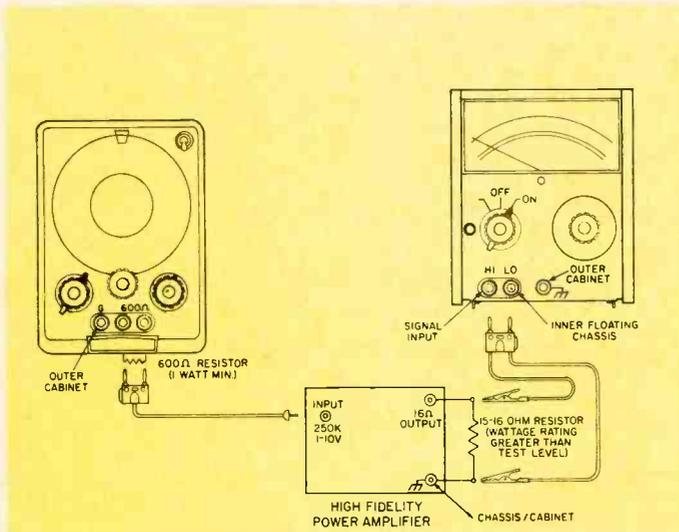
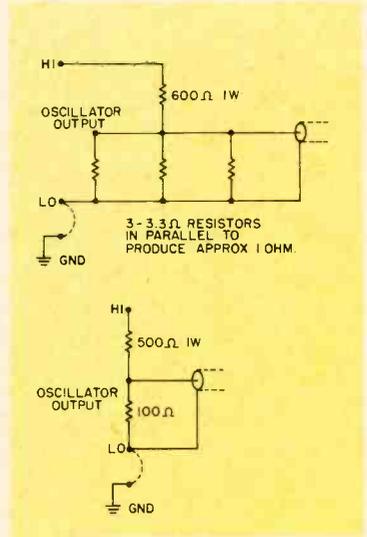


Fig. 1—Test set-up for measuring sensitivity of Hi Fi power amplifier.

Fig. 2—Two resistive voltage divider networks for dropping oscillator output voltage.



Audio Oscillators . . .

it to be in the range 0.1 to 10.0 v. This is in the range of voltages at which the oscillator we have selected will deliver clean signals. (Its rated output is 1 w into 600 Ω, or 24.5 v.)

We now decide that a precision calibrated attenuator is not needed here. We do not require great accuracy and we see that the selected voltmeter, with ± 2 percent full-scale accuracy, will easily meet the need.

Now we will strap one side of the oscillator output to ground, to make a single-ended driving source, realizing that we might equally well float the oscillator, omitting the ground strap. Then we will bridge the output with a resistor of "normal" 600 Ω. In this case there will be no hazard to our purpose if we choose a common 620 Ω ± 10 percent, 1 w or larger carbon resistor. The oscillator load requirement is entirely satisfied by this range of resistance values; we note that we will not approach the resistor's power dissipation limit. We see that the amplifier's 250,000 Ω input impedance will have negligible shunting effect.

Next we think of what load we should apply to the amplifier. Must we measure at exactly full rated power output, and thus require a precision resistor of high wattage rating? We may later want to know the amplifier's real maximum output power capability with accuracy, but now we only want to measure sensitivity. We might therefore accept the specifications, which define an amplifier that is essentially linear up to 30 w and make our measurements at some convenient fraction of 30 w.

Additionally, real audio power amplifiers must be designed to tolerate variations in load (more upward variation than downward, to be sure). So in this case, we may justifiably use a readily available 15 Ω 25 w wirewound resistor, and work at about 10 w. We should measure the resistor, to know its accuracy within ± 5 percent or so. A little exercise in algebra

will show that 5 percent variation from the assumed value will only barely affect the accuracy with which

we will measure the power by ohm's $P = \frac{E^2}{R}$ formula.

Now is our voltmeter going to shunt either the input circuit or output circuit, which we will be measuring, enough to affect the accuracy of the measurement? No. We find its input is rated at 10 M Ω, which is very many times higher than the impedance of either line to be measured:

At the input the 10 M Ω impedance will be shunting the oscillator's source impedance, its 600 Ω load resistor, and the 250,000 Ω amplifier input, all in parallel. The lowest of these is the oscillator source impedance; therefore, the impedance seen when looking from the signal line to ground will be just a little under this value. Similarly, the impedance of the output line will be effectively that of the amplifier's internal source impedance, which we know to be very low.

Calculating that 10 w into 15 Ω is 12.4 v, the rest of the measurement is simple. We will warm up the amplifier and instruments first, and make sure with the voltmeter that power line voltage is within the right operating range. With the amplifier's gain set at maximum, the voltmeter connected across the amplifier output and load, the oscillator set at any convenient mid-range frequency, we will increase the oscillator level control until 12.4 v appear at the amplifier output. Now we measure the voltage at the amplifier input. In this case the voltmeter leads may be connected between any ground in the system and any part of the input line, since all signal levels are high in relation to noise, all line impedances are low, and all ground connections, though common, are short.

We find, perhaps, that 0.90 v in gives 12.4 v out. Since 30 w is 21.2 v across 15 Ω, we calculate that a little under 1.6 v (1.56 to the nearest 1/100) drive will be required, since 12.4 is to 0.90 as 21.2 is to 1.56. Although we have not rigorously analyzed the case for accuracy, we are safe in guessing we are

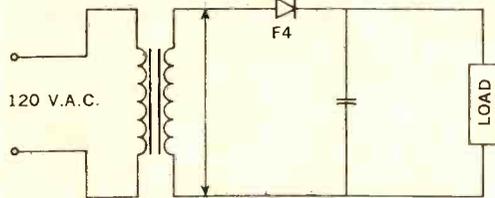
Continued on page 74

replace selenium rectifiers with the better kind TARZIAN SILICON RECTIFIERS without worrying ABOUT FAILURES OR CALL-BACKS!

Silicon rectifiers perform better and last longer than the outmoded selenium units. In most situations, it's simple to make the direct replacement *without changing the circuit*. In a few easily recognizable instances, a series resistance should be added to the circuit, because of the extremely low impedance of silicon rectifiers.

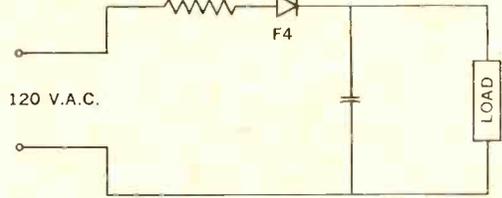
just
follow
these
simple
guide
lines:

1. If there is a transformer in the circuit, you'll have no problems.



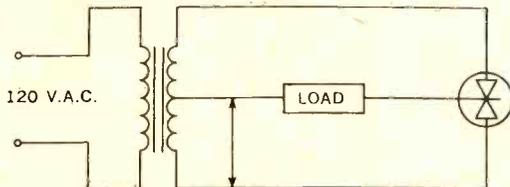
Make a direct replacement. (Tarzian F4)

2. If there is series resistance already in the circuit, you'll have no problems.



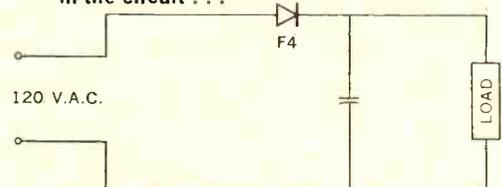
Make a direct replacement. (Tarzian F4)

3. On tube replacements, you'll have no problems.



Make a direct replacement. (Tarzian S-5251 or other appropriate unit.)

4. If there is no transformer or series resistance in the circuit . . .



insert any 5 to 10 ohm, 5 or 10 watt resistor in series between the rectifier and the line. You'll have no problems, because the resistor will eliminate the excessive inrush current during the first few cycles after turn-on.

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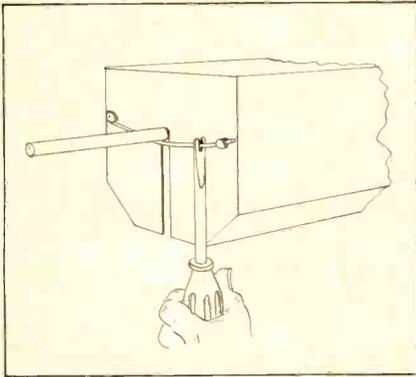
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SHOP HINTS

TIPS FOR HOME AND BENCH SERVICE

Tuner Spring Remover

A tricky shop job that arises frequently is removing the turret retaining spring in a TV tuner. Sometimes it comes off easily but

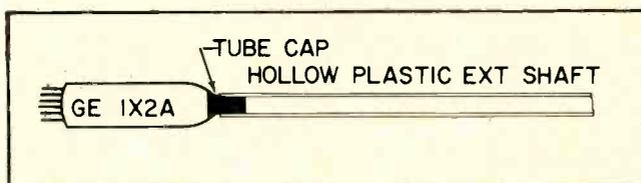


at other times it twangs across the shop like a projectile, resulting in fast ducking by the technician. Sometimes an extensive search is necessary to find it again. A special tool for removing these springs can be made from an old screwdriver. File or grind a slot in the end, as shown here. The slot should be about $1/16 \times 1/4$ in. deep. You will also find this tool useful for removing springs from some parts of record changers, tape recorders; and for twisting wires, etc.—*Hugh Gordon, Burlington, Ont., Canada.*

HV Tube Puller

In some TV sets the 1X2A tube is difficult to replace because of its location in the high voltage cage. A length of rigid plastic tubing which fits snugly over the plate connector of the tube makes a handy tool for removing or replacing the 1X2. Once the tube is seated, the shaft can be removed by twisting it as it is pulled off.

A length of rigid plastic tubing may be used to replace or pull HV tubes.



Plastic shafts of this type are used to extend controls through the backs of sets and are available from many manufacturers.—*Terry Maki, Libby, Mont.*

Knob Removing Aid

A simple method to remove tight plastic tuning knobs on ac/dc radios is to apply heat from a soldering iron to the tuning capacitor shaft while pulling gently on the knob.—*Fred M. Schultz, Ligonier, Ind.*

Tool Kit

An attache case, purchased from any department store or luggage shop, can be used as a tool kit.



Attache case may be converted into a functional tool box.

With the proper installation of a number of spring clips as toolholders, the case is transformed into a versatile tool container. The case has ample room for cleaning solvents, a soldering gun, and a small VOM besides all the necessary hand tools. A separate tool case eliminates loose tools from the tube cad-

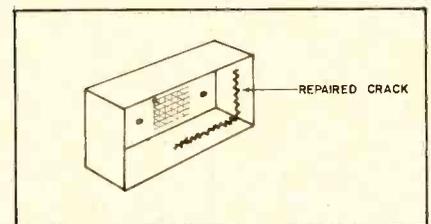
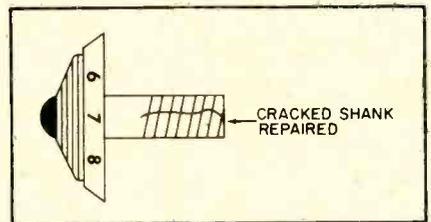
SHOP HINTS WANTED

\$3 to \$10 for acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do. Unacceptable items will be returned if accompanied by a stamped envelope. Send your entries to Shop Hints Editor, ELECTRONIC TECHNICIAN, Ojibway Building, Duluth, Minn. 55802. The hints published in this column have not necessarily been tried by ELECTRONIC TECHNICIAN editors and are the ideas of the individual writers.

dy and allows more space for tubes and replacement parts. This neat arrangement allows service technicians to easily check for missing tools after completing service calls. —*Anthony J. Fusco, Buffalo, N.Y.*

Plastic Repair

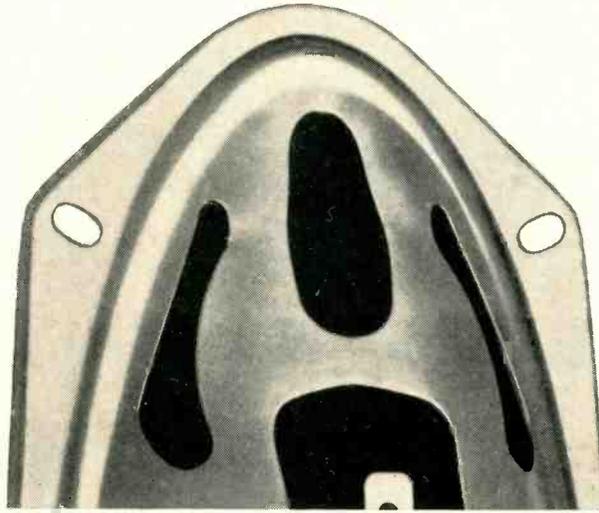
Cracked plastic cabinets may be effectively repaired by heating a piece of No. 22 gage wire and em-



Small gage wire imbedded with a hot soldering iron forms a strong bond on cracked plastic items.

bedding it in a zigzag fashion along the crack. This method may also be applied to irreplaceable, cracked plastic knobs. The wire is heated and wound around the knob shank as shown.—*William Schlickbernd, Cadron, Nebraska.*

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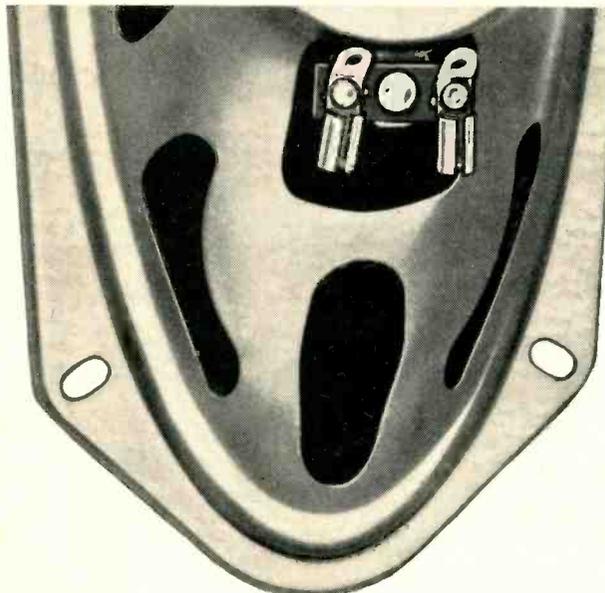
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3	3K7	.68	3.2	\$3.80
3½	35K7	.68	3.2	3.80
4	4K5	.55	3.2	2.90
4	4K7	.68	3.2	3.55
5	5K5	.55	3.2	3.25
5	5K7	.68	3.2	3.85
5¼	525K7	.68	3.2	4.35
6	6K7	.68	3.2	4.35
7	7W3	1.00	3.2	6.55
8	8W3	1.00	3.2	5.85
10	10J10	1.73	3.2	9.00
12	12J10	1.73	3.2	10.50

*DP—Alnico 5 Magnets

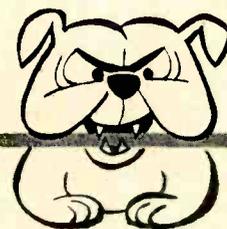
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4x6	4X6K7	.68	3.2	4.80
4x8	4X8W3	1.00	3.2	6.00
4x8	4X8W9	1.00	8-10	6.00
4x10	4X10W3	1.00	3.2	6.50
4x10	4X10W9	1.00	8-10	6.50
5x7	5X7W3	1.00	3.2	5.35
5x7	5X7W9	1.00	8-10	5.35
5x7	5X7V3	1.47	3.2	5.40
5x7	5X7V9	1.47	8-10	5.40
6x9	6X9W3	1.00	3.2	5.95
6x9	6X9W9	1.00	8-10	5.95
6x9	6X9V3	1.47	3.2	6.40
6x9	6X9V9	1.47	8-10	6.40

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Difficult Service Jobs Described by Readers

High Resistance Tiepoint

A customer complained that a Zenith 16021 chassis had insufficient vertical sweep for five minutes after switching the set on. After this time the raster filled out vertically but had very poor linearity, which was not readily adjustable. According to the owner the 6CY7 vertical oscillator and output tube had been replaced on two occasions and vertical adjustments made. The set was then brought to the shop for a thorough checkup.

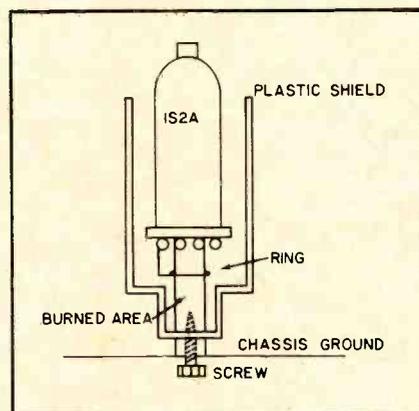
Preliminary inspection of the set revealed a dirty and rusty chassis. Voltage measurements were taken with a VTVM. The vertical oscillator plate voltage was somewhat low and as the vertical sweep filled out, voltage returned to normal. With a full sweep I was unable to properly adjust the height and vertical linearity. I then proceeded to make resistance measurements in the vertical stages. The VTVM indicated a reading of approximately 800K at pin 2, the grid of the vertical output section of the 6CY7. The 2.2MΩ resistor from pin 2 to ground was disconnected and it checked out OK. With the resistor unattached, the VTVM still read about 900K but

the reading should have been infinity. When the leads to pin 2 were removed one at a time, the VTVM indicated the same reading until a wire leading to a tiepoint was removed. When this lead was disconnected, the meter reading rose to infinity. I removed all connections from the tiepoint and checked the resistance to ground from the bare tiepoint. The meter read 900K. A high resistance path to ground caused by corrosion of the tiepoint changed the input resistance of the vertical output. The tiepoint connections were all twisted together, soldered and taped away from the original point. All parts removed were soldered back and the vertical circuit returned to normal.—Howard Keilholtz, Ellicott City, Maryland.

HV Leakage

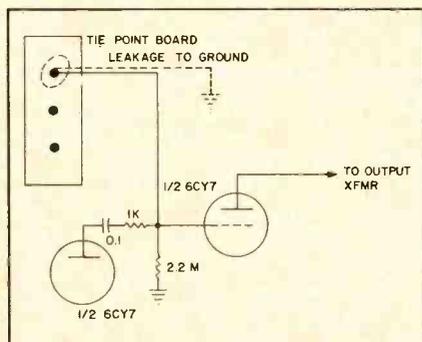
A Motorola TV chassis, QTS-430, was brought into the shop by the owner for repairs. The set lacked high voltage and tube substitution did not correct the trouble. VTVM voltage readings in the horizontal output stage were normal. An in-circuit check of the horizontal output transformer with a flyback-yoke tester revealed shorted turns in the transformer. The flyback was replaced but still no HV appeared. A thorough resistance and capacitor check was made in the damper circuit with nothing abnormal found. The new flyback and the original yoke were tested and found to be OK. Several 1S2 HV rectifier tubes were tried with no favorable results. Close inspection of the 1S2 socket assembly revealed a small brown spot on the socket support near the metal corona ring.

The rectifier socket is attached to the chassis with a mounting screw inserted in the fiber socket support. The fiber material broke down and the HV arced from the corona ring



Corrosion created high resistance from tiepoint connection to ground and caused poor linearity in vertical output stage.

through the support to the mounting screw. No blue arc was visible with the set on because the ring almost touched the socket support and the HV leaked through to the mounting screw. The mounting screw was replaced with a shorter one and the fiber support covered with corona dope. The arcing ceased and the set operated normally.—Frank D. McCreery, Providence Forge, Va.



Breakdown of a fiber socket support caused loss of high voltage.

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1964 ARTICLE INDEX

Antennas

Antenna Season	2/64-45
Are You Missing the 'Sky' Boat Jim Sarayotes	9/64-46
Cash in on UHF	Lon Cantor 2/64-56
Detect... Select... Install	J. E. Bayne 9/64-52
Get Aboard the UHF 'Aerial' Gravy Train!	Bob McDonald 9/64-50
Improving Color TV Reception	Lon Cantor 12/64-46
Mastering Master Antenna Systems	Marvin Thall 2/64-62
Rotors Sweep the Horizontal	9/64-49
Think Up—Sell Up—Put Up!	Dan Roher 2/64-48
Why Some Antennas Have 'It!'	Keith Peterson 9/64-43

Audio Communications

Home Multicoupler System	2/64-55
Installing Audio Distribution Systems, Part I	Chuck Overstreet 7/64-54
Installing Audio Distribution Systems, Part II	Chuck Overstreet 10/64-69

Batteries & Semiconductors

Avoiding Pitfalls in Transistor Testing	William Orloff 4/64-46
Next Time Use a Zener	Robert Brickey 7/64-64
Selling Packaged Power	6/64-46
Servicing Transistorized Equipment	Neil Ruffing 3/64-61

Business

Are Your Business Costs Climbing Too Fast?	Ernest Fair 11/64-59
Basic Business Practices for Independent Service-Dealers	Martin Tepper 12/64-39
Confidence—Important Trait for Technicians	3/64-59
Customer Relations	John LaCerde 2/64-59
Don't Go Bankrupt	6/64-40
Estimate or Guesstimate?	Reg Bartlett 5/64-60
Looking for a New Location? Part I	John Mertes 3/64-81
Looking for a New Location? Part II	John Mertes 4/64-92
'Magic Words' for Success	4/64-95
Telephone Directory Advertising	4/64-50
What's 'Public Relations?'	12/64-45
Writing Better Ads	F. Malcolm Minor 1/64-53
Your Credit Policy Can Make or Break You	Harold Ashe 8/64-56
Your Records Can Save Your Business	12/64-49

Closed-Circuit TV

A Glossary of CC-TV Terms	7/64-48
CC-TV Systems Combat Losses	7/64-44
Closed-Circuit TV Grows Up	John Haskell 8/64-54
There's Money in Closed-Circuit TV	7/64-50

Editors' Memo

Antenna Season?	9/64-34
Bigger and Better	5/64-36
Brown Tape	6/64-28

CB and the FCC	11/64-38
Honest Service	2/64-42
Keener	10/64-39
On Slaying Goliath	4/64-34
Progress	1/64-34
Through the Looking Glass	12/64-26
Time to Sell 'Gum'	8/64-32
3-D Television?	3/64-38

Hi Fi and FM/Stereo

Another Approach to FM Stereo Demodulation	Milt Langford and Jim Azbell 9/64-60
FM Stereo Receiver Alignment	Stanley Janas 11/64-60
Sampling Demodulators for FM Stereo, Part II	Ed Noll 3/64-57

Industrial Electronics

A Look at Meter Relays	6/64-66
Adjustable Speed Control	8/64-67
Carbon Monoxide Alarm	8/64-66
Clean Up with Fluorocarbon Solvents	Dr. Albert W. Bauer 11/64-77
Intrusion Protection	7/64-45
Opportunities in Remote Control Switching	7/64-39
Phase Shift, Part I	Louis Frenzel, Jr. 11/64-73
Phase Shift, Part II	Louis Frenzel, Jr. 12/64-71
Repairing and Troubleshooting Xenon Lamp Devices, Part I	R. W. Neale 7/64-68
Repairing and Troubleshooting Xenon Lamp Devices, Part II	R. W. Neale 8/64-64
Time-Delay Relays	Herman R. Holtz 12/64-68
Tube Aging Benefits—Fact or Fancy?	Carl Henry 7/64-66
Tunnel Diodes as Industrial Circuit Elements	Allan Lytel 6/64-64

Miscellaneous

Checking Power Transformers	George Oborto 8/64-73
Compactrons—Condensed Specifications	5/64-48
Electronic Organ Principles	Joe Hayes 10/64-72
ELECTRONIC TECHNICIAN'S Directory for 1964	5/64-52
Filters Can Do Funny Things	H. L. Davidson 11/64-51
Guide to Foreign Tubes	5/64-59
How to Choose and Use Controls	Norman Nelson 5/64-43
Know Your Electrolytics	5/64-56
Look Up—Move Up	Louis E. Frenzel, Jr. 8/64-68
Pleasure-Craft Electronic Equipment	Bill Kiley 3/64-53
Relays, Part III	William B. Lamb 10/64-104
Save Time with Power Tools	6/64-43
So You Think a Fuse Is a Fuse	Walter A. Mathews 5/64-64
Soldering—Profit or Loss? Part I	Melvin Zalkin 5/64-54
Soldering—Profit or Loss? Part II	Melvin Zalkin 6/64-48
There's Money in Ideas	4/64-55
Thinking Smaller	10/64-102
Tools and Techniques for Auto Radio Repair, Part I	Jack Brayton 6/64-35
Tools and Techniques for Auto Radio Repair, Part II	Jack Brayton 7/64-52
Tools for Busy Technicians	6/64-50
Troubleshooting!	S. P. Fairchild 9/64-72
Ultrasonic Leak Detector	8/64-73
What About Potting and Encapsulation?	Jim Hawkins 9/64-76

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... for more details circle 16 on post card

1964 ARTICLE INDEX

Radio

Eliminating Hum in Audio Amplifiers	Bob Batchelder	9/64-57
Extra Profits with Rear Seat Speakers		4/64-44
Stop Unwanted Oscillations	Eugene Fleming	6/64-53

Shop Hints

Aerosol Compressor	Thomas Casey	6/64-56
Another Spare Hand	H. Muller	8/64-60
Antenna Clip Adapter	John M. Tomlan	3/64-68
Automatic Screwdriver Adapter	Jan Girardot	11/64-68
Backward Saw	Harry J. Miller	8/64-60
Caddy Light	William Geneau	2/64-68
Cap/Connection Extensions	C. J. Barnes	8/64-60
Capacitor Replacement Tip	N. V. Travis	6/64-56
Capacitor Test	H. Josephs	4/64-64
Circuit Killer	Bob Hutson	11/64-68
Cleaning Record Changers	Dave Edwards	10/64-78
Clip-Lead Holder	E. P. Skretka	10/64-78
Collaring Dogs	Gilbert Clemons	10/64-78
Colored Lights	A. J. Fusco	2/64-78
Dial Cord Slippage	H. E. Cantrill	3/64-68
Drill Chuck Key	A. J. Fusco	3/64-68
Easy Etching	H. Josephs	6/64-56
Emergency Continuity Test	J. M. Tomlan	2/64-68
Extra Stereo Speaker	L. Davidson	11/64-68
Fail Safe	Harry J. Miller	7/64-60
Feed Line Aid	G. E. McClaskey	9/64-66
Functional Tool Holder	F. M. Burton	10/64-78
Fuse Clip	Wm. Schlickbernd, Jr.	3/64-68
Grille Cloth Installation	Paul Hennig	11/64-68
Head Light	S. Clark	1/64-64
Hose Clamp Handles	Anthony J. Fusco	5/64-70
HV Tube Puller	Terry Maki	12/64-58
Illegible Tube Numbers	Henry Muller	4/64-64
Intermittent Locator	M. Vincek	5/64-70
Jig Pad	Fred Stone	1/64-64
Knob Reamers	Ronald L. Ives	5/64-70
Knob Removing Aid	Fred M. Schultz	12/64-58
Liquid Tube Puller	Clem O'Brien	1/64-64
Mast Substitute	Samuel H. Miller	8/64-60
Miniature Hand Drill	F. M. Burton	5/64-70
Mobile Hookup	Stan Clark	4/64-64
Nut Driver Repair	E. S. Broyles	4/64-64
Nut Driver Tip	Don Studt	6/64-56
Nut Holder	Tom Ballentine	2/64-68
Parts Identification	Henry Muller	1/64-64
PCB Cleaner	Fred Harmon, Jr.	2/64-68
Phono Motor Speed-Up	Virgil W. Zieg	8/64-60
Plastic Repair	William Schlickbernd	12/64-58
Preventive Maintenance	Richard D. Mohrmann	1/64-64
Quick Color Antenna Check	Robert Appel	3/64-68
Rectifier Substitution	John Little	9/64-66
Remote Control Tester	Bob Hutson	7/64-60
Renewed Screw Holes	H. Josephs	9/64-66
Repeated Silicon Rectifier Failure	G-E Service Dept.	7/64-60
Rotator Thawer	Henry Miller	2/64-68
Safety First	RCA	10/64-78
Scratches Mark Spot	David F. Jacobs	4/64-64
Screw Holder	William R. Skilling	4/64-64
Short Detector	H. Muller	4/64-64
Simple Monitor	James J. Porten	5/64-70
Skid-Proofing Meters	S. Clark	9/64-66
Stringing Aid	George Boettcher	1/64-64
Strobe Saver	Samuel Jacobs	4/64-64
Technical Library	RCA	2/64-68
Template Tip	Ed Mayover	6/64-56
Tightens Pocket Clips	A. J. Fusco	1/64-64
Time & Work Savers	Leonard Blechman	9/64-66
Tool Kit	Anthony J. Fusco	12/64-58
Transformer Check	Si Clark	6/64-56
Transparent Heat Chamber	Tom Deedy	2/64-68

TV Jig	F. M. Burton	8/64-60
TV Shock	T. Wildon	6/64-56
Tuner Repair	John A. Krzwulak	7/64-60
Tuner Spring Remover	Hugh Gordon	12/64-58
Twin Head Stripper	H. Josephs	8/64-60
Ultr Insulator	John Timm	2/64-68
Vertical Convergence	G-E	10/64-78

Technical Digest

ADMIRAL

Schematics for TV Chassis C21A1, C21A1-1E and C21A10-1C Stamped Run 10 and Run 11—Component Listing Corrections	9/64-37
TV Chassis C21A1-1A, -1E and C21A10-1C Stamped Run 11—Improving Focus	4/64-37
TV Chassis Stamped Run 11, C21A1-1A, -1E and C21A10-1C—AGC Adjustment	6/64-31
TV Chassis Stamped Run 11, Models C21A101-1A, -1E C21A10-1C—Changes	6/64-35
TV Chassis Stamped Run 11 with Suffix "E"—UHF Channel Adjustment	2/64-39
Color TV Chassis D 11—Field Adjustment of Sync and Phase	11/64-22

AIRLINE (Montgomery Ward)

TV/FM/Am Phono Combinations, WG5914A, 5944A, 5974A, 6914A, 6955A, 6974A—Poor Resolution	1/64-35
Same Chassis—Drive Cord Replacement	4/64-37
FM Section of TV Combination Models WG-S914-5944A, 5974A-6814A; 6944A-FM Alignment Setup	3/64-41

DELCO

Oldsmobile and Pontiac Reverberation Amplifier Alternator Whine	1/64-35
All Chassis—Intermittent Noises	5/64-39
"Wonder Bar" Radios—Upside Down Operation Auto Radio, Chevrolet 985876, Buick 980655A, Oldsmobile 982249, Pontiac 984077 Alternate 1964 Audio Circuit Push Button Radios	6/64-31
All 1964 Push Button and Manual Tuning Auto Radios—Dead Radio Checks	3/64-41

DUMONT

TV Chassis 120734-A and 120735B—Circuit Changes	10/64-40
---	----------

EMERSON

TV Chassis 120677-A, 120678-B, 120679-A, 120689-A—UHF Channel Strips	5/64-39
Stereo AM/FM Hi Fi Phonograph Record Changer 819206—Adjustment Settings	9/64-37
TV Chassis 120744 c/753J—UHF Tuner Field Alignment	9/64-37
TV Chassis 120677-A, -678B, -679A, -684A, 689A—Field Modification Note	1/64-35

GAMBLE-SKOGMO

TV Chassis TV2-9542A—Centering 23 in. Receivers	5/64-39
TV Chassis TV2-9542A—Poor Vertical Linearity	1/64-35

GENERAL ELECTRIC

TV Chassis QX Models M500X—Horizontal Pulling	3/64-41
TV Chassis "NW"—Production Changes	4/64-37
TV Chassis "NW"—Production Changes	5/64-39
All TV Sets—Deflection Yoke Tests	6/64-31
All Sets—Shorted Yokes	7/64-35
TV FY Chassis—Horizontal Deflection Alignment	9/64-38
TV "FY" Color Chassis—Horizontal Interference During Alignment	8/64-35
TV Chassis DA RW 365—Power Tuning Function	11/64-22

MAGNAVOX

Companion Speaker Systems Models S-62, S-63 & S-65—Connections	5/64-39
--	---------

Combination, Model 1 MV/4381—AM Radio Interference in TV sound	7/64-35	What You'll Find in 1965 TV Sets	11/64-45
Series 75 AM/FM Tuners—FM Stereo Alignment Preliminaries	2/64-39		
MOTOROLA			
TV Chassis TS-908 Models 23CK37, 38, 39, 40, 42, 44 & 46—Tuner Disassembly	3/64-41		
Color TV Chassis TS-908—High Voltage Regulator Adjustment	4/64-37		
Color TV Chassis TS-908—Circuit Guard	5/64-40		
PHILCO			
All 1963 "L" Line TV Chassis—Noise Control Setup (Where Used)	3/64-41		
TV Chassis B, All 1963 "L" Line—Checking Horizontal Phase Comparator Selenium Diode TV Tuners TT82, TT83, and TT84 Series—Installation and Adjustment of UHF Channel Strip	5/64-40		
Color TV Chassis 14M91—No Color, Sound OK TV Tuners VHF TT-165 and VHF-155A—Disc Removal	11/64-24		
RCA			
Some 1964 TV Models—UHF Tuner	3/64-41		
Color TV Chassis CTC 15—"Boosted" Boost	6/64-32		
Color TV Chassis CTC 15—Convergence	7/64-35		
TV Color Chassis CTC 15—Blue Lateral Magnet	8/64-35		
Color TV CTC 15—High Voltage Regulation VHF TV Chassis KRK 102-S, 107-8, 113 and UHF KRK, 112—Tuner Field Service	2/64-39		
Current Sets, VHF Tuners—General Description	11/64-26		
SYLVANIA			
TV Chassis 573 19 in. Portable—Revisions in High Noise Impulse areas	7/64-35		
All 21 in. 70 deg. Glass Shadow-mask CRTs—Color Purity	8/64-35		
TRUETONE			
Record Changer, Model 400B755—Set-Down Adjustment	4/64-38		
TV Chassis 2DC3417B—Focus	9/64-38		
WESTINGHOUSE			
TV Chassis—Width and Linearity Coil Operation—TV Chassis V-2443—Horizontal Instability	1/64-36		
Tape Recorder Models H-21R, H-22RS, H-24RS, H25R	2/64-40		
All Tape Recorders—Troubleshooting with Record-Play Switch	8/64-36		
Phono Amplifier, Models H-105/106ACS—Circuit Operation	11/64-26		
ZENITH			
Royal 40 Transistor Portable Radio, Chassis 6KT50Z1—Component Replacement	4/64-38		
Television—Black and White			
By Gosh, You're Right!	4/64-52		
Choosing and Using Audio Oscillators, Part III	12/64-53		
CRT Implosion Protection	11/64-62		
Howie Gets a Lesson in Speed Servicing	3/64-63		
In-Cabinet UHF Converter	5/64-46		
It Only Looks Like AGC	4/64-88		
Picture Tubes—Black and White and Color	11/64-49		
Sound—the Easy Section	11/64-51		
Stop Unwanted Oscillations	6/64-53		
Substituting Flybacks	2/64-60		
The "Other" End of the Picture Tube	5/64-50		
Tinyvision—Color and Black-and-White	8/64-41		
Troubleshoot TVs Logically	2/64-51		
Vertical Lines	6/64-44		
Vertical Lines	7/64-43		
Vertical Lines	9/64-54		
Visual Symptoms Will Tell You, Part I	12/64-51		
Television—Color			
A Technician Views the Synchronous Color Demodulator	8/64-39	Reg Bartlett	
Aligning Color Receivers	3/64-49	Fred Jason	
Change that Color CRT Fast!	8/64-42	Homer Davidson	
Color Convergence in 15 Minutes	10/64-59	Al Nanni	
Color High Voltage Systems	8/64-46	John Holmes	
Color Trouble	8/64-52	Joe Hayes	
Kit Builders Have Graduated	3/64-45		
Saving "Phase" with Your Color TV Customers	10/64-65	Don Multerer	
Simplified Color Convergence	8/64-49	Bob Dunn	
Sound—the Easy Section	11/64-54	Bill Ganglinger	
The One-Gun Chromatron	8/64-45		
Test Equipment			
Choosing and Using Audio Oscillators, Part I	11/64-55	Art Walters	
Choosing and Using Audio Oscillators, Part II	12/64-57	Art Walters	
Choosing and Using Audio Oscillators, Part III	12/64-53	Art Walters	
Color Convergence in 15 Minutes	10/64-59	Al Nanni	
Reach for Your VTVM	8/64-38		
Saving "Phase" with Your Color TV Customers	10/64-64	Don Multerer	
Selecting a Scope for Industrial Work	10/64-66	J. P. Shields	
Selecting and Using Color TV Test Equipment	3/64-65	Bob Dunn	
Troubleshooting with the VTVM	4/64-58	Chuck Zachman	
Use the VOM	4/64-41	Eugene Pudil	
Why You Need a Transistor Tester	10/64-61	Pudil & Stevens	
Tough Dog Corner			
Buzz	1/64-62	Richard F. Doyle	
Circuit Changes	3/64-66	L. Boutin	
Corroded Clip	11/64-66	Charles Yountz	
Film Breakdown	1/64-62	Calvin Smith	
Foxy Dog	10/64-76	John Yenneti	
Grounded Control	5/64-55	J. H. Wyatt	
High Resistance Coil	11/64-66	L. Davidson	
High Resistance Tiepoint	12/64-60	Howard Keilholtz	
Hot Capacitor	7/64-58	Alan G. Sorenson	
Hum	4/64-62	R. S. Bartlett	
HV Leakage	12/64-60	Frank D. McCreery	
Intermittent Filament	3/64-66	Charlie Ferrell	
Lead-In Trouble	6/64-54	Jack Fennasi	
Leaky Capacitor	5/64-66	Reg Bartlett	
Light Sensitive No. 2	4/64-62	Larry Mings	
Loose Rivet	4/64-62	Scott R. Commons	
Lower Frequency Conversion	7/64-58	Reid Montgomery	
PC Network Dilemma	8/64-58	Arnold E. Nemmers	
Resistor "Run-Around"	8/64-58	Gary G. Backen	
Shocking Portable	9/64-64	Joe R. Sport	
Shorted Filament	2/64-66	L. E. Walker	
Shorted Turn	6/64-54	Reg Bartlett	
Spurious Oscillations	10/64-76	Clarence A. Bell	
Under-rated Capacitor	3/64-66	Howard Keilholtz	
Wrong Polarity	5/64-66	Donald H. Van Engen	
Yoke Clamp	2/64-66	Paul H. Besler	
Two-Way Radio			
A Look into Communications Receivers	1/64-54	Doug Hedin	
Communications Microphones	1/64-39	George Riley	
Establishing a Two-Way Service Shop	1/64-46	R. F. Clendenin	
Pocket Pagers	6/64-61		
Servicing Citizens Bank Communications Equipment	1/64-50	John Haskell	
Two-Way Radio Speeds Plan Operations	6/64-63		



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SECTION

CONTENTS

***Time-Delay Relays* 68**

Herman R. Holtz presents a guide to application and selection of electro-mechanical devices

***Phase Shift Part II* 71**

Louis Frenzel, Jr. continues his in-depth analysis of phase-shift circuits and applications

DECEMBER • 1964 • VOL. 80 • NO. 6

Time-Delay Relays

by Herman R. Holtz

A guide to application
and selection of time-proven
electro-mechanical devices

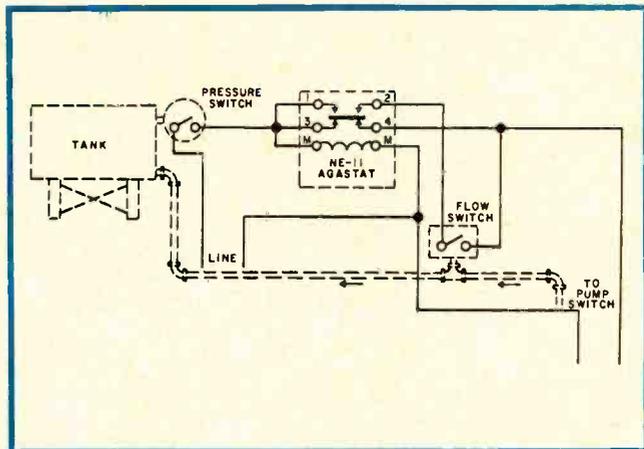


Fig. 1—Flow control and dry-pump protection.

■ Few control devices are as versatile and reliable as electro-mechanical relays. Basically inexpensive, simple, rugged, and requiring little maintenance, relays have grown into a vast family.

An important member of the family is time-delay relays. Time-delay relays are used to delay switch actuation (commonly from 5 to 30 minutes) following actuation of another switch.

Applications

Sometimes, for example, heat continues to radiate for a time from tubes and other components in forced-air-cooled equipment. Through time-delay relays the blowers continue to operate for several minutes after the equipment main switch is turned off. In other cases, equipment must be shut down or started up by stages — and a series of relays having progressively longer time delays may be used to control proper circuit sequence.

Aside from these general applications, time-delay relays are most useful in automatic control and fail-safe equipment. They are used to shut down jammed, overloaded, overflowed equipment; to protect meter movements against slamming; to prevent “dry pumping” or for dozens of other comparable applications.

A time-delay relay used to prevent pump damage is shown in Fig. 1. The tank contains water used in a continuous-flow process. It is supposed to be kept full at all times by a pressure switch and a pump. When the water falls below a certain level,

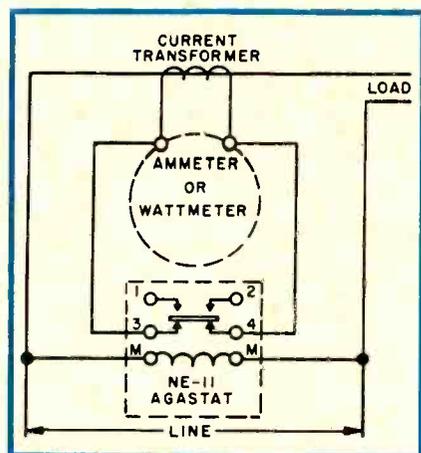


Fig. 2—Meter overload protection.

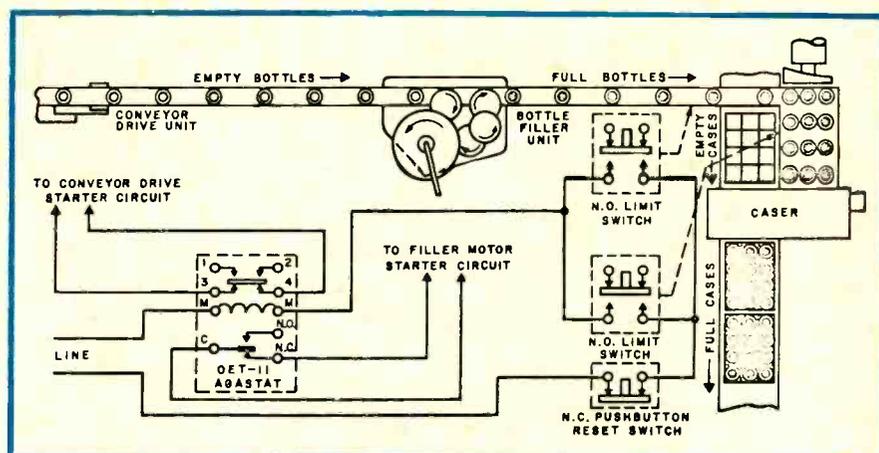


Fig. 3—Overload control of automatic bottling line.

the pressure switch closes a circuit to the pump through the pump switch. The pump supplies water to the tank until the water pressure opens the pressure switch, stopping the pump.

Should the water supply fail, the pump would be pumping "dry" and probably be damaged. The flow switch and time-delay relay — not part of the basic control arrangement — protect the pump against this condition.

When the pressure switch is actuated, the circuit to the pump is completed through normally closed contacts 3-4 of the time-delay relay. The same voltage is applied to the relay coil, starting delay time.

After a few seconds the contacts transfer; contacts 3-4 break and contacts 1-2 make. If water is flowing, the flow switch is closed and the pump continues to operate until the tank is filled and the pressure switch contacts break.

If water has not been flowing, the flow switch is open and the circuit to the pump is broken. The pump shuts down, having run dry for only a few seconds. Note that the time-delay feature of the relay is needed here to allow the pump to build up a flow and close the flow-switch contacts.

A meter measuring intermittent voltage or current coupled over by a transformer will sense two transients, or spikes, on each measurement — one at the beginning and another at the end of the measurement. At these two instants the meter may be overloaded and the needle slammed against the stop. This

can be prevented as shown in Fig. 2 by shunting the meter with a short circuit (the normally closed contacts 3-4 of the time-delay relay) during no-current conditions. When current is applied the relay will be energized but the contacts will transfer only after expiration of the time delay, which is set long enough for the transformer secondary current to stabilize. Thus, the meter will escape the transient and measure only the steady-state voltage or current. When the current is removed and the relay de-energizes the contacts transfer immediately and the protective short circuit is restored until the next measurement.

Another application of time-delay relays is shown in Fig. 3, symbolizing an automatic bottle-filling and packaging system. The conveyor motor is powered through a circuit completed through normally closed contacts 3-4 of the time-delay relay. The filler motor is driven through similar contacts on the relay. Each time a bottle moves across the bottle-limit switch, the limit-switch contacts transfer and energize voltage for the relay coil. Normally, the bottle moves on and beyond the switch before the time-delayed contacts transfer. The limit switch contacts transfer again and the relay energizing voltage is removed. Therefore, no contact transfer takes place as long as the line moves on.

Another limit switch, wired in parallel to the first one, operates in the same way for the case-filling unit. Should a stoppage occur — should the limit switch contacts remain transferred and keep the relay

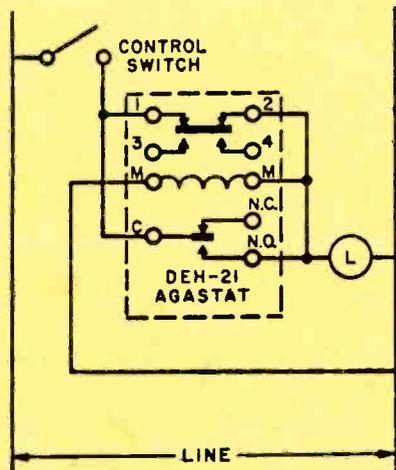


Fig. 4—Premature-restart protection.

TABLE I
Considerations in Selecting Relays

REQUIREMENT OR CONSIDERATION	REMARKS
Relay must be used in explosive, corrosive, dusty or moist atmosphere	Try sealed units, such as those in glass tubes with octal or noval bases; also mercury plunger types
Small mounting space	Many miniature units available
Need large number of contacts.	Try telephone types
Relay must latch up on transient pulse	Determine pulse duration and make sure relay has adequate operation time (see Table 2)
For office equipment; must be quiet in operation	Try mercury plunger types
May need relatively frequent replacement	Many plug-in types available
May need to change delay-time occasionally	Many types available with adjustable delay

TABLE II
Relay Parameters

RATING	EXPLANATION
Contact arrangement	Like switches; includes number and configuration: SPST, DPDT, etc; make before break, break before make, etc.
Contact rating	Current handled safely at specific voltages
Coil ratings	Voltages, current, resistance
Pick-up or pull-in voltage	Voltage across coil necessary to energize
Drop-out voltage	Voltage at which coil de-energizes
Operate time	Time between voltage application and contact transfer
Bounce time	Time for contacts to settle after transfer; add to operate and release time if closure time is critical.
Release time	Time for contacts to transfer when energizing voltage removed; inverse of operate time

energized until its contacts transfer — the conveyor-drive and filler-motor circuits are broken and the line automatically shuts down. When the stoppage is cleared and the bottles are removed from the limit switches the operation resumes. A pushbutton reset switch makes it unnecessary to remove bottles from the limit switches to restart the line and pressing the limit switch restarts the line.

In all the foregoing circuits contact-transfer delay followed relay coil energizing and the contacts returned to their normal, or de-energized-relay state when the energizing current was removed. However, time-delay relays also may be obtained with the opposite delay arrangement: contacts transfer immediately when the relay is energized, but when the energizing current is removed the contacts re-transfer only after a delay. This type relay has as many useful applications as the first.

In some systems, equipment cycles on and off frequently but it is necessary to prevent the equipment from restarting *immediately* after shutoff — pipes may need a few minutes to drain before a pump is started again or heating elements may require a cooling-off period before current is again applied to them (Fig. 4).

The relay shown in Fig. 4 has a main switch (contacts 1-2 and 3-4) and an auxiliary switch (contacts C-NC and C-NO). Both sets of contacts transfer immediately when the relay is energized but only the auxiliary switch re-transfers when the relay is de-energized and the main switch re-transfers only after a delay. Initially, when the energizing current is applied, the relay coil is energized through normally closed contacts 1-2. Although the current is broken as the contacts transfer it is re-established immediately through C-NO. Later, when the equipment is shut off, the auxiliary switch contacts re-transfer (C-NO breaks and C-NC makes) but main switch contacts 1-2 remain open while contacts 3-4 remain closed for the duration of the delay. Because voltage application will not energize the relay, it will be impossible to restart the equipment until the delay is over.

Selection

Deciding what relay to use for a particular application involves a large number of considerations because of the many variables in both relay design and operating conditions. Large as the relay family is, random catalog research can easily develop into an arduous and frustrating chore. To prevent this and guide your catalog research, it is advisable to analyze your requirements in detail; imposing or specifying only essential characteristics. Some factors you may wish to consider are listed in Table I, along with some helpful comments. Then a list of relay parameters is provided in Table II to give you some idea of the ways relays are rated. Restricting parameters to those reflecting your actual needs can be quite effective in keeping costs down. ■

Illustration credit: Elastic Stop Nut Corp.

■ You wouldn't think that a phenomenon as simple as phase shift could have so many applications. But it does. The phase shift oscillator of Fig. 1 is a good example. An oscillator is defined as an amplifier with feedback such that the output is in phase with and enforces the input.

This is exactly what a phase shift oscillator is. The common cathode electron tube amplifier has an inherent 180 deg phase shift. As seen in Fig. 1 the plate output is fed through an RC phase network which has a total shift of 180 deg. This plus the 180 deg shift of the tube makes a total shift of 360 deg. Since a 360 deg shift is the same as zero deg the grid of the tube is actually in phase with the plate. With the input feeding the output in phase, the circuit oscillates. The only other requirement for

Phase Shift

Understand oscillator networks, control circuits, PSK, SSB and other important circuits using this important principle

PART II

by Louis E. Frenzel, Jr.

oscillation is that the gain of the amplifier be great enough to overcome the loss in the RC phase shift network. For the network shown, a gain of 29 or greater is required.

The phase shift network in the oscillator consists of three cascaded sections of the simple RC shifter described earlier (Fig. 2A Part I). Each section provides a 60 deg shift with the three giving a total of 180 deg. Four 45 deg sections could also be used. Other phase shift oscillators have been designed using cascaded sections of the network of Fig. 2B (Part I). Either three or four sections can be used.

The frequency of a phase shift oscillator is de-

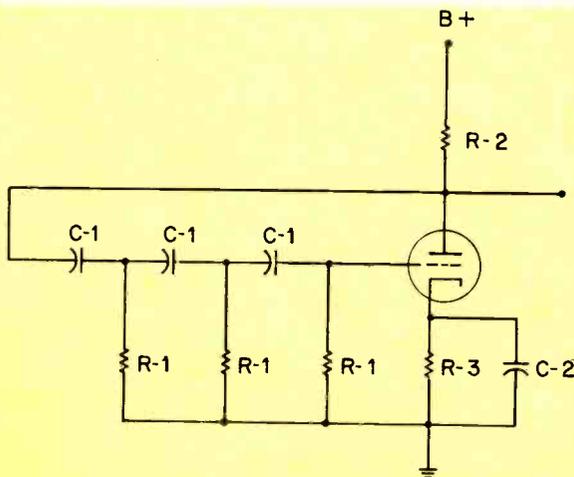


Fig. 1—Simplified schematic of phase shift oscillator.

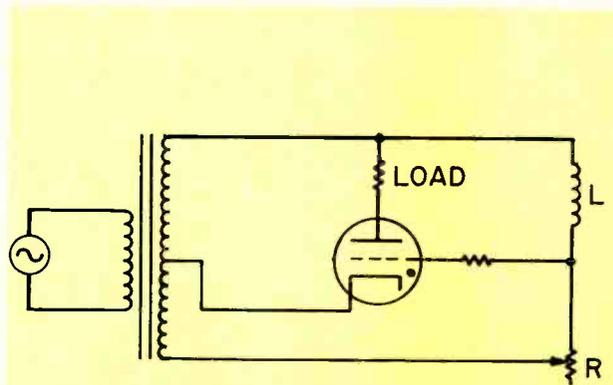


Fig. 2—Phase controlled thyatron rectifier circuit.

terminated by the values of R and C in the phase shift network. This network produces a 180 deg shift at only one frequency and it is at this frequency that oscillation occurs.

The big advantages of the phase shift oscillator are simplicity, stability, good sinusoidal waveform, and the ability to be used inexpensively at very low frequencies. The inductor in an LC oscillator at frequencies below 100 cps becomes very large and expensive. The simple, inexpensive RC network of the phase shift oscillator allows operation at frequencies well below 10 cps.

Control Circuit

The popular industrial control circuit shown in Fig. 2 uses a phase shift network like the one in Fig. 5 (Part I) to control the average current through a load. This circuit has a variety of uses in control applications. The load shown here is a simple resistor, but it could be a dc relay for OFF/ON control of other circuits, a variable temperature heating element or a dc motor whose speed is a function of the average current in its windings.

The only difference between this circuit and the one of Fig. 5 (Part I) is that an inductor (L) is used instead of a capacitor, and a thyatron tube with a load is connected to the transformer primary. By varying R a lagging phase shift from 0 deg to 180 deg can be produced between the junction of L and R and the center tap of the transformer. The signal applied to the primary winding is usually the 60 cps ac line voltage.

The thyatron will conduct current when its plate is positive with respect to its cathode and when a positive bias of sufficient amplitude is applied to the grid. If the resistor R is adjusted for maximum resistance, the phase shift will be 0 deg. The plate and grid signals will be in phase and the tube will conduct during the positive half cycles of the input sine wave. The thyatron then is essentially a grid controlled half wave rectifier.

If the resistance is now decreased, a phase shift will be introduced, and the grid voltage will lag the

plate voltage. The tube will still conduct when both grid and plate are positive, but because of the phase shift the tube will conduct for less than a half cycle. As more phase shift is introduced, the thyatron conducts for even a shorter period of time until a 180 deg shift is reached where no current flows through the tube or load. The average dc in the load depends on the amount of phase shift present, maximum current at 0 deg and zero current at 180 deg.

This circuit is also used with a capacitor as the reactive element in a phase shift circuit and can be used to control the current through an ignitron or SCR instead of the thyatron.

Digital Data Transmission

One of the most interesting applications of phase shift is in digital data transmission. Digital binary data is usually in the form of OFF/ON rectangular pulses, but any electrical signal that can assume two distinct states can also be used to transmit the data. A continuous sinewave could represent one of these states, while the same sinewave, shifted 180 deg could represent the other. Binary data transmission using a phase shifted sine wave is called phase shift keying (PSK). Fig. 3 shows a conventional binary pulse signal and its PSK equivalent.

The digital pulses are fed to a special circuit called a biphasic modulator. The modulator causes the carrier sine wave to be shifted in phase 180 deg at the trailing edge of each binary pulse (bit). This technique is called differentially coherent PSK. The data is transmitted by keying the phase of the carrier relative to the phase of the preceding transmitted bit. In another method, coherent PSK, the phase of the carrier is keyed relative to a stable phase reference that is transmitted along with the signal. This is more complex and requires more bandwidth, so differentially coherent PSK is preferred.

The transmitted data is retrieved at the receiver by comparing the phase of the carrier to a phase reference. In coherent PSK the reference is transmitted along with the data. The phase of the differentially coherent PSK signal (like Fig. 3) is com-

Continued on page 74

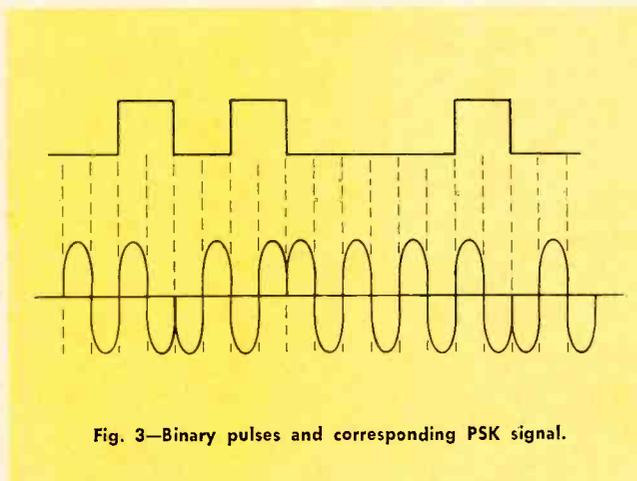


Fig. 3—Binary pulses and corresponding PSK signal.

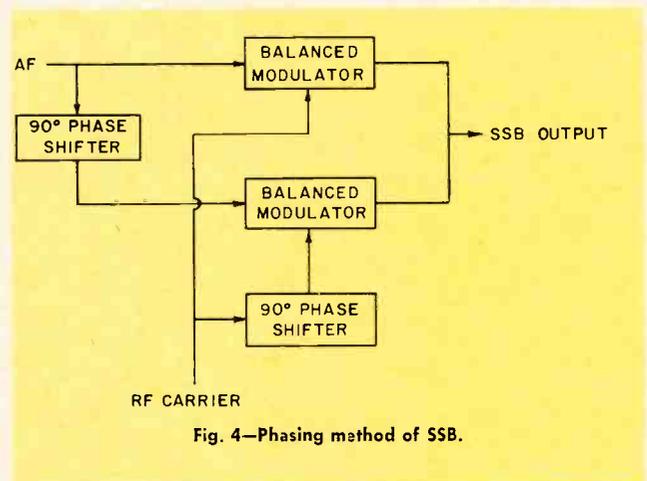
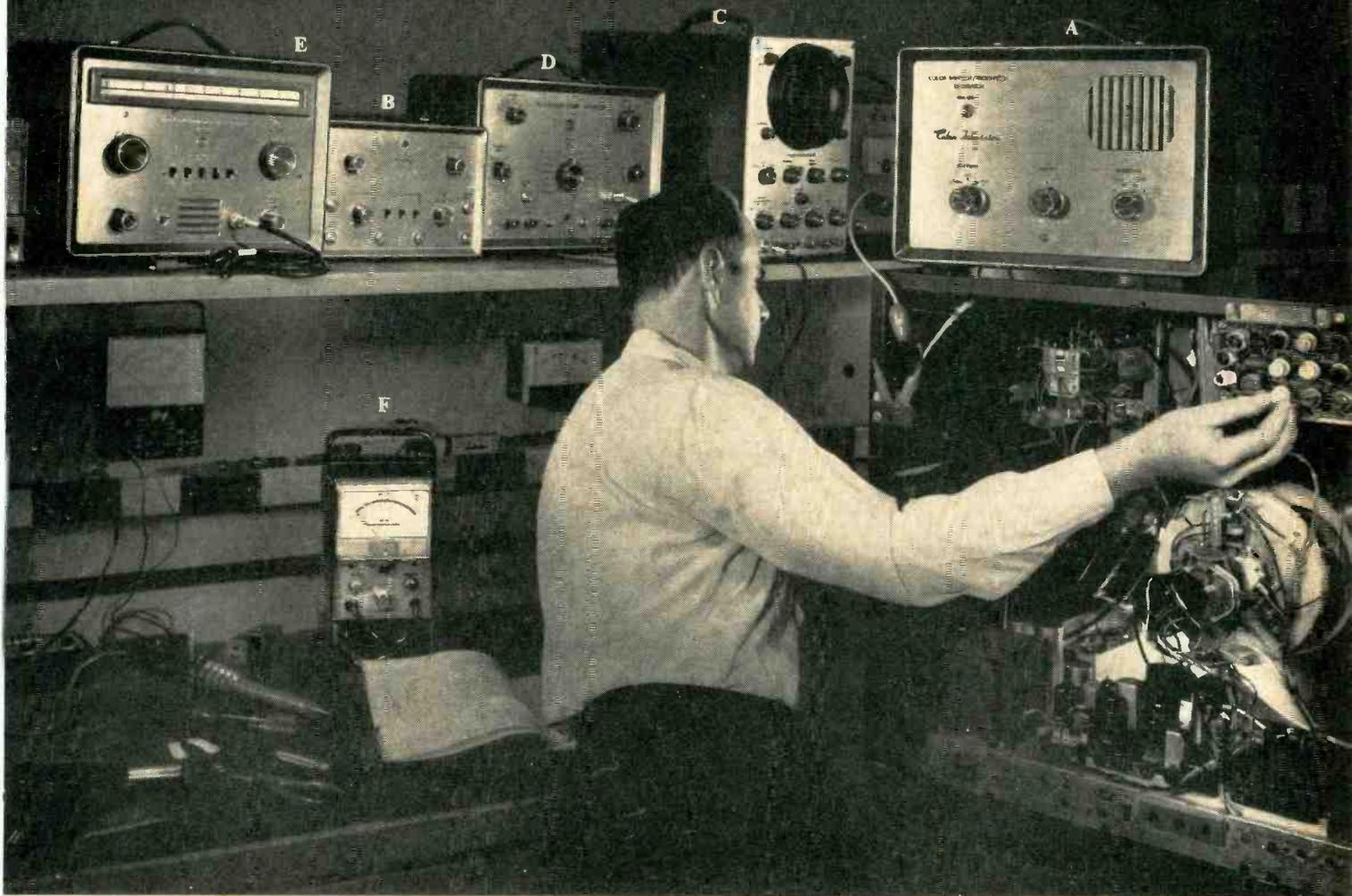


Fig. 4—Phasing method of SSB.

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Making last-minute convergence adjustments on a color-TV receiver with an RCA WR-64A Color-Bar/Dot/Crosshatch Generator.

**(A) RCA WR-64A COLOR-BAR/
DOT/CROSSHATCH
GENERATOR**

Low-cost, lightweight, portable instrument that provides all essential Color-TV test patterns:

- *Color-bar pattern*: ten bars of color for checking phase and matrixing, and for automatic frequency and phase alignment.
- *Crosshatch pattern*: thin sharp lines for adjusting vertical and horizontal linearity, static and dynamic convergence, raster size, and overscan.
- *Dot pattern*: small dots to facilitate accurate color convergence.

\$189.50* with output cables

**(B) RCA WR-70A RF/VF/IF
MARKER ADDER**

For use with a marker generator and a sweep generator. Used for RF, IF, and VF sweep alignment in color and B&W TV receivers.

- Choice of four different marker shapes
- Provides very high-Q markers of high amplitude and narrow bandwidth

\$74.50* complete with cables

**(C) RCA WO-91A 5-INCH
OSCILLOSCOPE**

A wideband scope for checking colorburst signals and general troubleshooting.

- Dual bandwidth: 4.5 Mc at 0.053 volt rms/in. sensitivity; 1.5 Mc at 0.018 volt rms/in. sensitivity.
- Continuously adjustable sweep frequency range: 10 cps to 100 Kc

\$249.50* including direct/low capacitance probe and cable, ground cable, and insulated clip.

**(D) RCA WR-69A TELEVISION
FM SWEEP GENERATOR**

For visual alignment and troubleshooting of color and B&W TV receivers, and FM receivers.

- IF/Video output frequency continuously tunable from 50 Kc to 50 Mc.
- Sweep-frequency bandwidth continuously adjustable from 50 Kc to 20 Mc on IF/Video and FM; 12 Mc on TV channels

\$295.00* including all necessary cables

**(E) RCA WR-99A CRYSTAL-
CALIBRATED MARKER
GENERATOR**

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- Most-used IF and RF frequencies indicated on the dial scale
- Sound and picture carrier markers available simultaneously

\$256.50* complete with output cable and phone tip.

**(F) RCA WT-115A COLOR
PICTURE TUBE TESTER**

Designed specifically to test color-TV picture tubes, either in or out of the set. Tests each gun for emission quality, inter-electrode leakage and shorts.

- Large sensitive meter with separate 3-color scales
- Provision for accurate adjustment of cut-off point for each gun



New RCA Color Pict-O-Guide is now available through Authorized RCA Electron Tube Distributors.

\$89.50* with cable, carrying case and socket assembly

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All prices are subject to change without notice. Prices may be higher in Alaska, Hawaii and the West.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N. J.



The Most Trusted Name in Electronics

... PHASE SHIFT

Continued from page 72

pared to a phase reference in the receiver. The differentially coherent PSK signal is full wave rectified to remove all phase information and is then used to synchronize a stable phase reference oscillator. Phase comparison circuits in the receiver reproduce the original digital pulse data.

The big advantage of PSK is that it conserves spectrum space by occupying only a very small bandwidth, smaller than the bandwidth required by a signal using AM, FM, FSK, or forms of pulse modulation. PSK receivers can use narrow bandwidth circuits which aid in improving signal-to-noise ratio. Another advantage of PSK is that like FM and FSK, peak power is continually being radiated under modulation.

Single Side-Band

Another modulation technique using phase shift is the phasing system of single sideband (SSB). An SSB signal is an AM signal from which one sideband and the carrier have been removed. Only one sideband is transmitted. There are two basic methods of generating a SSB signal, and both use balanced modulators to suppress the carrier. In the filter method, a very selective filter is used to reject the sideband and pass the other. The phasing method of SSB generation makes use of AF and RF phase shift networks to phase out one sideband.

The block diagram of a phasing type SSB gen-

erator is shown in Fig. 4. Here the audio modulating signal and the RF carrier are applied directly to the upper balanced modulator. The carrier frequency is suppressed while the upper and lower sidebands (sum and difference frequencies) appear at the balanced modulator output. The audio and carrier are also applied to the lower balanced modulator but through 90 deg phase shift networks. The carrier phase shifter can be a simple circuit like the RC bridge of Fig. 3 (Part I) or the double tuned transformer mentioned earlier. The audio phase shifter is not so simple, however. Unlike the carrier that is fixed frequency, the AF (voice) signal generally covers the 300 to 3000 cps range. The phase shifter must produce a constant 90 deg phase shift over this range of frequencies. The circuits developed to do this are complex networks made up of resistance and capacitance.

The output of the lower balanced modulator also contains the upper and lower sidebands but they are modified by the 90 deg phase shifts. The carrier is suppressed.

The outputs of the two balanced modulators are then added together. The phase shifts introduced cause one set of sidebands (either upper or lower depending on circuit arrangement), to cancel while the others aid thus producing a single sideband output. ■

... AUDIO OSCILLATORS

Continued from page 56

probably within 5 percent. Although we chose a good meter, rated accurate to 2 percent of full scale, we took readings below full scale. And there was a little error because of the 0.5 percent uncertainty of the amplifier load resistance.

Our practical purpose is easily served, however. We may be confident that if we can get at least 1.6 v out of the preamplifier, we may be sure of driving the power amplifier to its rated output, and that is what we set out to find.

We have seen that even this very simple case involved us in many considerations. Most of these become second-nature as many measurements are made, but all must be given, if we are to avoid measurement errors.

Technicians who make frequent use of audio oscillators find it convenient to make up a number of resistive voltage divider networks, and have them handy. When low-level signals are wanted, these networks drop the oscillator's output voltage allowing it to work in its high output range while delivering the desired low voltage for the test. Two simple examples are shown in Fig. 2.

When testing sensitive amplifiers with very low-level signals, special care is always necessary to avoid hum. If one of the conductors between oscillator and tested amplifier carries circulating power-line currents, through a loop, power-line hum appears in series with the test signal. It will usually be good practice to leave the G terminal on the oscillator *unconnected*. The two output terminals, being connected then to the input of the tested amplifier, are floated at the potential of the amplifier input, and no loop can be formed. ■

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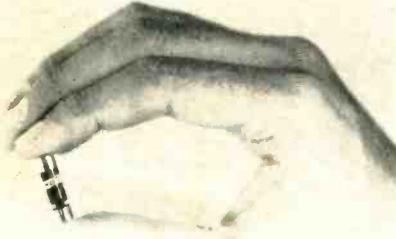
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— — — for more details circle 22 on post card

NEW PRODUCTS

REPLACEMENT RECTIFIER 200

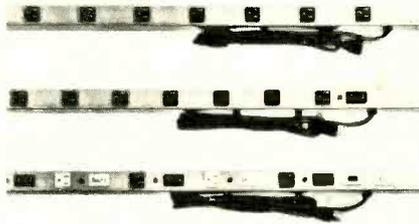
A direct replacement for the M-500, 1N1084 rectifiers, is the SM-



750. The rectifier is rated at 1.0 amp. Semitronics.

OUTLET BOXES 201

A line of pre-wired, heavy-duty electrical outlet boxes is announced. The units are ready to plug in for instant use, and were designed for industrial, laboratory and workshop use. Measuring four feet in length, the boxes are 1½ x 1¼ in. The units are of steel construction with mounting ears, and are finished in



textured gray hammertone. They are rated at 15 amp, 130 v continuous duty. Model 1000 has 12 "U" ground outlets, a pilot light and an ON/OFF switch. Model 1001 units are similar, but have no pilot light or ON/OFF switch. Also available is Model 1010 with 8 "U" ground outlets, each controlled by an individual switch and pilot light. Waber.

POWER TRANSISTORS 202

Two silicon power transistors with VCEO ratings of 400 v and collector current ratings of 1 and 2.5 amp are announced. The manufacturer reports that an immediately practical application of the devices is in large screen TV horizontal and vertical sweep circuits. Satis-

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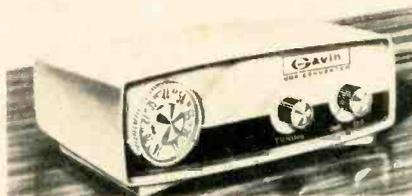
NEW PRODUCTS



factory operation of the horizontal output stage with a semiconductor device has been a major problem in the design of solid state, large screen TV, both technically and economically. Development of an advanced silicon wafer technique known as the triple sequential diffusion process will permit low cost volume production of the devices. Delco.

UHF-TV CONVERTER 203

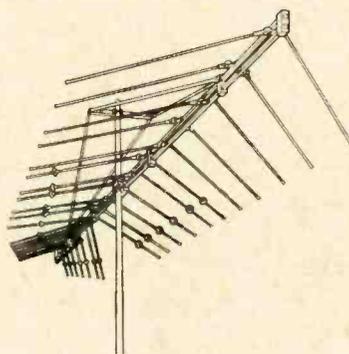
A line of UHF-TV converters is announced. The manufacturer re-



ports that the deluxe model converter features a new high built-in amplifier solid state circuitry for peak all-channel reception. Gavin.

ANTENNA 204

A version of the Log-Periodic concept — the LPV-VU All-Band VHF/UHF/FM antenna is an-



nounced. By introducing parallel plate capacitors into the dipoles and adjusting precisely their capacitance and location, the design creates more driven elements, the an-

nouncement said. Each LPV-VU is provided with a VHF-UHF-FM signal splitter to separate and feed the VHF-UHF-FM signals into their respective inputs. JFD.

SIGNAL GENERATOR 205

A signal generator for troubleshooting AM and FM radio, transistor radio, black/white and color



TV and communications equipment is announced. The model 1500 has a separate high level audio output for checking Hi Fi sets and video amplifiers. The unit provides seven overlapping bands, 115 kc to 110 Mc to cover frequencies required in normal service work. A panel slide switch changes the generator output from a RF sine wave to 400 cps AM modulated RF, each with control for adjustable output level. Mercury.

MINIATURE IRON 206

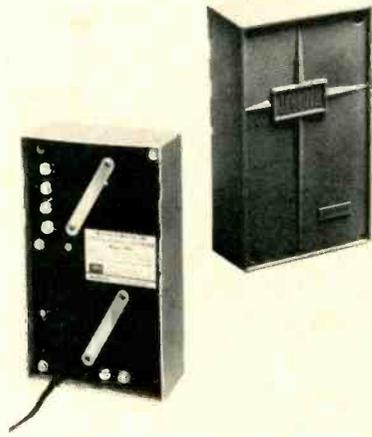
A miniature soldering iron having three wattages is introduced. A choice of 25, 30, or 35 w is avail-



able. The iron weighs 3 oz, is 6½ in. long and has 18 optional nickel plated or clod tips available. American Beauty.

SOLID STATE PREAMPLIFIER 207

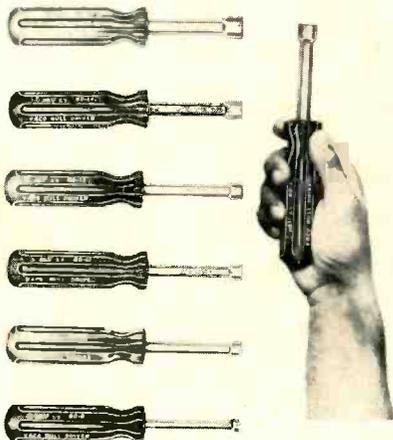
An FM preamplifier, designed to overcome the problems of FM stereo reception, is introduced. FM stereo broadcasts are weaker than monaural. According to FCC tests, an FM station gets twice as much range on monaural broadcasts as it gets with FM stereo. Thus, preamplification is highly desirable for



distant FM stations. According to the manufacturer the model SRX extends the range of FM tuners. A solid state device, the preamplifier can be mounted anywhere indoors between the antenna and the FM set. Jerrold.

NUT DRIVERS 208

A line of nut drivers, available in seven different socket sizes,



ranging from 1/4 in. to 1/2 in. with extra large, color-coded handles, is announced. Vaco.

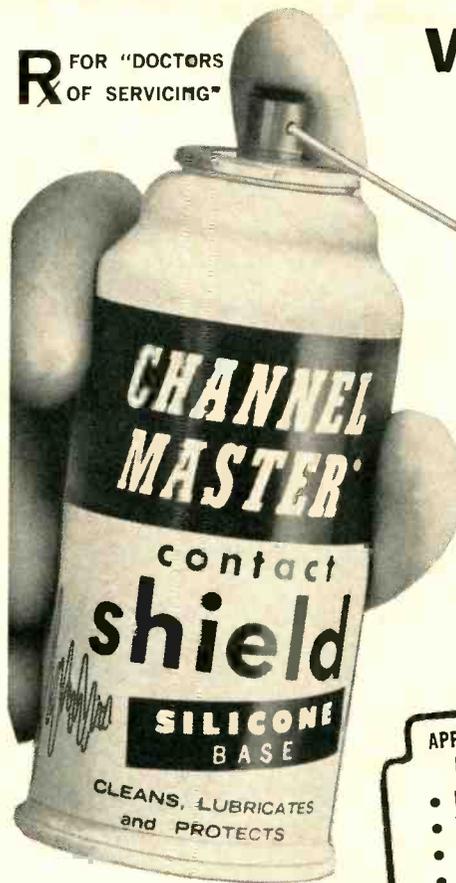
STEREO AMPLIFIER 209

The manufacturer lists the following specifications for a stereo amplifier: frequency response: 80



to 20,000 cps; output 15 w total. 7.5 w per channel; output imped-

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**Where there's
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Service with Contact Shield! Protective! Corrective! It not only cleans and safeguards contacts better on TV, radio, and hi-fi sets; on all relay-operated electrical equipment, regular protective maintenance with this versatile cleaner prevents sticky relays—while corrective servicing unsticks them... **in seconds.** Promotes greater conductivity, keeps relays working smoother, longer. Contact Shield—the professional service man's cleaner.

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- Pinball Machines
- Telephone Switchboards

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Color TV Coil Exact Replacements

Cat No.	Use	Mfr.	Part No.
6021	Chroma Bandpass Trans.	RCA	78887
6022	Chroma Bandpass Coil	RCA	78888
6023	Burst. Transformer	RCA	100431/78886
6024	3.58 Mc. Output	RCA	78889
6025	Sync and Phase	RCA	78895
6026	Chroma Reference Osc.	RCA	78891
6027	3.58 Mc. Trap	RCA	78892
6028	3.58 Mc. Chroma Sync	RCA	78892
6029-R	First Chroma	RCA	1107853-1/105213
6080-R	Burst. Amp	RCA	1107864-1/105214
6031-R	Video I.F.	RCA	106385
6032-R	Video I.F.	RCA	106386
6033-R	Video I.F.	RCA	106387
6034-R	Video I.F.	RCA	105292
6035-R	Video I.F.	RCA	105293
6036-R	Video I.F. and Trap	RCA	105294/1107858-1
6037-R	Horiz. Waveform	RCA	102195
6038-R	Horiz. Linearity	RCA	105196
7105-R	4.5 Mc. Sound I.F.	RCA	105286
7106-R	4.5 Mc. Sound I.F.	RCA	105287
7107-R	4.5 Mc. Quadrature	RCA	105288
7108-R	4.5 Mc. Sound I.F.	RCA	106381
7109-R	4.5 Mc. Sound I.F.	RCA	106382
7110-R	4.5 Mc. Quadrature	RCA	106383

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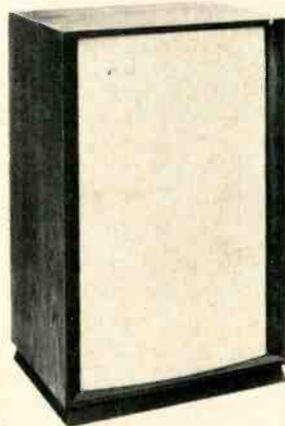
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NEW PRODUCTS

ance: 4, 8 and 16 Ω . Controls: input selector, volume, tone and balance. Has stereo reverse switch. Inputs: crystal or ceramic phono plus auxiliary for tuner or tape recorder. Complete with ventilated metal cabinet. Size: 10 $\frac{1}{4}$ x 6 $\frac{3}{4}$ x 4 in. Operates on 110-120 vac 50/60 cps. Olson.

SPEAKER SYSTEM 210

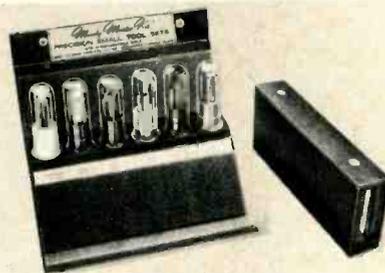
A playback speaker system is announced. The enclosure is finished in walnut with dimensions of



40 x 25 x 18 in. including its angled recessed base. Components in the unit are a pair of low resonance bass speakers and a cast aluminum sectoral horn powered by high frequency driver, and two-section, 800 cps dividing network. Altec.

TOOL KIT 211

A master kit containing a selection of the most popular, tiny tool sets is announced. The kit consists



of a leatherette carrying case 8 $\frac{1}{8}$ x 3 $\frac{1}{2}$ x 1 $\frac{1}{2}$ in. and six tool sets. The tools contained in the kit are ideal for miniature sub-assembly work in all types of industrial operations. Moody.

... IMPROVING COLOR

Continued from page 48

means that you will have to charge more for a color TV antenna installation. It's important to take a positive attitude about this. Explain the increased price to customers by pointing out the following:

(1) Color TV reception requirements are more demanding than for black and white.

(2) Although a cheaper installation may temporarily provide passable pictures, it takes a solid, professional job to deliver consistently excellent pictures over a long period of time.

Antenna Amplifiers

During the past few years antenna amplifiers have been used extensively in weak signal areas. Because color requires a stronger signal, amplifiers will be used even more frequently in coming years. A good antenna amplifier not only amplifies the signal, but improves system signal-to-noise ratio. For best signal-to-noise ratio, the amplifier should be mounted as close to the antenna as possible.

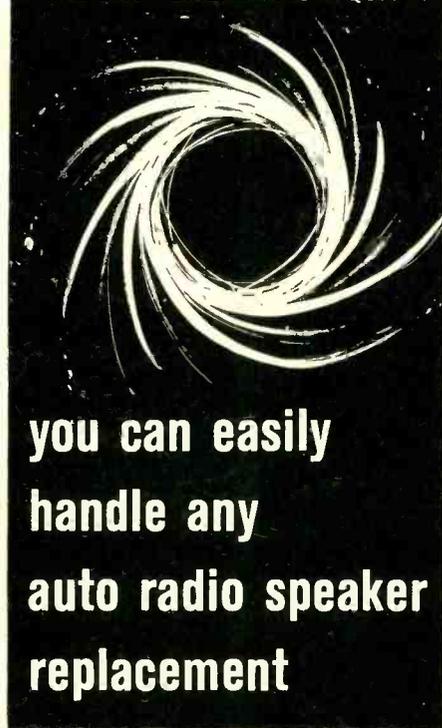
Multi-Set Couplers

Most of your color TV customers already own a black and white TV receiver. This means that your antenna installation will have to provide signal for two or more sets. The answer is a multi-set coupler. This is where many color installations go wrong. Ineffective and poorly matched couplers should be avoided. The coupler you select should provide adequate isolation between sets. It will pay you to use a good coupler when a color set is involved.

If you haven't used a mast mounted antenna amplifier, you may not get enough signal for two or three TV sets through a passive coupler. Even the best 2-set coupler causes about 4 db loss, while loss through a 4-set coupler is at least 7 db. For this reason, amplified couplers are recommended.

A color TV antenna installation is generally more complex than a black and white job. This is to the good. It tends to discourage the do-it-yourselfer. On the other hand, it requires that you abandon old practices and adopt new ones. ■

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Write for your free copy of the Quam Auto Radio Speaker Replacement Guide. It gives complete replacement information on front and rear seat speakers for auto radio models from 1955 to 1963.



New Quam Multi-Tap Speakers in 5"x7", 6"x9", and 4"x10" sizes. Taps for 10, 20, and 40 ohm impedances.

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NEW LITERATURE

PUSH-PULL SWITCHES 300

A series of push-pull ac line switches are described in an illustrated bulletin. Mallory.

MINIATURE TOOLS 301

This catalog describes a variety of miniature tools suitable for service use in electronics and precision mechanics. Seven pages are devoted to charts and tables of useful engineering data relating to screwdriver and plier selection, machine screws and solders. Jensen Tools.

PHOTOELECTRIC CONTROL 302

A comprehensive brochure discusses in detail a photoelectric control used in highway, street and residential lighting. Tungsol.

DATA LISTING 303

A four-page bulletin tells about some recently released radio and TV manuals. Supreme.

MICA CAPACITORS 304

A line of button mica capacitors is described in a 12-page bulletin. Complete engineering information, test data and dimension drawings on each style are included. Sangamo.

ELECTRONIC PROJECTS 305

This catalog contains a list of descriptive literature available for constructing various types of electronic equipment. Henry Francis Parks.

TOOLROOM EQUIPMENT 306

Toolroom equipment is featured in this catalog. The publication illustrates drawer units, benches, storage cabinets, tool totes and various other types of storage equipment. Equipto.

MICROWAVE TUBES 307

A condensed catalog contains application information on a line of microwave tubes and components. Amperex.

ANSWERING SERVICE 308

A brochure describes various uses for an automatic telephone answering device. Phoneminder.

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RCA

The KCS 136X, -148, and -149 chassis incorporate two new features to eliminate audio buzz at warmup. The first delays audio output tube warmup. The second speeds damper tube warmup. With one exception, the new 6HG5 audio output tube has electrical characteristics identical to the 6AQ5A. Heavy insulation is placed between the heater and cathode to increase the warm-up time approximately 40 percent. The 6AY3 damper tube heater element is placed nearer the cathode and warmup time is decreased about 20 percent.

KCS 136X and 149 chassis employ a linearity coil to provide a more symmetrical raster (Fig.10). In the 136X there are no provisions for adjustment. The linearity coil used on the 149 is actually two coils wound on the same form to minimize mutual inductance.

The AGC circuit in the KCS 151 chassis (Fig. 11) differs from that used in either the 148 or 149. The 6GH8 suppressor grid is internally tied to the cathode and cannot function as a control grid. Since no AGC noise cancellation action comes from grid 3, degeneration is added in the cathode circuit to prevent excessive tube conduction on noise pulses.

The CTC16 color chassis is similar in basic design to the previous CTC15 chassis but incorporates a number of circuit refinements.

Most color models have automatic degaussing (Fig.

BUSS: 1914-1964, Fifty years of Pioneering...

... 1965 TV SETS

Continued from page 44

is closed, the capacitor discharges in an oscillatory manner through the degaussing coils L. Resistor R2 and the series crystal limit the first current surge (first half cycle). The field generated by the ac current flow in the coils demagnetizes the area around the CRT face. The operation may be repeated any time as the circuit operates independently.

The 98C8 color chassis uses 3 stages of IF amplification (Fig. 9). The first two stages use semi-remote cutoff pentodes, a 6JH6 in the first stage and a 6GM6 in the second. The first two IF stages are dc series connected. AGC is applied to the first stage grid and with the series connection of the second stage the cathode voltage of V302 is dependent on the conduction of V301, thereby applying AGC to the second IF amplifier.

The third IF stage, V303, employs a high gain, frame grid 6EJ7 tube. The output of this stage is fed to two points. CR301 is the sound detector and CR302 is the video detector. The 4.5 Mc output of CR301 is fed to the 1st sound IF, V201A, with the video applied to V401A, the first video amplifier.

To reduce the difference in potential between the filament and cathode of V302, the heater of this tube is connected to a special heater winding. This winding, connected to a high positive voltage, is also used to supply heater voltage to the CRT and the 6BK4.



Actual Size

*Only 1-5/8 inches long...
Extends just 29/32 inch
behind front of panel*

BUSS Space Saver Panel Mounted Fuseholder

- Fuseholder takes 1/4 x 1 1/4 inch fuses. Converts to 9/32 x 1 1/4 inch fuses simply by changing screw type knob. Holder is rated at 30 ampere for any voltage up to 250.

- Also available in military type which meets all requirements of MIL-F-19207A.

BUSS

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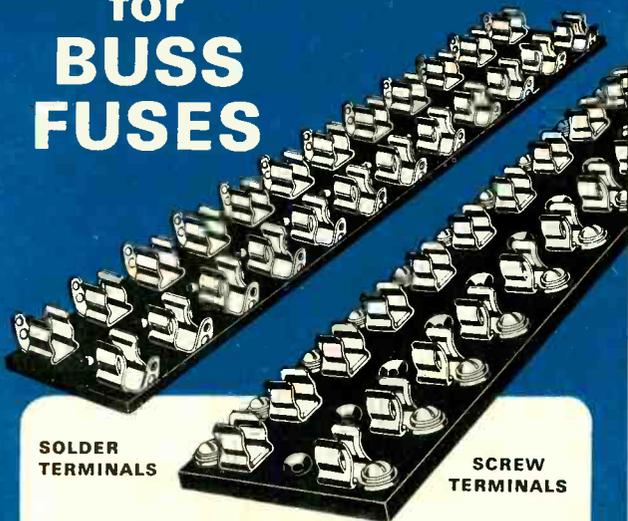
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ELECTRONIC TECHNICIAN

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A redesigned high voltage compartment permits more accessible relocation of the shunt regulator, giving better ventilation. In event of tube failure the high voltage would have a tendency to soar above normal. An interconnection exists between the blanker tube grid and the horizontal output grid (Fig. 16). If failure occurs, a high negative voltage will appear at the blanker grid and in turn apply bias on the horizontal output tube. This prevents excessive rise in high voltage.

A selection of peaking levels are also included in the peaking circuitry (Fig. 17).

On the highest position of the three-position switch a sharp picture is produced without "ringing" effects. The middle position gives uniform video response, and in the lowest position a soft picture can be produced. Since the transmitted picture detail can vary somewhat in different geographical areas, the switch can be thrown to the position giving the desired video response based on signal conditions and customer viewing preference. A new tube type, the 6LF8, is employed in the 1st and 2nd video amplifier stages. This tube is similar to the 6AW8 but has selected characteristics to provide optimum performance as a positive grid amplifier. ■

The final part of this article will appear in the January 1965 issue and will cover Setchell-Carlson, Sylvania, Westinghouse and Zenith TVs.

...New Developments in Electrical Protection

12). This is accomplished during initial warm-up each time the set is switched on. When this occurs, the power supply circuit causes a substantial current flow, part of which passes through the degaussing coils. RT201, being temperature dependent, has about 120Ω resistance at this time. The circuit functions as follows: RV201 presents a low resistance since it is voltage dependent, and ac voltage is present. As RT201 heats, its resistance drops to about 2Ω shunting the degaussing coils. Also since ac voltage is now lowered across RV201, its resistance rises. The accumulative effect is that after receiver warm-up, very little current flows through the coils and degaussing ceases. This action takes place prior to the appearance of a picture and causes no distraction to the viewer.

Basically the CTC 16's chroma section retains familiar circuitry. A change in the "X" and "Z" demodulator operation has been introduced, however. A value change in capacitor C728 results in greater displacement of the "X" and "Z" axes and improved color rendition (Fig. 13).

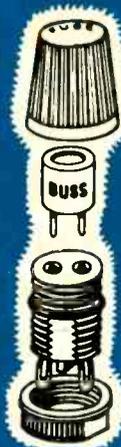
A new focus adjustment transformer permitting greater variation and faster action is also used (Fig. 14). A tube type focus rectifier is employed here and the over-all focus circuit gives minimum loading of the high voltage transformer.

A bridge type rectifier furnishing full wave rectification and resulting in less ripple is used in the low voltage B+ supply (Fig. 15). The silicon rectifiers are mounted on the sound board.

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Fuse held tight in holder by beryllium copper contacts assuring low resistance.

Holder can be used with or without knob. Knob makes holder water-proof from front of panel.

Military type fuse FM01 meets all requirements of MIL-F-23419. Military type holder FHN42W meets all military requirements of MIL-F-19207A.

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Chick Hunt has been an outstanding Winegard dealer for many years... and for good reason. Says Chick, "We use the Winegard Colortron exclusively for two very good reasons. First, it gives us cleaner, sharper color pictures than any other antenna. Second, its the only antenna we've found that brings in sharp, clear pictures on all five channels. 4, 6, 7, 8, and 10, in our area. We've tried other so-called revolutionary antennas that are okay on one or two channels, but they just don't deliver on the rest."

Chick also serves several nearby communities receiving UHF. He was extremely excited about the new UHF antennas and amplifiers from Winegard, especially the Tracker and UHF 212 amplifier.

The confidence Chick Hunt has shown in Winegard comes from installing Winegard products and seeing them in action. He is one more important service man who knows Winegard's standards of excellence first hand.

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ADVERTISERS INDEX

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Amperex Electronic Corp.	3rd Cover
Antennacraft Company	36
Arrow Fastener Company, Inc.	82
B & K Manufacturing Company	61
B & K Manufacturing Company	63
Blonder-Tongue	22
Blonder-Tongue	78
Bussman Mfg. Division	80-81
Channel Master Corp.	77
Cleveland Institute of Electronics	76
EICO Electronic Instrument Co., Inc.	38
Enterprise Development Corp.	74
The Finney Company	54-55
Hallmark Instruments	79
Jackson Electrical Instrument Co.	33
Jensen Manufacturing Company	59
E. F. Johnson Company	75
P. R. Mallory & Co., Inc.	28
J. W. Miller Company	77
Minnesota Mining & Mfg. Co.	30
Nortronics, Inc.	26
Olson Electronics, Inc.	78
Quam-Nichols Company	79
Quietrole Company	82
Radio Corporation of America RCA Electronic Components & Devices	4th Cover, 29, 73
RCA Parts and Accessories	37
Sarkes Tarzian Semiconductor Div.	19
Sarkes Tarzian Tuner Service Div.	57
Seco Electronics, Inc.	31
Sprague Products Company	23
Standard Kollsman Industries, Inc.	28
Sylvania Electric Products, Inc.	25
Sylvania Electric Products, Inc.	66
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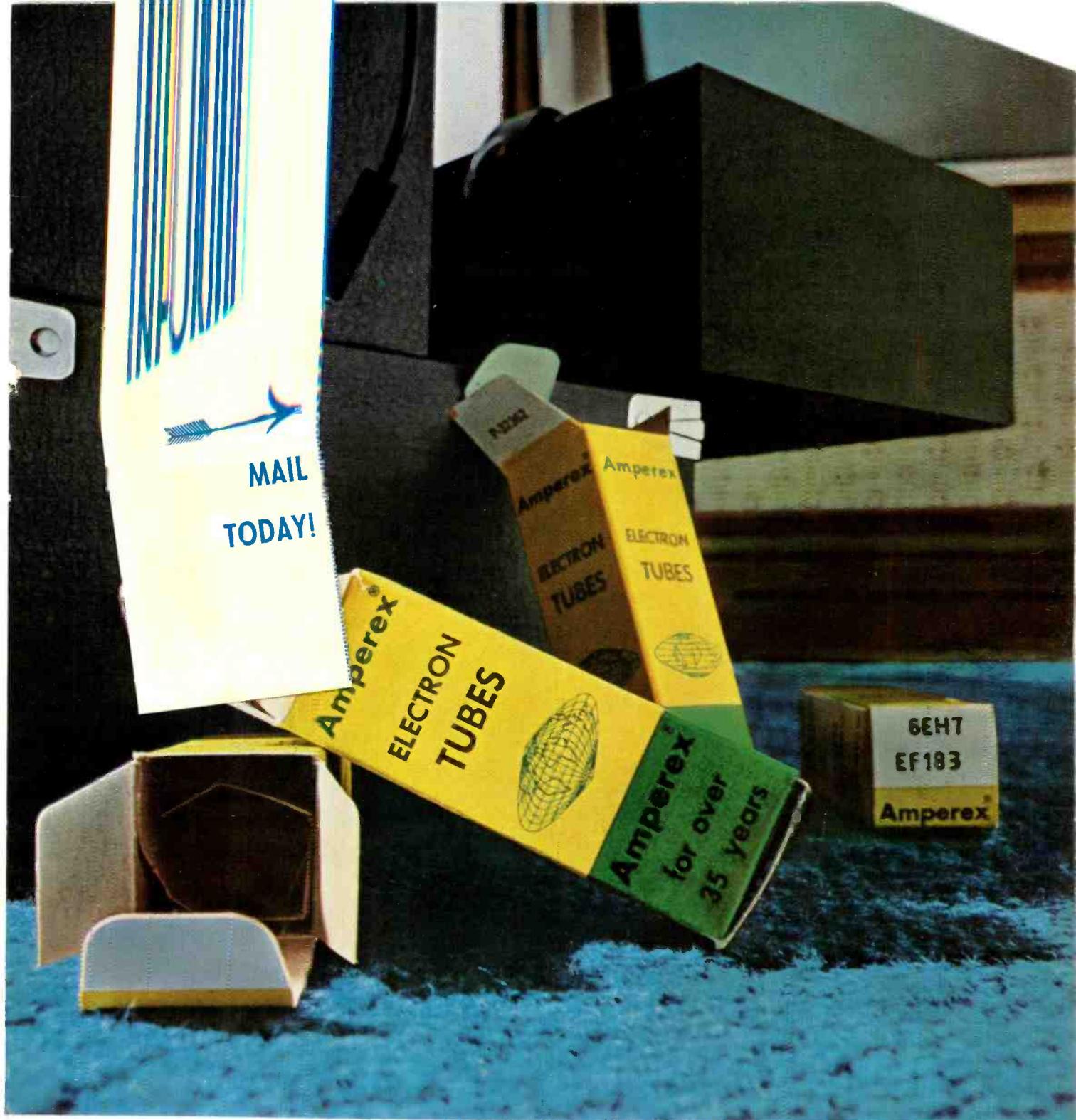
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How to replace top quality tubes with identical top quality tubes

Most of the quality TV sets you are presently servicing were designed around special Frame Grid tubes originated by Amperex. More and more tube types originated by Amperex are going into the sets you'll be handling in the future.

Amperex Frame Grid tubes provide 55% higher gain-bandwidth, simplify TV circuitry and speed up your servicing because their extraordinary uniformity virtually eliminates need for realignment when you replace tubes.

Amperex Frame Grid Tubes currently used by the major TV set makers include:

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6EH7	6EJ7	6ER5	6ES8	6FY5	6GJ7	6GK5	6HA5	6HG8	7HG8	8GJ7	

If your distributor does not yet have all the Amperex types you need, please be patient—in some areas the demand keeps gaining on the supply. Amperex Electronic Corporation, Hicksville, Long Island, New York 11802.



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WHERE THE SILVERAMA® SCREEN BEGINS

TV picture quality depends on precise control of phosphors

Television picture quality depends on the quality of the phosphor screen inside the faceplate. That's why every RCA Silverama replacement picture tube is completely rescreened—in the same painstaking manner and with the same precision—as RCA picture tubes produced for use in original equipment. Before receiving their new Silverama screens, reused glass envelopes are scrubbed completely clean and given a series of chemical baths internally to restore them to the peak of their optical capabilities.

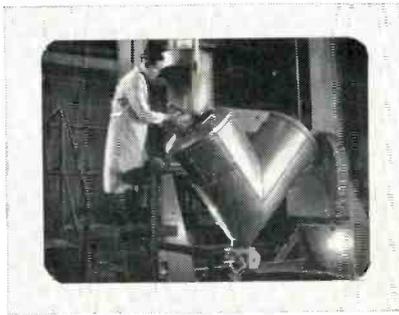
RCA produces and develops its own screen phosphors. These are

formed by reacting solutions of zinc sulfate and zinc and cadmium sulfates with hydrogen-sulfide gas in this complex precipitator, (above). The resulting zinc sulfide and zinc-cadmium sulfide are then activated, fluxed, fired, washed, dried, and screened to form phosphors which emit blue and yellow light, respectively. These are carefully blended to produce phosphors that possess the pleasing "white", high light output, and uniform smoothness, which characterize RCA Silverama picture tube screens.

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Phosphors are blended for best screen quality



Base materials are fired to form the phosphors

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