SPECIAL COLOR TV FEATURES

RADIO & TELEVISION NEWS

DECEMBER 1956 35 CENTS

World's Leading Electronics Magazine

IN THIS ISSUE

KEY TO COLOR TV INSTALLATION AND SERVICING (Test Patterns in Full Color)

ELECTRONIC AIDS FOR SMALL AIRCRAFT

LISTENING TESTS FOR SPEAKERS

DON'T BE AFRAID OF COLOR TV

EXPERIMENTAL HI-FI SYSTEM

LEARN TO SERVICE ALL COLOR SETS

ALL-TRANSISTOR HAM TRANSMITTER

> COVER STORY (See Page 79)



An Open Letter

To

Independent TV & Radio Service Dealers

Way back in the forties when you had only to combat the suspicion and mistrust of the public — a mistrust created through unfavorable and unfair criticism in press and magazine — the Raytheon Manufacturing Company, recognizing this threat to your existence, started the Raytheon Bonded Electronic Technician Program in a sincere effort to help you survive. This program has helped thousands upon thousands of independent service dealers from coast to coast to establish themselves as reputable businessmen, increase their profits and gain the full respect of their customers.

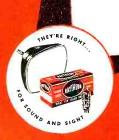
The program has been carefully controlled. Membership in the Raytheon Bonded Dealer group has been kept limited and selected for 2 reasons: (1) Raytheon wants only the finest service organizations to bear this proud distinction, and (2) it represents a substantial investment for every dealer registered.

Today, the growth of Manufacturers' Service Organizations creates new problems for you in maintaining and increasing the business you have worked so hard to earn. To help you win and keep customer confidence, we are going to lift the quotas on the number of we are going to first the quotas on the humber of you Bonded Dealers we will back. We know that many of you operate to standards that will enable you to qualify for operate to standards that will enable you to qualify for the Raytheon Bond. We recognize your need for this support and gladly offer this helping hand.

We regret that this offer can be made for a limited we regret that this offer can be made for a limited time only. If you are interested in getting the help of the Raytheon Bond, get in touch with your Raytheon the Raytheon Bonded Tube Distributor right now. He will sponsoring Bonded Tube Distributor Pand will have all the delighted to the pand will have the pand will be pand will have the pand will have the pand will have the pand will have the pand will be pand will have the pand will be pand will have the pand will be delighted to show you how the Bond will help you build your business. And helping you -- the independent service dealer — to prosper is something we at Raytheon are dedicated to do.



Receiving and Cathode Ray Tube Operations Newton, Mass.





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COVER PHOTO: Probably the No. I gift on Santa's list this year is a color TV receiver, like this RCA "Aldrich" model being received with such entusiasm. Heavy programming is expected to stimulate color TV sales. (Ektachrome by Chas. P. Mills & Son)

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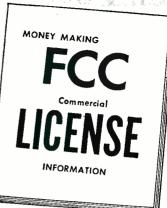
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These are just a few of the examples of the job offers that come to our office periodically. Some licensed technician filled each of these jobs; it could have been you!

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FACTORY TV SERVICE

WE HAVE received a great deal of correspondence of late dealing with the pros and cons of factory TV service plans. The average independent service technician states in no uncertain terms that factory TV service will rob him of his present customers and, in some cases, will ruin his business. Others question the wisdom of factory TV service, feeling that there will be long delays from the time a customer reports his troubles to the time when such factory technicians might show up at the customer's home. Still others fear that the manufacturers will sell components to their selected group of technicians at lower cost than to the independents.

No one can foretell, at least at this writing, as to how far the manufacturer will go in spreading his web of TV service. Some feel that the set makers will confine their operations to the large cities from which they have received the bulk of consumer complaints. Others feel that factory TV service will be limited somewhat to a regional operation; and still others feel that if such service procedures are profitable to the manufacturer, eventually all sets made by a particular company will be serviced directly through its own facilities.

Factory service is not new. The RCA Service Company, for example, has been operating successfully for many years. Other factory service departments are in the making or have already begun operations. We have repeatedly asked the question as to where the manufacturer would go for his technical talent and have received several entirely different answers.

The majority of set makers apparently will attempt to use established independent technicians or service dealers. Most of these dealers carry several different brands of TV sets. It would appear, then, that if each manufacturer attempts to woo a technician, specializing in several different makes, eventually there would result a situation leading to piracy. Available technicians then would find themselves in the position where they would actually have to either continue to be wholly independent or to join forces with a particular manufacturer.

It's a ticklish and somewhat complex situation, and after discussing the pros and cons of factory TV service with service executives of the companies there is little doubt that their intentions to go ahead are very real.

The consensus of the set manufacturers is that they have been literally forced to take over TV service as a "protection for their customers." They claim that with the wide acceptance of color TV, they would risk the fu-

ture of their products if they relied upon "non-factory trained" personnel to maintain their receivers. They feel that their own technicians, being supplied with essential test equipment and know-how, will, through special training, be able to serve the customer more promptly and with replacement parts and tubes of their own make which would not otherwise be assured.

Most of the industry leaders have high praise for TV service technicians throughout the country. Only recently Mr. Frank Folsom, president of RCA, declared: "There can be no doubt that one of the most important contributions to the tremendous growth of television in the past ten years has been the high quality of work being performed every day by the nation's television service technicians." Mr. Folsom also added: "We are proud to pass along all the color experience of the RCA Service Company team to the thousands of independent servicemen and organizations who will service an overwhelming majority of the new color sets."

Other industry leaders have not been so complimentary in their remarks. In talking with them we learned that the feeling runs high in favor of factory service which will serve, they claim, as an aid in maintaining good customer relations. Others feel that direct control of factorymade components will provide better service; and while we doubt that the average technician would agree with this philosophy, nevertheless there can be no question as to their future objectives.

We have personally had the opportunity to check both so-called factory distributor service, as well as independent TV service—neither of the two has shown any particular advantage over the other.

In the former case, there were repeated delays, after the set was reported out of order, before a technician showed up to perform his duties. There was also an occasion where a technician came to service a color set without any of the essential test equipment required.

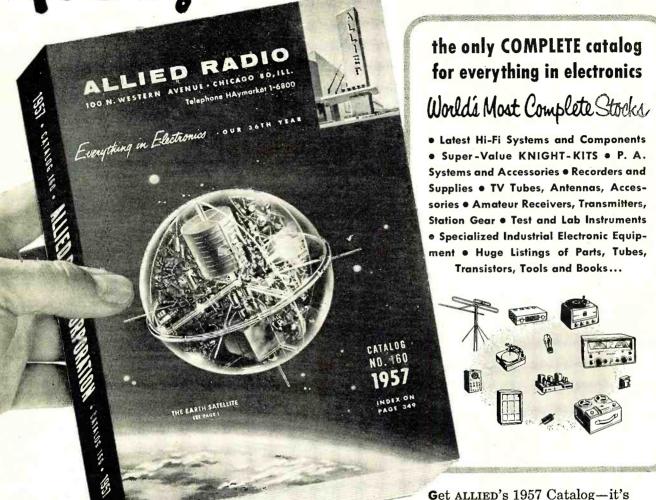
On the other hand, an independent diagnosed high-voltage failure as being due to a "burned-out transformer." Actually it amounted to nothing more than a faulty 2-watt resistor.

We cannot tell at this time whether or not "factory TV service" will be compatible or an improvement over existing techniques, but we have no reason whatsoever to believe that any serious threat exists for the progressive independent service technician who is well established and operates his business as a professional. . O.R.

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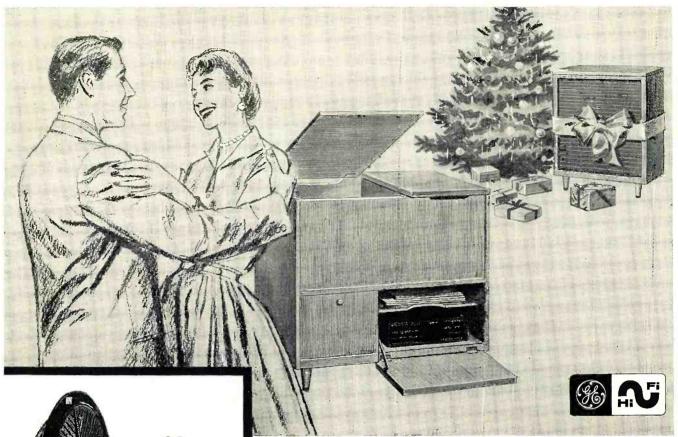
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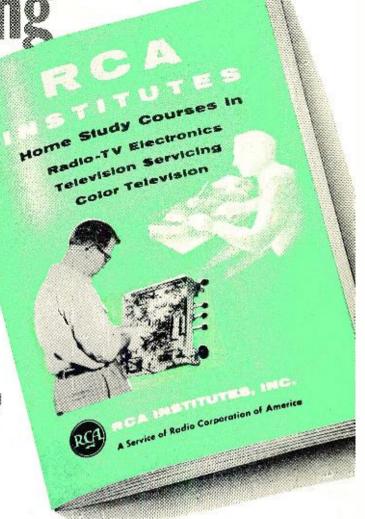
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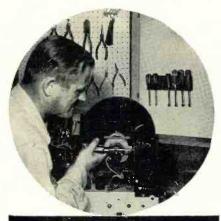
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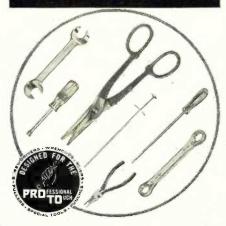
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Presenting latest information on the Radio Industry.

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

THE ALL-U.H.F. SHIFT, suggested by the FCC, has run into a storm of criticism in Washington, one equipment maker saying that such a move would be "... most injurious to the public interest..." and could "... jeopardize the whole future of television broadcasting in the United States."

However, it was stressed, u.h.f. must not be buried. "It is of greatest importance to the future of TV broadcasting," the Commission was told, "that u.h.f. television be encouraged now; that it not be left exposed to the possibility of withering in a state of suspended animation pending resolution at some future time of additional aspects of its operation. . . . The present obstacles to fully effective utilization of the u.h.f. channels do not lie primarily in failure to solve technical problems: These problems have arisen principally from problems of economics and circulation."

The differences between the ultrahighs and the very-highs, the comment to the Commission added, arise "... primarily from conditions of nature. These differences are such that the service provided by v.h.f. TV in areas of mountainous terrain and cities with large man-made structures will normally continue to be superior to that provided by u.h.f."

The ultra-highs, members of the FCC were told, can furnish a highly

". ... satisfactory service to the public provided allocations are made to take these factors into account. But v.h.f. should continue to be assigned to areas where use of the u.h.f. band would impair service to the public."

CALLING THE ALL-U plan a radical one, one broadcaster declared that there are too many vital questions to be answered before anyone can determine if the shift is a proper one; the move, it was noted, could entail too high a price in terms of service and cost to the public.

It will be necessary, the broadcaster added, to "... explore whether or not statistical data from field-intensity measurements of u.h.f. stations can properly take variables (actual service ranges of u.h.f. and v.h.f. under varied conditions) into consideration ... since it is difficult to take average projected conditions and know if they would be ... singularly applicable in specific circumstances."

The Association of Federal Communications Consulting Engineers also told the Commission that it found fault with the all-U idea. The u.h.f. formulas offered by the FCC's engineers were described as over-simplified; they cannot be used to gauge loss or gain of population. In addition, it was said, the departures from the averages are so great on the high bands,

NEW TV GRANTS SINCE FREEZE LIFT

Continuing the listing of construction permits granted by FCC since lifting of freeze. Additional stations will be carried next month.

STATE	CITY	CALL	CHANNEL	FREQUENCY	POWER*
Florida	Jacksonville	WFGA-TV	12	204-210	316
Indiana	Roanoke	WPTA	21	512-518	251
Louisiana	New Orleans		32	578-584	229
Oregon	Coos Bay		16	482-488	20.5
South Dakota	Aberdeen	KDHS	9	186-192	1.58
Texas	Alpine		12	204-210	.59
Wyoming	Riverton		10	192-198	64
	NEW C	ALL LETTE	R ASSIGNMI	ENTS	

	NEW	CALL LETTER	ASSIGNMEN	NTS	
Connecticut	Hartford	WHCT Formerly WGTH-TV	18	494-500	
New York	Rochester	WROC-TV Formerly WHAM-TV	5	76-82	
Tenressee	Knoxville	WATE-TV	6	82-88	

*FRP=(effective radiated power, kw.)

GET IN ON THE L. C. Lane, B.S., M.A. President, Radio-Tele-vision Training Asso-ciation. Executive Director, Pierce School of Radio & Television.

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Just figure it out for yourself. There are more than 400 television broadcasting stations operating right now and hundreds more to be built; more than 34 million sets in the country and sales increasing daily. moderately priced color television sets will be on the market and the color stampede will be on.

All these facts mean that good jobs will be looking for good men. You can be one of those men if you take advantage of my training now - the same training that has already prepared hundreds of men for successful careers in the radio-television-electronics field.

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Mr. Leonard C. Lane, President
RADIO-TELEVISION TRAINING ASSOCIATION



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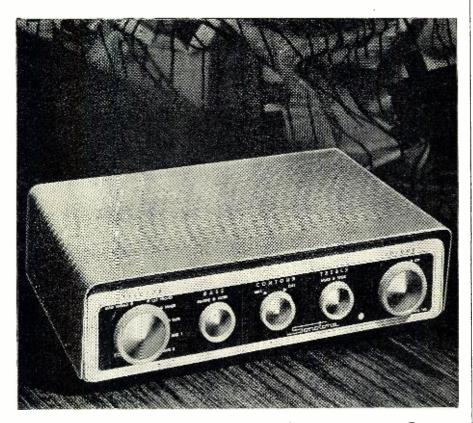
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due to terrain and miscellaneous factors, that average curves cannot be used in connection with measurements made at u.h.f. Actual tests on operating stations are necessary to arrive at plausible conclusions, the engineers reported to the Commission.

THE SIZZLING BOOSTER STATION issue, raised by Governor Ed Johnson, when he *authorized* a booster to continue operating (and since that approval many others have also begun operating with his blessing) even though the FCC said such operation was illegal, is still up in the air.

Commenting on his move, the Governor told one of the Commissioners that the approved translator system was "... splendid for the Atlantic Seaboard, but it is not necessary in the Rocky Mountains." Stations in the west, the Colorado chief said, were "... thousands of miles apart ..." and they were separated by mountains.

Asking the Washington authorities "... What is wrong with two systems in this big United States?", the former chairman of the Senate Commerce Committee went on to tell the FCC that "... just because you have found something that fits the area with which you are familiar, please don't force it down our throats arbitrarily."

The fiery legislator also tore into the Commission for taking no action against the community TV stations, but going ". . . out of its way to clap the booster system down.

"Why," he asked the FCC, "are you picking on us mountain folks? We are people, too."

DEVELOPMENT OF HIGHER POWER transmitting tubes to permit the Air Force to contact aircraft higher and farther away than with present equipment has been announced by the Air Research and Development Command.

In one case, the new tubes have been used in a one-kilowatt u.h.f. amplifier to provide a ten-fold increase in ground-to-air communication transmitting power. The power was chosen to afford the most efficient range, with the least interference, and at the lowest cost level. The modulator portion, it was said, operates at a distortion level less than three-fourths of one per-cent, which is unusually low for equipment of this type.

The entire amplifier unit weighs less than a ton and is composed of preamplifier and remote control, radio-frequency amplifier, power supply, cooling, power control, and modulator units. The amplifier was described as multi-purpose in design and function; its communication facilities can be permanent or mobile and can transmit voice or data signals.

The importance of this equipment can also be evaluated in terms of increased safety for Air Force personnel. In the past, aircraft often were lost only because they were beyond the range of radio contact. With the increased power provided by this new (Continued on page 132)

RADIO & TELEVISION NEWS



When your authorized Pickering Dealer is demonstrating the revolutionary new ISOPHASE SPEAK-ER, please, don't look behind it for the orchestra. Take our word for it—these magnificently realistic sounds are coming from the curved diaphragm itself. "Unbelievable," "extraordinary," "breathtaking," and "window-on-the-studio quality" are some of the comments we've heard from dealers and customers alike. But don't be persuaded by mere words alone. Hear it for yourself.

The Pickering ISOPHASE SPEAKER uses the electrostatic principle to recreate musical sounds with a degree of realism unattainable in conventional speakers.

The ISOPHASE reintroduces the original sound

into the air at a low velocity—instead of at a high velocity as in ordinary speakers. In addition, the ISOPHASE generates sound in phase from the entire surface of its large curved diaphragm—instead of from a point source as in conventional cone speakers. Thus the sound reproduced by the ISOPHASE closely approximates the unit-area energy of the original sound entering the microphone in the studio or concert hall.

Unlike ordinary speakers, the ISOPHASE does not "break up" at high frequencies. And because of the inherent linearity of the push-pull electrostatic design, harmonic and intermodulation distortion are virtually nonexistent—a tremendous advantage over conventional speakers. For further details, please write Department C-13.



PICKERING & CO., INC. OCEANSIDE, N.Y.

Professional Audio Components

"For those who can hear the difference"

Demonstrated and sold by Leading Radio Parts Distributors everywhere. For the one nearest you and for detailed literature: write Dept. C-13
EXPORT: AD. AURIEMA. INC., 89 BROAD ST., NEW YORK / CANADA: CHARLES W. POINTON LTD., 6 ALCINA AVE., TORONTO

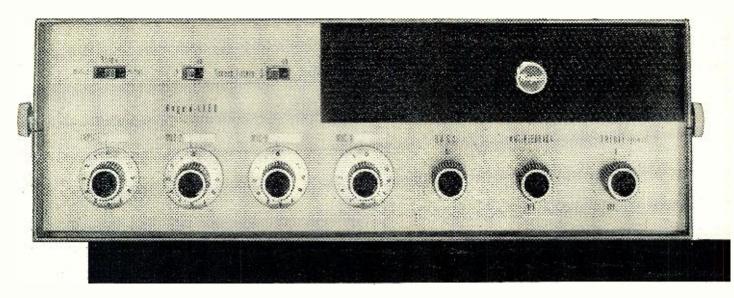


INTRODUCING BOGEN FLEX-PAK®*

*custom flexibility in packaged PA

EASIEST-TO-INSTALL, EASIEST-TO-SERVICE

portable or permanent . . . make more sales, more profits



NEVER AGAIN need you miss a sale because your "packaged" PA equipment wasn't designed for a specific commercial installation—and your customer wouldn't stand still for an expensive custom design. Meet BOGEN'S FLEX-PAK public address line. Here's true portability. Here's easy servicing. And here's all the flexibility, performance and dependability you'll need to satisfy 90% of your commercial applications—without going back to the manufacturer's "custom division" for expensive (i.e., hard-tosell) special designs. And, thanks to FLEX-PAK design, your cost-conscious customer need buy only the equip-

ment he needs—and you can see him later about additional features. (Note that record player mounts, locking panels, remote controls are all separate accessories.) You can offer these systems in every price range, at practically every popular wattage, in three handsome BOGEN FLEX-PAK series: LX, L and K.

(1) Get in touch with your BOGEN representative immediately, or (2) mail for all FLEX-PAK specifications and prices by checking the coupon on the facing page. NOTE: we also supply famous-make indoor and outdoor speakers, microphones and other accessories for all your BOGEN public address system installations.

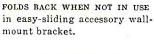
HOW'S THIS FOR EASY SERVICE ... EASY INSTALLATION

LOOSEN 4 THUMBSCREWS AND THE LID's OFF for easy access for fast servicing.





4 THUMBSCREWS ATTACH ACCESSORY RECORD PLAYER MOUNT. (Note: "cooling area" protects phono mechanism.)





A BOGEN FLEX-PAK PA SYSTEM FOR EVERY USE...EVERY BUDGET

The amplifier-control units shown here are representative of more than twenty different models available to you-in all desired wattages; handsomely finished in dark gray with brushed aluminum face plate. Dealer net prices range from \$45 to \$155 for "full control" amplifiers.

DELUXE "LX" SERIES



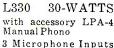
LX30 30-WATTS

4 Microphone Inputs (panel switch converts one mike channel for phono or tuner) Built-in Remote Gain-Control Circuit Exclusive Anti-Feedback Control Speech Filters Separate Bass and Treble Tone Controls Size: Height: 5%" Width: 161/4"

Depth: 13"

Wgt.: 25 lbs.

SUPERB "L" SERIES



(panel switch converts one mike channel for phono or tuner) Speech Filters

Separate Bass and Treble Tone Controls Size: Height: 5%"

Width: 14 1/4" Depth: 13" Wgt .: 24 lbs. without

phono



ECONOMICAL "K" SERIES



K130 30-WATTS with accessory KPA-3 Manual Phono 1 Microphone Input 1 Phono Input Speech Filter Separate Bass and Treble Tone Controls Size: Height: 61/4" Width: 14'

Depth: 8" Wgt.: 16 lbs. without

phono



BRIEFCASE PORTABILITY thanks to slim design, handy on-end carrying straps.



LOCKING PANEL (accessory) protects against tampering with settings. Covers entire control panel, not just on-off switch.



LX60 60-WATTS with accessory LPA-4 4-speed Manual Phono

Except for slightly greater weight (29½ lbs. without phono) and added power, the LX60 has same features and controls as LX30 shown above.

LPA-3 (3-speed) or LPA-4 (4-speed) phono mount includes manual record player, pan, legs, end pieces, couplings for easy mounting.



LOM PREAMPLIFIER CONTROL

5 Separate Microphone Gain Controls plus Master Gain Control. 1 Microphone channel converts to phono or tuner with selector

Illuminated Level (VU) Meter.

switch on panel.

Separate Bass and Treble Tone Controls plus Speech Filters for four microphone channels.

Size: Height: 5% Width: 164" Depth: 11"

Wgt .: 20 lbs.

KO100

100-WATTS

Powerful line amplifier. Built especially for long-term, dependable performance with no service problems.

Size: Height: 73%" Width: 17%" Depth: 61/2"

Wgt .: 28 lbs.



MAIL THIS COUPON TODAY FOR DESCRIPTIVE BROCHURES AND PRICES

Dept.MX, David Bogen Co., Inc., P. O. Box 500, Paramus, N. J. Gentlemen: Please send me descriptive literature and price information on your BOGEN FLEX-PAK public address equipment.

NAME_	
FIRM	

ADDRESS_

check one | dealer

□ jobber sound specialist

ZONE_

STATE

☐ Please send me 24-page, illustrated brochure, "What You Should Know About Sound Systems."

Please send me your 56-page, illustrated book, "Understanding High Fidelity," by L. H. Bogen and L. Biancolli. (I enclose 25c.)





Everything You Need for Profitable Rotor Sales

CDR ROTORS

have EVERYTHING



THE COMPLETE

... a model for every need... whatever the application there is a CDR Rotor that meets the situation best!

PRE-SOLD FOR YOU!

The greatest coverage and concentration of full minute spot announcements on leading TV stations in every major rotor market is working for YOU...pre-selling your customers!



CORNELL-DUBILIER

SOUTH PLAINMELD, N. J.

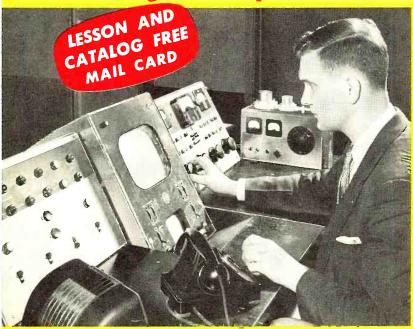


THE RADIART CORP.

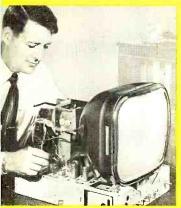
CLEVELAND 13. OHIO

You Can Tain a Home for Good Pay Jobs in RADIOTELEWSON

Fast Growing Industry Offers Good Pay, Security, Bright Future



Add to Your Income Starting Soon



Make \$10-\$15 a Week Extra Fixing Sets in Your SpareTime

Soon after enrolling, many N.R.I. students start earning extra money fixing neighbors' radio sets. Many earn enough extra to pay entire cost of course and provide capital to start their own full time Radio-TV business after getting N.R.I. Diploma. If you want a job with a future, find out how you can train at home for Radio-Television. Mail Postage Free postcard for Sample Lesson. See how practical it is to learn at home. Get 64-Page Catalog, too. See equipment you get, outlines of courses, facts about opportunities in this growing field. Prices of N.R.I. Courses are low, terms easy.

N.R.I. Training leads to good pay jobs like these. BROADCASTING: Chief Technician, Chief Operator, Remote Control Operator. SERVICING: Home and Auto Radios, P. A. Systems, Television Receivers, Electronic Controls, FM Radios, Hi-Fi. SHIP AND HARBOR RADIO: Chief Operator, Assistant Operator, Radiotelephone Operator. POLICE RADIO: Transmitter Operator, Receiver Serviceman. GOVERN-MENT RADIO: Operator in Army, Navy, Marine Corps, Coast Guard, Forestry Service Dispatcher, Airways Radio Operator. IN RADIO PLANTS: Design Assistant, Transmitter Design Technician . . . AND MANY OTHERS.

N.R.I. TRAINED THESE MEN

Thanks N.R.I. for Good Start



"Right now I am doing spare-time repairs on Radios and Television. Going into full time servicing soon." C. HIG-GINS, Waltham, Mass.

Engineer with Station WHPE



"I operated a successful Radio repair shop. Then I got a job with WPAQ and now I am an engineer for WHPE." VAN W. WORKMAN, High

Quit Job to Start Business



"I decided to quit my job and do TV work full time. I love my work and am doing all right financially." W. F. KLINE, Cincinnati, Obio.

N.R.I. Started His Way up



"I was a cab driver earning \$35 a week. Then I enrolled with N.R.I. Now tester with TV maker." J. H. SHEPHERD, Bloomington, Ind.

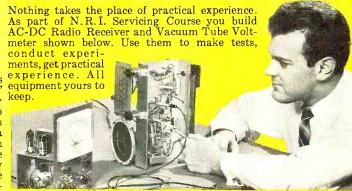
Training PLUS OPPORTUNITY is the ideal combination for success. Today's OPPORTUNITY field is Radio-Television. Over 125 million home Radios plus 30 million sets in cars and 40,000,000 Television sets mean big money, opportunity for trained Radio-Television Technicians. More than 4,000 Radio and TV Broadcasting stations offer interesting and important positions for technicians, operators. Color Television, portable TV sets, Hi-Fi, other developments assure future growth. Radio, Television are both growing. Need for trained technicians is increasing!



Find Out What Oldest and Largest Home Study Radio-Television School Offers You

Since 1914—for more than 40 years—N.R.I. has been training ambitious men at home in spare time for Radio-TV. Thousands of successful graduates say N.R.I.'s 50-50 training method is a fast, easy, effective way to higher earnings, desirable jobs. Carefully planned experiments and practice with equipment supplied free of extra charge, bring basic principles, techniques to life right in your own home. Find out what dependable training can do for you.

You Learn by Doing—Get Practical **Experience with Kits N.R.I. Sends**





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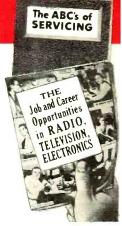
This card entitles you to Actual Lesson on Servicing, shows how you learn Radio-Television at home. You'll also receive

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Practice Servicing-Communications with Kits of Parts N.R.I. Sends



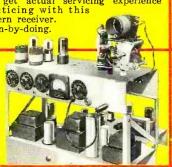
Broadcasting Transmitter

YOU BUILD

YOU BUILD AC-DC Superhet Receiver

N.R.I. Servicing Course includes all needed parts. By introducing defects you get actual servicing experience practicing with this modern receiver. Learn-by-doing.

As part of N.R.I. Communications Course you build this low power Transmitter, learn commercial broadcasting operators' methods, procedures. Train for your FCC Commercial Operator's License.



YOU BUILD Signal Generator

You build this Signal Generator. Learn how to compensate high frequency amplifiers, practice aligning typical I.F. amplifiers in receiver rcuits.

Make tests, conduct experiments.

YOU BUILD Vacuum Tube Voltmeter

Use it to earn extra cash fixing neighbors' sets; bring to life theory you learn from you learn from N.R.I.'s easy-tounderstand texts.



Radio-Television Can Give You a Good Job with a Future

N.R.I. Graduates do Important Work — Get Important Pay



Chief Engineer with Station

"I am Chief Engineer of Station KGCU in Mandan, N. D. I also have my own spare time business servicing high frequency, twoway communications systems." R. BARNETT, Bismarck, N. D.



Paid for Instruments out of Earnings

"I am doing very well in spare time TV and Radio. Sometimes have three TV jobs waiting and also fix car Radios for garages. I paid for instruments out of earnings." G. F. SEAMAN, New York, N. Y.



Has Own Radio-TV **Business**

"We have an appliance store with our Radio and TV servicing and get TV repairs. During my Army service, N.R.I. training helped get me a top rated job." W. M. WEIDNER, Fairfax, S. D.



You Can Train in Spare Time

expanding—making more jobs, greater opportunity

Here is a line of work that people respect—a vocation where you

can advance, win a place for yourself, earn good pay and gain much personal satisfaction in what you are able to do. And you can learn at home in your spare time. Smart fellows everywhere are using their spare time to develop new knowledge, new skills.

They know it is the trained man who gets ahead, gets the better

Keep your job until you're ready for a better one. Learn at home N.R.I. Courses are planned for men who can study only during spare time. You get many kits to build equipment, get practical experience. You work on circuits common to both Radio and TV Equipment you build "brings to life" things you learn in N.R.I.'s easy-to-understand texts. Experienced N.R.I. instructors, technicians, specialists devote full time to making sure you get the best and simplest Radio-TV training. Train as fast or as slow as you like

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N.R.I. Training is practical, thorough. You get the benefit of N.R.I.'s 40 years experience training men for success in Radio-Television. Most successful N.R.I. men start without any knowledge of Radio, many without a high school education. Find out what Radio-Television training can mean to you. Make a decisive move today toward becoming one of that select group—a Radio-TV Technician. Send for Actual Lesson and 64-Page Catalog, both FREE. NATIONAL RADIO INSTITUTE, Dept. E, Washington, D.C.

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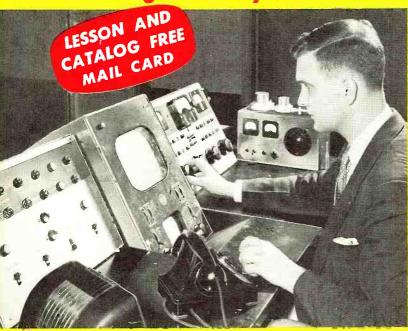
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You Can Train at Home o Good Pay Jobs in RADOTELENISON

Fast Growing Industry Offers Good Pay, Security, Bright Future



Add to Your Income Starting Soon



Make \$10-\$15 a Week Extra Fixing Sets in Your SpareTime

Soon after enrolling, many N.R.I. students start earning extra money fixing neighbors' radio sets. Many earn enough extra to pay entire cost of course and provide capital to start their own full time Radio-TV business after getting N.R.I. Diploma. If you want a job with a future, find out how you can train at home for Radio-Television. Mail Postage Free postcard for Sample Lesson. See how practical it is to learn at home. Get 64-Page Catalog, too. See equipment you get, outlines of courses, facts about opportunities in this growing field. Prices of N.R.I. Courses are low, terms easy.

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N.R.I. TRAINED

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Engineer with Station WHPE



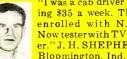
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N.R.I. Started His Way up



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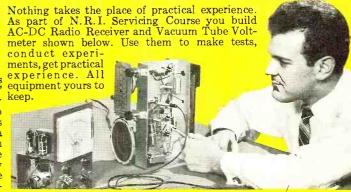


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Practice Servicing-Communications with Kits of Parts N.R.I. Sends



YOU BUILD AC-DC Superhet Receiver

N.R.I. Servicing Course includes all needed parts. By introducing defects you get actual servicing experience practicing with this modern receiver.



YOU BUILD Signal Generator You build this Signal Generator. Learn how to compensate high frequency amplifiers, practice aligning typical I.F. amplifiers in receiver circuits.

Make tests, conduct experiments.



As part of N.R.I. Communications Course you build this low power Transmitter, learn commercial broadcasting operators' methods, procedures. Train for your FCC Commercial Operator's License.



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Use it to earn extra cash fixing neighbors' sets; bring to life theory you learn from N.R.I.'s easy-tounderstand texts.



lechnician

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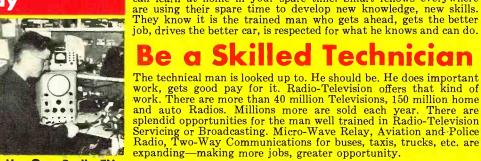
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You Can Train in Spare Time

Here is a line of work that people respect—a vocation where you can advance, win a place for yourself, earn good pay and gain much personal satisfaction in what you are able to do. And you

can learn at home in your spare time. Smart fellows everywhere

Keep your job until you're ready for a better one. Learn at home. N.R.I. Courses are planned for men who can study only during spare time. You get many kits to build equipment, get practical experience. You work on circuits common to both Radio and TV. Equipment you build "brings to life" things you learn in N.R.I.'s easy-to-understand texts. Experienced N.R.I. instructors, technicians, specialists devote full time to making sure you get the best and simplest Radio-TV training. Train as fast or as slow as you like.

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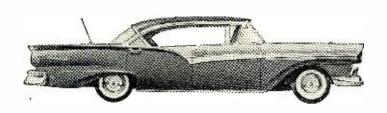
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FORD

FOR '57...

CBS TUBES

FOR '57...

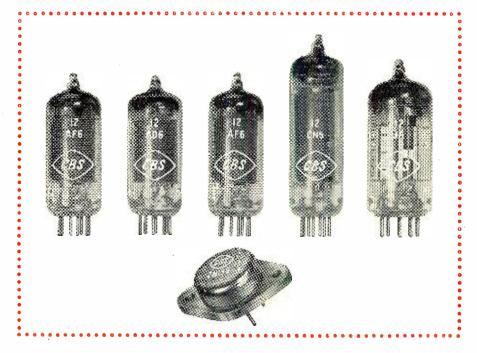
CBS TRANSISTORS
FOR '57



A new, sleek, long, low '57 Ford with the touch of tomorrow. Under the dash, a fine new Ford radio receiver, transistor-powered for the ultramodern touch. And in it, new low-voltage mobile radio tubes by CBS... new power output transistor by CBS.

That's only natural. CBS pioneered the first auto radio tube kit. CBS has been a major supplier of tubes to Ford and other leading auto radio set manufacturers for years. And now CBS offers tubes and transistors for the new "hybrid" auto radio receivers.

Whatever you need for auto radio replacements — tubes or transistors — old, modern, or ultramodern — follow the leading set manufacturers . . . replace with CBS.



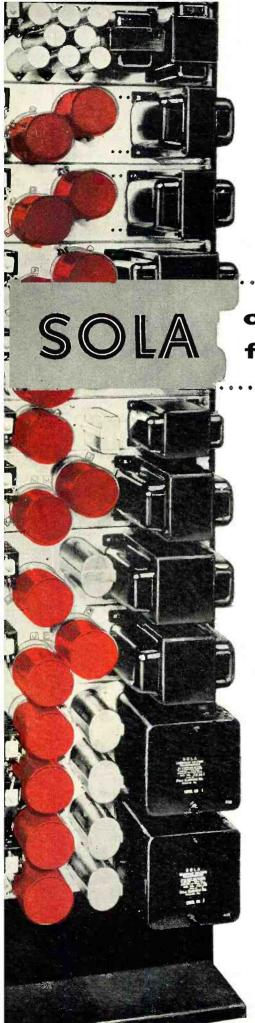


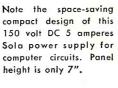
tubes · semiconductors

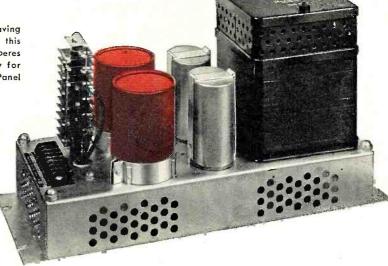
Reliable products through Advanced-Engineering

CBS-HYTRON

Danvers, Massachusetts
A Division of Columbia Broadcasting System, Inc.







chooses Sangamo Capacitors for Germanium Power Supplies

Space-saving compactness and light weight... features assured by the exacting demands of Sola engineers... are among the many advantages of Sola Constant Voltage DC Power Supplies for intermittent, variable, pulse or high current loads. That's why they specify Sangamo Type DCM Electrolytic Capacitors for the high-capacitance filter section of these power supplies.

Besides contributing to the space-saving, weight-reducing design of the "Sola CV DC," Sangamo Capacitors minimize ripple voltage and insure steady, stable DC

voltage. No further need for heavy, bulky choke components with their substantial and often-varying load voltage drops.

Just as Sangamo Capacitors meet the exacting specifications of Sola design engineers, they can meet yours... no matter how demanding—regardless of how specialized.

Sangamo DCM Electrolytic Capacitors provide excellent capacity stability with long life ... exceptionally low equivalent series resistance ... extremely high capacity for case size in low voltage ranges. Special design permits high ripple current without overheating. Can be supplied in maximum energy content rating of 80-watt seconds with maximum voltage rating of 450 VDC. Maximum capacity value of 33,000 mfds. can be supplied at 15 WVDC.



The Sangamo DCM Electrolytic Capacitor is housed in a seamless, drawn aluminum container with gasket-sealed molded alkyd resin base thermosetting plastic cover.

Detail of cover construction insures minimum contact resistance in current carrying members and provides an adequate safety vent in case of heavy overload.

SANGAMO ELECTRIC COMPANY CAPACITOR DIVISION . SPRINGFIELD, ILLINOIS



New <u>heavyweight</u> champion!

Hallicrafters <u>new</u> SX-101 receiver employs heaviest chassis in industry...incorporates V.F.O.feature*...has 2000° disc logging counter.



It's all amateur—and as rugged as they come! Hallicrafters presents the complete answer to ham reception, with every essential needed for today and for the future.

essential needed for today and for the future.

First—built like a battleship. Bigger. Heavier. Second—a marvel of stability—the result of 22 years of experience and development. Third—it brings you a long list of new features:

- Complete coverage of 7 bands-160, 80, 40, 20, 15, 11-10 meters.
- Special 10 mc. pos. for WWV, plus coverage of major MARS frequencies.
- Exclusive Hallicrafters upper/lower side band selection.
- S-meter functions with A.V.C. off.
- Tee-notch filter.
- *Local oscillator output available for use in heterodyne V.F.O.

PLUS: Band in use individually illuminated...built-in crystal calibrator...antenna trimmer...dual conversion...full gear drive from tuning knob to gang condensers...five steps of selectivity from 500-5000 cycles...sensitivity—less than 1 microvolt on all bands...direct coupled series noise limiter...50 to 1 tuning knob ratio...and many more.

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December, 1956

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* 2-Page Spreads

* Full-Color Ads

→ Full-page Ads

Progressive Farmer NEW YORKER Month after month...all thru the prime TV buying months ... this continuing series of sales-stimulating ads is creating loads of lively new prospects ... right in vour own selling area. ourna Tarm Journal BETTER TV PICTURES FOR ALMOST EVERYONE lown Journal 55,000,000 CHANNEL MASTER ads building new customers and sales for you!





This smartly styled antenna overcomes consumer objection to ugly "rabbit-ear" antennas. Exclusive "Metro-Dyne" electronic tuning brings in pictures sharp and clear on all channels. Tuning knob with channel markings just like a TV set makes channel selection so easy. It's the most powerful indoor antenna ever developed . . . and it's backed with an UNCONDITIONAL MONEY-BACK GUARANTEE. Engineered for Black and White and COLOR.

model no.	description	type
3900	Mahogany & Gold	YHF
3901	Blond & Gold	VHF
3902	Ebony & Silver	YHF
3905	Mahogany & Gold	YHF-UHF

Tremendous consumer response emphasizes desire for better TV antennas . . .

and there are no antennas on the market today that compare with these fabulous new Channel Master models



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The revolutionary new T-W is the very first TV antenna to use the "Traveling Wave" principle. This unique design electronically reinforces signals . . . eliminates "ghosts" and "snow"... rejects all unwanted signals and interference. In gain, front-to-back ratio, and mechanical strength, the T-W is unequalled by any other Broad Band antenna. Engineered for Black and White and COLOR.

description 350 7-element 350-2 7-element stacke 351 5-element 351-2 5-element stack 3-element



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WORLD'S LARGEST MANUFACTURER OF TV ANTENNAS AND ACCESSORIES

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ROBERT L. SHAW has been named to the newly created post of national

sales manager for the Radio and Television Division of Sylvania Electric Products Inc.

He formerly headed the company's wholly owned distributing firm, Victor H. Meyer Dis-

tributing Corp. Prior to that he was manager of branch operations, radio sales manager, and district sales manager in St. Louis, New Orleans, and Detroit. He joined Sylvania in 1952.

Mr. Shaw will have over-all responsibility for the division's field sales force and its distribution.

THE ASESA (Armed Services Electro-Standards Agency), Fort Monmouth, N. J., has announced that it is expanding its Qualification-Testing Program in view of a continuing and increasing need for qualified suppliers of electronic and electric parts.

To supplement Government testing laboratories, the ASESA recently inaugurated an extensive program providing for qualification testing of electronic and electric parts in commercial testing laboratories and in the plants of parts manufacturers. This program has proven so successful that it will be enlarged in scope to permit testing in the plants of electronic equipment manufacturers.

Equipment manufacturers who feel that their facilities are adequate for such testing should contact the Director, Armed Services Electro-Standards Agency, Fort Monmouth, N. J., for full details on this program.

MAXWELL RATNER has been named sales manager of General Transistor

Corp. of Richmond Hill, N. Y. He was formerly sales manager and development engineer of Prod-Germanium ucts Corp.

Prior to his most recent association, he was employed by

the research division of New York University as a project engineer and project director on the secretariat of the panel on electron tubes of the Research and Development Board. There he supervised and maintained liaison on all semiconductor contracts with the government. *

WALTER O. STANTON, president of Pickering & Company, Oceanside, N. Y., has been elected president of the

Audio Engineering Society succeeding Col. Richard H. Ranger, president of

Rangertone, Newark, N. J.
Mr. Stanton, who joined Pickering in 1948, is also secretary of the Institute of High Fidelity Manufacturers and the association's representative on the American Standards Association committee on sound recording and reproduction.

Sherman H. Fairchild, president of Fairchild Recording Equipment Company, was elected executive vice-president of the society. Henry J. Shroeder, president of Shroeder Sales Company, Cleveland, was named central vice-president, while Ross H. Snyder, manager of the custom products department of Ampex Corp., was chosen western vice-president.

C. J. LeBel, chief engineer of Audio Instrument Co., Inc., was re-elected secretary for his sixth consecutive term. Ralph A. Schlegel, technical facilities supervisor of WOR, was renamed treasurer.

DR. HARVARD L. HULL has resigned his post of president of Farnsworth Elec-

tronics Company to accept the position of vice-president of Litton Industries, Beverly Hills manufacturer of digital computers and controls, microwave power tubes, inertial guidance, radar, and other electronic components.



Dr. Hunt, who received his Ph.D. in physics from Columbia University, joined Sperry Gyroscope Co. following his graduation. He remained with the firm for ten years, leaving to join Tennessee Eastman Corporation at Oak Ridge.

He has been active in various phases of atomic energy development and has served on several governmental and industrial atomic energy committees.

HERBERT H. FROST, first president of the Radio Manufacturers Association -predecessor of today's RETMA, died recently after a five-month illness. He was 63 years old . . . DR. BERNARD SALZBERG has been named chief scientist of the Research and Engineering Division of Airborne Instruments Laboratory, Mineola, N. Y. He was formerly associated with the Naval Research Laboratory in Washington . . . The M. J. Johnson Co. Inc. has named OTTO M. LERZ, JR. vice-president of its new products department . . . DR. HENRY G. GIULIANI has been appointed to the newly created post of assistant to the director of engineering and sales for Gabriel Elec-



Selected hardwood veneers are hand-rubbed to lustrous finish on all exposed sides. Brushed-brass grille gives rich accent. Makes a striking appearance in any home. Size: 39 in. high, 29 in. wide, 21½ in. deep.

adjustment of "presence" and "brilliance" to room acoustics.

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CENTURION IV. Complete 4-way 15-in. speaker system with E-V Model 117 Package of driver components installed in corner enclosure. Mahogany. Net, \$325.00 Blonde. Net, \$335.00 Walnut. Net, \$343.80 SENIOR CENTURION IV. Complete 4-way 15-in.

SENIOR CENTURION IV. Complete 4-way 15-in. speaker system with E-V Model 105 Package of driver components installed in corner enclosure. Mahogany. Net, \$395.00 Blonde. Net, \$405.00 Walnut. Net, \$413.80

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E-V MODEL 105 High Efficiency System only, without enclosure. Has 15WK, 848HF, T35, X336 and two AT37. Net, \$217.00

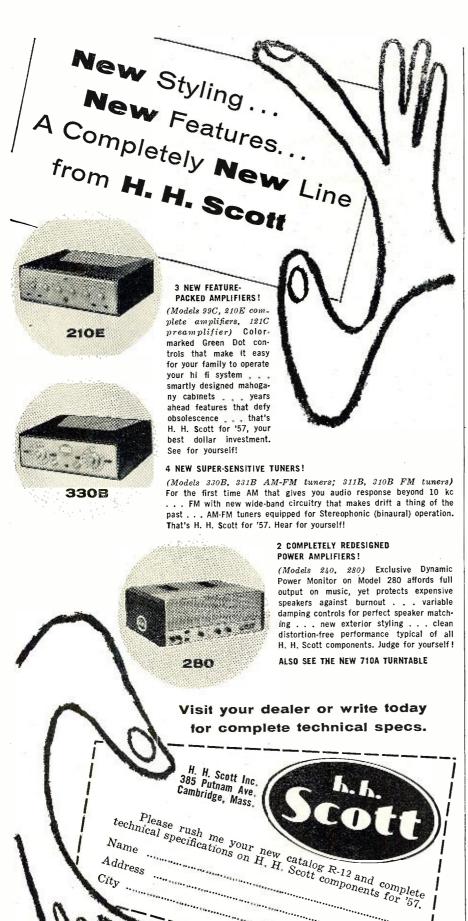
E-V MODEL 117 Medium Efficiency System only, without enclosure. Has 15BWK, 847HF, T35B, X336 and two AT37. Net, \$145.00

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tronics Division . . . HORACE B. McCOY, veteran career service official, has been elevated to the post of Administrator of the U.S. Commerce Department's Business and Defense Services Administration. He was formerly Deputy Administrator . . . BILL ASHBY has been named director of service engineering for Cornell-Dubilier Electric Corporation . . . Aerovox Corporation has named G. EMERSON PRAY to the post of general manager of its special products division. He will be in charge of all activities connected with printed wiring, etched circuitry, pressed silver products, electronics subassemblies, and electronics equipment . . . $\mbox{{\bf JOSEPH}}$ P. RICE is the new chief engineer of Fanon Electric Company, Brooklyn manufacturer of intercoms and phonographs . . . The appointment of DR. EARL L. STEELE as chief development engineer of the Device Development Department in the Semiconductor Products Division has been announced by Motorola Inc. . . . NILS HILLSTROM has been named national sales manager of Newcomb Audio Products . . . Amphenol Electronics Corporation has appointed RICHARD P. THORNTON to the post of marketing manager for the aircraft and guided missile industries . . . ROBERT G. BACH has rejoined Fairchild Recording Equipment Company in the capacity of sales manager.

LAWRENCE G. HAGGERTY has been named president of *Farnsworth Elec*-

tronics Company of Fort Wayne, Ind., a division of International Telephone and Telegraph Corporation.

He joined the system in 1950 as director of operations in the Capehart-



Farnsworth Company division. In 1952 he was elected vice-president and in 1954 named president of that division and a member of its management advisory board.

Prior to joining IT&T, he was associated with RCA Victor and F. L. Jacobs Company. He holds a mechanical engineering degree from Marquette University, Milwaukee. He succeeds Dr. Harvard L. Hull in his new position.

COL. WILLET J. BAIRD, USA (ret.) has been named editor of "Signal," official publication of the Armed Forces Communications & Electronics Association. He succeeds the late Col. George P. Dixon.

Col. Baird was born at West Point in 1902 and graduated from West Point with the class of 1926. He served with various units and on staff assignments in the U. S. and Hawaii. He was assigned as Professor of Military Science and Tactics at Valley Forge Military Academy and as Aide to the governor of Pennsylvania. His most recent appointment prior to his retirement in July of this year was as Assistant Commandant (Administration)

(Continued on page 144)

RADIO & TELEVISION NEWS

Export Dept: Telesco International Corp., 270 Park Ave., N. Y. 17

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MEMBER

December, 1956

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Mr. H. N. Ashby, Technical Employment Missile Test Project, Dept N-16M RCA Service Company, Inc., P.O. Box 1226 Melbourne, Florida

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You will hear a remarkable difference in the clarity of Norelco *Full Resonance Speakers. In a single speaker, twin-cones reproduce low frequencies, middle range, as well as the higher frequencies extending beyond the audible range—without distortion.

Blue prints are available for the do-it-yourself enclosure builder.

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They have incorporated a number of technical refinements which are evident the moment you listen. The air gap has been made long so that the coil is completely enclosed in an even magnetic field at all times. A copper ring has been fitted into the deep air gap to keep the

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Norelco speaker-matched enclosures are scientifically designed acoustical boxes which enhance the exceptional tone qualities of FRS speakers; bringing out their true performance values.

Norelco FRS Speaker Enclosures are available in three sizes to match the characteristics of the speaker in use. Supplied in either mahogany or blond, these enclosures incorporate a removable base permitting the enclosures to be placed horizontally or vertically to suit any room arrangement or decor.



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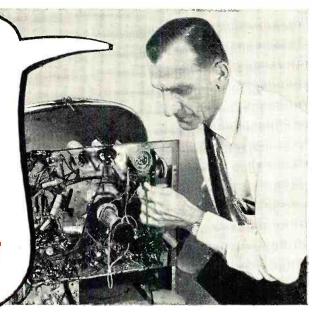
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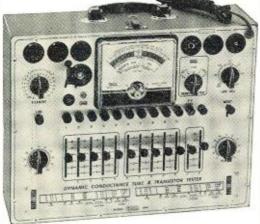
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NEW! DYNAMIC CONDUCTANCE

Tube & Transistor Tester #666

COMPLETE WITH MATCHING PROTECTIVE STEEL COVER AND CARRYING HANDLE

KIT... ONLY \$69.95 WIRED \$109.95

Speedy, simple operation, close simulation of actual tube operating conditions, unexcelled thoroughness, sensitivity and accuracy of test, excellent electrical and mechanical design-these are the superb advantages of the #666.

APPLICATIONS: Ideal for COLOR AND MONOCHROME TV servicing: Tests all receiving tubes including 4, 5, 6 and 7-pin, octal, loctal, miniature 7 and 9-pin, subminiature 5, 6, 7-pin (in-line base) and 8-pin (circular base) receiving tubes, many small transmitting and special-purpose tubes, voltage regulators, cold-cathode rectifiers, electron-ray indicators, and ballast tubes. Tests TV picture tubes with accessory adaptor. Tests n-p-n and p-n-p transistors.

ELECTRICAL CHARACTERISTICS

TRANSISTOR TEST: Dependable industry-approved two-step test on both n-p-n and p-n-p transistors, using internal dc power supply: (1) leakage measurement of collector current and (2) direct reading of current amplification factor or Beta. Saves you the cost of a separate transistor tester.

DYNAMIC CONDUCTANCE TUBE TEST: Composite indication of mutual conductance (Gm), plate conductance (Gp) and peak emission capability. Test accuracy is assured by the following:

- Multi-circuit lever switch for speedy simultaneous selection of any one of 4 combinations of 3 plate, 3 screen and 3 ranges of control grid voltages.
- Grid voltage variable over each range with a 5% accurate wirewound potentiometer.
- 5 ranges of meter sensitivity using 1% carbon-deposited shunts and 5% accurate wire-wound meter range potentiometer.
- 200 ua meter provides unusual sensitivity for checking tubes with low cathode current.
- Rectifiers tested near maximum rated current for extra accuracy. Leakage Test: Direct-reading of inter-element leakage in ohms, with these features:
- Sensitive 200 ua meter permits accurate readings up to 20 megohms.
- DC leakage test voltage always applied in correct polarity to eliminate emission effects from readings.
- Accurate heater-Cathode leakage readings achieved by isolation of heater and cathode from remaining tube elements during test.
- 10 push-button switches permit rapid insertion of alternate tube elements in leakage test circuit.

Each active tube element can be individually connected to any of the following busses: plate voltage, screen voltage, grid voltage, filament voltage, ground (cathode and filament return), no connec-

Multi-section tubes have each section individually tested by rapid push-button selection—while all sections are simultaneously drawing full-rated current . . . Pentodes are tested as pentodes, with no "lumping together" of tube elements. Filament switch provides selection from 20 filament voltages: adequate for all older tube types in use as well as for the new 600, 450 and 300 ma series string tubes.

Line voltage may be read directly off the dial of the line-adjust rheostat on the panel with good accuracy.

Rollchart is extensive, up-to-date, and includes settings for all new

Exceptional control accuracy makes possible a very easy method for developing accurate test settings for new tube types before such data is published on a new rollchart. Snap-in rollchart windows for easy entry of new test data.

Power: operates from 105-130 volts AC line, 50/60 cps. Provided with pilot lamp and fused for safety.

with pilot lamp and fused for safety.

PHYSICAL SPECIFICATIONS

Components specifically selected for ruggedness in day-after-day servicing.

New gear-driven rollchart mechanism is easily assembled, pro-

vides smooth trouble-free operation. Snap-in windows permit settings for new tubes to be entered on rollchart without disassembly.

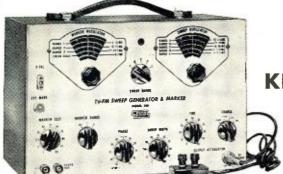
The 10 individual element push-buttons are ganged on one easily-mounted assembly through which they are interlocked mechanically and interconnected electrically to simplify mounting and wirely account after operation. ing and assure safer operation.

The 10 SIX-position lever switches plus the two lever switches The 10 SIX-position lever switches plus the two lever switches for meter shunt, and plate, screen, and range of grid voltage selection, are all ganged together to form one quick mounting assembly for not only very rapid settings but easier wiring for the kit constructor. The only internal adjustments in this tester are two calibrating rheostats for the line adjust and leakage measurement circuits. All the equipment required to calibrate the tester is one voltmeter of any

The "Tube Merit" Switch, through which plate, screen, and grid voltages are applied to the tube under test, is of the spring-return type to eliminate the possibility of damage to the tube tester by continuous operation of a defective tube.

Deep-etched, heavy gauge, brushed satin aluminum panel; 4½", 200

ua D-Arsonval meter movement, in clear lucite case; rugged grey wrinkle steel carrying case with matching steel cover and carrying handle for easy portability. Dimensions: 12" x 15" x 6". Weight:



The most highly perfected service instrument of this type presently being offered in either kit or wired form at ANY

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For accurate alignment of FM, TV Monochrome and Color sets; all RF, IF and oscillator stages, including intercarrier; all sound and video traps. High RF output for alignment of boosters, tuners, and other RF circuits without need for additional amplification.

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RADIO & TELEVISION NEWS



NEW! COLOR and Black-&-White LAB & TV 5" OSCILLOSCOPE #460 KIT \$79.95. Wired \$129.50

The FINEST professional 5 mc wide-band scope value. Ideal for research, h-f & complex waves, plus Color & Monochrome TV servicing. Flat from DC to $3.58 \text{ mc} \pm 1 \text{ db}$ (color burst freq.), flat DC to 4.5 mc + 1, -3 db. Vert. sens. 25 rms my/in. Vert. Z 3 megs. Has the following outstanding features not found in scopes up to several times its price, kit or wired:

VERTICAL AMPLIFIER: direct-coupled (DC) thruout to eliminate l-f phase shift; push-pull thruout for negligible distortion; K-follower coupthruout to eliminate 1-f phase shift; push-pull thruout for negligible distortion; K-follower eoupling between push-pull pentode stages for extended h-f resp. (minimizes h-f phase shift, extends useful resp. to 10 mc); full-screen undistorted vert. defl; 4-step freq-compensated decade step attenuator up to 1000:1. SWEEP CIRCUIT: perfectly linear sweeps, 10 cps — 100 kc (ext. cap. for down to 1 cps); pre-set TV vert. & hor. positions (30 & 7875 cps); automatic sync. ampl. & limiter eliminates sync amplitude adj. PLUS: direct or cap. coupling; bal. or unbal. inputs; edge-lit engraved lucite graph screen; dimmer; anti-glare filter; bezel fits std photo equipt. OTHER IMPORTANT FEATURES: High intensity trace CRT. Finest sq. wave resp. (.06 usec rise time). Push-pull hor. ampl., flat to 400 kc, sens. 0.6 rms mv/in. Built-in voltage calibration. Intensity mod. Sawtooth & 60 cps outputs. Astigmatism control. Retrace blanking. Instant, drift-free full-screen vert. positioning & 2X full-screen hor. Dositioning. Bal., cal. astig. adj. externally accessible. 5UPI CRT, 2—6AU8, 2-6CB6, 1-12AU7A, 2-6]6, 1-6AX5, 1-1V2. Deep-etched satin aluminum panel, rugged grey wrinkle steel cabinet. Designed for easy building at home with no special equipment. 13" x 8½" x 16". 30 lbs.

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HE great increase in private flying among businessmen, farmers, and others within the last few years has brought aviation electronics into a new importance. As the sales of small aircraft have skyrocketed it has had a very stimulating effect on the production of radio and navigation gear designed for these private and business type aircraft. Because of this surge of aircraft business a host of small, related industries have become great producers complete with research facilities and field engineers. Not the least of these are the producers of aviation electronic equipment which have grown from a small handful of little companies and little departments of big companies into "junior-grade titans" of industry. They are producing intricate radio, navigation, and control gear that formerly was available only to the large airlines and military aircraft. They have accomplished this by eliminating elaborate circuitry and utilizing better design features. The net result has been a wider selection of equipment for the private pilot and new fields of endeavor for the electronics technician.

In this article we shall discuss some of the many electronic aids that are in current use in small aircraft. Important stress is put upon characteristics that affect aircraft performance such as weight, size, power drain, and any design features that may be detrimental to flight safety. For this reason aircraft installations use integrated units and combinations to prevent duplication of function wherever possible. Power supplies are highly versatile and designed so several units may obtain plate voltage from a single source.

A review of some of the electronic gear that the airport technician will encounter and be called upon to service.

Another important factor in the design of aircraft radio systems is the cost. Many of these planes are owned and operated by small concerns and individuals who are subject to a strict budget and cannot afford a large cash outlay for a complete communications system. Therefore, designers have devised "building block" methods whereby a complete system can be obtained in easy stages starting with a few basic units. One company advertises eighteen different combinations from primary to complete systems.

Of first importance to a pilot is some means of two-way communications so he can obtain weather information and flight instructions. An early answer to this problem came in the form of a single-channel transmitter and two-band receiver. The transmitter was a crystal-controlled oscillator feeding a single-ended power amplifier. The crystal was cut for the low operating frequency of 3105 kc. This frequency, however, has been changed by the FCC to 3023.5 kc., which is now the calling and working frequency for private aircraft in the low-frequency band. The receiver was a two-band affair tunable from 200 kc. to 400 kc. and across the standard broadcast band. Plate voltage was supplied by a vibrator power supply similar to the type used in many auto radios. Although many of these lowfrequency systems are still in use in early model aircraft, they have a great many drawbacks. At the low transmitting frequency used by these sets

a considerable length of wire must be strung about the aircraft to obtain good transmission characteristics. These antennas may be either fixed or trailing wire types. However, the added drag caused by these antenna systems and the possibility of a broken wire becoming tangled in control surfaces was a strong argument in favor of higher frequencies.

Lighter component parts, streamlined antenna systems, and better signal-to-noise ratio evolved the v.h.f. command systems of today. A typical v.h.f. system may have from four to twenty-seven crystal-controlled transmitter channels and a tunable v.h.f. receiver from 108 to 126 mc. A quarter-wave whip antenna gives very satisfactory communications for lineof-sight transmissions up to 75 miles or more, depending on altitude and atmospheric conditions. Most of these v.h.f. transmitters employ a twin triode, such as the 6J6, as an oscillatortripler, another as tripler-doubler and a 6AK5 or 6AN5 for power output. Overtone crystals are used to generate fundamentals. The eighteenth harmonic is then taken as the operating frequency. A small, slug-tuned transformer with a loop for an indicator bulb and an antenna completes the two-watt v.h.f. transmitter. The audio output stage of the receiver usually doubles as the modulation circuit for the transmitter and plate voltage is derived from a common source with the receiver and other equipment.

A few dynamotor supply systems are

in use although vibrator systems are more popular because of lower cost. The "black box" for the power supply is usually an integrated piece of equipment which may house the audio output-modulator system or more complicated circuitry for an automatic direction finder or omnirange system.

The v.h.f. receivers feature slug tuning and dual impedance output so either headsets or speakers may be used. Receivers are usually part of a package that contains transmitter, v.h.f. receiver, and low-frequency receivers. These low-frequency receivers also have some means of receiving the 75-megacycle marker beacon that indicates airways and runway approaches. This whole package mounts on the instrument panel of the ship.

Radio Compass—ADF

In fair weather or foul the radio compass is an important aid to navigation. With it the pilot may tune in a known station and his radio compass will present a needle indication giving him the relative bearing of the station from the azimuth of his ship. By keeping the needle on the zero mark he may home in on his destination and greatly simplify navigation. On long flights he can determine his exact location by taking a "fix" on two or more stations with his radio compass and then plotting the bearings on a chart. Where the bearings intercept there is his position.

The radio compass is not a new idea. It has been used by ships at sea for many years and a version of it appeared in the early, low-frequency radio systems. This consisted of a loop of wire strung inside the fabric fuselage. In order to obtain a bearing the pilot would fly his ship to get an aural null. This would indicate that the station was facing a broad side of the loop and a signal was being induced into each leg of the loop, out-of-phase, cancelling each other. By obtaining this null point the pilot knew his heading was either directly toward or directly away from the station. To determine which, he had to take two bearings on the same station. First he would obtain his null on a known station then he would make a 90° turn and fly tangent to the course for a few minutes. Then he would turn back toward the original heading and seek his null point again. By observing the change in his magnetic bearing he could determine the true null and the direction of the station. To eliminate this time-consuming procedure the manual loop antenna was produced and added to the low-frequency system. Instead of turning the airplane the pilot needed only to turn the loop antenna. Radio compasses of today offer a completely automatic loop that uses a "sense" antenna to distinguish between the true and false null. The heart of the automatic direction finder is this ability to give only one true null point for a received station. This is accomplished by using the signal received on the sense antenna as a reference point to which the signals from the loop are compared.

The signal received on the loop antenna is 90° out-of-phase with the signal received on the sense antenna and leads or lags the sense signal depending on position to left or right of true null. In the set this loop signal is retarded another 90°. Consequently, the loop signal will then be either in-phase or 180° out-of-phase with the sense signal. After it is retarded 90° the loop signal is fed to the grids of a dual triode. This is the balanced modulator. The halves of the balanced modulator are fired by an a.c. switching voltage which modulates the in-phase or outof-phase loop signal. When combined with the signal from the sense antenna the modulated signal is either cancelled or added to the sense signal. There are several means of transmitting this information to the loop mo-There are thyratron systems, saturable-reactor systems, and phasesensitive motor systems. The simplest is the phase-sensitive motor which reacts to the output of the balanced

Some of the disadvantages of the radio compass lie in its low operating frequency which is susceptible to a high degree of noise. "Mountain effect" and "cloud effect" are deceptive characteristics of the radio compass whereby it may home on a reflected signal from a mountainside or the ionosphere. If a pilot relaxes his vigilance when using the radio compass he may very well follow a false signal to a serious accident. Another disadvantage of ADF operation is inherent in the concept itself. The radio compass indicates the relative position of the station to the heading of the aircraft. This does not fix the position of the ship along a given line without taking other headings and correlating this information with other instruments. A pilot may know that a station is 30° to port but he cannot know where he may be around the station unless he

takes another fix or observes his magnetic compass.

The radio compass automatic direction finder is a useful bit of gear in any aircraft as long as the pilot realizes its limitations and does not try to make the ADF do all his navigating for him.

Omnirange

The omni system works in the 112 mc. to 118 mc. region and therefore has all the advantages of v.h.f. It is noise free and much less susceptible to mountain effect. Since omni is above the zone of ionospheric reflection there is no trouble from that source. In addition the omni signal gives the pilot considerable information about his position relative to the ground station. There are now more than 375 omni stations throughout the country and more appropriations have been released for further construction. This makes it possible to fly from almost any point in the U.S. to any other point solely on omni navigation.

The omnirange system works on the composite signal principle. The v.h.f. carrier is amplitude modulated with a 9960 cps signal which is usually detected in existing v.h.f. receivers and fed to a separate unit, the omni converter. Impressed on the 9960 cps subcarrier are two 30 cps signals that owe their phase relationship to their compass position from the omni transmitter. One 30 cps signal is the reference signal which is of constant phase about the transmitter. The other is a variable phase signal. This signal is created by a slotted, revolving cylinder about the transmitting antenna which frequency modulates the radiated signal. This signal, then, is the means whereby the omni information is obtained. At 0°, or magnetic north, from the omni transmitter the variable 30 cps signal is exactly in-phase with the 30 cps reference signal. As a circle is transcribed about the transmitting antenna, the variable phase signal begins

Twin Cessna 310 showing "V" shaped dipole on top of vertical stabilizer for v.h.f. reception of omnirange signals. Mast on top is for v.h.f. transmitter and fixed wire from mast to the stabilizer is for low-frequency reception of transmissions.



RADIO & TELEVISION NEWS

to move out-of-phase with the reference, due to the action of the revolving drum. At 90° magnetic bearing from the omni station the variable phase signal is 90° out-of-phase with the reference signal. At 180° magnetic bearing it is 180° out-of-phase and so on around the points of the compass. This is the equivalent of radiants progressing from the center of an imaginary circle into space. Each radiant is of a different characteristic which identifies magnetic direction. This gives the pilot a ready indication of his direction and relative position to a fixed point on the ground.

Omnirange installations in small aircraft can be identified by the horizontally polarized dipole antenna usually projecting from the top of the vertical stabilizer or under the tail. Some omni systems employ a scope mounted on the instrument panel. The face of the scope has a calibrated circle marked off in degrees of the compass. When the omni signal is received the electron gun in the CRT traces a circle coincident with the one scribed on the face. The directional indication is represented by a small pip along the circular trace.

Instrument Landing Systems

The approach to every major airport has a system of instrument landing by the use of radio beams. These consist of the glidepath beam, the localizer beam, and the marker beacon. The marker beacon consists of an outer and inner marker which indicates the distance to the end of the runway. It is used in conjunction with the localizer and glidepath to properly position the ship prior to let down.

The principle of operation of the localizer and glidepath is basically the same. The localizer operates on a carrier of 108.3 mc. to 110.3 mc. The left side of the approach is amplitude modulated with 90 cps and the right side is modulated with 150 cps. The carrier frequency is received in existing v.h.f.

receivers and detected. This detected signal is then applied to the ILS unit which contains two bandpass filters and a system of rectification. The detected signal is applied to both filters. one of which is tuned to 150 cps and the other to 90 cps. If the aircraft is to the left of the center approach, then the 90 cps signal will be admitted by the 90 cps filter, rectified, and the subsequent d.c. component will be applied to the vertical needle in the ILS indicator. The glideslope operates in the same manner with 90 cps above the glidepath and 150 cps below the glidepath center. As long as the aircraft is following the center line between the localizer and glidepath beams, equal d.c. signals will be applied to a vertical and horizontal needle in the ILS indicator. The needles will then be centered and indicate that the ship is "on the beam."

Automatic Pilot

An aircraft has three axes of motion; roll, pitch, and yaw. In small aircraft every slight air current tends to deter the plane from its on-course straight and level flight. Because of this the pilot is working continuously to keep his aircraft on course and in the proper attitude. It is obvious that if he must spend all his time flying the airplane he is left little time for navigation and less to enjoy the ride. This also induces "flight fatigue" which is a serious deterrent to maintaining safety on long flights. For these reasons there have been a number of autopilots and partial autopilots put on the market for small aircraft. They range from simple, singleaxis rudder controls to complete, three-axis autopilots that even have an approach coupler to follow the ILS beam automatically!

Basically, all autopilot systems employ three devices, the sensing element such as a gyro with a *pick-off* system, an amplifier which amplifies and analyzes the "signal" from the gyro

pick-off, and a servo system that translates the analysis of the amplifier into mechanical efforts on the aircraft control surfaces to return the ship to its on-course attitude. When the autopilot is engaged the human pilot may tend to his navigation or just sit back and relax because the autopilot can make minute corrections in his course faster than he can detect them. The result is a smooth, level flight, on course, without flight fatigue.

There are several refinements to the basic autopilot system just described that go a long way toward perfecting the system. One of these refinements is the follow-up. The follow-up acts as an artificial "spring" to help keep the plane from overshooting the course when the autopilot acts to correct errors. The follow-up is connected to the control surface of the aircraft and gives negative feedback into the amplifier. This produces a closed loop system to dampen the action of correction so the aircraft will not oscillate about the on-course line.

Another refinement in the basic autopilot concept is the rate network. This is an RC bridge that develops the change of the sensing device across a resistor. The output of the sensing device determines that the aircraft has left its on-course attitude, how far the ship is off course, and in which direction. The rate network determines the rate of departure from the course and gives additional energy to the correction system proportional to the rate of departure. Likewise it determines the negative rate when the aircraft returns to its course and helps the follow-up dampen the return to on-course position. Some systems have an altimeter working in conjunction with the autopilot to maintain a constant altitude as well as constant attitude.

Automatic Propeller Control

Many of the functions once performed by mechanical means are now done electronically because of cost. efficiency, and adaptability to small aircraft needs. In some of the more elaborate small aircraft an electronic device is employed to control the speed of the propeller and thereby gain maximum performance from the powerplant of the ship. This device has a sensing element in the nature of a spinning magnet that is coupled directly to the propeller. The speed of the magnet exerts force on an iron vane to keep it in a neutral position. Since the vane is spring loaded it will deflect in one direction if the magnet slows down and will deflect in an opposite direction when the spinning magnet speeds up because of the increased magnetic pull exerted upon it. The vane is positioned in such a manner so that it covers the orifice to two photocells when it is in the neutral position. If it deflects in either direction, one of the photocells will be exposed to a small light. This, then, is the sensing element. The signal from the sensing element is fed to an am-

(Continued on page 100)

Topside is the fixed wire from mast to tail for the low-frequency receiver. Midwing is the whip antenna for v.h.f. transmitter and omni-dipole is extended from top of tail. Fixed wire on the bottom is for the reception of marker beacon transmissions.



December, 1956

GREAT DEAL has happened in the world of high fidelity since the famous Cinaudagraph and Jensen speakers of the thirties. The growing demand for good sound has spurred the establishment of dozens of new speaker manufacturers and today the hi-fi fan can choose from literally hundreds of speaker models. The purpose of the speakers has not changed however; to convey to your ear the impression of a full symphony orchestra or a girl with a song on her lips. It's a tall order and the wonder is that modern speaker systems can come so close to filling the bill.

It will be confirmed by most highfidelity experts that the selection of the speaker system is the most critical choice in assembling a good hi-fi rig. All of the components are, of course, important but there are more noticeable differences in speaker systems than in the other parts. Unfortunately, no method of measuring the fidelity of a speaker has been devised which will tell how it sounds. Even the experts disagree on the type of sound at which we are aiming. Specification sheets and advertisements cannot describe the sound of a speaker and can actually be misleading.

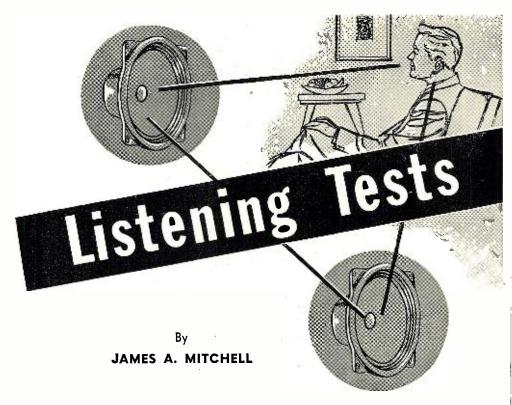
In general, most newcomers to high fidelity choose their speakers from the most widely advertised and promoted ones. Those with a bit more knowledge often make a choice from specification data or from the principles of engineering used. On the basis of experience, the author maintains that both of these methods can lead to bad selections. Only one method of speaker system selection has proven to be satisfactory. This is the listening test, but even this method can be ambiguous without a little experience.

It is our plan, therefore, to discuss the fundamentals of listening tests to enable you to select a speaker system which will best fit your needs. Now by "the speaker system best fitting your needs" we mean the speaker system which within your space and budget limitations will give you the most satisfying reproduction of music in your home over a long period of time. Since different people have different ideas of how music sounds or how it should sound, there will naturally be differences of opinion about speakers. However, a good listening plan will enable each type of listener to find the speaker which will satisfy him.

About Listening Tests

Our perception is such that differences in sound are best observed by an instantaneous switch from one speaker to another. Most of the audio equipment salons are set up to make such A-B comparisons. Under proper conditions these tests can be most revealing. Listening at a friend's home can also be valuable as the longer listening periods and home acoustics help you imagine the same speaker in your home.

The most pleasant sounding speaker



If you have a good ear or are musically trained and know how a musical selection should sound, listening tests are OK, but don't trust them 100% if blessed with a "tin ear".

system, in the long run, is generally one that is the most natural or realistic. For this reason it is well for the prospective speaker buyer to educate his ear on "live" sound. If you have done most of your listening to records or radio, go to a few concerts. Listen to a symphony orchestra, a violinist, a soprano, a jazz band. Imagine the sound in your home which would give the best illusion of the real thing. Remember this when comparing speakers

The more experience you have in listening the better you are able to select a satisfactory system. If you are a newcomer to high fidelity you may profitably buy a speaker in the lower priced brackets first; then after your tastes have matured, select a better and more expensive unit. Learning how to pick a speaker system which will satisfy you for a long period of time takes some perception, but it can be done. This is not all a matter of paying a lot of money for a speaker system. There are some excellent moderately priced units which will meet the needs of the sophisticated listener, and there are some high priced systems which can set you on edge after a period of listening.

There are a number of points about listening tests which should be kept in mind if we are to gain the correct impression. The source of the sound used in the test is most important. Some records can cause very misleading results. A record with considerable distortion at the very high fre-

quencies can make the speaker with the poorest high-frequency response sound the most distortion free. Other sources of confusion are discs containing rumble, buzz, transient distortion, and unnatural or overemphasized effects. A bad record doesn't sound good over a good speaker; a poor speaker may mask some of the distortion on the record. It is a good plan, therefore, to do your comparative listening using records you know to be good. The author believes that comparative speaker tests should be run using the best quality records available. Records will probably keep improving after you buy your speaker. Old and distorted records can best be handled by tone controls and cut-off filters, not by buying limited range speakers. author recommends that you use some of your own records for listening tests. A few well chosen ones will be all you need and you will have the advantage of being thoroughly familiar with

It is also important that the rest of the equipment used in the sound comparison test be in good condition and properly adjusted. A worn pickup stylus can upset any listening demonstration. Make sure that the preamplifier-equalizer settings are the correct ones for the records used. It is also desirable to start the listening tests with the tone controls set at flat response. Also make sure that the loudness compensation is switched out. Tests conducted with the loudness compensation on can be very ambig-



uous since you are never sure of the amount of bass and treble boost especially when the volume control position is changed. As far as the choice of specific pickups, preamps, and amplifiers for speaker demonstration is concerned, there are two theories. One is to use the same equipment up to the speaker as you are now using or planning to buy. The other plan is to use the best equipment available. Either method is OK but the latter may be preferred if you plan to upgrade your equipment progressively.

The audio demonstrator has a problem in conducting A-B speaker tests when the two speakers have different efficiencies (which is nearly always the case). It is universally agreed that in order to compare speakers they should be heard at the same loudness level as they are switched back and forth in the A-B test. Our hearing is such that we are led to believe that the louder of two sources has more bass, is more brilliant, and has less distortion when they are, in fact, the same. This can cause confusion in any listening comparison depending on how the problem is handled. Some audio showrooms use attenuators between the amplifier and the speakers to adjust all of them to the same loudness. Others feed the speakers directly and let the loudness vary with the speaker's efficiency. While the use of attenuators solves the problem of changes in loudness, it introduces a difficulty of its own. Attenuators between the amplifier and speaker change the damping factor of the amplifier as seen by the speaker. Changing this damping factor, or source impedance, changes the frequency response of the speaker (especially in the low bass) and the damping characteristics (trancient response) of some speakers. To be fair, speaker systems should be compared using the same amplifier damping factor or, to be even more correct, the A-B test should be conducted switching between two identical amplifiers each adjusted to the optimum damping factor for the speaker with which it is used. This complication is really necessary only for a few speakers. The author prefers the

method where no efficiency corrections are built in, as this gives you a chance to learn what differences in speaker efficiency really exist. In making an *A-B* test, twist the volume control as the speaker switch is flipped to get the same loudness from the two speakers. A few trials show how.

Another problem in making speaker comparison tests is created because the unit is housed in the wrong type of cabinet or enclosure. It should be emphasized that the enclosure or baffle for the speaker is as important as the speaker itself in determining the quality of the sound. You will note that we have been talking about speaker systems rather than just loudspeakers. By a "speaker system" we mean a speaker or set of speakers in a complete mounting or enclosure. The whole system must be considered as a unit when talking about the ability of a speaker to reproduce musical quality faithfully. To give a fair listening comparison a speaker should be tested in the enclosure recommended by the manufacturer. Be wary of judging a speaker of one brand which is demonstrated in an enclosure designed for a different speaker. Sometimes these mixed systems work out well but more often they do not. It is common practice in many audio showrooms to mount a group of 10 to 20 speakers in a wall for listening comparison. While this has the advantage of allowing the comparison of a lot of speakers, it may be a bad setup for running a really definitive test. If the units are all mounted on the same board without separating partitions between them. there may be serious interaction between some of the units. The position of the speaker on the wall will greatly influence the bass response. If the speakers are each in small boxes with bass reflex ports, the cabinets are probably not properly adjusted for each speaker. Then, too, some speakers are definitely not designed for bass reflex mounting. If the speakers are mounted in closed boxes of reasonable size with rugged construction and with good acoustical padding, the setup may be regarded as a reasonable compromise between compactness and fair

comparison. The high-frequency and mid-range tones of the speakers can be fairly judged under these conditions. The low bass range can be quite different in a properly matched enclosure and this should be constantly kept in mind. Preliminary comparisons can thus be made on this type of setup but for final choice always insist on hearing the speaker in the enclosure which you intend to buy. Remember it is the sound of the speaker system to which you will listen.

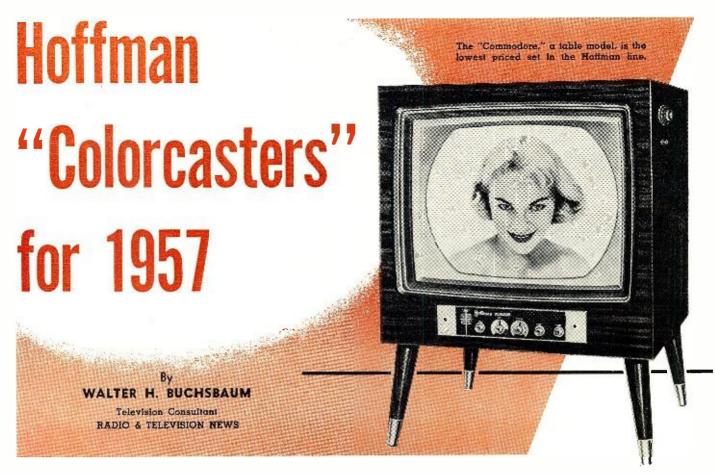
Choosing a System

If you are a novice at this hi-fi business, it is suggested that you visit an audio sales showroom. Discuss your installation with the salesman and get a general picture of what he has to offer and the type of listening facilities available. Listen a little if you wish but don't decide on the first visit. Make an appointment to come back when you can bring your own records and listen for an hour or so. Most audio salesmen are anxious to help you find the speaker which best suits your ear and will be glad to work with you.

A good way to start the listening comparisons is with a wide-range, lowdistortion symphonic orchestra disc. The music at the start of RCA Victor's "An Adventure in High Fidelity" (LM 1802) is a good example for this test. So is Westminster's "Sailor's Dance" from "The Red Poppy" (WL 7001). If you prefer jazz, try the Ray Anthony "Sound Off March" on *Cap*itol LAL-9022. Listen for over-all naturalness of sound. Are the high notes clear but not overemphasized? Can you hear the shimmer of the triangle free from buzz? Note if the mid-range instruments (trumpets, cellos, clarinets) are full bodied and real in sound. while remaining separate and distinct. Listen for the bass response of bass viol, organ, tuba, and tympani. These instruments should be clearly reproduced with good volume by the speaker system while maintaining the character of each. Beware the "boompwhoomp" quality of loud but muddy one note bass. Be careful not to mistake excessive brilliance for clarity. It's easy to build a tweeter which will give cymbals more clash than they really have. Such a speaker may amaze you at first, but listen longer and keep the sound of that live symphony orchestra in mind.

Compare the speaker's performance at low- and high-volume levels. Listen to the differences in clarity as the music hits volume peaks at loud levels. Then turn the volume down to a quiet living room level. Note which speakers change the least in tone color with this change in volume. Many speakers have a tendency to sound as if they lose uniformity of frequency response at fairly quiet volume levels. Low volume listening quality is very important in a speaker for home use. It takes a good speaker to sound full and

(Continued on page 160)



Owner appeal, convenient operation, and quality performance are the goals of this manufacturer.

NE enthusiastic manufacturer of color TV receivers, Hoffman Electronics Corp., is now featuring its third series of color models. The first two were the 15- and 19-inch shadowmask tube versions of several years ago; the latest series of receivers uses the 21AXP22 exclusively. This tube is the round metal envelope improved shadow-mask version used in RCA, Emerson, and many other late-model color sets. In all Hoffman "Colorcasters" the picture tube is mounted in the cabinet and shipped in place.

Four basic receiver models comprise the new "Colorcaster" line, each available in mahogany, limed oak, and Salem maple veneers with prices varying according to the type of finish. Basically equipped with a v.h.f. tuner, each receiver is also furnished for full 82-channel reception at a slight increase in price. When a u.h.f. tuner is included, the model number remains the same but with the letter "U" added.

The lowest priced model is the "Commodore," a table model costing from \$595 to \$645, depending on the finish and whether or not it includes a u.h.f. tuner. The "General" is an open-faced console with the speaker panel below the screen; while the "Ambassador" is a lowboy style cabinet with the speaker mounted alongside the picture tube. An elaborate three-speaker sound system is used in the

most expensive model, the "President." Table 1 lists the recommended retail prices on the *Hoffman* color line.

Like some of the new RCA color receivers, the Hoffman "Colorcasters." with the exception of the "President" model, have the station selector and "on-off"-volume control at the upper side panel. The "President" has all controls on a vertical front panel alongside the screen. An unusual and novel feature is the addition of color dials to the hue and chroma-gain controls. As indicated in Fig. 1, the hue control background dial has a red and green section at the sides with a flesh color setting in the center. This helps the customer to remember that, by turning the knob to the right, greenish hues will predominate, while turning it to the left will increase the emphasis on the reds. The correct position of the hue control is indicated in the viewed picture by the naturalness of the flesh colors. When the flesh tones in the picture appear too reddish, the customer will have no difficulty in deciding in which direction the hue control should be turned.

The action of the chroma gain or "color brilliance" control is made graphic as well. Three color stripes, which taper from the weakest chroma gain to the saturation point where the stripes are thickest, are shown in Fig. 1. This clever use of human engineer-

ing in illustrating the purpose and action of the hue and chroma controls should avoid many service calls due to customer misunderstanding.

Another control that is not found in many other color receivers is the "Town and Country" switch included in every model. The action of this switch is basically the same as the "local-distance" switch used in many familiar monochrome TV receivers. Its presence in a color set, however, is new and will be a considerable help in locations of either excessive signal strength or in fringe areas.

In the "President" model, the chassis is mounted on its side, with the tubes pointing toward the picture tube and the bottom of the chassis accessible when the side panel of the cabinet is removed. The other three models have the chassis mounted underneath the picture tube, but with the feature that the entire chassis slides out at the rear for easy servicing. In addition to the customer-operated controls, almost all of the other adjustments are located under the removable small subpanel below the screen. These controls, together with some adjustments accessible from the rear of the receiver, permit the service technician to adjust for optimum monochrome and color performance.

Service and Installation

Hoffman's policy is that TV receiver installation and all service is the function of its distributors and dealers. Detailed service bulletins, as well as con-

RADIO & TELEVISION NEWS

siderable basic instruction in color TV, have been furnished by the factory and, in addition, each receiver is supplied with a diagram (complete with frequencies, voltages, and waveforms) fastened on the inside of the cabinet.

The standard warranty for one full year on the picture tube and 90 days on all parts is provided by the manufacturer. Regular installation and service contracts are available from local dealers. Prices of these service contracts depend on the individual store and local labor charges.

Each "Colorcaster" is shipped complete and ready to operate but the average purchaser will still require an expert to install the set. Aside from the availability of a usable antenna, the color purity, convergence, and synchronizing controls almost invariably require adjustment.

Circuit Features

All of the Hoffman color receivers use basically the same receiver chassis with only minor modifications, usually involving the number of speakers, u.h.f. tuner, etc. This chassis employs circuitry described in detail in the September 1956 issue of this magazine and is quite similar to the RCA Victor receiver described in the March 1955 issue. One of the outstanding differences is in the action of the contrast and chroma-gain controls. By coupling these two controls together and by some modifications in the video circuitry, the usual problem of balancing out contrast with chroma gain is eliminated. Whenever the contrast control setting is changed, a corresponding change takes place in the chroma section with the result that color and Y-signal gain track closely.

Other features include the use of a synchroguide horizontal oscillator and a.f.c. stage, instead of the familiar multivibrator circuit. Also, in the interests of producing a quality image, there have been alterations in the color producing portions of the re-

ceiver circuit.

Revisions in the latter direction are concerned mainly with providing wider bandpass in the color-signal circuits. As an example, two stages of bandpass amplification now precede the color demodulator circuits, where one was used before.

Also, the widely adopted high-level narrow-band triode demodulators have been abandoned in favor of low-level wide-band stages. The receivers use a pair of color detector stages identified as the X demodulator and the Z demodulator. The X demodulator feeds to the grid of the R-Y amplifier, while output from the Z demodulator is applied to the B-Y amplifier. The G-Y signal is produced from the mixed R-Y and B-Y signals.

Another alteration is intended to facilitate balancing out the outputs of the three guns in the picture tube. In earlier receivers, separate controls were provided for the blue and green guns, but none for the red gun. Balance was achieved by manipulating

			SCREEN		
NAME	MODEL NO.	TYPE	SIZE*	FINISH	PRICE**
Commodore	M2021	Table	21"	Mahogany	\$595.00
	B2021	Table	21"	Limed Oak	615.00
	P2021	Table	21"	Salem Maple	615.00
General	M4041	Console	21"	Mahogany	695.00
	B4041	Console	21"	Limed Oak	715.00
	P4041	Console	21"	Salem Maple	715.00
Ambassado	r M4061	Lowboy	21"	Mahogany	775.00
	B4061	Lowboy	21"	Limed Oak	795.00
	P4061	Lowboy	21"	Salem Maple	795.00
President	M4021	"Soundorama" Console	21"	Mahogany	795.00
	B4021	"Soundorama" Console	21"	Limed Oak	815.00
	P4021	"Soundorama" Console	21"	Salem Maple	815.00
*D:1		. 1			

Diagonal measurement.

Table 1. The current line of Hoffman "Colorcasters" includes four basic models, available in a choice of three different wood finishes, from \$595 to over \$800.

the blue and green controls along with the master brilliance control, which affected output of all three guns simultaneously. The present arrangement is easier to adjust: there are separate controls for the red, green, and blue guns on the latest "Colorcasters."

For the rest, circuit design and lavout do not present any radical departures from the color sets of other manufacturers.

Since installation and service are not under direct control of the manufacturer, with policy being determined locally by distributors, there is no set pattern as to whether the distributor's service personnel or that of the dealer will be responsible for the receivers after they are in the hands of their owners. Nor is there any pattern evident as to whether the receivers will be serviced on an individual-call or contract basis and, if the latter policy is to prevail, what the cost of the contracts will be. With this uncertainly, the set maker has apparently felt obligated to make available the best possible data for use by whomever will be called on to work on the sets. The well-illustrated service

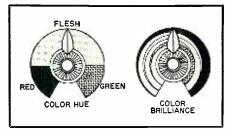


Fig. 1. Use of actual colors on the color hue and color brilliance controls is to make their functions graphic to the technically uninitiated. Note taper of the three color stripes around the color brilliance knob, to indicate range from pastel shades to saturated shades.

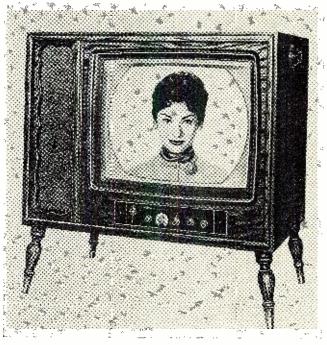
booklets on the "Colorcaster" chassis give complete and detailed instructions on procedure and adjustment.

At the time this article was prepared, Hoffman had scheduled full production of all the models discussed here. Plans call for the marketing of this color line throughout the 1956-57 business year. Additional models may be released as required but the main line has been planned for current availability.



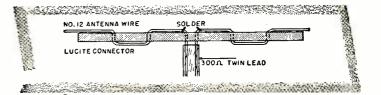
The "Ambassador," lowboy model available in choice of three finishes, is made to sell for under \$800. Note station selector and onoff-volume control on upper side panel, while other controls are under the picture tube, located on the horizontal chassis.





^{**}Price is suggested retail for manufacturer's local zone (with tax) on v.h.f. models. The u.h.f. models are from \$20 to \$30 higher.

Off-Center-Fed



ANTENNA DESIGN

Basic off-center-fed long wire antenna with 300-ohm feedline. Two methods of connecting transmission line to the antenna are shown at the right. Note that line is not fanned out.



Details on a multiband antenna which is especially useful in locations where only one array is possible.

THE off-center-fed antenna is a convenient type to use for multiband operation under conditions where it is impractical to have a separate antenna for each band and a non-resonant feeder is desired. It should be understood that this is not a cure-all antenna and its operation must be studied if the most satisfactory results are to be obtained.

This antenna has shown some popularity in the last few years because of the desire of many amateurs to change bands with their "Viking" or Collins 32V series transmitters without changing antennas. By using the proper matching networks, such as balun coils or antenna tuner, the off-

center-fed antennas will load up easily.

The frequencies at the low end of each short-wave amateur band are harmonically related to each other, except for 160 meters, yet the resonant frequencies of a piece of wire are not. To be resonant for a certain frequency, a piece of wire is shorter than the wavelength of the frequency in space due to the end effect (loading caused by the added capacity of the insulators and tie loop). The wire is about 5% less, which may be written:

L = 492(N - .05)/f

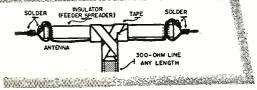
where:

L = length of wire in feet

N = number of half wavelengths f = frequency in megacycles

	80-METER FUNDAMENTAL			
Length	Frequenc	ies (in mc.) for	following wa	velengths
(ft.)	1/2	1 .	2	4
138	3.39	6.95	14.1	28.4
137	3.41	7.0	14.2	28.6
136	3.44	7.05	14.3	28.8
135	3.46	7.1	14.4	29
134	3.49	7.15	14.5	29.2
133	3.52	7.21	14.6	29.4
132	3.54	7.26	14.7	29.6
131	3.57	7.32		
130	3.6	7.38		
128	3.65			
126	3.71			
124	3.77			
	40-ME	TER FUNDAM	ENTAL	
68.5	6.84	14.0	28.4	
68	6.88	14.1	28.6	
67.5	6.93	14.2	28.8	
67	6.98	14.3	29.0	
66.5	7.04	14.4	29.2	
66	7.09	14.5	29.5	
65.5	7.15			
65	7.2			
64.5	7.26			

Table 1. Various harmonic frequency combinations are shown here for multiband ham operations with 80 and 40 meter fundamentals.



By WILLIAM O. HAMLIN, WIMCA

Supervisor, Technical Information Service CBS-Hytron, Division of CBS, Inc.

If the length is interchanged with frequency in the formula it is readily seen that the resonant frequencies are not harmonically related by the factor (N-.05). Table 1 has been worked out to aid in choosing the most desired frequencies in multiband operation.

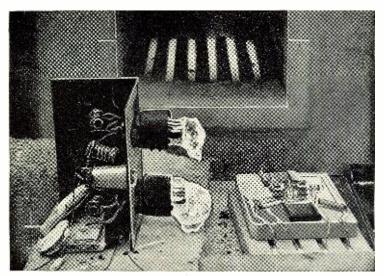
Generally, the ten-meter frequency that is to be used is the first consideration because the resonant length is more critical at the higher order of harmonics. If ten meters is not to be used, it would be more advantageous to cut the antenna for the high end of twenty meters.

Feeder Point Connection

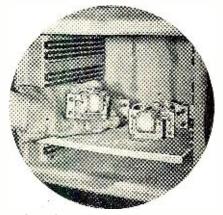
If the impedance of a long wire is plotted on semilog paper at even multiples of a half wavelength, it will be found that some 300-ohm points scatter fairly closely about the same point on the wire. They do not coincide exactly because the current node radiation resistance varies with the number of half wavelengths the wire represents. The radiation resistance of one half wavelength approximates 70 (Continued on page 150)

Table 2. Close impedance matching to 300 ohms on multiband antenna in the clear. Connection point at .325 length on 1st, 2nd, and 8th harmonics and .34 length on the 4th harmonic.

ANTENNA LENGTH	BAND	CONNECTION POINT FROM
(ft.)		END (in ft.)
137	80-40-10	44.5
	20	46.5
135	80-40-10	43.9
	20	46
133	80-40-10	43.25
*	20 ·	45.25
131	80-40	42.6
68.5	40-20	22.5
	10	23.25
67.5	40-20	21.9
	10	23
66.5	40-20	21.6
	10	22.6



Ordinary and new high-temperature circuits after being exposed to 1500 degree F. heat.



Special transformers have been run for long periods in electric ovens.

Red Hot Components for Guided Missiles

Special electronic components developed by G-E can operate reliably at high temperatures and withstand large amounts of nuclear radiation.

THE penetration of a critical temperature barrier in the development of guided missiles and supersonic aircraft was dramatically demonstrated recently when *General Electric* scientists exhibited laboratory models of revolutionary electronic devices and circuits operating literally "red hot." The achievement was described as a major step toward overcoming the inability of electronic controls to withstand the skin-sizzling heat generated by air friction at extreme speeds.

An equally important "plus" feature of the new electronic circuits is their ability to operate for long periods while exposed to nuclear radiation.

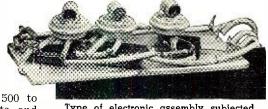
Tremendous defense implications were attributed to the heat-resistant, radiation-tolerant electronic tubes, resistors, capacitors, coils, transformers, wiring, and circuit boards. Radically new concepts in these components and circuits represent a breakthrough in the "thermal barrier" and give new impetus to the nation's guided missile, satellite, and supersonic plane programs. Among the advantages predicted are extensive weight reductions made possible by elimination of bulky, power-consuming cooling equipment from missiles and aircraft.

Military demands of World War II resulted in the development of several components that would operate at 300 degrees F., but the over-all reliability limit was, and in much of present-day equipment still is, about 200 degrees F. The recent emphasis on guided missiles and supersonic aircraft has greatly increased the requirements, but until now extensive research and expenditure has produced only a few compo-

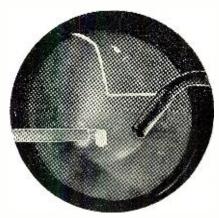
nents capable of operation at 500 to 600 degrees F. The components and circuits shown here are capable of proper and reliable operation in the temperature range of 900 to 1500 degrees F. At these elevated temperatures ordinary electronic assemblies would stop working and actually melt into a puddle of metal and glass.

Guided missiles are one of the most challenging applications of high-temperature components, which must operate reliably in two sources of heat: internal and external. The high internal heat is the result of a large number of electronic components that must be jam-packed into an absolutely minimum volume for weight and space reduction. For example, an air-to-air missile requires a relatively elaborate guidance and control system that is within a cubic volume not much larger than that of a basketball. With all the components operating, compartment temperature may increase several hundred degrees so as to cause faulty operation or outright failure.

The intercontinental ballistic missile (ICBM) is a classic example of an application of high temperature components to the problem of external heating. The ICBM must descend from extreme altitudes at velocities of about 10,000 mph and re-enter the dense layer of air surrounding the earth. Within this envelope of air, friction between the ICBM and the air around it generates heat equal to the heat generated by a half dozen or more of the world's largest steam turbines. If not dissipated, this heat rise can make ICBM electronic components either malfunction or fail.



Type of electronic assembly subjected to radiation tests in Oak Ridge reactor.



Ceramic tube operates—shown by scope pattern—even when glowing in blowtorch flame.

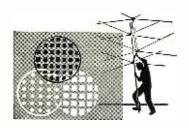
This special motor can be operated so hot that a cigarette may be lit on its housing.



Don't Be A aid of Colo TV

By ART MARGOLIS

Many troubles resemble those in black-and-white sets; others start to become familiar quickly.



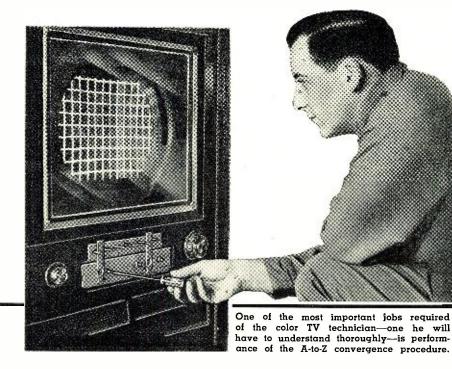
THE service call was timed perfectly. The setting up and convergence of the new 21-inch *RCA* color receiver had been completed a good ten minutes before the colorcast was scheduled to start. The set owner, a new car dealer, perched on the edge of his chair awaiting his first look at color TV.

The pre-show time was consumed by last-minute chores—packing up the test equipment and closing the tube caddy. Then, on the screen, the MC entered through parted curtains and announced, "You are now watching color TV." The program may have been transmitted in color but there was no rainbow on the screen!

The color and hue controls were turned all the way up—still no color. A cursory inspection revealed no obvious source of the trouble so the tubes were checked. After about the fifth tube substitution, the light began to dawn. Why was there no color when the dot-bar generator produced beautiful hues on the screen? The only difference between the two set-ups was the outdoor antenna! A hastily procured rabbit ears solved the problem long enough to avert a heart attack by the owner until the rooftop antenna could be inspected.

Finding the lightning arrester burned and shorted, this was replaced and the color flowed over the screen. Evidently the lightning arrester had been faulty for some time but in this prime signal location its absence was of no importance to monochrome reception but it made a vast difference where color was concerned.

Service technicians approaching color television for the first time are more or less faced with the same problems the old timers tackled when blackand-white first came on the scene.



There is one redeeming feature, however, and that is that those who have coped with monochrome sets will find that color troubles fall into similar categories. There are the obvious tube replacements and adjustments to be made. Then there are some hard-to-figure symptoms that ultimately resolve themselves into tube changes and adjustments. There are the normal bench-type repairs and, inevitably, the familiar "dogs" and intermittents.

One great difference in the two

One great difference in the two types of service is in the importance of the role played by the antenna. Antennas that are performing well on monochrome may not work satisfactorily for colorcasts. Of the twenty-two color service calls handled by the author thus far, ten involved tube replacements, two called for adjustments of various types, five were antenna jobs, and five involved bench-type repairs. Although no real conclusions can be drawn from this breakdown, it does indicate some sort of a trend.

Monochrome Experience Helps

Color TV today stands on familiar ground. Most of the circuitry and many of the troubles are the same as for monochrome. In many instances black-and-white servicing experience will prove adequate.

For example, the author was called upon to service a 15-inch set that had snowy pictures. Although it was "Technicolor" snow, there was no mistaking the familiar flakes. The 6BQ7 r.f. amplifier tube had shorted and burned out two resistors in the tuner. The installation of new resistors and a tube replacement set things aright.

Another 15-inch set brought the

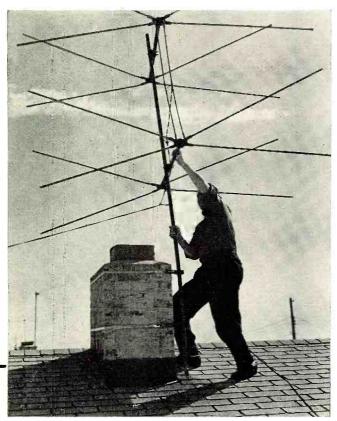
familiar "no raster but sound" complaint. Like its monochrome counterpart, the high voltage rectifier was cracked, killing the high voltage. A 21-inch set whose owner reported raster but no sound or video turned out to be a simple case of a burned out 6AQ5 audio output amplifier tube. It killed the video, too, for the screen of the 3rd i.f. draws "B+" from the 6AQ5's cathode circuit.

On another 21-inch set where the strong stations blacked out and the weak ones trickled in, the 6U8 a.g.c. amplifier tube proved defective—just as it might in a monochrome receiver.

Another "case" which required a slight variation in black-and-white theory involved a report that the picture disappeared only during commercials! The program was received OK but when the commercial came on the picture bloomed, defocused, deconverged into a rainbow of colors, and then disappeared. At the end of the commercial, the program came back in fine shape.

A decrease in the high voltage appeared to be the trouble so the rectifiers were checked first—to no avail. A new 6BD4 high voltage regulator tube was installed and that did the trick. The commercial held firm. It seems that when a high level of white is sent into the tri-color tube, as during the commercials, the CRT draws more current. The high voltage regulator tube is supposed to allow more current to be drawn without a drop in high voltage. With the tube defective, as the current was drawn the high voltage decreased and the multicolor blooming occurred.

While the service jobs thus far cited





Even an antenna that is adequate for color reception may have to be reoriented for optimum performance.

needed no more than normal blackand-white theory plus common sense, some troubleshooting chores involve a thorough understanding of theory.

To demonstrate this point, take the case of the set where the top half of the picture was blue with retrace lines, the bottom yellow. The first step was to adjust the color gun controls. This operation resulted in the blue changing to black and the yellow to near-white. The reason was obvious. This was a classic case of 60-cycle hum in the video. The r.f. amplifier, a 6BQ7, had a filament-to-cathode short.

Another complaint involved a low brightness level and a brownish picture during a black-and-white transmission. The 6BC7 d.c. restorer was dead

Another problem which came up about this time involved the color set cited first-the new car dealer of the shorted lightning arrester. Timing the service call for a scheduled colorcast, it was found that only the top few inches of the picture were affected. The top sparkled with all colors, red predominating. The hero of the scene, whose head reached the top of the screen, looked as though his ears were bleeding badly. It was an extreme case of misconvergence at the screen top. A second symptom, the "pointy" head, was a tip off that this was, indeed, a familiar problem. Replacement of the vertical output tube restored the picture. The weak vertical output tube was causing vertical stretching and misconvergence.

Training a Must

With a bit of luck, any TV technician worth his salt could undoubted-

ly have scraped through all of the cases mentioned so far. However, there are still plenty of color jobs that require formal and thorough color training. For the past year the author's firm has been on active lookout for all the color information and training being offered. All available articles have been studied carefully and the technicians have been attending the RCA lectures and taking the Philco color course. We have found that certain color jobs require formal training. One absolute "must" for every color technician is complete familiarity with the convergence procedure.

Among the unusual problems that arise in convergence cases are the ef-

fect of weak or defective 12BH7 red adder and output tubes, a loose or defective field neutralizing coil, and the misadjustment of the bandpass a.g.c. control. The effect of these components on the color picture would have been lost on a technician unfamiliar with color theory.

Another component, unique with color sets, is the additional oscillator running at 3.58 mc. This may prove to be a headache to technicians. One case involved the hue control which wouldn't permit the color to be turned up bright enough. In order to place this control in the center of its range, it was necessary for the technician to phase align the oscillator. This same symptom on a second set proved to be caused by a bad oscillator tube. So it goes!

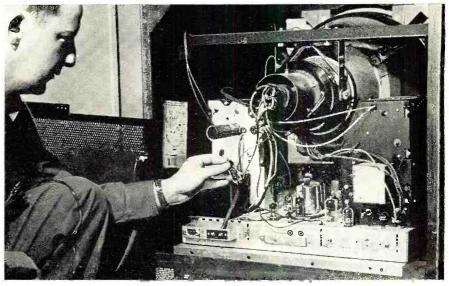
Color Antenna Troubles

With the advent of colorcasting, antenna orientation troubles have again reared their ugly heads. While many existing installations are OK for color reception, more are going to require work. Antenna rotators will be needed in some locations in order to provide good color reception.

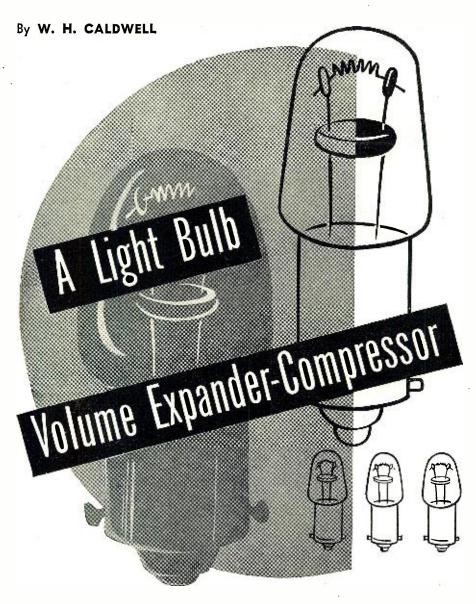
Technicians who thought their problems of ignition interference were a thing of the past with the newer black-and-white circuitry and keyed a.g.c. will be encountering this old bugaboo with color receivers. There is little that the technician can do to eliminate this trouble; it is just a matter of "sitting it out" until the manufacturers whip the problem on the drafting board.

Color TV, like all good things, is here to stay. Eventually refinements will be made, the circuits will be simplified, and repairs will be easier to make. At this pioneer stage, servicing is strange and sometimes rough. This doesn't mean it can't be handled—because, eventually you are the fellow who will have to cope with it. Sooner or later color is your problem—so don't be afraid of color TV.

Circuits may differ—but the technique of changing tubes in an attempt to localize a fault is a familiar procedure that works with any type of equipment.



December, 1956



An inexpensive, easy-to-build gadget which provides added enjoyment when listening to your hi-fi system.

THE volume compressor is useful for reducing the dynamic range of speech or program material. In recording, too large a signal will cut into an adjacent groove, while too small a signal will be lost in the surface noise of the record. With tape, too strong a signal will saturate the tape and may cause "print-through" of a strong passage on an adjacent layer of tape, while too weak a signal will be lost in the background hiss.

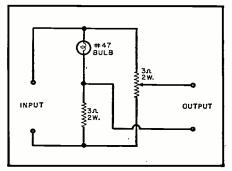
In communication radio transmitters, voice compression helps to override noise. In high-fidelity broadcasting and recording the trend today is away from volume compression, to insure full dynamic range.

The average listener, however, may not want his music too loud, to avoid offending the neighbors; nor can he have it too soft since ordinary room or street noises will drown out the music.

The volume expander, by the same token, is useful for restoring full dynamic range to an old record or to reception over a channel where compression has previously been employed.

A good volume expander-compressor is a useful addition to any audio system, provided it doesn't introduce

Schematic of volume expander-compressor.



unnecessary distortion and is easy to operate.

The complete circuit of such a device is shown in the diagram. It uses only three components, and connects directly between the output transformer and the speaker voice-coil. It is designed for speaker impedances from one to eight ohms and for amplifiers in the 1-10 watt class.

The operation depends on the characteristics of the #47 pilot bulb. The resistance of the bulb increases as more power is applied to the circuit; however, the thermal heat capacity of the filament is sufficient so that its resistance remains constant over several cycles of audio. This latter characteristic preserves the waveform of the audio. Some may find that the attack and decay times are far too long due to the thermal lag of the bulb's filament, but the simple gadget is worth trying if this characteristic is not too objectionable.

There is only one control to the compressor-expander: the potentiometer. This should be mounted near the volume control for greater convenience, since a change in the setting of the expander will affect the volume as well as the degree of expansion.

In operation, the lamp will glow and also serve as a visual volume indicator. When testing the circuit for the first time, set the volume so that the bulb glows moderately brightly. Now by adjusting the potentiometer, you will find there will be a null point near the center of its range, where the sound will be weakest. This is the balance point of the resistance bridge, and the greatest degree of compression will be found just below this point, and the greatest degree of expansion just above this point.

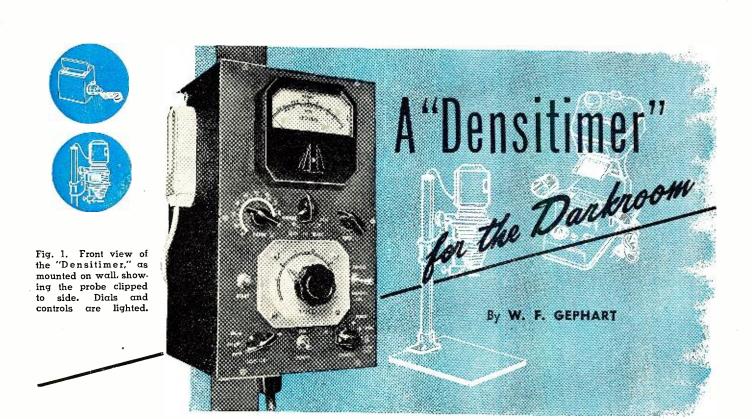
For moderate compression, turn all the way down; for moderate expansion, turn all the way up.

For use as a squelch circuit, set the potentiometer to balance on noise; the signal will then unbalance the circuit and come through, when present, while in the absence of signal the noise is blocked-out. This is especially useful for playing old scratchy records since it not only squelches the scratch, but also expands the dynamic range of the record.

In home recording, the compressor setting can be used when recording and the expander used on playback.

For the radio amateur's transmitter, a maximum of speech compression is very effective in overriding QRM and QRN. However, if speaking from an acoustically noisy location, the expansion adjustment to balance out distracting local background noise may prove helpful at the transmitting end.

A few words about the losses of the expander. You will need to set the volume control higher than usual to overcome the losses in this circuit. And these losses are greater near balance where the most effective action takes place. If more power is needed, it should be added after the expander in the form of a power amplifier. —30—



MOST photographers have long recognized the value of an enlarger timer for the darkroom, and many have wanted an exposure meter for the enlarger as simple as the meter for the camera. Some, who have more than one enlarger, or other equipment to be controlled, have felt the need for a switching unit, to eliminate excess cords and switches and the need for changing plugs. The unit to be described covers all three of these needs, although any part of it can be built separately.

This unit consists of a photoelectric enlarger exposure meter, an electronic timer, and various control switches. Any one of three units (enlargers or printers) can be controlled by the unit which provides timed, manual, or external (footswitch) contional part required is R_4 , a 1-megohm, required, which can be set on the timer, which can then be started by either a panel switch or external footswitch. A spring-return "Manual" (S_6) and a locking "Focus" position on "Control" switch S_4 are also provided.

Circuit Description

The exposure meter circuit consists of the photocell V_2 , V_3 , V_4 , V_3 , V_4 , and their associated components. The two halves of V_3 are connected in a balanced bridge circuit whose indicating meter is set to zero (under no-signal conditions) by R_{10} . When light strikes the photocell, current flowing in grid resistance R_2 unbalances the bridge and is indicated on the meter. The operating point of the bias on the tube is such that the action will be linear and the meter deflection will be directly proportional to the amount of light striking the photocell.

To provide stable operation, the sup-

Details on a home-built exposure meter for an enlarger, an enlarger timer, and control-switching unit for photographic printers or enlargers, all housed in a compact enclosure.

ply voltage for the photocell (150 v.) is regulated by V_1 . The cell load, R_2 , is variable, to allow for various speed photographic papers. The cell output, for a given amount of light, is reasonably constant with loads down to about 10,000 ohms, and R_2 should not be set below this value unless special calibrations are made.

The cell used is well-suited to this application, due to its small size and good sensitivity. The face is less than $\frac{1}{4}$ " in diameter which permits the measurement of light through a very small negative area. Since consistent, exposure results can best be obtained by measuring shadow areas where minimum detail is required, the small cell permits accurate measurements even in small diameter enlargements. Furthermore, the short length (about ½") permits the sensitive area to be very close to the focal plane on the enlarging easel. These cells may be secured from Allied Radio Corporation in Chicago, or from the Clairex Corporation, 50 West 26th Street, N.Y.

The over-all sensitivity required will depend largely on the illumination of the enlarger to be used. The ideal design must be linear over its range, and should permit a reading over a wide range of lens apertures and magnification diameters. Since there is no simple way to foresee the sensitivity requirements for any given enlarger, the circuit was designed to use any of several twin triodes, with different amplification factors, interchangeably. A

12AT7 furnishes maximum sensitivity, a 12AV7 medium, and a 12AU7 minimum sensitivity. The cathode resistance provides sufficient bias to stay within the operating range of all three tubes, so the proper tube can be selected after the unit is built, during testing and calibration.

Two ranges are provided to give a wide range of readable exposure time. Since the longer exposure times tend to crowd into the lower end of the meter scale, about a five-to-one time ratio is all that can be read on a single scale. The other range is established by switching a resistance across the meter, to reduce its sensitivity, and permit readings at bright light values. This switching is done by S_1 , which also connects the cell into the circuit for reading. This is a spring-return switch, to keep the cell out of the circuit during high light intensities, such as when the room lights are on.

The timing circuit is essentially that shown in the article "Bootstrap Interval Timer" in the October, 1954, issue of Radio & Television News, except that a single range and timing capacitor are used. This particular circuit provides a range from less than one second to about 32 seconds. Increasing the size of either C_5 or R_{10} will increase this range if desired. Care should be taken in the selection of C_5 . This should be a high-quality oil or paper capacitor, preferably of the sealed type. Electrolytics should be avoided because of instability.

The switching circuits consist of S_3 (which selects the unit to be controlled, as plugged into SO_3 , SO_2 , or SO_3), while S_4 selects the function. Position 1 is "Focus" which turns the unit on, position 2 is "Time" which connects the unit to the timer, position 3 is "Footswitch" which connects the unit to an external footswitch, and position 4 is "Footswitch Time" in which the unit is connected to the timer, but the timer is started by the footswitch, rather than the panel button.

If only one unit is to be controlled, the three sockets and S_3 (in dotted area "A," Fig. 4) may be eliminated, and a single socket connected to the arm of S_1 . If the footswitch features are not desired, S_4 and SO_4 (in dotted area "B," Fig. 4) may be eliminated, and the lead from relay contact "X" run to the arm of S_3 . If neither of these functions is needed, all parts within both dotted areas may be eliminated, and a single socket connected with the dotted leads shown to SO_4 . In such case, the "Manual" position of the "Manual-Cancel" switch is used for focus.

Construction Hints

The unit shown in the photos was designed to hang on the darkroom wall hence a vertical arrangement was required. Construction would be simpler if all sockets were mounted on the front panel and a horizontal arrangement would eliminate the need for two chassis. If the unit is to hang on a wall, it is best to have the sockets on the bottom, and with a horizon-

tal arrangement, a "Flexi-Mount" *ICA* chassis is recommended, since the panel and bottom can be one piece, eliminating the need for a connecting cable.

The photocell is mounted in a small wooden block, with the sensitive surface flush with the top (see Fig. 3). A hole is gouged out of the bottom for connecting the leads, which is twoconductor shielded microphone cable. and the hole is covered with an aluminum plate. The block should be painted white, to simplify locating the proper shadow area of the negative being projected. The sensitive area of the cell should be shielded from light whenever it is not being used, and plans should be made to provide a bracket on the side of the case, as shown in Fig. 1, to hold the cell mounting block with the sensitive area against the case.

The "Cancel-Manual" switch provides a spring return on the "Manual" side (for "flash" exposures) and a locking switch on the "Cancel" side. The latter position cancels any timing interval after the timing has started. if desired. However, the switch must be left in the "Cancel" position approximately the length of the timing interval, so the locking feature seemed desirable. Since such a switch was not available to the author when he built his unit, one side of a Switchcraft 3003L was altered by filing down one shoulder of the plastic actuator, to provide a spring return. The springreturn version of this switch (3003) is also not suitable.

Since the unit is to be used in a

darkroom, certain items on the panel must be illuminated. The entire panel could be made of translucent plastic and illuminated from the rear, although most of it can be seen well enough by safelights. However, the meter and timer control should be illuminated.

Since illuminated meters are not too common, a regular meter can be converted. The meter assembly is removed from the case, and a 3/8" hole was drilled in the back of the case, large enough to admit a pilot light. A second hole was drilled and tapped to mount the pilot light holder, and a red bulb was used. The regular metal scale of the meter was replaced with one of translucent plastic, on which calibrations were made.

To illuminate the timer dial, a three-inch hole was cut in the steel panel, and a dial plate was made of translucent plastic. This plate was somewhat larger than the hole in the panel, and was fastened to the panel with screws. The timer potentiometer was mounted on the plastic and calibrations lettered on the plastic with India ink. Two red lights were mounted inside the cabinet, behind the translucent plastic.

To provide ventilation, holes were cut in the top and bottom of the case, and covered with screened ventilation plugs.

Calibration

Before starting any phase of the calibration, it is essential that all tests be made under operating conditions. The unit should be in the cabinet, with the back on, and a minimum of 10 minutes warm-up should be allowed before testing.

In making the timer dial, a 300degree arc should be scribed on the plastic before the hole for the potentiometer is drilled, using the centerpoint of the control as the center of the arc. Also scribe a similar arc on a piece of bond paper. When mounting the potentiometer, fasten the paper to the front of the plastic with rubber cement. During calibration of the timer, marks can be made on the paper. When calibration is complete, an awl pressed against the marks on the paper will transfer the calibration points to the plastic. The paper can then be removed, and lettering done on the plastic.

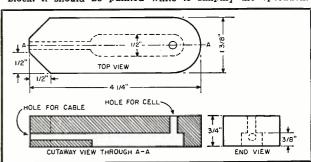
In calibrating the timer, a stop-

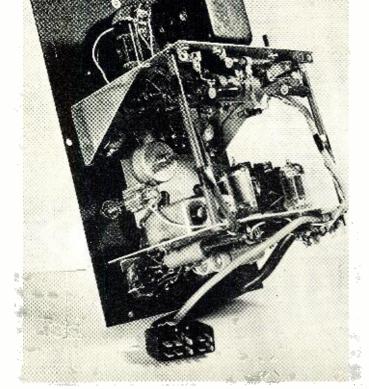


Fig. 2. Chassis view of the instrument. The top chassis houses the density measuring circuit, the bottom chassis is the timer unit.



Fig. 3. Mechanical details for building the photocell mounting block. It should be painted white to simplify the operation.





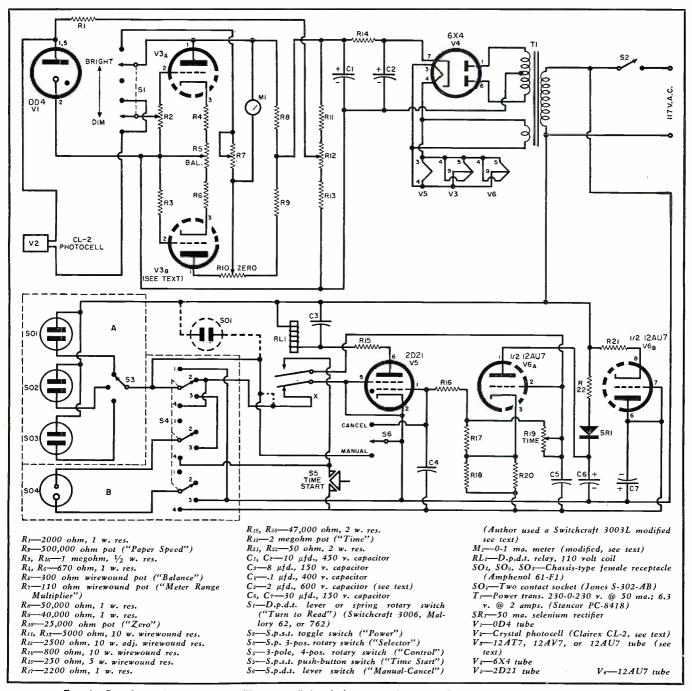


Fig. 4. Complete schematic of the "Densitimer" for darkgoom applications. Standard parts are used throughout.

watch is handy, but any large sweep second hand on a clock can be used. Do not plug an electric clock into the timer for calibration; the time lag of starting, and "coasting action" when stopping will give inaccurate results.

Before calibrating the exposure meter, run some tests in your own darkroom, to determine the minimum and maximum "usual" exposure times. This will determine the "desired usable range" that you should work toward, such as 3 to 30 seconds, 5 to 40 seconds, etc.

To start calibration, set the enlarger up to provide the minimum exposure normally encountered, such as 2, 3, or 4 seconds. To do this will require an average negative and several test strips.

Using one of the three tubes (pref-

erably a 12AV7 with medium sensitivity), and with the "Turn to Read" switch in the center (off) position, set the meter needle to any easily-read value (e.g., 60), using the "Zero" control. Then, with the photocell unplugged, turn the "Turn to Read" switch to "Bright," and adjust R_{τ} to read one-third value. This establishes two ranges, one being three times the other.

Plug in the photocell and re-set the meter to zero with the "Zero" control. Place the cell face in the shadow area of the projected image set up above, and turn the "Turn to Read" switch to "Bright" (which has the resistance in the meter circuit). Then adjust the "Paper Speed" control to see if a full-scale reading can be obtained on the meter. If the paper used in the test

strips was an average speed enlarging paper, it is preferable to secure full-scale deflection with the paper control near the center of the range. Naturally, this step must be done in the dark-room.

If, under the conditions just outlined, full-scale reading is determined with the "Paper Speed" control at about mid-range, your unit will properly measure minimum exposure. If full-scale deflection cannot be obtained, a more sensitive tube must be used, and if the "Paper Speed" adjustment is too critical, a less sensitive tube should be used. If a more sensitive tube still will not provide full-scale deflection, the ratio of the ranges can be reduced to two-to-one, by re-adjusting R_7 .

(Continued on page 134)



Clear and concise instructions on how to repair the most frequent troubles occurring in new color TV sets. Also — how to set up a receiver for the installation.

ASICALLY, the installation procedure for the latest line of color television receivers is much less involved than for the earlier models. In most cases, the only installation requirement is de-magnetization of the picture tube. This should be done irrespective of whether or not it is considered necessary.

To accomplish de-magnetizing, use a coil 12 inches in diameter and consisting of 400 turns of #20 enameled wire. To this coil attach an a.c. line cord 10 feet in length with a switch. Apply 117 volts a.c. to the coil, holding the coil with its plane parallel to the face of the picture tube. Move the coil slowly about the face of the CRT for a few moments, then back away from the tube about 6 feet and turn the coil 90° so that it is perpendicular to the face of the tube. Remove the a.c. from the coil and the de-magnetizing job is completed.

Shown in Fig. 2 is a color-contaminated black-and-white picture on a color picture tube. This condition may be caused by a magnetized picture tube and the simple de-magnetizing procedure given here could save many fruitless hours of attempting to correct this situation by other means.

In some cases the condition shown in Fig. 2 could be caused by the yoke or purity magnet becoming dislodged during receiver shipment. If de-magnetizing does not cure the condition, turn the blue and green screen controls completely counterclockwise. A red picture with color impurity at the edges of the screen will result. Adjust the yoke and/or the purity magnet until a uniformly red picture is obtained. Then readjust the blue and green controls to obtain a good black-andwhite picture. It is very important that center convergence be maintained during the purity adjustment. Otherwise, a good red field may be obtained but the blue and green fields may be slightly contaminated causing a poor black-and-white picture.

After completing the purity adjustments, the convergence should be checked. To do this, a convergence generator causing a crosshatch pattern (Fig. 1) or regularly spaced white dots to appear over the entire screen of the color tube should be connected to the receiver. Many dot generators provide both dot and crosshatch patterns. One method of using these patterns is to work with the crosshatch for dynamic convergence and dots for final static adjustments. Generally, dynamic convergence adjustment is not required for the initial setup of the receiver. Fig. 5 illustrates a condition where red and green has shifted. This is typical of static convergence complaints. A slight adjustment of the red and green d.c. convergence controls will correct this condition.

Obtaining a good black-and-white picture is extremely important if good color reception is to be expected. Some of the newer black-and-white picture tubes tend to give a slightly bluish tint to white areas whereas the early 10-inch picture tubes were on the brownish side. The black-and-white picture on a color tube should be adjusted so as to be slightly brownish in color. Most technicians lean too heavily in the blue direction. In many cases the picture is much too blue, even bluer than the bluest black-and-white picture tube. As a guide, check the picture against the one on a blackand-white receiver if one is available. If not, lean slightly toward the brownish hue. Doing this will actually enhance color reception since, if the tube has a bluish background, flesh tones will wash out or become very pasty

After checking out the color receiver for black-and-white reception, check

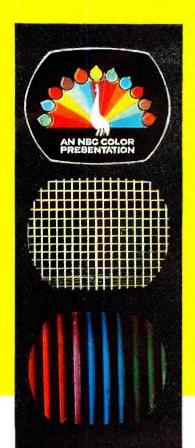
it for color. If color program material is not available when the receiver is installed or being serviced, a color-bar or similar color pattern generator must be used. A normal bar pattern presentation with receiver correctly adjusted is shown in Fig. 1. Note that the bars range from red on the left through blue to green on the right. Each bar has some significance when adjusting the color receiver. For example, the third bar from the left is vectorially 90° from burst phase and represents R-Y. The sixth bar is 180° from burst and represents B-Y.

When the color-bar pattern is adjusted properly, the fourth bar should have a magenta color. In Fig. 6 the second bar is magenta. This indicates that the hue control is adjusted improperly. It should be rotated until the fourth bar is magenta as seen in Fig. 1. If the fourth bar can be made magenta by rotation of the hue control, but if as a result, the colors of the other bars are incorrect, a complete matrix adjustment must be made.

Basically, there are two methods by which this adjustment can be accomplished using the color-bar generator. An oscilloscope can be connected to the grids of the picture tube and adjustments made to obtain the proper waveforms. This method is the most accurate; however, it may be inconvenient to carry an oscilloscope into the customer's home. An alternate method of matrix adjustment which is simple and accurate will be described here. It is necessary in this method to make two of the guns in the kinescope inoperative while the third is being used. To accomplish this conveniently, connect a 100,000-ohm resistor between the grid of each gun to be cut off and ground. Take two clip leads, cut them in half, and insert a 100,000-ohm resistor in series with the two parts of each lead. Thus, one end of the lead can be connected to the grid and the other end to ground.

If the blue and green guns of a color tube were cut off by means of these clip leads, and if a color-bar generator were connected to the receiver, the resulting red pattern would be that due to the R-Y signal. The sixth bar from the left, which was formerly blue, (Continued on page 55)

Key to Color Patterns



The color patterns shown here will help you install and service color TV. If the receiver displays any of the incorrect pictures reproduced, this tells you why, and how to correct the proper circuit.

Fig. 1. The pictures shown here were displayed on the face of a normally-operating color TV set. At the top is the peacock color trademark of NBC. The crosshatch pattern (center) indicates good convergence; the color bar pattern shows correct hues.

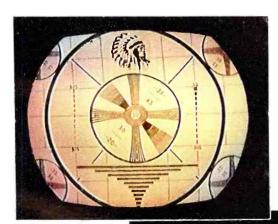


Fig. 4. Right. This pattern shows loss of color sync (the input is from a color bar generator). Check the 3.58 mc. oscillator and synchronization circuit.

Fig. 5. Right center. Red and green lines appear in this crosshatch pattern indicating lack of static convergence. To correct this adjust red and green d.c. convergence controls.

Fig. 6. Bottom right. In this pattern, the second bar from the left is magenta—it should be red. If adjusting the hue control does not correct the pattern, the color phase controls must be readjusted.

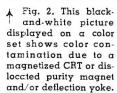
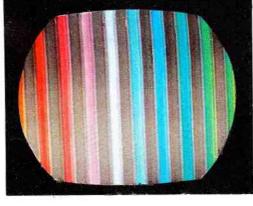
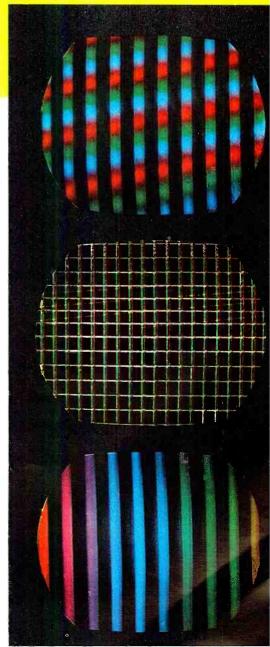
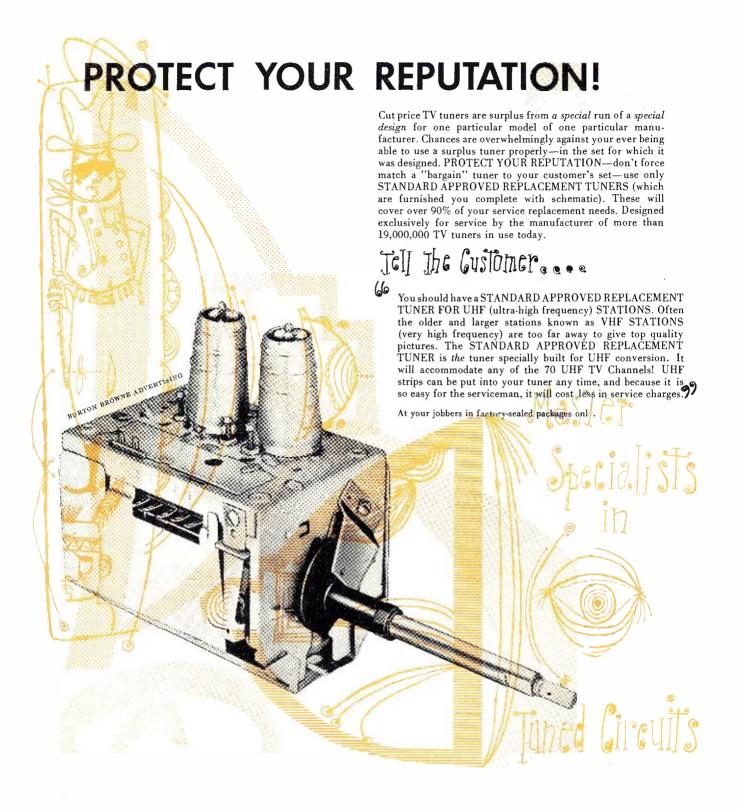


Fig. 3. The edges \rightarrow of the color bars shown here are not sharp and distinct as they should be. This indicates "ringing" and is usually due to a defect in the video stage (check for an ungrounded delay line).









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should be the same brightness as the adjacent red background. This bar represents B-Y and the fact that its brightness is the same as that of the background indicates that the magnitude of the B-Y signal on the red grid is zero, which is correct. If the sixth bar is not the same brightness as the background, then the phase of the R-Y 3.58 mc. c.w. signal needs to be readjusted. All recent color receivers have a control for this; on the RCA color sets using the CTC5 series chassis, for example, the top slug of transformer T_{705} is the applicable adjustment (see Fig. 7).

After making the necessary adjustments to obtain the correct pattern, remove the clip lead from the blue grid and attach it to the red grid. Now the green and red guns are cut off leaving a blue color bar pattern. In this pattern, the third bar from the left is of the same color content and brightness as the adjacent background, which is blue. This bar represents R-Y and its appearance shows whether there is any R-Y signal on the blue grid. If there is some R-Y signal on the blue grid, bar three will not show up as pure blue and the phase of the B-Y signal has to be reset. This is effected by varying the B-Y 3.58 mc. c.w. phase control.

Next, remove the clip lead from the green grid and connect it to the blue grid. A green bar pattern should be on the screen now. Here the seventh bar should be the same brightness as the adjacent background. If not, adjust the *G-Y* phase control.

With all of the conditions met as a result of adjustments, the bar pattern shown in Fig. 1 should be obtained after removing the clip leads. Checking the receiver in this manner will assure the customer proper color operation.

The antenna system is the only other link to be checked out during installation. Most TV stations currently transmitting color provide a color test stripe during black-and-white transmissions. This vertical stripe is positioned at the right hand side of the screen and is normally not visible. However, by setting the fine tuning control so that sound bars are barely visible and adjusting the horizontal frequency so that the picture moves to the left, the stripe will become visible, provided the color control is turned maximum clockwise. With the hue control set properly, the color of the stripe should be a greenish yellow.

If the stripe cannot be obtained and it is known that it is being transmitted, re-orienting the antenna is usually all that is required. In addition to this, it is a good idea to check the transmission line for opens and poor termination. Also check the lightning arrester if one is present.

Customer Instruction

After completing the color receiver installation it is very important that the customer be properly instructed on the use of the customer controls. Prob-

ably the best starting point is to obtain a good black-and-white picture. First, set the fine tuning control to the point where sound bars appear in the picture, then turn back the control until the bars just disappear. This must be done with the color control fully counterclockwise or in the off position. Adjust the contrast, brightness, and fine tuning controls for proper color saturation. The hue control can then be adjusted for proper flesh tones.

If there is no color transmission at the time of customer instruction, make sure he or she can demonstrate proper black-and-white picture adjustments. However, explain the proper use of the hue and color controls. Service calls can be greatly minimized by a good receiver installation and proper customer instruction.

Service calls after initial installation include the normal troubles encountered in black-and-white sets plus additional problems related only to color. The troubles dealing with color only include: no color, improper color, no color synchronization, and low color saturation.

Before attempting to service the color circuits, it is important that the receiver must be capable of receiving a normal black-and-white picture. The same techniques apply for servicing the black-and-white circuits of color receivers as those presently employed in the service of standard monochrome

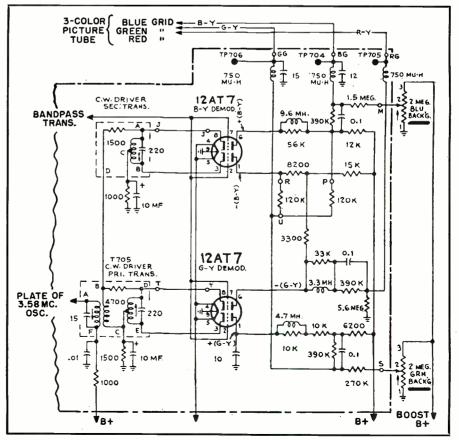
receivers. The only exception to this is the picture tube circuitry.

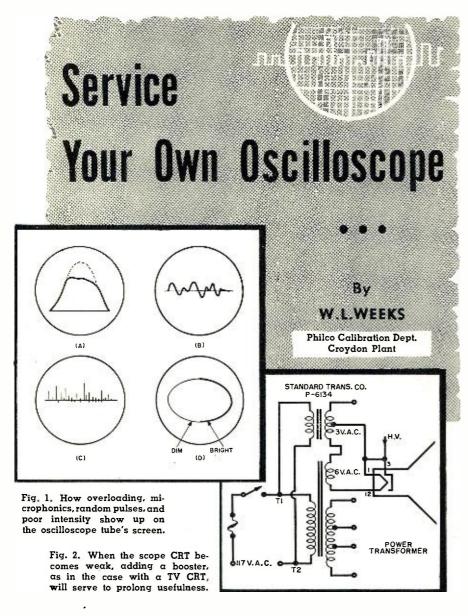
It is possible that the customer may complain of a completely red screen during reception of a black-and-white TV broadcast. This would indicate that the red gun of the tri-color picture tube is shorted. However, the bias voltages should be checked before replacing the picture tube. Also, the customer may complain of color fringing around objects in an otherwise black-and-white picture. This would indicate that either convergence is misadjusted or that there is trouble in the convergence circuits. Another possible customer complaint may be that there is color contamination in the black-and-white picture (Fig. 2). If the set was properly installed and adjusted initially, this trouble would indicate that the receiver has been moved. De-magnetizing will probably clear this up. These malfunctions have no real bearing on the color circuits yet appear as colored defects.

To service the color circuits, it is usually necessary to use a color-bar generator or other source of color signal for troubleshooting. This is necessary since there may be no color telecast at the time of the service call. Also, by using such equipment, the technician can check the color matrixing as a final step of the service call.

Troubles in the color section are usually confined to the bandpass am(Continued on page 179)

Fig. 7. Schematic diagram of color demodulator circuits of the RCA CTC5 chassis. When it is necessary to correct color phasing this is done by adjusting the top and bottom slugs of transformer T_{705} . The various color tube grids are connected to ground via test points TP_{704} , TP_{705} , and TP_{706} , through 100.000 ohm resistors.





The troubles you are likely to encounter with an oscilloscope. How to recognize and remove them.

N THE past few years, many oscilloscope kits have been assembled and put to use by television technicians and electronic hobbyists. When troubles develop in these oscilloscopes, many of those people who purchased and assembled the kits are at a disadvantage when it comes to correcting such troubles. The scope has its own brand of bugs that are only remotely similar to television or radio troubles.

Presented here are a few common troubles along with suggestions on how to proceed in troubleshooting an oscilloscope:

1. Overloading and low vertical gain: The most common cause of overloading or poor vertical gain, outside of a defective vertical amplifier tube, is low "B" voltage. Fig. 1A shows the effect of overloading with a sweep output response curve displayed on the

scope. The broken line indicates how the top portion of the curve should appear. The solid line indicates the effect of overload as amplitude is increased. It is advisable, before tearing the vertical section to pieces, to check your "B" voltage. A weak 5Y3 rectifier in the back of the scope can really foul up the vertical input amplifier.

2. Microphonic effect: In Fig. 1B we can see the effects of a microphonic tube. The trouble is particularly annoying when the operator wishes to observe weak signals. Lightly tapping the vertical amplifiers will disclose the faulty tube, but usually the high-gain input amplifier is the chief offender.

3. Random pulses: Random pulses, affectionately called "figliggies" by our group at work, occur as shown in Fig. 1C, running across the baseline of the scope. Again the chief offender is the vertical input amplifier tube, which

has usually developed high tube noise. Many scopes now use a voltage regulator tube, 0D3 or similar type. When these become defective, they can produce a similar effect.

4. Poor focus: The high voltage rectifier supplies the accelerating and focusing potentials and is the chief cause of poor focus and intensity. Since the deflection plates affect the beam after it is sharply focused, noisy centering controls occasionally cause a slight defocusing of the beam. If noisy carbon potentiometers are causing the defocus, this can be detected by observing the sharpness of focus as the control is rotated. A slight rotation will seem to shift the phase of focus from vertical to horizontal. Power supply hum due to defective capacitors will affect focusing the same way, but in a more exaggerated manner.

5. Poor intensity: After a few years of use, you could expect a cathode-ray tube to weaken but usually you will go through several high voltage rectifiers before replacing a CRT. Fig. 1D shows an unusual intensity problem caused by the high-voltage capacitor losing capacity due to drying up or old age. Replacing the high-voltage capacitor will eliminate this problem. The hum developed by the defective capacitor causes a blanking effect on the beam. If the CRT does become weak, it is possible to add a booster as shown in Fig. 2. This will give added life to your present oscilloscope. The transformer mentioned has adequate highvoltage insulation. On some scopes this booster transformer can be conveniently mounted on the CRT mounting bracket. Proper phasing must be observed in adding the 3 volts a.c. If you try this circuit and your weak cathode-ray tube does not light up, reverse connections T_1 and T_2 to obtain proper phasing.

6. Blowing fuses: If your oscilloscope continues to blow fuses after changing tubes, and checking with an ohmmeter fails to locate the short, the trouble is usually a faulty high-voltage capacitor. When you check the highvoltage capacitor with an ohmmeter, it may appear normal and charge up; but under the strain of a kilovolt it will break down. To check for this trouble, disconnect the high-voltage capacitor (observing safety precautions at all times) and energize the equipment. If the fuse does not blow, the capacitor is the culprit. If the fuse does blow, start checking with your ohmmeter again. Occasionally, the power transformer will short out, and since it has such low resistance, the ohmmeter is not much help. The most reliable piece of test equipment for a shorted transformer is the "nose" common to all troubleshooters.

Sweep generator circuits are not discussed because every manufacturer seems to use a special design. Some like neon tubes, thyratron circuits, or modified multivibrator types. The individual oscilloscope design would determine troubleshooting procedures on this part of the circuit.





Developing Your Service Association

NEWS about the mass meetings of service operators that are being held in all parts of the country in protest against the extension of consumer service activities by the General Electric Company has overshadowed a very important development that was inspired by the steady efforts of manufacturers to expand their consumer service business.

The Television Service Association of Michigan, which long has been one of the industry's most dynamic and successful service organizations, has adopted drastic measures to show its displeasure to offending manufacturers for their stepped-up activities in the retail service market. Members of TSA realized, however, that while drastic measures might bring about some temporary restrictions in manufacturers' service promotions, the future of independent service could not be made stable and secure unless independent service shops themselves worked together in long-range programs for the improvement of their activity and for the protection of the set-owning public.

After two years of painstaking work, earlier this year TSA had succeeded in getting a television service licensing ordinance passed by the Detroit city council. This licensing law, which encompasses both shop owners and technicians, has been recognized as a superior measure.

TSA pushed for passage of the law only after it had exhausted all legal means to curb the activities of service sharpies in the Detroit area. In the most ambitious of its attempts to stop the gyps, the association contributed \$500 to the Detroit Better Business Bureau for a campaign, and members gave freely of their time to assist the BBB and the district attorney pull the service malefactors into court. While they secured many convictions, there were no laws that prevented a culprit from opening a new service business under another name, immediately after a conviction, to continue his larcenous activities.

Most service associations are made up of only a small minority of the clean-minded, technically competent service dealers in their areas. As a result many of the best association programs fail to accomplish their objectives because of the lack of indus-



By WILLIAM LEONARD

The only successful defense against manufacturer service is possible through organized activity.

try-wide support. Recognizing this weakness in the armor of the independent electronic service industry, the officials of TSA financed the development of a professionally prepared, comprehensive program to interest service dealers in cooperation—through associations—for their mutual well-being.

The complete association promotion campaign plan is assembled in a striking $9\frac{1}{2}$ " by 15", four-section folder. Assembled in this folder are all of the materials needed to put on an aggressive association "member selling" drive. The key piece is a 4-page folder titled "Unite to Fight," which details why independent service businessmen must work together to preserve a free market for the operation of service businesses in the electronics field.

A second section of the folder contains samples of stickers for use on letters and envelopes; postal meter messages; slugs for newspaper ads; and an independent dealer association decal.

The third section contains proofs of ads for dealer associations to run in local newspapers; mats for jobber house ads; and a cartoon book to mail to customers.

The fourth section contains a copy of the Detroit licensing bill with two separate flyers. One of the flyers carries a detailed explanation of the requirements for obtaining a Certified Technician's License, and the other covers those for a Television Service Dealer's License. The flyer to be used in urging service dealers to join their local association states:

"Do you want your business to develop into a real, solid security for

yourself and your family? Most everybody else does, too!

"Throughout the country, other alert dealers are achieving this objective by joining their local independent organization: For, as the saying goes, in union there is strength. By banding together, business improvements, better public understanding, and a host of other benefits have been obtained. Things like ordinances to license only qualified service dealers are now in effect in many communities. A spirit of cooperation and free exchange of ideas, and a common code of practice and standardization of charges-formerly so confusing to the public-are notable accomplishments.

"As a member of an organization, your voice is heard. And, as a member of an organization. you are protected against any serious outside encroachment—swiftly and effectively. For the better business life and security we all must have, Join Your Local Independent "Service Association."

The copy for local newspaper advertising to set owners urges readers to patronize a local independent service dealer who displays the association emblem when a radio or TV set needs repairs. It tells the reader:

"Your local independent service dealer is the man to see when your radio or TV set needs attention. Your neighborhood dealer is a highly qualified local business man. He has invested a lot of time and money in technical training and in costly shop equipment to serve the entertainment needs of your community.

"As a resident of your town, your (Continued on page 131)

Hi-Fi Amplifier for Ceramic Cartridges



DURING the past ten years the high-fidelity world has seen many new developments. Some of these have been merely elaborations of existing ideas while others have been founded on truly new principles. In the entire picture there may be discerned a new trend which, although slow, is nevertheless firmly directed toward the simplification of high-fidelity equipment.

One of the outstanding developments in recent years has been the creation of the ceramic phonograph cartridge. The discovery that ceramic material could be made piezoelectric was independently made in the Sonotone laboratories in 1946. At that early stage the promise of the ceramic cartridge seemed to lie mainly in the fact that it was impervious to moisture and temperature variations. It was quite an event to produce a cartridge which behaved almost exactly like a crystal cartridge but which, at the same time, would last indefinitely in tropical climates, in the hot confines of a radio phonograph, or on the dealer's shelf. The first ceramic cartridges to reach the phonograph market in 1947 performed in an outstanding manner, which although not truly high fidelity by today's standards were nevertheless equal to the performance then obtainable from any piezoelectric device.

With the introduction of long-playing records the design of the ceramic cartridge was carried forward to the point where advantage could be taken of a second unique feature. This feature was the fact that the ceramic cartridge

is a "constant-amplitude" type of transducer. That is, the voltage output of the cartridge is constant with frequency if the amplitude of the modulation of the groove is constant with frequency. This is in direct contrast to the "velocity" type of transducer (magnetic, reluctance, moving coil, etc.) in which the voltage output is proportional to the side-to-side speed of the needle in the groove. Since the present-day recording characteristic is very close to one having amplitude constant with frequency, it follows that a constant-amplitude pickup will play such records back almost flat without any need for equalizers in the circuit. Further careful attention to the design of the cartridge itself makes it possible to tailor the response to within a few db of the required characteristic. Thus the new Sonotone Series 3 cartridges play back the RIAA, LP, "New Orthophonic," etc. characteristics within 3 db of flat without any equalization, providing a proper load resistor is used.

When it is considered that the frequency response of the ceramic cartridge without equalization can equal that of most velocity cartridges employing commercially available equalizer amplifiers, it is apparent that the ceramic cartridge signals a new approach to true high fidelity. When on top of this is added the fact that the ceramic cartridge requires no preamplifier (its voltage is about 20 to 100 times that of most velocity types), that it is immune to magnetic hum

pickup, that it has a compliance equal to or better than most velocity cartridges, that its distortion is equal to or less than that of many other types of cartridges one asks why it should be necessary to use equalizers, preamplifiers, oscillators, etc. to obtain high-fidelity phonograph reproduction.

(EDITOR'S NOTE: Ceramic cartridges are known to have more needle talk than the velocity type cartridge. However, Sonotone claims that its new Series 3 unit does not have this objection. It is also known that ceramic cartridges, in general, have a different tonal response (coloration) in comparison to other types of units. This may or may not be objectionable. Some individuals prefer this type of response while others object to it.)

The answer is, in the author's opinion, that such equipment is entirely unnecessary for the very best in high-fidelity reproduction. In fact such equipment may (and very often does) introduce noise, hum, and distortion. The fewer the links in the chain, the simpler, cleaner, and more reliable does the whole circuit become.

This is the philosophy behind the creation of the *Sonotone* HFA-100 amplifier. This unit was designed to work specifically with the new Series 3 ceramic cartridges.

The schematic of the amplifier is shown in Fig. 1. As may be noted, this is a very simple, straightforward circuit. Every individual part and value was carefully chosen to produce the optimum in performance. Several de-

RADIO & TELEVISION NEWS

partures from conventional practice were made in the design of the amplifier and since these are not all apparent from the schematic they will be discussed individually.

The load impedance presented to the output tubes has been changed from 8000 ohms plate-to-plate to 6000 ohms. This enables 12 watts to be obtained at the secondary of the transformer at 1% distortion without feedback. When feedback is applied the distortion is reduced to 0.1% or less.

Every tube, without exception, is enclosed in a feedback loop of at least 20 db. This means that the 0.1% distortion figure holds from the input to the output. This avoids the ridiculous situation, all too often encountered, of having a low-distortion power amplifier section preceded by a high-distortion voltage amplifier section.

The frequency response is flat at any setting of the volume control. This is achieved by making the volume control a low impedance (50,000 ohm) control, which is unaffected by

stray capacitance following it. The importance of this cannot be stressed too much since it means that the high-frequency transient response is maintained no matter what listening level the user may choose.

The hum output of the amplifier is independent of any of the controls. That is, the hum is just as low with the volume and bass controls turned all the way up as it is with these controls in their normal position. This is achieved by using a d.c. filament supply for the first two tube sections. This is an added feature thought highly desirable, since, together with a ceramic cartridge, it permits full bass boost with negligible hum.

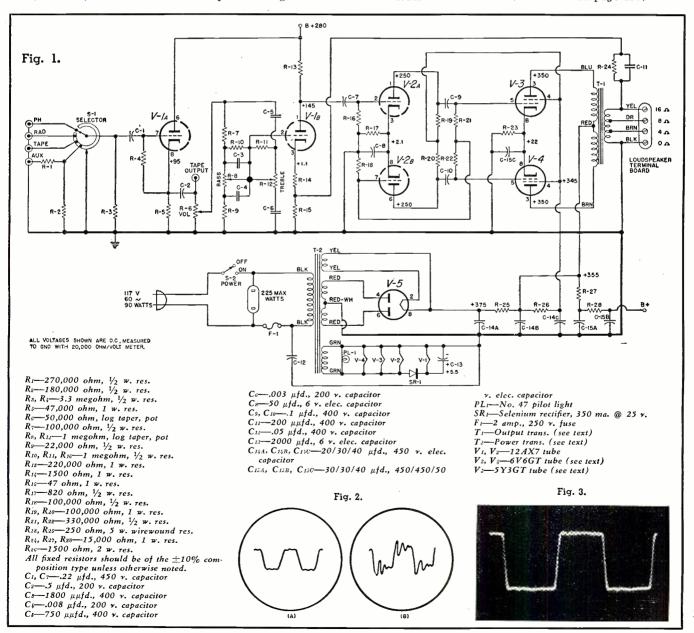
The frequency response is not flat beyond the audible range. The response is flat to 20,000 cps but beyond that it is deliberately controlled so as to maintain the transient response under working conditions. Many amplifiers have been shown to have a good transient response when working into a resistive load. The

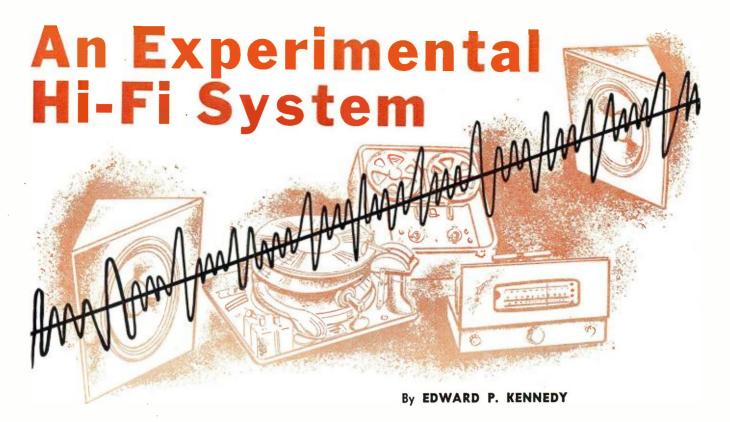
pattern at 10,000 cps is generally as shown in Fig. 2A. When many such amplifiers are connected to a loudspeaker, however, the response is more like Fig. 2B. The transient response of the HFA-100 amplifier is equally good on loudspeaker or resistive loads. The performance of a typical amplifier at 10,000 cps with a loudspeaker load is shown in Fig. 3.

The over-all circuit description is as follows: There are four inputs, all of which feed into the selector switch. Three inputs have an input impedance of 3.3 megohms and a sensitivity of 0.35 volt while the fourth has an input impedance of 0.5 megohm and a sensitivity of one volt. This fourth input is designed to accommodate a high output device, such as an extra-sensitive tuner.

The input tube is a cathode follower for several reasons: it presents a high input impedance to the ceramic cartridge, it has a low output impedance to feed the tape output jack and the

(Continued on page 159)





THIS article will describe a simple crossover network which produces a simulated stereophonic effect that the audiophile may wish to try out in conjunction with his home music system.

The lack of so-called dimensional effect in sound produced by a single speaker leaves discerning listeners somewhat unsatisfied. In an attempt to supply the needed ascendency many listeners raise the sound level to deafening proportions. This fills the whole room with sound and gives the illusion of reality. When the sound level is raised above a comfortable listening level, unnatural and unpleasant physiological strain is imposed on the listener. By adding a simple crossover network the sense of sound spread may be simulated, providing the listener with good reproduction at moderate levels.

The several methods to be described here involve the use of frequency dividing networks which separate and channel certain bands of the reproduced audio frequencies into two or more loudspeakers. Adjacent corners of the room appear to be the most suitable location for the speakers. The sound sources to be considered here include radio programs, TV sound, tape recordings, phonographs, opera broadcasts, and the like. The illusion created by this method is most effective with music, especially orchestral selections or numbers recorded by groups which, when performing, occupy an area of appreciable dimensions.

It should be remarked, however, that the voice of an announcer will usually emerge from the array rather than from a single speaker. However, those who have listened to this repro-

Details on a relatively simple and low cost method of simulating dimensional sound from a single source, such as AM-FM tuners, tapes, phonographs, etc. Basically, the unit is an elaborated crossover with speaker separation.

ducing system for a short time soon become accustomed to these speech characteristics and lose their awareness of it. The speech intelligibility and the high-frequency spectrum in general are cleaner than from a single speaker.

Before going into details on the network characteristics some comment should be made regarding the results of the author's experiments. In general, the better the quality of the speakers the more lifelike will be the illusion. Speakers of less noble peerage may be used, however, with surprisingly good results. Unsuspected liberties may also be taken with cer-tain speaker enclosures without impairing the bass reproduction. However, a good speaker for the highs seems to be a necessity if satisfactory results are to be obtained. It is suggested that the speaker chosen for low frequencies be placed to the right of its companion.

The illusion may be created in a number of ways and to a worthwhile degree using available equipment. Perhaps the simplest and least expensive method is to use two good radio receivers which have been slightly altered. In one, a single high-pass section of the dividing network should be connected between the present output transformer and the speaker. In the

companion radio a single low-pass section of a dividing network should be similarly connected. When both altered receivers are tuned to the same station and the proper level established for each set the illusion should be pronounced. Its degree of excellence will be completely dependent upon (a) the quality of the broadcast itself, (b) the response of the individual sets, (c) the skill with which the listener adjusts each set for tonal balance, (d) the relative placement of the high-frequency reproducing set with relation to its companion lowfrequency reproducing set, and (e) the acoustical characteristics of the listening room where the sound outputs will be acoustically recombined in space to form the whole illusion. The latter statement will also apply to any of the combinations to be described.

The separate filter sections should be selected on the basis of the speaker load impedance of each particular set if they differ one from the other. Each section should then be individually designed to operate at the same cross-over frequency.

A second method that may be employed is the addition of a two-channel dividing network and loudspeaker to a high quality radio receiver. This receiver should have its own built-in high-quality amplifier and transform-

er-coupled speaker. The built-in speaker may serve as one channel if it is reconnected through the output of the network. The external or outboard loudspeaker is then connected to the remaining network output channel.

If the two speaker load impedances differ, the technique of using single channel networks in each circuit should be adopted.

The third method involves an existing installation which includes highquality AM, FM, and TV, and a tape machine. The amplifier is a Williamson-type which is flat from 30 to 20,000 cps. The speaker dividing network is a 1200-cycle crossover, 16ohm, constant resistance type. The highs are delivered by a quality coaxial speaker housed in a good enclosure. Surprisingly, the woofer is a 12-inch speaker which is used in the TV console. The speakers are placed at a 45-degree angle in the opposite corners of a 16-foot wide living room, making the distance between speaker centers about 12 feet. The best listening area, although not sharply defined, is near the center of this room and about six feet from the front wall. Despite the poorly baffled TV woofer the bass is pleasingly solid, natural sounding, and free from objectionable peaks, thumps, and box-barks. When the tweeter highs are attenuated to a good musical balance the illusion created and the sound quality itself are excellent. Orchestral reproduction is such that the instrumentalists seem to be spread across the room. Some new and interesting things were noted as experience with this array accumulated. Individual instruments in an orchestra can be distinguished with uncommon ease. The tamborines, cymbal crashes, drums, bells, brushdrums, and triangles are unbelievably clean and clear. Audience noises, applause, etc., take on a new life-like characteristic. Furthermore, these phenomena are obvious even at a sound level much lower than that at which the orchestra originally recorded the material and much below that used by the average high-fidelity enthusiast operating a single high-grade speaker.

Some humorous by-products were also observed. Before the network and TV speaker were employed in this new system the owner operated his coaxial speaker at the usual audiophile level. His wife either fled the house or forbade the use of the equipment in her presence. Peace now prevails as evidenced by the fact that she uses the system daily for her own entertainment.

We will now take up the matter of the actual construction of the network. Inductance and capacity values are the same for both the high- and low-pass sections where the speaker load impedances are the same in each output. It should be emphasized that values will change according to the crossover frequency chosen and the impedance for which each output of the dividing network is designed. This should be remembered when attempt-

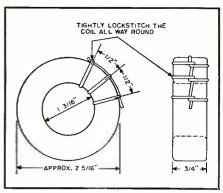
ing to use either of the first two applications suggested. The impedance of speakers used in commercial sets varies over a considerable range, hence flexible design data is required. Many of the available speakers are 16-ohm types, consequently the chart is computed on this basis. To find the values for networks of other impedances, choose the desired crossover frequencv. read the values indicated for 16 ohms at this crossover, and then multiply that figure by R/16 to get the figure for the new inductances. For the new capacity values divide the 16ohm figure by R/16.

The work done to date has used crossovers between 2000 and 300 cps. To suggest a starting place for home experimentation, 900 cps is recommended. This frequency has yielded very satisfactory results.

It will be noted from reference to the chart that the higher crossover regions use capacitors of lower value. These low-capacity units are somewhat cheaper than those of higher capacity. The inductances are variables which are relatively simple to wind and are fairly inexpensive.

Simple air core inductances are best for this application. They may be wound on any removable form having proper hub and flange diameter. If the 900-cycle crossover frequency is chosen, for example, a stamped metal 16 mm film reel may be used as a winding form, then taken apart and removed after winding is completed. This produces a good form factor for this size inductance. 330 turns of #21 heavy "Formvar" wire tightly wound on this form will come close to 4 mhy. After removing the winding form the coil should be tightly lockstitched with waxed lacing cord, then taped, using any good acid-free friction tape, but better still, a half lapped serving of vinyl base electrical tape. These servings of lacing cord and tape make the coil self-supporting and will also avoid inductance changes due to sponginess.

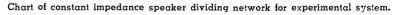
The capacitors should be of the impregnated paper type. They may be 50 or 100 volt types which are stand-

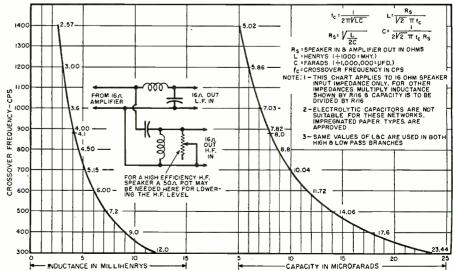


Data for constructing the "900 cycle" crossover. A typical coil is 333 turns of #21 heavy Formvar or Formex. This will produce an air core coil of approximately 4.1 mhy. using dimensions given above. When connected with an 8 μ id. capacitor, as shown below, it should give an f_c of about 880 cps in circuits loaded with 16-ohm speakers.

ard ratings and readily available. To arrive at the odd values of capacity indicated for some crossover frequencies, it may be necessary to use parallel and/or series combinations. The resultant capacity should be within $\pm 10\%$. Good commercial capacitors fall within this tolerance limit. If an impedance bridge is available, both capacity and inductance values can be checked quite readily.

Perhaps a simple way out of the capacitor value problem is to choose capacitors of nominal ratings and construct the companion inductances, as determined from the chart. For example, two commercially available oil impregnated paper 4 µfd., 100 volt capacitors of the bathtub type may be connected in parallel to give 8 µfd. or thereabouts. Measurement of six bathtub types averaged 3.996 μfd. Reference to the chart indicates a crossover frequency, when using 8 μ fd. and 4.1 mhy. inductance, to be about 880 cycles for a 16-ohm network, which is a good crossover frequency for the wanted illusion. Consequently wind the inductances for about 4.1 mhy. 333 turns of #21 heavy "Formvar" or equiva-(Continued on page 166)





All-Transistor Amateur Transmitter

Fig. 1. Over-all view of transmitter. It is built on a perforated Masonite board measuring 8"x12". By using perforations to hold parts, soldering work is minimal.

By GENE BRIZENDINE, W4ATE

Build this compact, portable rig for the 40- or 80-meter band. It uses standard transistor components throughout.

S THE versatile transistor invades more and more electronic fields, the urge grows to explore its possibilities in amateur applications. Admittedly, the project of constructing a useful transistor transmitter was approached skeptically. However, the sporting idea of using very low power in communications brought a fresh viewpoint, similar to fishing with archery equipment, or big-game hunting with a candid camera. Encouraged by reports of two-way communications upward to 2000 miles, the transistor transmitter was undertaken.

Circuit

The base oscillator circuit selected is relatively simple to adjust and none of the components is especially critical. This arrangement also has the advantage of requiring no power switch. The transmitter is ready to go the instant the sending key is pressed.

The 365 µµfd. miniature tuning capacitor (C_1) is of special interest, since it is only $1\frac{1}{2}$ " by $\frac{3}{16}$ " thick!

By mounting the sending key and supply batteries directly on the perforated Masonite board (8" x 12", Lafayette Radio Type ML-81), all power and keying leads are eliminated, resulting in a completely portable transmitter. Stability of the emitted signals is not affected by mechanical disturbances of the key, since crystal control is used.

Construction

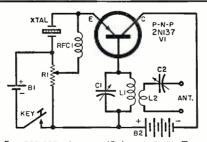
Assembly is best begun by mounting small parts first, and gradually working toward the key, which is the last item to be mounted.

The tank tuning capacitor is spotsoldered to two spade lugs whose shanks are pressed into the perforated board holes. The evelet rivets in the capacitor are convenient for this.

The tank coil is soldered to a lug and one rivet on the tuning capacitor. The 2N137 transistor is mounted by simply pressing its seal end into one of the perforated holes. All other components are bolted to the board, using the ready-made holes.

The antenna pickup coil is slipped over the "cold" or ground end of the tank coil. The two coils are solidly

Fig. 2. Complete schematic diagram of transistor transmitter. See text for parts substitutions which can be made in circuit.



–500,000 ohm pot (Lafayette Radio Type VC-18) C1, C2-365 µµfd. tuning capacitor (Lafayette

Radio Type MS-215)

RFC₁—1 mhy. r.f. choke L₁—32 t., 3/8" dia., 2" #3003) long (Miniductor

L2-9 t., 3/4" dia., 3/8" long (Miniductor #3012)

1.34 volt battery (Mallory Type RM-4010)

B2-15 volt battery (Burgess Type U-10)

Xtal.—7 mc. quartz crystal (See text)
V1—"p-n-p" junction transistor (General Electric Type 2N137)

joined, by applying small drops of Duco cement where their plastic strips contact.

Rubber "feet" are bolted to each of the board's corners, to protect furniture and prevent movement of the transmitter during keying.

Wiring is simple and best done with a small-tipped soldering iron or gun. Heat should be applied sparingly while soldering in the transistor, potentiometer, and the coils. Leave the 2N137 leads full-length, as additional protection to the sensitive transistor.

Adjustment

A field-strength meter or receiver equipped with an "S" meter is useful in tuning up the transmitter. Lacking either of these, a receiver tuned to the transmitter frequency may serve, by reading its a.v.c. voltage, as a field strength indication.

First, the crystal to be used should be placed in another oscillator or transmitter, and used to locate the receiver or field meter on the correct frequency.

The transistor circuit should be visually checked for any wiring errors and incorrect battery polarities. Now, transfer the crystal to the new transmitter. A 0-10 ma. meter connected in series with the collector may be helpful, although it is not essential.

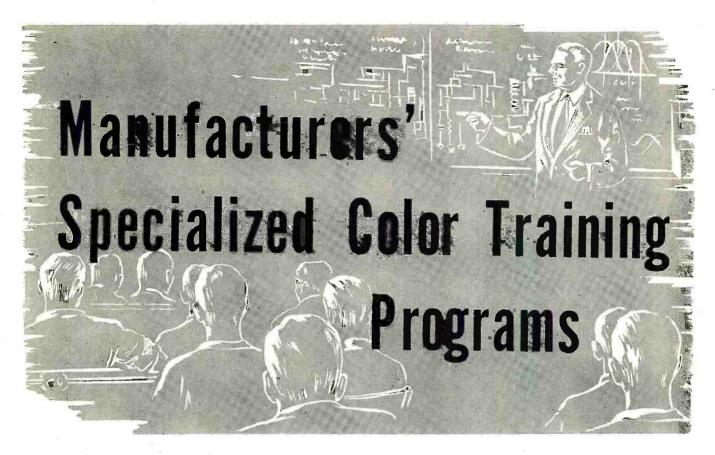
Next, turn the bias potentiometer and tank capacitor fully counterclockwise. While keying the transmitter, explore slowly with the capacitor and pot controls. The carrier should be heard in the receiver with the potentiometer advanced almost fully clockwise, and the capacitor at about 30 degrees from minimum capacity. As either the bias pot or the capacitor is advanced past the optimum point, oscillation will suddenly cease.

If the transmitter is not heard, carefully recheck the connections to the 2N137 and the battery polarities. The crystal should be chosen for good ac-

Although the crystal indicated in the parts list is in the 40-meter band, operation on 80 meters is also possible with this transmitter. It is only necessary to use an 80-meter crystal and to retune the tank tuning capacitor to about two-thirds maximum capacitance. In either band, the approximate input power during normal operation is 75 milliwatts.

When these tests are satisfactory and the keying is clean, a doublet antenna, cut to the operating frequency, may be connected, using a second, similar midget capacitor (C_2) to "tune out" the inductive reactance component of the coupling coil.

With the field-strength meter or "S"-metered receiver tuned to the transmitter, the controls may be adjusted for maximum field strength indications, consistent with clean keying. Once optimum settings of the tank, bias, and coupling controls are found, no difficulty should be experienced, and the transmitter is ready for communication. --30--



In courses given at all levels, set manufacturers will prepare you, at no cost, to service their sets.

THE stepped-up push to get color receivers into American homes means that you, if you are a technician, must get ready to meet the special demands that will be placed on you. No matter how thorough your background in color may be up to now, there is some additional type of training you need. Some of the newest developments may have slipped by you. The mere fact that you haven't had much opportunity to use what you have learned in color helps it to become stale.

Training programs provided by set manufacturers, generally at no cost, range from practical in-shop residence courses, given at the factory, to local lecture series. Eligibility to take part in a training program may range from employment in the manufacturer's service department to minimum evidence of independent work. Registration may involve formal application direct to the manufacturer or simply putting your name on a local distributor's list. Somewhere in these alternatives, there is a program that suits your needs, availability, and eligibility.

Among those providing local training, *Emerson* sends out field service engineers at regular intervals to conduct two-day lecture courses throughout the country. Coverage of the theoretical and practical aspects of color service includes the use of test equipment in setting up convergence and other procedures unique to color sets. If you are interested in getting in on the next two-day course, get your name on file with the local *Emerson* distributor now.

A one-week course at the factory is

the pattern of training provided by General Electric. This concentrated course in theory and lab work, with particular attention to the manufacturer's color receivers, calls for six calendar working days with two or three night sessions during the week if needed. Once the student is in Syracuse, no charge is levied for attendance or materials furnished. When inaugurated last July, attendance was confined to distributor service personnel. While these people continue to enjoy priority, the course is also open to dealer service personnel and independents. Enrollment is supervised by G-E field service representatives throughout the country, who pass upon the suitability of the applicant's previous training and experience. Further information is available from J. R. Davis, Field Service Manager, General Electric Company, Bldg. 4, Room 242, Appliance Park, Louisville, Ky.

A clinic course at its factory presently being offered by Hoffman Radio is being confined to distributor service personnel. In this way, the manufacturer hopes to qualify distributor technicians to train, in turn, servicing dealers and independent technicians. Locally offered training courses will coordinate with and support the distributors' efforts. Hoffman distributors will be the best source of information on how the local program is shaping up and when it is ready to roll.

Successful completion of an entrance

exam on monochrome TV theory has been the ticket of admission to color schools held by The Magnavox Company for its dealers and authorized service agencies. To accommodate students from all parts of the country, five-day schools were set up in San Francisco, Chicago, and New York, at no charge to the technician who could get to these centers. With no definite date set for the next such series, the manufacturer's service engineers are holding informal lectures in various parts of the country. To follow up on forthcoming offerings in the training program, get in touch with the General Service Manager, The Magnavox Company, Fort Wayne 4, Indiana.

Offering factory courses until the middle of last year, *Motorola* has transferred all of its color training activities to the field, with field service engineers collaborating with distributors' service managers in conducting schools and training sessions locally. Local contact with the distributor must be made for participation.

Philco Corp. offers 40 hours of lectures, demonstrations, and lab projects in a comprehensive course that includes a copy of the text "Color Television—Simplified Theory and Service Techniques," which normally retails for \$5.00. While the course was primarily planned for members of the Philco "Factory Supervised Service" plan, other service personnel may also

(Continued on page 130)



Extensive programs given in training institutions cover all models—all aspects of the new field.

ANUFACTURERS of color receivers have played an impressive role in providing technicians with color training, usually at no cost. Despite these far-flung programs, reputable training institutions throughout the country are enjoying a brisk turnover in students willing to pay for schooling in this same field. In some cases, the paying students are those who have already experienced some form of training provided by a manufacturer. Obviously, the private school must have something special to offer.

One advantage provided by the paying institute is the broader manner in which it surveys the field. A given manufacturer is likely to consider color training adequate or complete when the technician-student has acquired some general background plus reasonable familiarity with that manufacturer's receivers. The well-equipped school will survey as many of the extant receivers as possible.

Class size, instead of involving possibly hundreds under simultaneous instruction, is held to small groups. This permits the benefits of individual instruction and gives the student greater opportunity to engage directly in practical work, using actual chassis and test equipment. Whereas the longer manufacturer-sponsored courses seldom exceed 48 hours of instruction, if they go that high, private courses generally run into the hundreds of hours. Small wonder, then, that the training institution is able to hold its own against other types of training.

If you have had at least a year's experience in black and white television servicing or have successfully completed a course in this area given by a recognized training institution, the Baltimore Technical Institute will admit you to a resident course in color TV. Generally following the outline of the course recommended by the Service Committee of RETMA, the program has been enlarged and extended to include recommendations made by other authorities. The newest in color TV circuitry, apparatus, and equipment is used. Running for 500 clock hours, the course takes four months by day, but may also be pursued in the evenings at the rate of two, three, or four nights a week. Applications are accepted throughout the year.

Offering a specialized course in television, with special emphasis on color, Capitol Radio Engineering Institute asks for a basic course on electronics and electrical circuit theory as a prerequisite, for this or any of its specialized courses. The inclusive course covers such fundamentals as the mechanism of the eye (persistence of vision, resolution, flicker, and theory of color perception), chromaticity diagrams, and bandwidth requirements. This is followed by instruction in lighting of color studios, frequency multiplexing, the color subcarrier and chrominance signals, color separation, and other aspects of the signals involved. Then the actual studio, transmitter circuits, receiver circuits, and color picture tubes are analyzed.

Color training is part of the regular TV service course at Coyne Electrical School. Resident training includes lectures, discussions, demonstrations, films, and texts, with half of training time being devoted to work with receivers, tools, and test instruments. Special jobs on color sets are planned to qualify the student for making all required home-installation adjustments and for troubleshooting color chassis on the bench. A home training course consisting of illustrated lesson material includes special lessons on color, together with practical "job guides" giving detailed service procedures.

A separate course in color is available to graduates of regular TV courses or adequately experienced technicians at the Delehanty Institute. It consists of 120 hours of lectures and demonstrations, with specialists handling the several areas covered. These include color TV fundamentals, twophase modulation, the NTSC system. colorimetry, and the color signal. Also covered are color receivers and circuits, picture tubes, mechanical and electrical adjustment, special test equipment, and the practical problems of alignment, servicing, and troubleshooting the color TV sets.

Principles of color TV are included as part of both the resident and home training programs in television servicing at *DeVry Technical Institute*. Among the subjects covered are color TV signals and picture tubes, circuits for the shadow-mask tube, color demodulation, color sync circuits, special test equipment, receiver installation and alignment. Those who attend the resident program have the advantage of working with name-brand receivers

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and test equipment, the latter including dot and bar generators. In addition, broadcast-type equipment in the school's studios make locally generated color signals available whenever they are needed.

Greatest emphasis is being placed on set-up and service in the home at the Electronic Trades Institute. This approach grows out of the feeling that, considering chassis size and the delicacy of adjustments, more actual work on color receivers will be performed in the home than has been the case with their monochrome forebears. Color receivers, including the latest 21-in. models, are used, along with dot and color bar generators. Each student has the opportunity to become directly familiar with the purity, convergence, and other procedures in the complete set-up. While this course is available to resident students during the day, a short course similar to it is offered to local service technicians in the evening.

Indianapolis Electronic School offers a complete resident course that includes color TV circuits and servicing. The 12-month, 1300-hour course is broken up into four sections, the last of which, Section III-C, involves 325 hours in color TV theory and circuitry. Other training equivalent to the first three sections (these cover electronic fundamentals, basic theory and circuitry, advanced circuit theory, and TV receivers) may be accepted for admission to Section III-C. Evening classes are offered on a half-time basis for those who work while attending school.

To keep abreast of color developments as they occur, National Schools keeps its courses of study, both in the resident and home study divisions, as flexible as possible. Basic to the course, however, is the method of comparing the unknown color receiver to the known monochrome instrument, with treatment of similarities and differences, a breakdown of new and additional circuits, and coverage of new test instruments and servicing techniques. This involves a description of the NTSC system, colorimetry, vector analysis, signals, receivers and their special circuits, picture tubes, and conversion circuits.

Practical home-study courses, based on actual work with equipment kits, are featured on two levels by National Radio Institute. In each case, color training is part of a broader course that covers the entire field of TV service. The course in radio and TV servicing provides basic theory, then progresses to detailed study of monochrome and color TV, with actual practice on common receiver circuits. For men who know their theory but are seeking additional skill and speed. there is the all-practice course, professional TV servicing, which involves work on 10 kits, including a receiver and test equipment, as well as special instruction in color.

In the resident school of RCA Institutes, a firm base of fundamental principles is laid down to give understand-

ing of the design and operation of the color receivers and of the transmitting station functions employed in producing color transmissions. Color set servicing is included, in addition, on all levels of instruction. A broadcasting course also covers this ground but includes principles and equipment involved in generating and transmitting color signals. An advanced technology course also adds analysis of design and operation. In the home study division, a series of eleven lessons in color is available to those already qualified in black-and-white television. The last two lessons, recently released, keep the course in step with latest develop-

The step-by-step approach found successful in teaching its other correspondence electronic courses has been applied by the Radio-Television Training Association to its lessons in color receiver service and maintenance. The student proceeds from the development and transmission of color signals to an over-all view of how the receiver functions, followed by separate analysis of receiver circuits. Analysis is emphasized in preference to rote learning. Training in test equipment, alignment, and service is included.

The special six-week resident course given by *Universal Television System* has been approved by the Missouri State Dept. of Education. Comprising 180 clock hours of lectures and demonstrations, it is a separate and special course in color apart from monochrome TV and, as such, is one of the earliest to have received official endorsement. Approval was given in June of 1954. Lectures are augmented with over 400 color slides and accompanying tape-recorded commentary.

Up-to-the-minute servicing techniques and shortcuts are included in

the coverage of all aspects of color TV at *Video Specialties, Inc.* After a study of fundamentals, the student is instructed in all color stages, circuit functions, modifications in late models, and in troubleshooting techniques. The emphasis is on practical lab training, with most school hours being devoted to work on live sets. This work consists of circuit tracing and repair, involving the use of appropriate modern test equipment.

While the institutions already mentioned are not the only ones to offer courses in color TV, training in this area available from other educational organizations is not on the service level. Such other schools include Cleveland Institute of Radio Electronics, Milwaukee School of Engineering, and Tri-State College. In the first mentioned, correspondence courses are offered in basic communications, Color-TV is touched on in this program, but principal emphasis is on electronic theory and communications technique. At the Milwaukee School, there is a choice of day and evening residence courses. The daytime program is an 18-month technician training course leading to the Associate in Applied Science degree in Electronics Communications. This course includes study in monochrome and color transmitters and receivers, as well as in other types of receivers and the basic theory and practice of electronics. The evening course in color covers the physics of color, the receiver, and receiver circuits that are peculiar to color sets.

At *Tri-State College*, a resident course is given that leads to a degree in radio engineering. It includes credits in both monochrome and color TV.

For the prospective student, there is a wide enough choice to meet any study requirements. $-\overline{30}-$

Write to registrars of the schools below for full information on color courses.

Baltimore Technical Institute 1425 Eutaw Place Baltimore 17, Maryland

Capitol Radio Engineering Institute 3244 16th Street, N. W. Washington 10, D. C.

Cleveland Institute of Radio Electronics 4900 Euclid Avenue Cleveland 3. Ohio

Coyne Electrical School 500 S. Paulina Street Chicago 12, Illinois

The Delehanty Institute 117 East 11th Street New York 3, New York

DeVry Technical Institute 4141 Belmont Avenue Chicago 41, Illinois

Electronic Trades Institute 431 South Dearborn Street Chicago 5, Illinois

Indianapolis Electronic School 312 East Washington Street Indianapolis 4, Indiana Milwaukee School of Engineering 1025 North Milwaukee Street Milwaukee 1, Wisconsin

National Radio Institute 16th and U Streets, N. W. Washington 9, D. C.

National Schools 4000 South Figueroa Street Los Angeles 37, California

RCA Institutes, Inc. 350 West 4th Street New York 14, New York

Radio-Television Training Association 52 East 19th Street New York 3, New York

Tri-State College 16106 College Avenue Angola, Indiana

Universal Television System 1224-28 Admiral Boulevard Kansas City 6, Missouri

Video Specialties, Inc. 4570 Firestone Boulevard South Gate, California



By BERT WHYTE

S MOST readers know, the majority of high-fidelity equipment manufactured have banded together and formed a trade high-fidelity equipment manufacturers organization known as the "Institute of High Fidelity Manufacturers". The aims and pur-poses of this group I reported on some months ago. One of their objectives was to sponsor hi-fi shows in the various major market areas. These shows were to supplant the Audio Fairs which we have had for the past 7 years. The whys and wherefores of this are too complicated to discuss and it is not my business to try and analyze the reasons. Suffice to say that the Audio Fair is no more and on Sept. 27 through 30 the Institute held its first New York High Fidelity Show. Inevitably, one must compare it with the Audio Fairs of recent years. First round goes to the new Institute Show, the sponsors very sensibly holding the show much earlier than did the Audio Fair and thus giving the hi-fi dealer a longer marketing period for the new

equipment. There was a lot said about the new location of the show which is the New York Trade Show Building. It was highly touted as being very superior in facilities available as compared to the former site of the Audio Fair in the New Yorker Hotel. Well, I'd call this round a draw. It was true as advertised that the hallways were much more spacious, the fluorescent lighting much easier on the eyes. One of the major attractions was supposed to be the air-conditioning, but during all the time I was there, I didn't notice any appreciable difference. . . . I was as hot and sticky as in former years. And while a few of the more fortunate manufacturers had acquired rooms which were far larger than anything the New Yorker ever had to offer, on the whole the rooms were disappointingly small. It looked rather ridiculous to see some of the most gargantuan speakers in these tiny rooms. More than that and my main objection was that all the rooms were exceedingly hard sounding as might be expected with vinylite floor covering and hard plaster walls. The New Yorker rooms with carpeting on the floor would have greatly aided in subduing the merciless treble screech some of the more peakier speakers were putting forth! But by and large, the first Institute show was a success. Despite the fact that admission (50 cents afts.--75 cents eves.) was charged, the crowds were greater than ever. Here is where the Institute really shone, their handling of these crowds very much more

efficient and well organized than ever obtained at the New Yorker. This year the people who attended the show seemed a more reasonable breed than their predecessors. They were generally more knowledgable about hi-fi, and seemed more concerned with good musical balance than with the spectacular tricks and "gimmicks"

of yesteryear. Perhaps the most amazing thing was that the levels at which the equipment were demonstrated did not increase as they have cumulatively in past years, but were actually quite reasonable. On an overall basis, there wasn't a great deal of new equipment at the show and certainly nothing world-shaking turned up. This is evidently the year of re-design . . . facelifting and restyling . . . and technical refinement. How-ever, there is absolutely no basis for any ideas about the stagnation of hi-fi design and engineering.

To help harried hi-fi Santas, I'll have to keep the reviews short as I want to list as many records as possible as an aid to your Christmas buying. Most of the records reviewed will be new material, but some will be older discs in the catalogue which are outstanding recordings and have special values as gifts.

To all of you my favorite people . . a very Merry Christmas to you and yours and best wishes for a joyful holiday season!

Equipment used this month: New Weathers arm, cartridge, and oscillator; Marantz and McIntosh preamps; Components Corp. turntable; 2-60 watt McIntosh amplifiers; Jensen "Imperial" speaker; Electro-Voice "Georgian" speaker, Ampex monaural/stereo tape equipment.

BEETHOVEN

SYMPHONY #3 (EROICA)
Philharmonia Orchestra conducted by
Otto Klemperer. Angel 35328. RIAA
curve. Price \$4.98.

It is too bad this version of the "Eroica" follows so hard on the heels of the excellent Fritz Reiner reading of some months ago. If you bought that recording you can be assured that performance and soundwise you have one of the very best versions available. But if Beethoven is your pet, if the "Eroica" is close to your heart . . . then you cannot afford to ignore this recording. For along with the Toscanini performance, this is one of the greatest readings ever committed to disc. And with the added plus of magnificent modern sound it is without question the finest "Eroica" in the catalogue. Klemperer is a giant here, this is a reading of incredible power and vitality. The passionate utterances of the 1st, 3rd, and 4th movements are projected with great intensity, yet Klemperer never overplays, he is never mannered. And the dolorous broodings of the 2nd movement, the famous "Marche Funebre", Klemperer, approaches with great reverence. His tempo is slow, measured, but he never allows matters to go beyond the bounds of good taste. And the playing Klemperer elicits from the

The opinions expressed in this column are those of the reviewer and do not necessarily reflect the views or opinions of the editors or the publishers of this magazine.

men of the Philharmonia is truly wondrous.

Soundwise, this is hugely proportioned, one of the biggest sounds Angel has thus far produced. First and second strings are beautifully clean and well defined and the dark sonority of the celli and contrabassi must be heard to be believed. Add great resounding brass, lovely mellow woodwind and percussion of great impact and accuracy and couple with the most felicitous of acoustic perspective and you have a recording of near definitive proportion. I can't recommend this too highly!

MOZART

CONCERTO #25 CONCERTO #26

Friedrich Gulda, pianist, with New Symphony Orchestra of London conducted by Anthony Collins. London LL1370. RIAA curve. Price \$3.98.

A fine coupling, sensitive and more than satisfactory performances from Gulda, Anthony Collins a little out of his element but doing a creditable job nonetheless, and exemplary sound in the proper light frame for Mozart . . . all adds up to one of the better Mozart releases in this year of surfeit.

BRAHMS

SYMPHONY #4
Philharmonia Orchestra conducted by Herbert Von Karajan. A RIAA curve. Price \$4.98. Angel 35298.

This Brahms 4th is heroic in line and conception. Von Karajan makes of it a great sonorous edifice which will appeal to many and not at all to others. Taste aside this is a real conductorial tour-de-force with playing of miraculous precision. Big clean sound from Angel to match the grandiose efforts of Von Karajan.

BIZET

SYMPHONY IN C MAJOR JEUX D' ENFANTS

London Symphony Orchestra conducted by Emanuel Young. Capitol P18018. RIAA curve. Price \$3.98.

Bizet's scintillating symphony and his ingratiating "Children's Games" are given a warm and sympathetic reading by newcomer Young, who obviously is a conductor of considerable merit. His reading lacks some of the vivo of the Cluytens/Angel version, but soundwise his engineers have done a fine job in coming up with just about the cleanest disc yet in Capitol's European series.

RUBENSTEIN PLAYS LISZT Artur Rubenstein, pianist. Victor LM-1905. RIAA curve. Price \$3.98.

Take bravura repertoire, a Rubenstein at the top of his form, add a "big" piano sound of startling brilliance and you have pianism in "le grande tradition". Rubenstein has the happy faculty, that when he is "right", he can take works like the "Mephisto Waltz", the "Hungarian Rhapsodies" 10 and 12, and even the ubiquitous "Liebestraum" . . . all found on this disc . . . and done to death though they may be . . . make them sound fresh and interesting. One of the best piano recordings musically and technically ever issued by RCA Victor, and a "must" to demonstrate piano sound on your hi-fi system.

SAINT SAENS

SYMPHONY #3 (ORGAN)

Henriette Roget, organist, with Orchestre de la Societe des Concerts du Conservatoire de Paris conducted by Andre Cluytens. Angel 35336. RIAA curve. Price \$4.98.

This is the 5th recording of this popular work and in all respects the best. This recording was awarded a Grand Prix du Disque

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and one listen to it, and I am in complete accord. Cluytens approaches the work with respect (which few other conductors do) and his affection for it allows a warm and lyrical reading, flawlessly executed. Oddly enough, although this has by far the best and cleanest sound of any of the present versions, it too lacks the extremely low organ pedal, which so endeared the old Munch/Columbia reading to the hi-fi fan. Whether it was chance or circumstance or recording trickery, none of the recordings since then has captured the shuddery, soul satisfying throb of the organ pedal as it was captured on the old Carnegie Hall organ. This aside, this is a most exciting recording and highly recommended to you.

VIRGIL FOX PLAYS BACH Virgil Fox, organist, playing the organ of the Riverside Church, New York. Victor LM1963. RIAA curve. Price \$3.98.

The critics have murdered poor Virgil for this one, and in all honesty I must admit that his playing of Bach is not always according to the score nor the accepted standards of performance. However, Fox has a tremendous talent for communication and he can make Bach acceptable and assimilable to many who otherwise would never give Bach a second thought. The "Toccata and Fugue in D Minor" is such a dazzling work it always has a great impact on an audience, however musically unsophisticated the audience might be. But it takes a real showman to make that same audience accept and like Bach works like the Chorale preludes. Yes, Fox is flagrantly guilty of romanticizing and oversentimentalizing these works but, believe me, the audience generally eats it up! The proof of this pudding is that Fox is one of the few money-making touring organ virtuosi on the concert-hall circuit. I know whereof I speak, as several years ago, he drew an audience of close to 2500 people in Orchestra Hall, Chicago, where I had the pleasure of recording his program stereophonically! Recordingwise, this is a huge organ sound with great gutrumbling pedals much in evidence for the pleasure of the hi-fi fan.

BEETHOVEN

LEONORE OVERTURES #1, #2,

OVERTURE TO FIDELIO OVERTURE TO CORIOLAN Boston Symphony Orchestra conducted by Charles Munch. Victor LM2015. RIAA curve. Price \$3.98.

A magnum sampling of Beethoven Overtures and a fine opportunity to compare the first three overtures written for Leonore with the fourth and final one chosen for the opera which was renamed "Fidelio". Munch turns in deft, if hardly definitive, performances of these overtures, aided and abetted by the virtuoso playing of the Boston Symphony men. Big plus here is the sound which is all luster and sheen, crisp definition, and weighty sonority. This was probably recorded in stereo and the tape should be a knockout!

SCOTS GUARDS ON PARADE The Regimental Band and Massed Pipers of the Scots Guard conducted by Lt. Col. S. Rhodes. Pipe Majors J. S. Roe and R. Crabb. Angel 35337, RIAA curve. Price \$4.98.

Aye mon, the laddies are at it agin. A Scotsman knows a good thing when he sees it and having made more than a few farthings with the first Scots Guard recording, they would like to divest their "yonkee" friends of a few more bob. That they will succeed I have no doubt as this is on the same order of excellence and excitement as the first effort. Unlike so many other sequels, (Continued on page 167)

A CHRISTMAS RECORD BUYING GUIDE

A listing of some of the outstanding recordings of the past year which are sure to please the real audiophile.

past year	which are sure to please the	real
COMPOSER	TITLE	ARTIS
Beethoven	Ninth Symphony	Toscar Von K
Beethoven Beethoven	Ninth Symphony. Violin Concerto	Milstei
Bartok Berlioz	Concerto for Orchestra Romeo and Juliet (Complete) Symphonie Fantastique Symphonie Fantastique	Dorati- Munch
Berlioz Berlioz	Symphonie Fantastique	Dorati-
Berlioz	Symphonie Fantastique	Munch Navar
Block Brahms	Schelomo Violin Concerto	Milstei
Brahms Brahms	Violin Concerto Four Symphonies (Complete)	Heifetz Walter
Britten	Young Persons' Guide to the Orchestra	Dorati-
Chavez Copeland	Toccata for Percussion El Salon Mexico	Slatkin Fiedle:
Copeland	Third Symphony	Dorati-
Debussy Debussy	La Mer Le Martyre de St. Sebastien	Toscar Danco
Dukas	La Peri	Anseri
Dukas DeFalla	Sorcerer's Apprentice Three Cornered Hat (Complete)	Paray- Anseri
Franck	Symphony in D Minor	Paray- Furtwo
Franck Gliere	Symphony in D Minor Symphony No. 3	Schero
Gould Gould	Dance Variations	Stokov Hanso
Handel	Latin American Symphonette The Messiah	Boult—
Haydn Hindemith	The Creation	Woldil Ormar
Hindemit h	Mathis Der Maler Symphonic Metamorphosis	Kubeli
Holst Holst	The Planets The Planets	Sarger Boult—
Ibert	Ports of Call	Paray Kapell
Khachaturian Khachaturian	Piano Concerto Violin Concerto	Kapell Oistra
Kodaly	Hary Janos Suite	-Solti-
Kodaly Liszt	Peacock Variations Les Preludes	Dorati Paray
Liszt	Todtentanz	Paray Katin- Kubeli
Mahler Mahler	Symphony No. 1 Symphony No. 1	Walter
Mendelssohn	Violin Concerto	Milstei
Mendelssohn Mozart	Symphonies No. 3 and No. 5 The Magic Flute	Mitrop
Mozart Mozart	Don Giovanni	
Mozart	Marriage of Figaro Cosi Fan Tutti	
Mozart Moussorgsky	Symphonies No. 36, No. 39, No. 40, No. 41	Reiner Kubeli
Moussorgsky	Pictures at an Exhibition Night on Bald Mountain	Stokov
Moussorgsky Offenbach	Boris Godounov (Complete) Gaite Parisienne	Fiedle
Paganini	Violin Concerto No. I	France
Paganini Piston	Violin Concerto No. 1	Ricci Hanso
Prokofiev	Symphony No. 3 Alexander Nevsky	Rossi~
Prokofiev Prokofiev	Buffon Suite Piano Concerto No. 3	Golsch Kapell
Prokofiev	Lt. Kije Suite	Boult- Callas
Puccini Puccini	Madame Butterfly Tosca	Callas
Puccini Puccini	Turandot Manon Lescaut	Tebala Tebala
Rachmaninoff	Piano Concerto No. 2	Andα-
Rachmaninoff Rachmaninoff	Rhapsody on a Theme of Paganini Symphony No. 2	Katche Steinb
Ravel	Bolero	Paray
Ravel Ravel	La Valse Daphnis and Chloe (Complete)	Paray Dorati
Ravel	Scheherazade	Danco
Resphigi Resphigi	Feste Romana Pines and Fountains of Rome	Dorati Dorati
Reubke	Sonata on the 94th Psalm	Biggs-
Rimsky-Korsakov Rimsky-Korsakov	Antar Antar	Anser Paray
Rimsky-Korsakov Rimsky-Korsakov Rimsky-Korsakov	Capriccio Espagnole	Paray
Rimsky-Korsakov	Russian Easter Overture Scheherazade	Paray Dorati
Rimsky-Korsakov Schubert	Scheherazade Unfinished Symphony	Anser Muncl
Schubert	Unfinished Symphony Symphony No. 7 in C Major	Boult-
Schumann Schumann		Giesel Parav
Shostakovich	Symphony No. 5	Paray Rodzir
Shostakovich Sibelius	Symphony No. 10 Symphony No. 2	Mitrop Collins
Sibelius	Symphony No. 3	Collin
Sibelius Smetana	My Fatherland (Complete)	Von K Kubeli
Strauss, R.	Also Sprach Zarathustra	Reiner
Strauss, R. Strauss, R.	Piano Concerto Symphony No. 4 Symphony No. 5 Symphony No. 10 Symphony No. 2 Symphony No. 3 Symphony No. 4 My Fatherland (Complete) Also Sprach Zarathustra Don Juan Till Eulenspiegel	Reiner Kraus:
Strauss, R. Strauss, R.	Ein Heldenleben Ein Heldenleben	Reiner Dorati
Strauss, R.	Salome (Complete)	Goltz- Dorati
Stravinsky Stravinsky	The Rite of Spring Petrouchka	Dorati Schere
Stravinsky	Petrouchka	Dorati
Stravinsky Tchaikovsky	Petrouchka Manfred Symphony	Anser: Kletsk
Tchaikovsky	1812 Overture	Dorati Dorati
Tchaikovsky Tchaikovsky	Nutcracker Ballet (Complete) Swan Lake (Complete)	Dorati
Tchaikovsky Vaughn Williams	Sleeping Beauty (Complete) Job	Dorati Boult-
Vaughn Williams	Sinfonia Antarctica	Boult-
Verdi	Requiem	De Sa

ST AND LABEL nini-Victor arajan—Angel Karajan—Angein—Capitol
iti—Mercury
th—Victor
i-Mercury
h—Victor
ein—Capitol
tz—Victor
ein—Cabitol
iti—Mercury er---Columbio i---Mercury in---Capitol er---Victor ii---Mercury mini---Victor mini—Victor
o—London
rmet—London
y—Mercury
rmet—London
y—Mercury
chencury
rchen—Westminster
wski—Victor iwski—Victor
on—Mercury
—London
like—Vanguard
indy—Columbia
lik—Mercury
ent—London
—Westminster y—Mercury ll—Victor akh—Angel –London ti—Mercury y—Mercury —London ik—London er—Columbia ein—Capitol poulos—Columbia London London London London Angel -Victor lik—Mercury wski—Victor Victor Victor er—Victor cescatti—Columbia —London ...London
jon...Mercury
jon...Mercury
i...Vanguard
chmann...Capitol
jol...Victor
i...London
as...Angel
ddi...London
ddi...London — Angel nen—London berg—Capitol y—Mercury London i-Mercury ti—Mercury
ti—Mercury
s—Columbia
rmet—London
y—Mercury
y—Mercury
ti—Mercury
ti—Mercury rmet—London h—Victor —Westminster is—London is—London Karajan—Angel lik—Mercury er—Victor r---Victor ss—London er—Victor r—victor li—Mercury -London net—Londo —Angel —Mercury —Mercury –Mercury –Mercury -London Boult-London
De Samata-Angel



THE current line of *Emerson* color receivers consists of v.h.f. model C-506A (chassis 120319-A) and its u.h.f.-v.h.f. counterpart, model C-507A (chassis 120320-A). The model C-507A looks exactly like the C-506A pictured here except for the appearance of the tuner knobs.

As the block diagram of Fig. 2 shows, the basic circuitry of all color receivers, including Emerson's, does not differ much from that of Admiral, Hoffman, Westinghouse, and other receivers that are based on the RCA color receiver circuits. The circuit was described in the March 1955 issue of this magazine. Some modifications and innovations have been made, but the critical color circuits are still the high level triode demodulators, the crystal-controlled 3.58-mc.-subcarrier oscillator, and reactance tube/phasedetector color-synchronizing system. The convergence circuit is almost identical to those found in other color sets which use the 21AXP22 shadow-mask color picture tube.

The most outstanding contribution of the *Emerson* design to the TV service industry is in the arrangement of the secondary controls, the alignment and adjustment points, and in the over-all mechanical layout.

A novel h.v. interlock is used, which consists of a plastic hollow rod that separates two contacts. When the back cover is removed, the plastic rod is withdrawn and the high voltage is shorted to ground. This grounding contact must be opened with a dummy plug before a regular "cheater" line cord is used; otherwise the flyback transformer or some other portion of the h.v. supply could be damaged.

A glance at the underside of the

Emerson color chassis will show that it very closely resembles the familiar chassis wiring of monochrome sets. At the time of writing, no printed-wiring sub-assemblies were being used. These models featured conventional components and chassis layout.

The picture tube is shipped in place, and is mounted independently of the chassis. The entire assembly is quite heavy, but not much more than a 21in. monochrome tube and separate chassis. For most service and troubleshooting work, however, the chassis need not be removed, since the rear as well as the front and the top of the cabinet are removable for servicing. Accessibility of parts is further improved by the use of a removable plate at the bottom of the chassis. A total of 28 different tuning and adjustment functions are available from the front of the set, most of them hidden by the sub-panel.

Adjustment and Controls

When the hinged customer-adjustment panel is opened, two woodscrews are exposed which hold the removable sub-panel in place. Fig. 1A shows all of these adjustments and their respective functions.

In addition to the front controls there are 11 adjustments available at the rear of the chassis, as shown in Fig. 1B. The focus potentiometer is located inside the h.v. cage, as is usual in color TV sets. Note the horizontal size switch at the bottom rear of the chassis. This switch, which has three positions, connects the horizontal width-control coil for three different picture widths, compensating for line voltage variations and aging conditions

Also shown in Fig. 1B are tie-points used in alignment and troubleshooting procedures. A quick oscilloscope check at each of the three picture-tube grids, for example, will show whether color video signals are present. The voltage at the cathode of the horizontal output tube serves as indication of proper horizontal sweep power. When a color strip is transmitted on monochrome telecasts, the edge of the picture can be observed by shorting out the indicated test point in Fig. 1B and moving the entire picture off center.

Color purity is obtained by the same components used with most 21AXP22 picture tubes, the purity magnet and the field equalizing assembly. The latter component has a rough adjustment through a radial push-pull action, and a fine adjustment by rotary motion. At the start of the purity adjustment, all magnets are pulled farthest from the rim of the picture tube and the two tabs of the purity control are set to overlap each other. This provides minimum corrective action. A gradual increase and step-by-step adjustment procedure usually permits good color purity to be obtained.

Recommended Test Instruments

In addition to the test instruments normally used by TV technicians, certain special items are required for any thorough alignment and troubleshooting of a color receiver. Oscilloscopes used only for alignment need not be of the wide-band variety, but for rapid troubleshooting a wide-band scope will be invaluable.

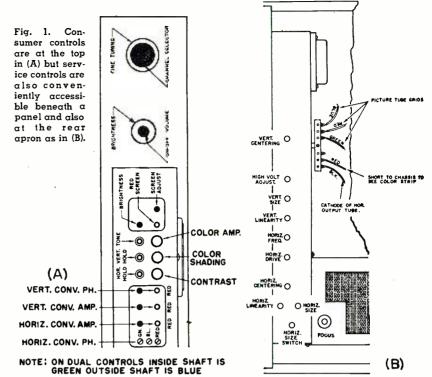
The *Emerson* service notes are planned for use without a special scope and require only the standard v.h.f., u.h.f. and i.f. sweep generator,

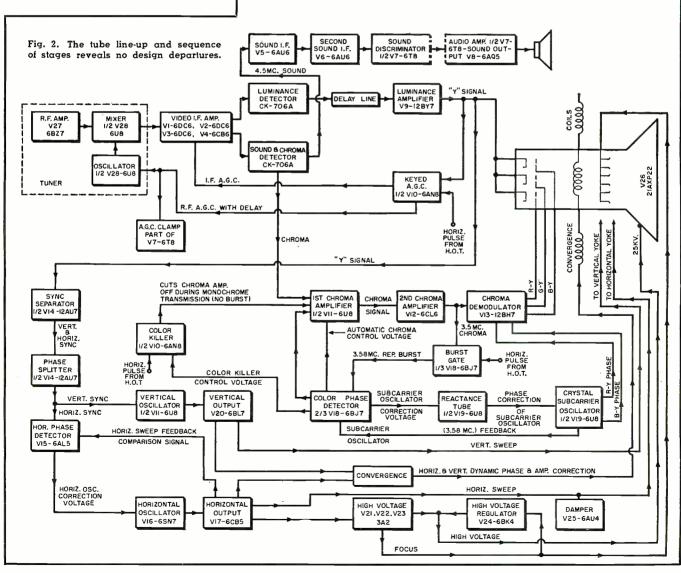
RADIO & TELEVISION NEWS

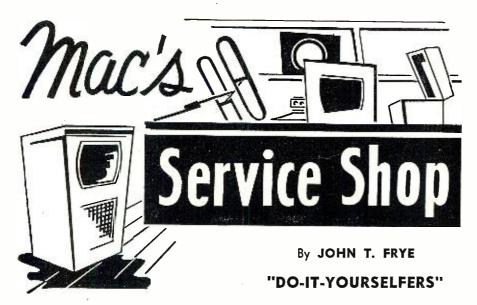
By ROBERT B. GARY

scope, and v.t.v.m. for the monochrome receiver sections. To align the color portions and check receiver performance, Emerson recommends the use of a dot generator with r.f. output, a color bar generator with r.f. output, and a 50-kv. probe for the v.t.v.m. The use of a line voltage monitoring meter is recommended, since the h.v. adjustments should be made with consideration of the a.c. line. For waveshape observation, a low-capacity probe is required and a crystal diode probe is also helpful, but both of these items are usually available in the service shop.

Probably unique among the leading manufacturers, *Emerson* provides a considerable number of fuses in its color sets. "B+" and filament short circuits will be indicated whenever the respective fuses are open. Two fuse(Continued on page 169)







T WAS a typical December day. In the morning the sun had shone briefly, but then it clouded up and now scattered snowflakes were blowing against the steaming windows of Mac's Service Shop.

Inside Mac and his apprentice, Barney, were fresh out of work. At Mac's urging, they had really been slaving away at forced draft for several days in order to have the shop all cleaned out and ready for the pre-holiday rush of business. Mac was a firm believer in being prepared to give the "extra" service during this period that could spell the difference between a customer's having a perfect Christmas or one marred by a dead radio, TV, or hi-fi in the home or by an electronic Christmas present that would not work. They had gone at the thing so industriously that they had worked themselves completely out of a job; so now they were seated side by side on the service bench chatting contentedly.

"I certainly hated to miss that technicians' meeting last night," Mac said; "but you just don't leave your wife alone on her wedding anniversary—at least not if you expect to have any more anniversaries. How did things go?"

"It was a real lively meeting," Barney said as he pulled a dog-eared notebook from his pocket and glanced at it. "I thought you would want to know what went on; so I jotted down some notes. Since I was the youngest guy there, I thought the old timers would appreciate my keeping my yap shut; but that didn't keep me from listening."

"What was all the conversation about?"

"About the growing number of people who try to repair their own radio and TV sets. Jim Barker got up and said he thought we ought to present a united front on this problem. He suggested we talk it over in the meeting and thresh out exactly what our attitude toward these people should be. That really touched things off, and there was never a dull moment from

then until the meeting was gavelled closed at eleven-thirty."

"I can well imagine," Mac said. "That's a pretty tender subject with some of the boys. What did you decide?"

"Nothing really. We're going to take up where we left off at the next meeting. There was a pretty broad gulf between the extremes of opinion."

"How about a ferinstance?"

"Well, for instance, Dick Boyd really wanted to get rough with the Do-It-Yourselfers. To his way of looking at it, they were trying to take bread right out of his mouth, to scab on the union, and to get themselves electrocuted all at the same time. Any measures to discourage them were, to his way of thinking, more than justified."

"Sounds like Dick," Mac said with a chuckle. "What measures did he have in mind?"

"Oh, he had some dan-dan-dandies. One was to give the people misinformation when they came asking for free advice. If the symptoms sounded like something wrong in the horizontal circuit, advise them to look for trouble in the i.f. stages, etc. Another bright idea was to 'overlook' a bad tube when one of these free-loaders brought in a whole set of tubes to be checked."

"That's going pretty far. On top of that, it's cutting off your nose to spite your face. After all, a sale is a sale."

"Not always. As Dick pointed out, quite often these fellows have a whole-sale catalogue sticking out of their rear pocket; and after you tell them which tubes are bad, they thank you and go home and order the tubes from the wholesale firm."

"That's a possibility, it's true; but after they finally do find out you failed to locate the tube that was really bad, they'll have a pretty poor opinion of you and your test equipment."

"Another guy pointed that out to Dick, but he stubbornly insisted he didn't give a hang what one of these cheapskates thought of him."

"How about the rest of the fellows? Did they go along with Dick?"

"Not many of them. Old Mr. Elkins had just about the opposite view. He thought we ought to do everything possible to help the Do-It-Yourselfers in order to secure their good-willeven to lending them schematic diagrams and helping them diagnose their troubles. He insisted that in the long run this would pay off. If we impress the Do-It-Yourselfers with our honesty and desire to be helpful, sooner or later he will realize how foolish it is to try and do service work without the know-how, the service literature, or the test equipment. Then he will bring his set to us because he has learned to trust us."

"Hm-m-m-m," Mac said dubiously. "That sounds pretty good and noble, but I'm afraid Mr. Elkins does not appreciate how hard some of these fellows are to discourage. And I flatly refuse to let any of them see our service literature. After all, we have invested several hundreds of dollars in our schematics; and I'm not about to let one of these jokers use them for free. I wouldn't even let another technician make a practice of that. To do so would be stupid.

"Neither do I intend to hand out any free advice on how to correct trouble in a set. That would be giving away our most valuable asset: our knowhow. In such a case, if we guessed wrong—and you know how easy it is to make a mistake about symptoms relayed to you by an untrained person—all we'd get is the suspicion and ill-will of the Do-It-Yourselfer. If we guessed right, we'd just show how 'smart' we are by doing ourselves out of a possible service job."

"That's about the way most of the fellows seemed to feel. While they were not ready to go along with Dick in actually misleading the Do-It-Your-selfers or giving them dishonest tests, they felt it was being mighty foolish to aid these people in fixing their own

"Carl Marshall brought up an interesting point, though. He said it was a case of the pot calling the kettle black because every one of us was a Do-It-Yourselfer in other lines. Some of us work on our own cars; others do plumbing around the house; still others make changes in their house wiring. And in about every instance we do exactly what the radio and TV Do-It-Yourselfer does: try to get free information from a person who makes his living doing what we are trying to do."

"And he's right," Mac said with a guilty grin. "Just night before last I was talking to Jimmy Palmer, the brick mason, about how I should go about building an outdoor oven for our patio next spring. He promptly got out some miniature bricks that bricklayers use to work out their problems and showed me exactly how to go about it."

"While we're confessing, I may as well, too," Barney said. "Carl Farmer, the garage mechanic, brought his set (Continued on page 135)

RADIO & TELEVISION NEWS

A Professional Tape Recording Amplifier for Home Hi-Fi Systems

By
MAURICE P. JOHNSON
Facilities Engr., Station WAAM

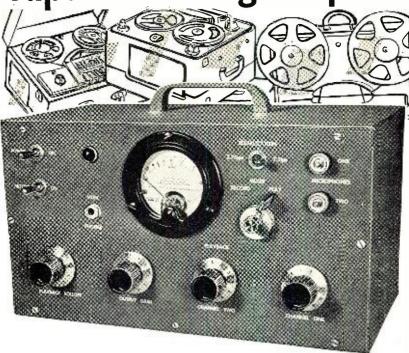


Over-all view of the author's home-built "professional-type" tape recorder amplifier designed to improve home music systems.

N A SHORT period of years, tape recorders have come to play an increasingly important role in the home audio system. A few years back, tape recorders were found only in recording studios, broadcast stations, and other professional establishments. Today, by contrast, there are recorders available in all price ranges, with the result that they are being used at all levels of audio system complexity, including the home music system.

There is little need to emphasize the convenience of recording as offered by the tape recorder in conjunction with the home audio outfit. The advantages of recording broadcasts, such as those aired by fine-music FM stations, for future use are obvious. The sentimental aspects of recording the voices of children, friends, or others need not be expounded. In short, it is apparent that a tape recorder is a valuable adjunct to any home sound system.

It is, of course, possible to buy commercial recorders in many price ranges and of varying degrees of excellence. However, there are many audio fans who enjoy constructing their own high-fidelity systems. From such a constructor's point of view, there are two general assemblies in the tape recorder. The tape transport mechanism is a mechanical device requiring close tolerances and careful fits, as well as ingenious design. As such, it is not easily duplicated by the home constructor. Fortunately, tape transport mechanisms of good quality are readily available so that the job of assembling a custom tape recorder can be confined to the construction of a suitable amplifier. Such an amplifier will be discussed in this article. While the unit described is capable of providing high-fidelity performance, emphasis



The design and construction of a versatile recording and playback amplifier for use with inexpensive tape decks to produce quality tapes at low cost. Audio mixer is provided.

has been directed toward a design involving a relatively small cash outlay.

The design of the amplifier is predicated, to a large degree, by the recording heads and transport mechanism involved. An inexpensive *Pentron* 9T-3M mechanism was selected as typical of the commercially available tape transports. Naturally, one of the others might have been equally satisfactory.

Specifications on the 9T-3M include 3.75 and 7.5 inches-per-second tape speeds, and a flutter of 0.3% at 7.5 ips. Speed stability, wow, and flutter determine the mechanical limits of tape fidelity, with values below 0.5% considered necessary for quality results. The inexpensive mechanism compares favorably with more expensive units in this respect. One professional broadcast tape recorder, as an example, is rated at 0.2% r.m.s. combined flutter and wow at 7.5 ips speed. Thus, it is seen that the mechanical abilities of the inexpensive transport need not be a limiting factor in the design of a high-fidelity tape outfit.

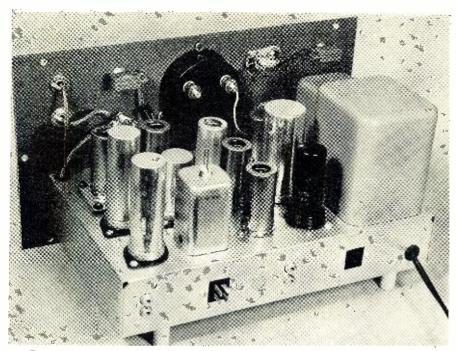
The heads furnished in production models of the 9T-3M have removable pole pieces, so that single-track or dual-track heads may be interchanged as desired. Single-track heads were used during development work on the project, so that tapes could be recorded on the 9T-3M and played on an RCA RT-11A broadcast recorder for quality and equalization checks.

A combined record-playback head

with a gap of .0005" is used, thereby becoming the limiting factor on the frequency response. Such heads as the Brush "Redheads" with .00025" gaps, or Dynamu heads with .00015" gaps are theoretically capable of more extended high-frequency response. However, with the existing heads on the Pentron, and proper equalization, it should be possible to obtain reasonably flat response from 50 to over 10,000 cps, at the 7.5 ips speed. This range compares quite favorably with professional machines operating at this speed. Distortion-free response bevond 10 kc. makes the use of professional speeds of 15 or even 30 ips almost essential. Other factors such as beats and intermodulation between high audio frequencies and the supersonic erase and bias oscillator serve to complicate the design for extremely high frequency response.

In general, at 7.5 ips speed, the overall characteristic of the head without equalization is as shown on next page. At this speed, it will be noticed that peak response is obtained in the vicinity of 1 to 3 kc. Because the head is a magnetic device, lower frequencies fall off in direct proportion to frequency, the slope being independent of the tape speed. Another way of stating the same thing is to say that the response falls off at a rate of 6 db per octave.

At high frequencies, however, the roll-off is determined to a large degree by tape speed as well as the head gap. The individual head thus enters

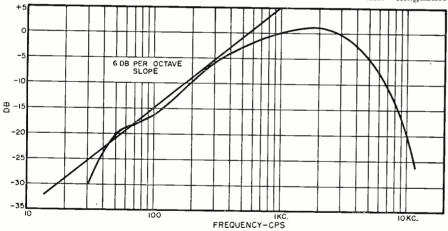


Rear view shows 2 separate input jacks (left) and 2 paralleled output jacks (center). The Jones connectors carry signals to the tape heads and a.c. power to the tape deck.

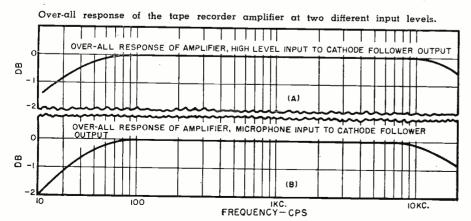
into the design problem. Frequency response curves of magnetic heads are covered in detail in such texts as Oliver Read's "Recording and Reproduction of Sound," or "Magnetic Recording" by S. J. Begun, for those interested in a more complete analysis. It should be noted, however, that in

this case the relative levels at 50 cps and at 10 kc. are approximately 20 db below the response at 2 kc. This unequalized head response indicates the nature of equalization which must be introduced in the amplifier.

An article by W. E. Stewart in the June 1955 issue of this magazine



Recording head characteristics shown at 7.5 ips tape speed with no equalization provided. This curve is based on data supplied by the Pentron Corporation and is taken with the Pentron 9T-3M head and the 3-M Company's "Scotch" #111-A tape.



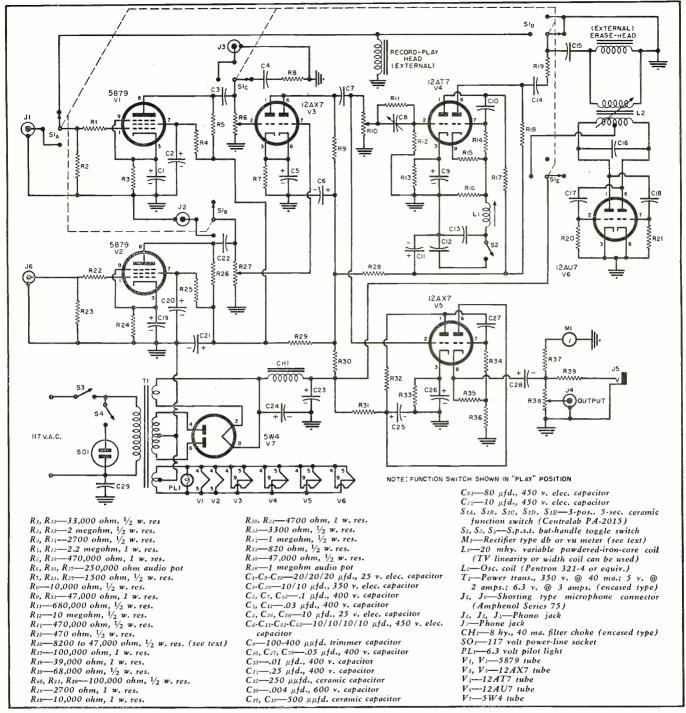
("Why the NARTB Curve for Magnetic Tape") discusses the NARTB recording standard. Such factors as tape overload characteristics, frequency vs energy content of music and voice, as well as head characteristics enter into the selection of the recording curves. In general, most satisfactory results are obtained by pre-emphasis on the highs during recording, and low-frequency boost inserted as post-emphasis at playback.

Progressing to the amplifier itself. now that the nature of the problem has been considered, it was decided that the design should be as flexible and versatile as practical, in order to cope with almost any recording situation which might arise. To this end, the amplifier was designed for three definite purposes: namely, a record amplifier, a playback amplifier, with the third application of mixer amplifier for public address work included without adding complexity to the circuit. Several stages have been made multi-purpose by incorporating a fivesection transfer "function" switch.

Discussing the playback amplifier first, it is necessary to provide a high gain circuit, with low noise and hum levels to amplify the feeble tape signals to levels sufficient to feed into the usual home high-fidelity audio system. Bass boost must be included, with a turnover at 1000 cps, and a maximum boost of 20 db at 50 cps. Examination of the circuit will reveal four stages devoted to this function.

The record-playback head is connected to a low-noise pentode preamplifier stage, with function switch $S_{1.4}$ in the "Play" position. This 5879 stage is designed for maximum gain, in the interests of a high signal-to-noise ratio. The preamplifier stage is coupled to the playback gain control, R₆. Section S_{10} of the function switch inserts the bass boost equalizer, consisting of C_4 and R_8 shunted across the preamp plate load. The equalized signal is further amplified by a triode mixer stage. then applied to the following 12AX7 output tube. One triode is used for additional voltage gain, while the remaining half of the dual triode serves as a cathode follower to furnish a low impedance output at a signal level of over one volt.

It should be noted that the only frequency compensation in this entire chain is that produced by the shunt equalizer, C_4 and R_8 . In fact, with the equalizer removed, the response of the playback amplifier is flat within ±1 db from 20 to 20,000 cps. Such convenient methods of equalization have the advantages of easy adjustment or modification to conform to the needs of a particular head. For example, the values of the shunt equalization components given are correct only for the .0005" gap recording head. If it is desired to use a head with a .00025" gap, the value of C_i should be reduced to .01 or .02 μ fd. If a head with a gap of .00015" is employed, C_4 should be further reduced to .005 or .008 μ fd. Additional data on this equalization



Complete schematic diagram of the tape recorder amplifier. It may also be used as a two-channel audio mixer for p.a. applications.

technique is available in the article, "Design Considerations for High-Quality Reproducing Systems" (Part 2), by Herb Matthews in the May 1950 issue of this magazine.

The playback amplifier is straightforward, but the record amplifier becomes a bit more complex. The first aspect to be considered concerns the input facilities to be provided. Some simple recorders provide a single mixer channel, but greater flexibility is a decided asset. Two mixer channels are obviously needed. A high-level and a low-level input for each channel allows complete mixing flexibility. Thus, two inputs are available for crystal or other high impedance microphones.

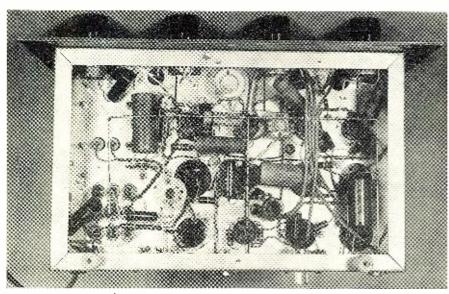
Two additional inputs for high-level signals provide for FM-AM tuners, TV audio, phono signals, or other sources. With two mixer channels, independent control of each channel level is possible. It is apparent that recorded music can be introduced as "background" for a microphone pickup; cross-fades and similar professional mixing techniques are possible, to list a few of countless examples.

Referring again to the circuit, the 5879 stage now functions as one microphone preamp with S_{14} in the "Record" position. An additional 5879 is similarly used for the second microphone preamp. Series grid resistors are added to avoid rectification of strong

broadcast carriers which can occasionally prove troublesome in high-gain amplifiers. (See the short item "FM Interference" by Ken Maxwell on page 122 of the February 1951 issue of this magazine.)

The two high-level inputs are introduced through sections S_{10} and S_{18} of the function switch. $R_{\rm e}$ and R_{27} serve as the mixer gain controls. These controls feed individual grids of the mixer tube, the common plate load producing electronic mixing without interaction or crosstalk. The output of the mixer is parallel-fed to two independent output amplifiers.

The 12AX7 amplifier-cathode follower circuit now functions as the



Under chassis view of amplifier. Note ground bus which is used as major tie-point.

monitor amplifier. A recording level meter and a headphone output jack are added to the cathode follower for this application. Notice that only the mixer gain controls determine the level supplied to the meter and headphones. Additionally, the normal amplifier output is available with an output gain control affecting this output signal only.

A 12AT7 is used for the record amplifier section. A screwdriver-adjusted gain control, R_{10} , determines the level fed to the recording head, and is used to coordinate the level read by the meter and that being supplied to the head. The two triodes of the 12AT7 are connected as conventional voltage amplifiers, plus the addition of high frequency pre-emphasis to produce the necessary tape equalization. The parallel combination of R_{11} and C_8 provide high frequency boost. The capacitor acts as a high-pass filter, with an inherent slope of 6 db per octave. The shunt resistor limits the loss at low frequencies. The variable capacity permits the turnover to be adjusted.

Additional high peaking is accomplished by an LC circuit added to the

cathode of the output stage. The stage normally operates with some degeneration, because of the configuration of R_{14} , R_{15} , and R_{16} . The coil and capacitor form a series circuit in shunt with R_{16} , thus producing considerable gain at the resonant frequency.

Because high-frequency response is determined by the individual head, the high-frequency equalization is made variable in three ways. As stated, capacitor C_8 determines the turnover frequency of the high boost circuit, hence it affects the response in the vicinity of 2 to 5 kc. The inductance of the cathode coil determines the frequency of resonance. Normally, it is tuned to approximately 10 kc., but the variable iron core permits shifting this frequency as needed to control the response at the extreme high frequency end. The shunt resistor across the resonant circuit (R_{16}) controls the amplitude of the peaking. Larger values of resistance give a higher "Q" with consequent greater amplitude at resonance, but at the expense of increased loss in the normal gain of the stage. Likewise, smaller values of resistance will reduce the peaking, and increase the over-all stage gain. For example, with R_{10} at 8200 ohms, there will be a boost of about 8 db at 10 kc. This should suffice for very narrow gap heads. A value of 47,000 ohms will boost 10 kc. about 15 db, and will be adequate for .0005" head gaps.

It should be pointed out that the total high peaking is limited by the permissible distortion. This is based on the fact that the harmonic distortion is increased by the high-frequency boosting required for equalization as compared to that inherent in a normally flat system. One additional means of high boost, which may be included, is that of resonating the record head at the desired high frequency by connecting a suitable capacity across the head, if needed.

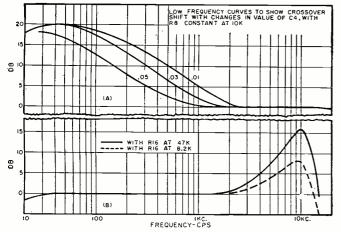
It is suggested that any individual constructor make some frequency runs on the head used and adjust the compensation networks as necessary to obtain desired flat response. Of course, the tape should be recorded with the amplifier under discussion so that the over-all equalization can be checked. With proper adjustment of these variables which determine the equalization, it should be possible to record any good microgroove record and produce playback quality which is indistinguishable from the record itself.

Quality recording should, of course, be done at the 7.5 ips speed. However, the 3.75 ips speed is available for less critical applications, such as spoken material. Switch S_2 is closed at the slow speed, to add additional capacity to the series resonant circuit, thereby lowering the frequency of resonance, to produce boost to help compensate for the increased roll-off at this speed.

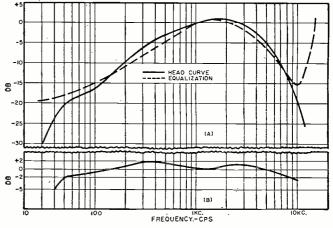
The recording output stage is coupled to the record head through the resistor R_{10} , passing through section S_{1D} of the function switch. Also necessary for tape recording, of course, is a suitable source of bias and erase voltage. This requires a supersonic oscillator which produces a symmetrical a.c. waveform. A 12AU7 standard push-pull oscillator is used for this

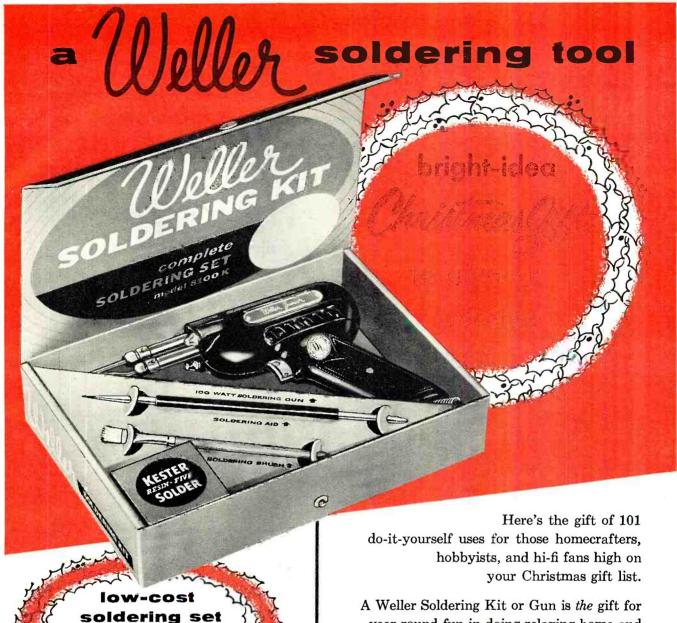
(Continued on page 163)

Low-frequency equalization characteristics of the playback amplifier (A) and high-frequency equalization characteristics of the recording amplifier (B). See discussion in text.



(A) A comparison of head characteristics and over-all equalization curves. (B) The resultant over-all record-playback transfer curve of "professional-type" recorder amplifier.





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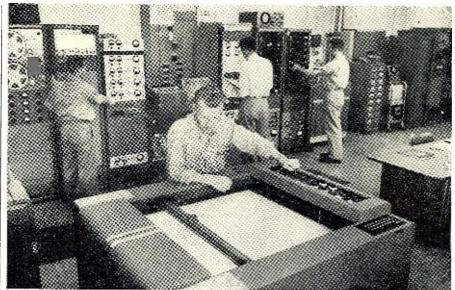
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Electronic equipment at Lockheed Missile Systems Division changes tape recording of scrambled tones into graphs from which scientists and engineers interpret a missile's flight performance. Plotter in foreground draws graphs from information on cards.

Analyzers for Missiles and Jet Pilots

Record and examine flight of guided missiles and interpret brain waves of men who pilot our jets.

OMPLETE details of a Lockheed-developed method of recording and analyzing a guided missile's flight was shared recently with a group of NATO aeronautical experts. The new technique processes in only two days a mass of flight information that formerly took scores of engineers and technicians weeks to analyze.

Before a missile is fired, scores of test instruments are loaded aboard. Miniaturized radio transmitters in the vehicle relay thousands of the instruments' readings, including speed, temperatures, pressures, voltages, altitude, etc., to the ground in terms of pure tones. A variation in pitch indicates a variation in reading. The tape-recorded playback is a bedlam of scrambled sound that resembles the tuning of a gigantic symphonic orchestra. Patiently unscrambling and interpreting one tone at a time took weeks in the older systems.

The automatic data reduction machine shown above accurately classifies as many as 100 readings per second. It then feeds the desired readings into a converter that controls a standard accounting type card-punching machine. The punched cards can be fed into a high-speed electronic computer and then into an automatic plotting machine that produces a graphic picture of the missile's performance.

The system in operation at the right was developed by Air Force and American Machine & Foundry Co. scientists to interpret the information presented by another instrument long used by the medical profession—the electroencephalograph. The latter is a sensitive electronic device which de-

tects and records human brain waves.

The Air Force is now interested in the new unit for its possible use to objectively assess level of alertness in its pilots. Researchers are attempting to establish a mathematical basis for the characterization of brain waves. The instrument—called a Period Analyzer—is being developed to implement the mathematical theory.

The use of the new instrument provides techniques that appear to be more sensitive and much more rapid than present methods in distinguishing degrees of sleepiness and wakefulness in subjects. It can also correlate the brain wave pattern with deficiency of oxygen in the blood precisely. —30—

Period analyzer, a new medical research instrument developed by American Machine & Foundry Co. and Air Force scientists, measures certain physiological changes affecting the shape and frequency of brain waves.



RADIO & TELEVISION NEWS

SPARKY SAYS

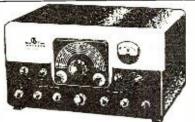
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Have you ever wondered what happens to the equipment that is returned to the dealer trial? So have we! We ship new gear in factory sealed cartons. yes, this is a fact. Most trade-ins are more than ough for the down payment. Write, wire or phone for our Deal today.









JOHNSON PACEMAKER. Wired tested.....\$495.00



NEW HALLICRAFTERS SX-101 RE-CEIVER. Less speaker. Net.....\$395.00



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Continuously tunable from 540 kc to 31 mc. Separate calibrated band-spread dial for 80, 40, 20, 15, and 10 meter bands. Built-in 100 kc crystal calibrator. Crystal filter and Qmultiplier for unsurpassed reception on SSB, CW, and AM. Improved "S" meter. 13 tubes including rectifier and VR tube. With tubes, less speaker. Net...... \$ 294.00

SURPLUS BARGAINS



Navy version of the famous BC-459. Covers 7-9.1 mc. Brand new. Easy-to-follow conversion in-structions included. With tubes,

MODEL T-22. Net......\$ 9.95 TYPE P-6469. 25-volt filament transformer for T-22. Net......\$ 2.88 Less speaker. Net.........\$ 369.95

NC-300 ACCESSORIES Six Meter Converter. Net.....\$ 41.25

NATIONAL NC-300 RECEIVER The "Dream Receiver" with super selectivity and sensitivity. For all bands 160 thru 11/4 meters (6,2, and 11/4 meters with plug-in converters).

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HARVEY'S RECOMM



... the DYNAKIT MARK II

50-Watt Power Amplifier Kit

Because of the enormous demand for DYNAKITS (everybody who has heard one seems to want one) they have because the constant of the constant of

NOW BACK IN STOCK!

nas neard one seems to want one), they have been in short supply this past summer. Now HARVEY has enough of them in stock to end the drought. Any random sample of the DYNAKIT will deliver a minimum of 50 watts with astonishingly low distortion—and that means not just harmonic and intermodulation distortion but phase shift, square-wave ripple, and low-frequency bounce and flutter as well. Construction time? Three or four hours—with no special skill. Listening quality? "The Greatest!" say the audiophiles. The price? Still only.....\$6975



SHERWOOD S-2000

High-Fidelity FM-AM Tuner

High-Fidelity FM-AM Tuner

Here's one of those rare top-quality tuners designed with just as much attention to audio quality as to RF circuit refinements. At 100% modulation, the specified intermodulation distortion is less than 1.5% and the harmonic distortion at 400 cps less than 1% — meaning very superior sound indeed. Specified FM sensitivity is also tops among commercially available tuners — 0.95 μν for 20 db quieting, made possible by the special 6888 cascode input stage and balanced antenna input transformer. Add to that a very low-distortion wide-band AM section, and you have a tuner that's hard to beat at any price—and unbeatable at only..... \$13950 (Slightly higher with tooled leatherette covers.)

(Slightly higher with tooled leatherette covers.) Signify nigner with tooled leatherette covers.)

S-3000: An FM-only tuner containing the FM section of the S-2000 plus new-type tuning eye and LOCAL-DISTANCE switch for suppression of cross-modulation images on strong signals.

\$99.50

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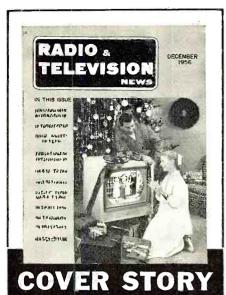
New Tube Tester Data

Keep your Simpson and Philco tube testers up-to-date for the new radio and TV tubes.

SIMPSON MODEL 1000						
Tube	Fil.	Bias	Range	Toggles	Push B Shorts	uttons Value
2BN4	2.0	7	75	041-025-500-012	AB	E
3B2	2.8	0	35	515-555-050-213	J	J
5CL8-TRI	5.0	28	90	420-100-000-011	\mathbf{AGH}	В
5CL8-TET	5.0	30	15	000-102-204-012		\mathbf{F}
5CM8-TRI	5.0	7	15	340-103-204-013	CGH	A
5CM8-PEN	5.0	20	18	340-103-204-012		F
6BA8-TRI	6.3	7	23	042-100-423-012	ACFH	C I J
6BA8-PEN	6.3	7	92	042-100-423-011		I
6BK4	6.3	30	95	015-545-050-303	$^{ m AE}$	
6BN4	6.3	7	- 44	041-025-500-012	AB	E
6BR8-TRI	6.3	20	80	420-100-000-001	ACGI	В
6BR8-PEN	6.3	7	62	000-103-204-002		B F J
6CB5	6.3	7	62	210-455-050-300	$^{\mathrm{CD}}$	J
6CH8-TRI	6.3	40	90	032-100-042-011	ACF	I
6CH8-PEN	6.3	12	29	032-100-403-012		В
6CL8-TRI	6.3	13	90	420-100-000-001	\mathbf{AGH}	В
6CL8-TET	6.3	11	20	000-102-204-002		\mathbf{F}
6CM8-TRI	6.3	7	25	340-103-204-013	$_{\rm CGH}$	A
6CM8-PEN	6.3	20	20	340-103-204-012		\mathbf{F}
6CR6-PEN	6.3	15	22	051-032-400-002	FG	\mathbf{E}
6CR6-DIO	6.3	0	22	051-032-400-005		В
6DQ6	6.3	56	9	010-240-000-321	$_{ m DH}$	J
12AC6	12.6	7	40	401-022-000-034	BG	$_{\rm E}$
12AD6-MIX	12.6	7	55	401-022-000-033	AFG	\mathbf{F}
12AD6-OSC	12.6	7	80	401-022-000-033		\mathbf{E}
12AE6-TRI	12.6	14	20	401-055-200-034	ABEF	G
12AE6-DIO-1	12.6	14	10	401-055-000-005		\mathbf{F}
12AE6-DIO-2	12.6	14	10	401-055-000-005		\mathbf{E}
12AF6	12.6	7	85	401-022-000-033	\mathbf{AG}	\mathbf{E}
12CU5	12.6	7	96	041-052-200-000	BF	G
12DQ6	12.6	56	9	010-240-000-321	$_{ m DH}$	J
12 K 5	12.6	7	63	041-025-200-031	AB	G
12F8-PEN	12.6	26	90	222-102-040-033	GI	C
12F8-DIO-1	12.6	26	0	222-102-040-033		C F
12F8-DIO-2	12.6	26	0	222-102-040-033		A

PHILCO MODELS 7052 & 9100

Tube Type	Fil.	R-G	Bias	Fil.	Fil.	Gr.	Pl.	Sc.	C.	Su.	Press	Gm	Notes
1V6	1.1	20	10	E	X	3	1	2	0	0	P1 with P4	300	Pentode Sect.
1V6	1.1	5	35	\mathbf{E}	X	5	6	0	0	0	P1 with P4	100	Triode Sect.
2AF4	2.5	85	36	J.	\mathbf{R}	2	3	0	5	0	P4	3200	
3A2*	3.0	83	0	J	\mathbf{R}	0	0	0	0	0	P5		Cap = P. Short on 3.
3DT6	3.0	48	11	J	\mathbf{R}	3	5	6	2	7	P4	800	
6AU4	6.3	60	0	J	\mathbf{X}	0	5	0	3	0	P3		
6BA8	6.3	83	28	\mathbf{E}	V	2	3	0	1	Ö	P4	2300	Triode Sect.
6BA8	6.3	87	18	\mathbf{E}	V	7	9	8	6	0	P4 -	3000	Pentode Sect.
6BJ8	6.3	83	25	\mathbf{E}	V	8	7	0	9	0	P4	2400	Triode Sect.
6BJ8	6.3	84	0	\mathbf{E}	V	0	6	0	3	0	P1		
6BJ8	6.3	84	0	\mathbf{E}	V	0	1	0	2	0	P1		Diode No. 2
6BN8	6.3	89	8	\mathbf{E}	V	8	7	0	9	0	P4	3700	Triode Sect.
6BN8	6.3	79	0	\mathbf{E}	V	0	6	0	3	0	P1		Diode No. 1
6BN8	6.3	79	0	\mathbf{E}	V	0	1	0	2	0	P1		Diode No. 2
6BR8	6.3	88	21	\mathbf{E}	·V	1	2	0	3	0	P4	3350	Triode Sect.
6BR8	6.3	80	11	\mathbf{E}_{\cdot}	V	9	· 6	7	8	0	P4	2100	Pentode Sect.
6BW4	6.3	95	0	Ε.	V	0	7	0	9	0	P5 .		Diode No. 1
6BW4	6.3	95	0	E	V	0.	1	0	9	0	P5		Diode No. 2
6BY8	6.3	76	11	\mathbf{E}	V	1	7	8	9	0	P4	1840	Pentode Sect.
6BY8	6.3	78	0	\mathbf{E}	V	0	•6	0	3	0	P1		Diode Sect.
6CE5	6.3	87	11	J,	\mathbf{R}	3	5	6	2	0	P4	3100	
6CL5	6.3	90	68	J	\mathbf{R}	4	0	2	3	0	P4	3200	Cap = P
6CS7	6.3	77	24	\mathbf{E}	V	7	6	0	8	0	P4	1800	Triode No. 1
6CS7	6.3	83	32	\mathbf{E}	V	3	1	0	9	0	P4	2400	Triode No. 2
$6CU_5$	6.3	91	0	J	\mathbf{R}	2	7	6	3	0	P4	6000	
6DT6	6.3	48	11	J	\mathbf{R}	3	5	6	2	7	P4	800	
12BW4	12.6	95	0	\mathbf{E}	V	0	7	0	9	0	P5		Diode No. 1
12BW4	12.6	95	0	\mathbf{E}	V	0	1	0	9	0	P5		Diode No. 2
$12CU_5$	12.6	91	0	J.	\mathbf{R}	2	7	6	3	0	P4	6000	
12 K5	12.6	. 0	0	J	\mathbf{R}	5	7	2	3	0	P1	225	Good—Read above Diode OK
35L6	35.0	87	21	J	\mathbf{R}	5	3	4	7	0	P4	3680	•
35W4	$_{\mathrm{Blst}}$			J	\mathbf{R}	0	3	6	7	0			Short on 1-2-3-4-5
35W4	35.0	65	0	J	\mathbf{R}	0	5	0	7	0	P3		Rect. Sect.
35Z5	Blst			J	\mathbf{R}	0	5	3	7	0	<u>.</u> .		Short on 1-2-3-4-5
35Z5	35.0	67	0	J	R	0	5	0	7	0	P3		Rect. Sect.
$\underline{\text{CK533AX}}$	1.1	20	21	D	1.	4	1	2	0	0	P1 with P4	480	
*Revised		,											



Top TV programs and many local shows now available

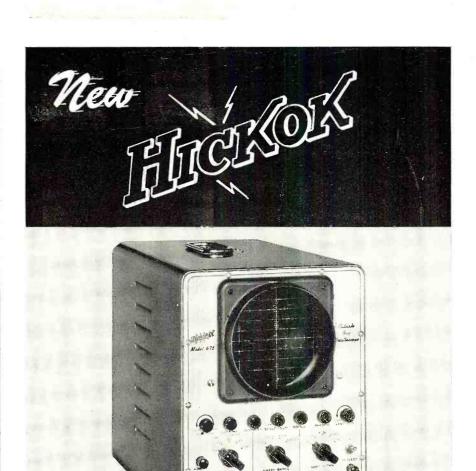
in color all over country.

THIS is truly the year for color television. Now for the first time, families with color receivers will be able to view at least one major color program every evening in the week. NBC, which has been in the forefront on color, is broadcasting weekly a well-balanced lineup of programs including its most popular shows. CBS is also telecasting about 5½ hours of color programs per week. Among the NBC shows to be regularly colorcast each week are "The Chevy Show," "The Goodyear Playhouse," "Robert Montgomery Presents," and "The Perry Como Show." In addition, the "spectaculars" will also be in color. Such CBS star programs as "The Arthur Godfrey Show" and "The Red Skelton Show" will be regularly shown in color. Special CBS color shows are "The Ford Star Jubilee" and "Shower of Stars."

This means that all viewers within the reception area of any NBC or CBS network station which has the facilities to telecast network shows in color, can receive these programs on a color set, such as the RCA "Aldrich" model 21CS-781 {\$495.00} shown on this month's cover. Over 50 per-cent of the 200 NBC network stations now broadcast network color. The number of CBS color network stations is also high.

In addition to the network shows, many stations are originating local color shows. WABD, the New York City Du Mont station, plans to telecast cartoon shows in color during the day and evening. All shows originating at WNBQ in Chicago are broadcast in color. It broadcasts approximately 25 hours of local color a week. Many other stations now have color cameras and/or color film equipment and many stations are now expanding for color.

This all means that buyers of color TV sets this winter can look forward to many pleasant hours of entertainment in full-color.



MODEL 675
WIDE BAND

Response at

HIGH

SENSITIVITY

Flat Frequency Response Through 3.58MC Color Burst Less Than 3db Down at 4.5MC

A very recent HICKOK engineering achievement eliminates necessity for dual sensitivity. Moderately priced... High quality... Ask for a demonstration today!

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- * In improved model of what was already an butstanding instrument.
- * Performange is unmatched in this price sange.
- Imcorporates the extra features required for color TV vervicing.

HEATHKIT ETCHED CIRCUIT, PUSH-PULL

5" Oscilloscope Kit

COLOR TV

The previous Heathkit oscilloscope (Model O-10) which was already a most remarkable instrument, has been improved even further with the release of the Heathkit Model O-11. It incorporates all the outstanding features of the preceding model, plus improved vertical linearity, better sync stability, especially at low frequencies, and much-improved over-all stability of operation, including less vertical bounce with changes in level. These improvements in the Model O-11 circuit make it even more ideally suited for color TV servicing, and for critical observations in the electronic laboratory. Vertical response extends from 2 CPS to 5 MC without extra switching. Response only down 11/2 DB at 3.58 MC. The 11-tube circuit features a 5UP1 cathode-ray tube. Sync circuit functions effectively from 20 CPS to better than 500 kc in five steps. Modern etched circuit boards employed in the oscilloscope circuit cut assembly time almost in half, permit a level of circuit stability never before achieved in an oscilloscope of this type, and insure against errors in assembly. Both vertical and horizontal output amplifiers are push-pull. Built-in peak-to-peak calibrating source step-attenuated input - plastic molded capacitors and topquality parts throughout - pre-formed and cabled wiring harness - and numerous other "extra" features. A professional instrument for the serviceshop or laboratory. Compare its specifications with those of scopes selling in much higher price brackets. You can't beat it!



A FULL YEAR

SEND FOR DETAILS OF HEATH TIME-PAYMENT PLAN.

- FEWER DOLLARS BRING MORE REAL QUALITY.
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BENJON HARBOR 15, MICH.

- PROVEN DESIGNS MEAN RELIABLE PERFORMANCE.
 - · Research and development efforts concentrated on kits
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- EVERY KIT BACKED BY WORLD-WIDE REPUTATION.
 - The world's largest manufacturer of electronic equipment in kit form.
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GREATEST SELECTION ...

Whether your particular special interest is in servicing, ham-radio, high-fidelity, or just experimenting—there are Heathkits to fill your needs. You can equip an entire service shop ar lab, buy a complete ham station or highfidelity system, or set up a really deluxe hame warkshop, by choasing from the more than 70 different "da-ityourself" electronic kits by Heath. Just glance through the kits displayed in this ad, and you will get same idea of the tremendaus array of low-priced, high-quality electronic equipment available.

NOW HEATHKIT ETCHED CIRCUIT

5" Oscilloscope Kit

- * Brand new model with improved performance specifications.
- * Full 5" scope for service work at a remarkably low price.
- * Attractively styled front panel in charcoal gray with sharp white lettering.
- * Easy to build from step-by-step instructions and large pictorials. Not necessary to read schematic.

This new and improved oscilloscope retains all the outstanding features of the preceding model, but provides wider vertical frequency response, extended sweepgenerator coverage, and increased stability. A new tube complement and improvements in the circuit make these new features possible. Vertical frequency response is essentially flat to over 1 mc, and down only 1½ DB at 500 kc. The sweep generator multivibrator functions reliably from 30 to 200,000 CPS, almost twice the coverage provided by the previous model. Deflection amplifiers are push-pull, and modern etched circuits are employed in critical parts of the design. A 5BP1 cathode-ray tube is used. The scope features external or internal sweep and sync, one volt peak-to-peak reference voltage, 3-position step-attenuated input, adjustable spot-shape control, and many other "extras" not expected at this price level. A calibrated grid screen is also provided for the face of the CRT, allowing more precise observation of wave shapes displayed. The new Model OM-2 is designed MODEL CM-2. for general application wherever a reliable instrument with good response characteristics may be required. Complete step-by-step instructions and large pictorial diagrams assure easy assembly.



Shpg. Wt. 21 Lbs.

HEATHKIT LOW CAPACITY PROBE KIT

Oscilloscope investigation of high frequency, high impedance, or broad bandwidth circuits encountered in television requires the use of a low-capacity probe to prevent loss of gain, circuit loading, or waveform distortion. The Heathkit low-capacity probe may be used

with your oscilloscope to eliminate these effects. It features a variable capacitor, to provide correct instrument impedance match. Also, the ratio of attenuation can be varied.

Na. 342

Shpg. Wt. 1 Lb.

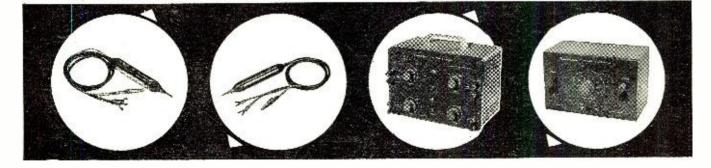
HEATHKIT ELECTRONIC SWITCH KIT

lower than its predecessor.

This handy device allows simultaneous oscilloscope observation of This handy device allows simultaneous oscilloscope observation of two signals by producing both signals, alternately, at its output. If features an all-electronic switching circuit, with no moving parts. Four switching rates are selected by a panel switch. Provides actual gain for input signals, and has a frequency response of ± 1 DB from 0 to 100 kc. Sync output provided to control and stabilize scope sweep. Will function at signal levels as low as 0.1 volt. This modern device finds many applications in the laboratory and service shop. It employs an entirely new circuit, and yet is priced lower than its predecessor.

Shps. Wt. 8 lbs.

Shog, Wt. 8 Lbs.



HEATHKIT SCOPE DEMODULATOR PROBE KIT

Extend the usefulness of your oscilloscope by employing this probe. Makes it possible to observe modulation of RF or IF carriers found in TV and radio receivers. Functions much like an AM detector to pass only modulation of signal, and not the signal itself. Among other

uses, it will be helpful in alignment work, as a signal tracer, and for determining relative gain. Applied voltage limits are 30 volts (RMS) and 500 volts DC. It uses an etched circuit shpg. Wt. 1 Lb. board to simplify assembly.

NO. 337-C

HEATHKIT VOLTAGE CALIBRATOR KIT

This entirely new voltage calibrator produces near-perfect square This entirely new voltage calibrator produces near-perfect square wave signals of known amplitude. Precision 1% attenuator resistors assure accurate output amplitude, and multivibrator circuit guarantees good, sharp square waves, as distinguished from clipped sine waves. Output frequency is approximately 1000 CPS. Fixed outputs selected by panel switch are; .03, 0.1, 0.3, 1.0, 3.0, 10, 30, and 100 volts peak-to-peak. Allows measurement of unknown signal amplitudes by comparing to known peak-to-peak output of VC-3 on an oscilloscope. Will also double as a square wave generator at 1000 cycles for

double as a square wave generator at 1000 cycles for determining gain, frequency response, or phase-shift characteristics of audio amplifiers. Equally valuable in the laboratory or in radio and TV service

\$1250

Shpg. Wt. 4 Lbs.

shops.

HEATHKIT ETCHED CIRCUIT VACUUM TUBE



- * Easy to build a pleasure to use.
- * 1% precision resistors employed for high accuracy.
- * Etched circuit board cuts assembly time in half.

Voltmeter Kit

The fact that this instrument is the world's largest-selling VTVM says a great deal about its accuracy, reliability, and overall quality. The V-7A is equally popular in the laboratory or service shop, and represents an unbelievable test equipment bargain, without a corresponding sacrifice in quality. Its appearance reflects the performance of which it is capable. A large 4½" panel meter is used for indication, with clear, sharp calibrations for all ranges. Front panel controls consist of a rotary function switch and a rotary range selector switch, zero-adjust, and ohmsadjust controls. Precision 1% resistors are used in the voltage divider circuits and etched circuits are employed for most of the circuitry. This makes the kit much easier to build, eliminates the possibility of wiring errors, and assures duplication of laboratory instrument performance. This multi-function VTVM will measure AC voltage (rms), AC voltage (peak-to-peak), DC voltage, and resistance. There are 7 AC (rms) and DC voltage ranges of 0-1.5, 5, 15, 50, 150, 500, and 1500. In addition, there are 7 peak-to-peak AC ranges of 0-4, 14, 40, 140, 400, 1400, and 4000. 7 ohmmeter ranges provide multiplying factors of X1, X10, X100, X1000, X10K, X100K, and X1 megohm. Center-scale resistance readings are 10, 100, 1000, 10K, 100K ohms, 1 megohm, and 10 megohms. A DB scale is also provided. The precision and quality of the components used in this VTVM cannot be duplicated at this price through any other source. Model V-7A is the kind of instrument you will be proud to own and use.

HEATHKIT Etched Circuit RF PROBE KIT

This RF probe extends the frequency response of any 11-megohm VTVM so that it will measure RF up to 250 megacycles within ± 10%. Employs printed circuits for increased stability and ease of assembly. Ideal for extending service and

laboratory applications of your Heathkit VTVM. Shpg. Wt. 1 lb.

HEATHKIT 20,000 OHMS/VOLT VOM KIT

Sensitivity of this instrument is 20,000 ohms-per-volt DC and 5,000 ohms-per-volt AC. Measuring ranges are 0-1.5, 5, 50, 150, 500, 1500, and 5000 volts for both AC and DC. Also measures current in the ranges of 0-150 microamperes, 15 ma, 150 ma, 500 ma, and 15 a. Resistance ranges provide multipliers of X1, X100, and X10,000, resulting in center scale readings of 15, 15,000, and 150,000 ohms. DB ranges cover from -10 db to +65 db. Housed in attractive black bakelite case with plastic carrying handle, this fine instrument provides a total of 25 meter ranges MODEL MM-1 on its two-color scale. It employs a sensitive 50 microampere, 41/2" meter and features all 1% precision multiplier resistors. Requires no external power, and is,

\$2950

Shpg. Wt. 6 Lbs.

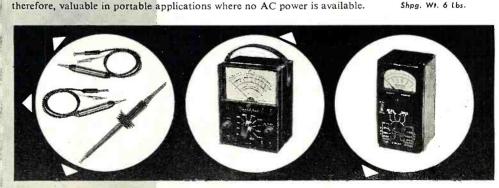
HEATHKIT SCOPE DEMODULATOR PROBE KIT

This probe functions like an AM detector to pass only modulation of signal and not signal itself. Permits observation of modulation from RF or IF carriers in TV and radio receivers. Extends usefulness of your resillences. Vol.

oscilloscope. Voltage limits are 30 V. rms, and 500 V.DC. Very valuable in service or laboratory applications. Shpg. Wt. 1 Lb.

No. 337-C

\$350



HEATHKIT 30,000 VOLT DC HIGH VOLTAGE PROBE KIT

This probe provides a multiplication factor of 100 on the DC ranges of the Heathkit 11-megohm VTVM. Precision multiplier resistor mounted inside the two-color plastic probe body. Plenty of insulation for completely safe operation, even at highest TV potentials. Designed especially for TV service work.

7.50 \$450

Shpg. Wt. 2 Lbs.



HEATH COMPANY

A Subsidiary of Daystrom, Inc. BENTON HARBOR 15, MICH.

HEATHKIT HANDITESTER KIT

The Model M-1 measures AC or DC voltage at 0-10, 30, 300, 1000, and 5000 volts. Direct current ranges are 0-10 ma, and 0-100 ma. Ohmmeter ranges are 0-3000 (30 ohm center scale) and 0-300,000 ohms (3,000 ohms center scale). Uses a 400 microampere meter for sensitivity of 1000 ohms-per-volt. A very popular test device for the home experimeter, electricians, and appliance repairmen, and for use as an "extra" instrument in the service shop. Its small size and rugged construction

make it perfect for any portable application. Easily slips into your tool box, glove compartment, coat pocket, or desk drawer. Topquality, precision components employed throughout.

MODEL M-1

57450

Shpg. Wt. 3 Lbs.

CONTROLLED QUALITY ...

Incoming parts inspection, and inspection of material coming off of our own production line assures you of the finest "build-it-yourself" kit that money can buy. Each kit contains all the components you need for assembly—and you can have confidence in the quality of the parts themselves. In addition to this inspection procedure, an extensive proofbuilding program for each new kit guarantees easyto-follow instructions and reliable performance.

HEATHKIT NEW AUDIO VACUUM TUBE

Voltmeter Kit

- * Brand new circuit for extended frequency response and added stability.
- * Ten accurate ranges from 0-.01 to 0-300 volts.
- * Modern, functional panel styling. "On-off" switch at both extreme ends of range switch.

This brand new AC vacuum tube voltmeter emphasizes stability, broad frequency response, and sensitivity. It is designed especially for audio measurements, and low-level AC measurements in power supply filters, etc. Employs a cascode amplifier circuit with cathode-follower isolation between the input and the amplifier, and between the output stage and the preceeding stages. An extremely stable circuit with high input impedance (1 megohm at 1000 CPS). Response of the AV-3 is essentially flat from 10 CPS to 200 kc, and is usable for tests even beyond these frequency limits. Increased damping in the meter circuit stabilizes the meter for low frequency tests. Nylon insulating bushings at the input terminals reduce leakage, and permit the use of the 5-way Heath binding post.

The extremely wide voltage range covered by the AV-3 makes it especially valuable not only in high-fidelity and service work, but also in experimental laboratories. AC (RMS) voltage ranges are 0-.01, .03, .1, .3, 1, 3, 10, 30, 100, and 300 V. Decibel ranges cover -52 DB to +52 DB. An entirely new circuit as compared to the previous model. Employs 1% precision multiplier resistors for maximum accuracy. Handles AC measurements from a low value of one millivolt to a maximum of 300 volts.



MODEL AV-3

Shpg. Wt. 5 Lbs.

HEATHKIT AUDIO WATTMETER KIT

This instrument measures audio power directly at 4, 8, 16, or 600 ohms. Load resistors are built in. Covers 0-5 MW, 50 MW, 500 MW, 5 W, and 50 W full scale. Provides 5 switchselected DB ranges covering from -10 DB to +30 DB. Large

4½" 200 microampere meter and precision multiplier resistors insure accuracy. Frequency response is ± 1 DB from 10 CPS to 250 kc. Functions from AC power line. Use in the audio laboratory or in home workshop.

MODEL AW-1

\$7050

Shog, Wt. 6 Lbs.

HEATHKIT AUDIO ANALYZER KIT

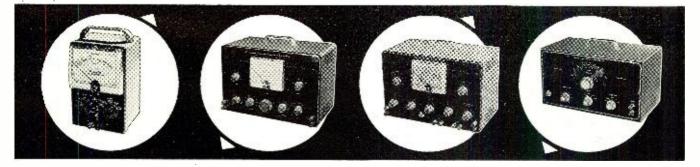
This multi-function instrument combines an AC VTVM, an audio wattmeter, and an intermodulation analyzer into one case, with combined input and output terminals and built-in high and low frequency oscillators. The VTVM ranges are .01, .03, .1, .3, 1, 3, 10, 30, 100, and 300 volts (RMS). Wattmeter ranges are .15 MW, 1.5 MW, 15 MW, 150 MW, 1.5 W, 150 W. IM scales are 1%,

3%, 10%, 30%, and 100%. Provides internal load resistors of 4, 8, 16, or 600 ohms. A valuable instrument for the engineer or serious audiophile.

MODEL AA-1

\$4995

Shpg. Wt. 13 Lbs.



HEATHKIT HARMONIC DISTORTION METER KIT

The HD-1 is equally valuable for the audio engineer or the serious audiophile. Used with a low-distortion audio signal generator, this instrument will measure the harmonic content of various amplifiers under a variety of conditions. Functions between 20 and 20,000 CPS, and reads distortion directly on the panel meter in ranges of 0-1, 3, 10, 30, and 100 percent full scale. Built-in VTVM for initial reference settings and final

distortion readings has voltage ranges of 0-1, 3, 10, and 30 volts. 1% precision resistors employed for maximum accuracy. Features voltage regulation and other "extras". Meter calibrated in volts (RMS), percent distortion, and DB.

MODEL HD-1

Shpg. Wt. 13 Lbs.

HEATHKIT AUDIO OSCILLATOR KIT

Producing both sine waves and square waves, the Model AO-1 covers a frequency range of 20 to 20,000 CPS in three ranges. An extra feature is thermistor regulation of output for flat response through the entire frequency range. AF output is pro-

vided at low impedance, and with low distortion. Produces good sine waves, and good, clean square waves with a rise time of only two micro-seconds for checking square wave response of audio amplifiers, etc. Designed especially for the serviceman and highfidelity enthusiast. A real dollar value in test Shpg. Wt. 10 Lbs. equipment.

MODEL AO-1

83 December, 1956

HEATHKIT MODEL AG-9 Shpg. Wt. 8 Lbs.

- Less than 0.1% distortion ideal for hi fi work.
- * Large 41/2" meter indicates output.
- * Step-type tuning for maximum convenience.

Audio Generator Kit

This particular audio generator is "made to order" for high fidelity applications. It provides quick and accurate selection of low-distortion signals throughout the audio range. Three rotary selector switches on the front panel allow selection of two significant figures and a multiplier for determining audio frequency. In addition, it incorporates a step-type output attenuator and a continuously variable attenuator. Output is indicated on a large 4½" panel meter calibrated in volts and in db. Attenuator system operates in steps of 10 db, corresponding with the meter calibration. Output ranges are 0-.003, .01, .03, .1, .3, 1, 3, and 10 volts rms. A "load" switch provides for the use of a built-in 600 ohm load or an external load of higher impedance when required. Output and frequency indicators accurate to within \pm 5%. Distortion is less than .1 of 1% between 20 cps and 20,000 cps. Total range is 10 cps to 100 kc. New engineering details combine to provide the user with an unusually high degree of operating efficiency. Oscillator frequency selected entirely by the switch method means that accurate resetability is provided. Comparable to units costing many dollars more, and ideal for use in critical high fidelity applications. Shop and compare, and you will appreciate the genuine value of this professional instrument.

HEATHKIT RESISTANCE SUBSTITUTION BOX KIT

The RS-1 contains 36 10% 1-watt resistors ranging from 15 ohms to 10 megohms in standard RETMA values. All values are switch-selected for use in determining desirable resistance values in experimental circuits. Man napplications in radio and TV service work.

Shpg. Wt. 2 lbs.

service work.

Shpg. Wt. 2 Lbs.

HEATHKIT CONDENSER SUBSTITUTION BOX KIT

This kit contains 18 RETMA stand-This kit contains 18 RELIMA standard condenser values that can be selected by a rotary switch. Values range from 0.00001 mfd to 0.22 mfd. All capacitors rated at 400 volts or higher. Capacitors are either silver-miga or plastic.

mica, or plastic molded.

\$550

Shpg. Wt. 2 Lbs.

HEATHKIT AUDIO GENERATOR KIT

The Model AG-8 is a low cost, high performance unit for use in service shop, or home workshop. It covers the frequency range of 20 cps to 1 mc in five ranges. Output is 600 ohms, and overall distortion will be less than .4 of 1% from 100 cps through the audible range. Output is available up to 10 volts, under no

load conditions, and output remains constant within ±1 db from 20 cps to 400 kc. A fivestep attenuator provides control of the output. Precision resistors are employed in the frequency determining network.

MODEL AG-8

\$2950 Shpg. Wt. 11 Lbs.

HEATHKIT DECADE CONDENSER KIT

Precision, 1% silver-mica capacitors are employed in the Model DC-1 in such a way that a selection of precision capacitor values is provided ranging from 100 mmf (0001 mfd) to 0.11 mfd (110,000 mmf) in 100 mmf steps. Extremely valuable in all types of design and devel op ment work. Switches are ceramic wafer types.

wafer types.

Shpg. Wt. 3 Lbs.



HEATHKIT DECADE RESISTANCE KIT

The Model DR-1 incorporates twenty 1% precision resistors arranged around five rugged switches so that various combinations of switch positions will provide a total range of 1 ohm to 99,999 ohms in 1-ohm steps. Switches are labeled "units," "tens," "hundreds," "thousands," and "ten thousands," Use it for observed the collaboration in bridge circuits as test before the collaboration in bridge circuits as test before. \$1050 ohm-meter calibration in bridge circuits as test values

Shpg. Wt. 4 Lbs.



in multiplier circuits, etc.

HEATH COMPANY

A Subsidiary of Daystrom, Inc. BENTON HARBOR 15, MICH.

HEATHKIT VARIABLE VOLTAGE REGULATED POWER SUPPLY KIT

This power supply is regulated for stability, and the amount of DC output available from the power supply can be controlled manually from zero to 500 volts. Will provide regulated output at 450 volts up to 10 ma, or up to 130 ma at 200 volts output. In addition to furnishing B-plus, the power supply provides 6 volts AC at 4 amperes for filaments. Both the B-plus output

and the filament output are isolated from ground. Ideal power supply for use in experimental work in the laboratory, the home workshop, or the ham shack. Large 41/2" panel meter indicates output voltage or current.

MODEL PS-3

\$3550

Shpg. Wt. 17 Lbs.

BONUS PERFORMANCE ...

If a single word had to be selected to describe Heath Company advertising policy, it would be "conservative." By this we mean that the performance specifications and features are not exaggerated, and that the descriptions are accurate. We specify performance on the conservative side so you can be sure of equaling or exceeding our specifications. In almost every instance our kits will do more than we claim. Extra care in construction, and calibration against an accurate standard can extend performance well beyond ad-

HEATHKIT

Signal Generator Kit

- * No calibration required with pre-aligned coils.
- * Modulated or unmodulated RF output.
- * 110 mc to 220 mc frequency coverage.

Here is an RF signal generator for alignment applications in the service shop or the home workshop. Thousands of these units are in use in service shops all over the country. Produces RF signals from 160 kc to 110 mc on fundamentals on five bands. Also covers from 110 mc to 220 mc on calibrated harmonics. RF output is in excess of 100,000 microvolts at low impedance. Output is controllable with a step-type and a continuously variable attenuator. Front panel controls provide selection of either unmodulated RF output or RF modulated at 400 cps. In addition, two to three volts of audio at approximately 400 cps are available at the output terminals for testing AF circuits. Employs a 12AU7 and a 6C4 tube. Built-in power supply uses a selenium rectifier.

One of the most outstanding features about the Model SG-8 is the fact that it can be built in just a few hours, even by one not thoroughly experienced in electronics work. Complete step-by-step instructions combined with large pictorial diagrams assure successful assembly. Pre-aligned coils make calibration from an external source unnecessary.



Shpg. Wt. 8 Lbs.

HEATHKIT LABORATORY GENERATOR KIT

This laboratory RF signal generator covers from 100 kc to 30 mc on fundamentals in five bands. The output signal may be pure RF, or may be modulated at 400 cycles from 0 to 50%. Provision for external modulation has been made. RF output available up to 100,000 microvolts. Output controlled by a fixed step and a variable attenuator. Output impedance is 50 ohms. Panel meter

reads RF output or percentage of modulation. Incorporates voltage regulated B+ supply, double shielding of oscillator circuits, copper plated chassis, and other "extras."

MODEL LG-1

\$4895

Shpg. Wt. 16 Lbs.

HEATHKIT TV ALIGNMENT GENERATOR KIT

covering 19 to 60 mc on fundamentals and from

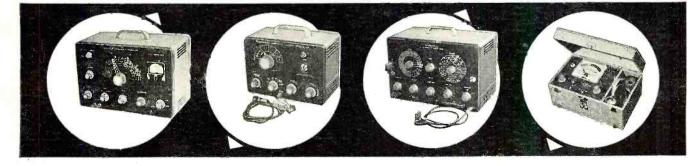
57 to 180 mc on harmonics. Effective two-

This improved sweep generator model provides essential stability and flexibility for work on FM, monochrome TV, or color TV sets. Covers 3.6 mc to 220 mc in four bands. Provides usable output even on harmonics. Sweep deviation from 0-42 mc, depending on base frequency. All-electronic sweep circuit eliminates unwieldy mechanical arrangements. Includes built-in crystal marker generator providing output at 4.5 mc and multiples thereof, and variable marker

MODEL TS-4A

\$4050

Shpg. Wt. 16 Lbs.



way blanking.

HEATHKIT LINEARITY PATTERN GENERATOR KIT

This instrument supplies information for white dots, cross-hatch pattern, horizontal bar pattern, or vertical bar pattern. It feeds video and sync signals to the set under test, with completely controlled gain, and unusual stability. Covering channels 2 to 13, the LP-2 will produce 5 to 6 vertical bars and 4 to 5 horizontal bars. The dot pattern presentation is a must for the setting of color convergence controls in the color TV set. Panel provision made for external sync if desired. Use for adjustment of vertical and horizontal linearity, picture size, aspect MODEL LP-2

ratio, and focus. Power supply is regulated for added stability. Essential in the up-to-date TV service shop.

\$2250

Shpg. Wt. 7 Lbs.

HEATHKIT CATHODE RAY TUBE CHECKER KIT

This instrument checks cathode emission, beam current, shorted elements, and leakage between elements in electro-magnetic picture tube types. It eliminates all doubt for the TV serviceman, and even more important, for the customer. Features its own self-contained power supply, transformer operated to furnish normal test voltages for the CRT. Employs spring-loaded switches for maximum operator protection. Large 4½" meter indicates CRT condition on "good-bad" scale. Luggage-

type portable case ideal for home service calls. Special "shadowgraph" test permits projection of light spot on screen. Also gives relative check of picture tube screen coating.

MODEL CC-1

\$2250

Shpg. Wt. 10 Lbs.

HEATHKIT MODEL 12 Lbs. TC-2 * Attractive counter-style cabinet.

- * Wiring-harness simplifies assembly.
- Large 41/2" meter with two-color "good-bad"
- Separate tube element switches prevent obsol-

Tube Checker Kit

This fine piece of test gear checks tubes for quality, emission, shorted elements, open elements, and filament continuity. Will test all tube types normally encountered in radio and TV service work. Sockets provided for 4, 5, 6, and 7-pin large, rectangular, and miniature types, octal and loctal types, the Hytron 9-pin miniatures, and pilot lamps. Condition of tubes indicated on a large 41/2" meter with multi-color "good-bad" scale. An illuminated roll chart is built right in, providing test data for various tube types. This tester provides switch selection of 14 different filament voltage values from 0.75 volts to 117 volts. Individual switches control each tube element. Close tolerance resistors employed in critical test circuits for maximum accuracy. A professional instrument both in appearance and performance,

The Model TC-2 is very simple to build, even for a beginner. It employs a color-coded cable harness for neat, professional under-chassis wiring. Comes with attractive counter style cabinet, and portable cabinet is available separately. At this price, even the part-time serviceman can afford his own tube checker for maximum efficiency in service work.

HEATHKIT TV PICTURE TUBE TEST ADAPTER

Designed especially for use with the Model TC-2 tube checker. Use it to test TV picture tubes for emission, shorts, etc. Consists of 12-pin TV tube socket, 4 ft. cable, octal connector, and necessary technical data.



MODEL 355

\$450

HEATHKIT PORTABLE TUBE CHECKER KIT

This portable tube checker is identical, electrically, with the Model TC-2. However, it is housed in an attractive and practical carrying case, finished in proxylin impregnated material. The cover is detachable, and the hardware is brass plated. This rugged unit is ideal for home \$34.50 Shpg. V service calls or any portable application.



HEATHKIT VISUAL-AURAL SIGNAL TRACER KIT

Although designed primarily for radio receiver work, this valuable instrument finds extensive application in FM and TV servicing as well. Features a high-gain channel with demodulator probe, and a low-gain channel with audio probe. Will trace signals in all sections of a radio receiver and in many sections of a FM set or TV receiver. Uses built-in

speaker and electron beam eye tube for indication. Also features built-in wattmeter and a noise locater circuit. Provision for patching speaker and/or output transformer into external set.

MODEL T-3

\$2350

Shpg. Wt. 9 Lbs.

HEATHKIT DIRECT READING CAPACITY METER KIT

Operation of this instrument is simplicity itself. One has only to connect a capacitor to the terminals, select the proper range, and read the capacity value directly on the large 41/2" meter calibrated in mmf and mfd.

Ranges are 0 to 100 mmf, 1,000 mmf, 0.01 mfd, and 0.1 mfd full scale. Precision calibrating capacitors supplied. Not susceptible to hand capacity effects. Residual capacity less than I mmf. Especially valuable in production line checking, or in quality control.

MODEL CM-1 \$2950



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HEATHKIT CONDENSER CHECKER KIT

The Model C-3 consists of an AC powered bridge for both capacitive and resistive measurements. Bridge balance is indicated on electron beam eye tube, and capacity or resistance value is indicated on front panel calibrations. Measures capacity in four ranges from .00001 mfd to .005 mfd, .001 mfd to .5 mfd, .1 mfd to 50 mfd, and 20 mfd to 1000 mfd. Measures resistance in two ranges, from 100 ohms to 50,000 ohms, and from 10,000 ohms to 5 megohms. Selection of

five different polarizing voltages for checking capacitors, from 25 volts DC to 450 volts DC. Checks paper, mica, ceramic, and electrolytic capacitors. Indicates power factor of electrolytic condensers.

MODEL C-3

PIONEER DESIGN ...

New and unique approaches to instrument and equipment designs are a Heath Company tradition. We concentrate all our development efforts on kit projects, since this is our prime activity—and not just a sideline. This logically results in more efficient, more reliable circuit designs—and you benefit from this constant engineering progress. Buying from the undisputed leader in the electronic kit field assures you of completely modern equipment, with outstanding advanced

HEATHKIT

Impedance Bridge Kit

- * 1/2% precision resistors and silver-mica capacitors.
- * Battery-type tubes, no warm-up required.
- * Built-in phase shift generator and amplifier.

The Model IB-2 is a completely self-contained unit. It has a built-in power supply, a built-in 1000 cycle generator, and a built-in vacuum tube detector. Provision has been made on the panel for connection to an external detector, an external signal generator, or an external power supply. A 100-0-100 microampere meter on the front panel provides for null indications. Measures resistance from 0.1 ohm to 10 megohms, capacitance from 10 mmf to 100 mfd, inductance from 10 mh to 100 h, dissipation factor (D) from 0.002 to 1, and storage factor (Q) from 0.1 to 1000. ½ of 1% decade resistors employed for maximum accuracy. Typical accuracy figures are: resistance, ±3T; capacitance $\pm 3\%$; inductance, $\pm 10\%$; dissipation factor, $\pm 20\%$; storage factor, ±20%. Employs a Wheatstone bridge, a Capacity Comparison bridge, a Maxwell bridge, and a Hay bridge. Special two-section CRL dial provides maximum convenience in operation. Use the Model IB-2 for determining values of unmarked components, checking production or design samples, etc. A real professional instrument.



Shpg. Wt.

HEATHKIT "Q" METER KIT

The O Meter permits measurement of inductance from 1 microhenry to 10 millihenries, "W" on a scale calibrated up to 250 full scale, with multiplying factors of 1 or 2, and capacitance from 40 mmf to 450 mmf, ±3 mmf. Built-in variable oscillator permits testing components from 150 kc to 18 mc. Large 4½" panel-mounted meter is features. Very handy for checking peaking coils, chokes, etc. Use to determine values of MODEL QM-1 unknown condensers, both variable and fixed. Compile data for coil winding purposes, or

measure RF resistance. Distributed capacity,

\$4450

Shpg. Wt. 14 Lbs.

HEATHKIT ISOLATION TRANSFORMER KIT

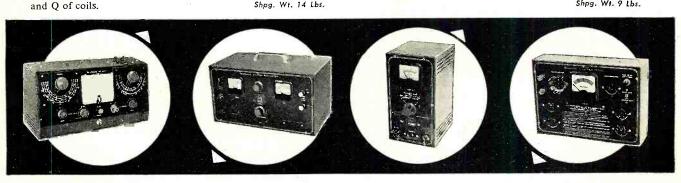
Panel meter monitors output voltage. A very

handy device at an extremely low price.

This device isolates equipment under test from the power line. It is rated at 100 volt-amperes continously, or 200 volt-amperes intermittently. AC-DC sets may be plugged directly into the IT-I without the chassis becoming "hot." Additionally, since the IT-I is fused, it is ideal for use as a buffer between the power line and a questionable receiver, or a new piece of equipment. Protects main fuses. Features voltage control, allowing MODEL IT-1 control of the output from 90 volts to 130 volts.

\$1650

Shpg. Wt. 9 Lbs.



HEATHKIT 6-12 VOLT BATTERY ELIMINATOR KIT

This completely modern battery eliminator will supply DC output in two ranges for both 6-volt and 12-volt automobile radios. The output is variable for each range, so that operating voltage can be raised or lowered to determine how the receiver functions under adverse conditions. Range is 0-8 volts DC or 0-16 volts DC. Will supply up to 15 amperes on the 6-volt range, or up to 7 amperes on the 12-volt range. Two 10,000 microfarad output

filter capacitors insure smooth DC output. Two separate panel meters indicate output voltage or output current. Makes it possible to test automobile radios inside at the workbench. Will also double as a battery charger.

\$3150

Shpg. Wt. 17 Lbs.

HEATHKIT 6-VOLT VIBRATOR TESTER KIT

This instrument functions very much like a tube checker, to test auto radio vibrators. Vibrator condition is indicated on a simple "good-bad" scale. Tests for proper starting and overall quality of operation, of both interrupter and self-rectifier types of 6-volt vibrators. The model VT-1 is designed to operate from any battery eliminator capable of delivering continuously variable output from 4 to 6 volts DC at 4 amperes or more. It is an ideal companion unit for the Heathkit Model BE-4 MODEL VT-1

battery eliminator. The construction book for the VT-1 contains vibrator test chart for popular 6-volt vibrator types. A real time saver!

\$1450

Shpg. Wt. 6 Lbs.

HEATHKIT DX-100 PHONE AND CW



- * Phone or CW on 160, 80, 40, 20, 15, 11 and 10 meters.
- * Built-in VFO, modulator, and power supplies.
- * High quality components used throughout for reliable performance
- * Features 5-point TVI suppression.

Transmitter Kit

The Heathkit DX-100 transmitter is in a class by itself in that if offers features far beyond those normally received at this price level. It takes very little listening on the bands to discover how many of these transmitters are in operation today. A truly amazing piece of amateur gear. The DX-100 features a built-in VFO and a built-in modulator. It is TVI suppressed, and uses pi network interstage coupling and output coupling. Will match antenna impedances from approximately 50 to 600 ohms. Extensive shielding is employed, and all incoming and outgoing circuits are filtered. The cabinet features interlocking seams for simplified assembly and minimum RF radiation outside of the cabinet. Provides a clean strong signal on either phone or CW, with RF output in excess of 100 watts on phone, and 120 watts on CW. Completely bandswitching from 160 through 10 meters. A pair of 1625 tubes are used in push-pull for the modulator, and the final consists of a pair of 6146 tubes in parallel. The VFO dial and meter face are illuminated, and all front panel controls are located for maximum convenience. Panel meter reads driver plate I, final grid I, final plate I, final plate voltage, and modulator current. The chassis is constructed of heavy #16 gauge copper-plated steel. Other high-quality components include potted transformers, ceramic switch and variable capacitor insulation, silver-plated or solid-silver switch terminals, etc. All coils are pre-wound, and the main wiring cable is pre-harnessed. The kit can be built by a beginner from the comprehensive step-by-step instructions supplied. It is a proven, trouble-free rig, that will insure many hours of "on-the-air" enjoyment in your ham shack.

. HEATHKIT COMMUNICATIONS TYPE

ALL BAND RECEIVER KIT
This receiver covers 550 kc to 30 mc in four bands, and is ideat for the short-wave listener or beginning amateur. It provides good sensitivity and selectivity, combined with good image rejection. Amateur bands clearly marked on illuminated dial scale. Employs transformer type power supply bandspread—antenna trimmer—separate RF and AF gain bandspread—antenna trimmer—separate RF and AF gain bandspread—antenna trimmer—separate RF and AF gain scale. Employs transformer type power supply-electrical controls—noise limiter—headphone jacks and automatic gair control. Has built-in \$3075 VFO for CW reception.

CABINET: Fabric covered cabinet with aluminum panel as shown. Part 91-15A. Shipping weight 5 Lbs. \$4.95\$

INCLUDING NEW (Less Cabinet) Shpg. Wt. 12 Lbs

HEATHKIT VFO KIT

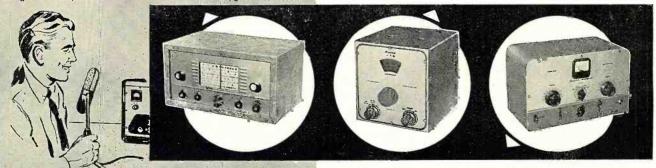
You can go VFO for less than you might expect. Here is a variable frequency oscillator that covers 160, 80, 40, 20, 15, 11, and 10 meters with three basic oscillator frequencies, that sells for less than \$20. Provides better than 10 volt average RF output on fundamentals. Plenty of drive for most modern

transmitters. Requires a power source of only 250 VDC at 15 to 20 ma. and 6.3 VAC at 0.45A. Incorporates a regulator tube for stability. Illuminated frequency dial reads frequency directly on the band being employed. Temperature-compensated capacitors offset coil heating.

MODEL VF-1

\$1950

Shpg. Wt. 7 Lbs.



EASY ON THE BUDGET!

You can buy Heathkits on an easy time-payment plan that provides a full year to pay. Write for complete details and special order blank.



HEATH COMPANY

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HEATHKIT CW TRANSMITTER KIT

This is the original low-priced Heathkit CW transmitter. Its This is the original low-priced Heathkit CW transmitter. Its reliable performance has been proven time and time again on the CW bands. Designed for crystal control, the Model AT-1 covers 80, 40, 20, 15, 11, and 10 meters. May be excited from external VFO. Plate power input up to 30 watts. Power supply built in. Panel meter indicates grid current or plate current for final. Incorporates pre-wound coils, copper-plated chassis, built-in line filter, profuse shielding, and top-quality parts throughout. Crystal socket and key jack on front panel. Built-in key-click filter, and single-knob bandswitching. 52-ohm coaxial output. Uses 6AG7 oscillator-multiplier. 6L6 power amplifier-doubler. and

plier, 6L6 power amplifier-doubler, and Shpg. Wt. 15 Lbs. 5U4G rectifier.

DOLLAR-SAVING ECONOMY ...

There would be no particular achievement in selling inexpensive merchandise at a low price—although it is being done every day. However, there is something to crow about when, through tremendous purchasing power and factory-to-you distribution, Heath Company can offer top-quality equipment, using name-brand components, at such low prices. This is real economy, as opposed to the so-called "bargains". Needless to say, there is a big difference.

HEATHKIT PHONE AND CW

Transmitter Kit

- * 6146 final amplifier for full 65-watt plate power input.
- * Phone and CW operation on 80, 40, 20, 15, 11, and 10 meters. Pi network output coupling.
- * Switch selection of three crystals provision for external VFO excitation.

The DX-35 features a 6146 final amplifier to provide 65 watts plate power input on CW, with controlled carrier modulation peaks up to 50 watts on phone. In addition, it is a most attractive transmitter. Modulator and power supplies are built-in, and the rig covers 80, 40, 20, 15, 11, and 10 meters with a single band-change switch. Pi network output coupling provided for matching various antenna impedances. A 12BY7 buffer stage provided ahead of the final amplifier for plenty of drive on all bands. 12BY7 oscillator and 12AU7 modulator. Provision for switch selection of three different crystals. Crystals reached through access door at rear. Front panel controls marked "off-CW-stand-by-phone", "final tuning", "antenna coupling", "drive level control", and "band change switch". Panel meter indicates final grid current or final plate current. A perfect low-power transmitter both for the novice, and for the more experienced operator. A remarkable power package for the price. Incidentally, the price includes tubes, and all other components necessary for assembly. As with all Heathkits, comprehensive instruction manual assures successful assembly.



MODEL DX-35

Shpg. Wt. 24 Lbs.

HEATHKIT ANTENNA IMPEDANCE METER KIT

This instrument employs a 100 microampere panel meter and covers the impedance range of 0-600 ohms for RF tests. Functions up to 150 mc. Used in conjunction with signal source, such as the Heathkit Model GD-1B grid dip meter, the Model

AM-1 will determine antenna resistance and resonance, match transmission lines for minimum standing wave ratio, determine receiver input impedance, etc. Will also double as a phone monitor. A very valuable device for many uses in the ham shack.

MODEL AM-1

\$1450

Shpg. Wt. 2 Lbs.

HEATHKIT "Q" MULTIPLIER KIT

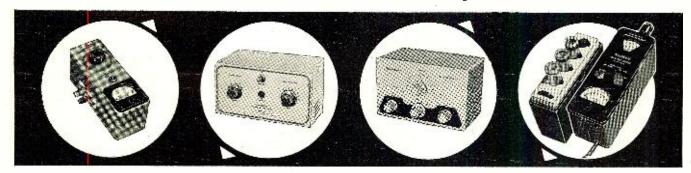
The QF-1 functions with any receiver with an IF frequency between 450 and 460 kc that is not AC-DC type. Operates from the receiver power supply, requiring only 6.3 VAC at 300 ma. and 150 to 250 VDC at 2 ma. Simple to connect with cable and plugs supplied. Provides additional selectivity for

separating two signals, or will reject one signal and eliminate heterodyne. A big help on crowded bands. Provides an effective Q of approximately 4,000 for sharp "peak" or null". Tunes to any signal within the IF bandpass of the receiver, without changing main receiver tuning dial.

MODEL QF-1

\$995

Shpg. Wt. 3 Lbs.



HEATHKIT ANTENNA COUPLER KIT

This device is designed to match the Model AT-1 transmitter to a long-wire antenna. In addition to impedance matching, this unit incorporates an L-type filter which attenuates signals above 36 megacycles, thereby reducing TVI. Designed for 52 ohm coaxial input. Handles power up to 75 watts, 10 through

80 meters. Uses a tapped inductor and variable capacitor. Neon RF indicator on front panel. Copper-plated chassis—high quality components throughout—simple to build. Eliminates waste of valuable communications power due to improper matching. A "natu-ral" for all AT-1 transmitter owners.

MODEL AC-1

HEATHKIT GRID DIP METER KIT

The grid dip meter was originally designed for the ham shack. However, its use has been extended into the service shop and laboratory. Continuous frequency coverage from 2 mc to 250 mc with pre-wound coils. 500 microampere panel meter employed for indication. Use for locating parasitics, neutralizing,

determining RF circuit resonant frequencies, etc. Coils are included with kit, as is a coil rack. Front panel controls include sensitivity control for meter, and phone jack for listen-ing to zero-beat. Will also double as an absorbtion-type wavemeter.

MODEL GD-1B

\$1995

Shpg. Wt. 4 Lbs.

HEATHKIT BROADCAST BAND



ATTENTION BEGINNERS . . .

This kit is an ideal "first project" if you have never built a Heathkit before. A good chance to "learn by doing."

- * Miniature tubes and high- * 51/2-inch PM speaker. gain IF transformer.
- * Rod-type built-in antenna. Good sensitivity and selectivity.
- * Provision for phono jack.
- * Transformer operated power supply.

Receiver Kit

You need no previous experience in electronics to build this table-model radio. The Model BR-2 receiver covers 550 kc to 1620 kc and features good sensitivity and selectivity over the entire band. A 51/2" PM speaker is employed, along with high gain miniature tubes and a new rod-type built-in antenna. Provision has been made in the design of this receiver for its use as a phonograph amplifier. The phono jack is located on the back chassis apron. A transformer operated power supply is featured for safety of operation, as opposed to the usual AC-DC supply commonly found in "economy radio kits." Don't let the low Heathkit price deceive you. This is the kind of set you will want to show off to your family and friends after you have finished building it.

Construction of this radio kit is very simple. Giant size pictorial diagrams and detailed step-by-step instructions assure your success. The construction manual also includes an explanation of basic receiver circuit theory so you can "learn by doing" as the receiver is built. The manual even provides information on resistor and capacitor color codes, soldering techniques, use of tools, etc. If you have ever had the urge to build your own radio receiver, the outstanding features of this popular Heathkit deserve your attention.

CABINET: Proxylin impregnated fabric covered plywood cabinet available for the BR-2 receiver as shown. Complete with aluminum panel, reinforced speaker grill, and protective rubber feet. Shipping weight 5 lbs., part No. 91-9A.....\$4.95‡

HEATHKIT PROFESSIONAL RADIATION COUNTER KIT

This sensitive and reliable instrument has already found extensive application in prospecting, and also in medical and industrial laboratories. It offers outstanding performance at a reasonable price. Front-panel meter indicates radiation level, and oral indication produced by panel-mounted speaker.

Meter ranges are 0-100, 600, 6,000 and 60,000 counts per
minute, and 0 - 02, 1, 1 and 10 milliroent-MODEL RC-1

gens per hour. The probe, with expansion cord, employs type 6306 bismuth counter tube, sensitive to both beta and gamma radiation. It is simple to build, even for a beginner.

\$7995

Shpg. Wt. 8 Lbs.

HEATHKIT CRYSTAL RECEIVER KIT

The crystal radio of Dad's day is back again, but with big improvements! The Model CR-1 employs a sealed germanium diode, eliminating the critical "cat's whisker" adjustment. It is housed in a compact plastic box, and features two Hi-Q tank circuits, employing ferrite core coils and variable air tuning capacitors. The CR-1 covers the standard broadcast band from MODEL CR-1

540 kc to 1600 kc, and no external power is required for operation. Could prove valuable for emergency signal reception, This easy-tobuild kit is a real "learn by doing" experience for the beginner, and makes an interesting project for all ages.

\$87.5 INCLUDING NEW EXCISE TAX \$
Shpg. Wt. 3 Lbs.









Amazing new circuit for high efficiency.

- * Compact, portable and rugged.
- * Stable circuit requires only one 67½ volt "B" battery and two 1½ volt "A" batteries.



HEATH COMPANY

A Subsidiary of Daystrom, Inc. BENTON HARBOR 15, MICH.

HEATHKIT ENLARGER TIMER KIT

The Model ET-1 is an easy-to-build device for use by amateuror professional photographers in controlling the timing cycle of an enlarger. It covers the range of 0 to 1 minute with a continuously variable, clearly calibrated scale. The timing period is pre-set, and the timing cycle is initiated by depressing the spring-return switch to the "print" position. Front panel provision is made for plugging in the enlarger and a safelight. The safelight is automatically turned "on" when the enlarger is "off". Handles up to 350

watts. The timing cycle is controlled electronically for maximum accuracy and reliability. Very simple to build in only one evening, even by a beginner.

MODEL ET-1

Shpg. Wt. 3 Lbs.

COMPREHENSIVE INSTRUCTIONS . . .

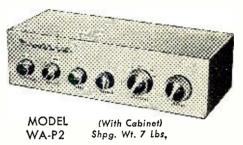
The step-by-step assembly instructions provided with each Heathkit are the finest available anywhere. Each manual begins at the beginning, and assumes no previous trainnegins at the neginning, and assumes no previous training or experience on the part of the kit builder. This means that our kits can be built successfully by anyone who can follow instructions. As a matter of fact, new manuals are tested by having the kit built by someone In our office who has had no previous experience in electronics. This is your guarantee of complete and thorough

HEATHKIT HIGH FIDELITY

Preamplifier Kit

- 5 switch-selected inputs, each with its own level
- **Equalization for LP, RIAA, AES, and Early 78's.**
- Separate bass and treble tone controls, and special hum control.
- Clean, modern lines and satin-gold enamel finish.

Literally thousands of these preamplifiers are in use today, because the kit meets or exceeds specifications for the most rigorous high-fidelity applications, and will do justice to the finest available program sources. Provides a total of 5 inputs, each with individual level controls (three high-level and two low-fevel). Frequency response is within 1 DB from 25 CPS to 30,000 CPS, or within 1½ DB from 15 CPS to 35,000 CPS. Hum and noise are extremely low, with special balance control for absolute minimum hum level. Tone control provides 18 DB boost and 12 DB cut at 50 CPS, and 15 DB boost and 20 DB cut at 15,000 CPS. Cabinet measures only 12-9/16" W. x 3\%" H. x 4\%" D, and it is finished in beautiful satin-gold enamel. 4-position turnover and 4 position roll-off controls provide "LP," "RIAA," "AES," and "early 78" equalization, and 8, 12, 16, and 1 flat position for roll-off. Derives operating power from the main amplifier, requiring only 6.3 VAC at 1 ampere and 300 VDC at 10 MA. Easy to construct from step-by-step instructions and pictorial diagrams provided.



HEATHKIT HIGH FIDELITY FM TUNER KIT

- Huminated slide-rule dial covers 88 to 108 MC.
- Modern circuit emphasizes sensitivity and stability.
- Housed in attractive satin-gold cabinet to match WA-P2 and BC-1.

This amazing new FM tuner can provide you with real highfidelity performance at an unbelievably low price level. Covering 88 to 108 MC, the modern circuit features a stabilized, temperature-compensated, oscillator, A.G.C., broadbanded

IF circuits, and better than 10 UV sensitivity for 20 DB of quieting. A high gain, cascaded, RF amplifier is used ahead of the mixer to increase overall gain and reduce oscillator leakage. It employs a ratio detector for high efficiency without sacrifice in high-fidelity performance. IF and ratio transformers are pre-aligned, as is the front end tuning unit. This means the kit can be constructed by a beginner, without elaborate test and alignment equipment. The FM-3A is designed to match the WA-P2 preamplifier and the BC-1 AM tuner. An illuminated slide-rule dial is em-MODEL FM-3A \$**26**^{9,5}

.

ployed for frequency indication. Step-by-step INCLUDING NEW EXCISE TAX \$ instructions and large pictorial diagrams assure success. (With Cabinet) Shpg. Wt. 7 Lbs.



HEATHKIT BROADBAND AM TUNER KIT

This AM tuner has been designed especially for high-fidelity This AM tuner has been designed especially for high-fidelity applications. It incorporates a low-distortion detector, a broadband IF, and other features essential to usefulness in high-fidelity. Special voltage-doubler detector employs crystal diodes for low distortion. Sensitivity and selectivity are excellent. Audio response is ± 1 DB from 20 CPS to 2 kc, with 5 DB of pre-emphasis at 10 kc to compensate for station roll-off. Covers the standard broadcast band from 550 to 1600 kc. Incorporates a 10 kc whistle-filter and provides a 6 DB signal-to-noise ratio at 2.5 UV. RF and IF coils are prealigned, and power supply is built-in. Incorporates AVC, two outputs, and two antenna linguits.

(With Cabinet)

Shpg. Wt. 8 Lbs.

HEATHKIT ELECTRONIC CROSS-OVER KIT

This unusual device functions to separate low frequencies and This unusual device functions to separate low frequencies and high frequencies so that they may be fed to separate amplifiers and to separate speakers. This eliminates the need for conventional cross-over circuits, since the Model XO-1 does the complete job electronically. Cross-over frequencies of 100, 200, 400, 700, 1,200, 2,000 and 35,000 CPS are selectable with front panel controls on the XO-1, and a separate level control is provided for each channel. Minimizes intermodulation distortion problems. Handles unlimited power, since frequency division is accomplished ahead of the power stage. Attenuation is 12 DB per octave, with sharp "knee" at cut-off frequency.

\$1895\$

HEATHKIT ADVANCED-DESIGN



MODEL W-5

Consists of Model W-5M plus Model WA-P2 preamplifier.

Shpg. Wt. 38 Lbs. Express only....\$79.50

- * Full 25 watt output with KT-66 output tubes.
- * All connectors brought out to front chassis apron.
- * Protective cover over all above-chassis components.

HIGH FIDELITY

Amplifier Kit

This 25 watt unit is our finest high-fidelity amplifier. Using a special design peerless output transformer, and KT-66 output tubes by Genalex, the Model W-5M provides performance characteristics unsurpassed at this price level. Frequency response is ± 1 DB from 5 to 160,000 CPS at 1 watt. Harmonic distortion is less than 1% at 25 watts and 1M distortion is less than 1% at 20 watts (60 and 3,000 CPS, 4 to 1). Hum and noise are 99 DB below 25 watts. Damping factor is 40 to 1. Input voltage for 5 watts output is 1 volt. Tubes employed are a pair of 12AU7's, a pair of KT-66's and a 5R4GY rectifier. Measures 13-3/32" W. x 8½" D. x 8¼" H. Output impedance is 4, 8, or 16 ohms. Featured, also, is the "tweeter saver" which suppresses high frequency oscillation, and a new type balancing circuit requiring only a voltmeter for indication. This balance is easier to adjust, and results in a closer "dynamic" balance between output tubes. The Model W-5M provides improved phase shift characteristics, reduced IM and harmonic distortion, and improved frequency response. Conservatively rated high-quality components are used throughout to insure years of trouble-free operation. No technical background or training is required for assembly. Step-by-step instructions are provided for every stage of construction, and large pictorial diagrams illustrate exactly where each wire and component is to be placed. An amplifier for music lovers who can appreciate subtle differences in performance. Just ask the audiofile who owns one!

HEATHKIT DUAL-CHASSIS—WILLIAMSON TYPE HIGH FIDELITY AMPLIFIER KIT

This, 20-watt high-fidelity amplifier employs the famous Acrosound Model TO-300 "ultra-linear" output transformer and uses 5881 output tubes. The power supply is built on a separate chassis, and the two chassis are inter-connected with a power cable. This provides additional flexibility in mounting. Frequency response is ± 1 DB from 6 CPS to 150 kc at 1 watt. Harmonic distortion is only 1% at 21 watts, and IM distortion is only 1.3% at 20 watts. (60 and 3,000 CPS). Output impedance is 4, 8, or 16 ohms. Hum and noise are 88 DB below 20 watts. A very popular high-fidelity unit employing top-quality components throughout.

MODEL W-3M: Shpg, Wt. 29 Lbs. Express only\$49.75
MODEL W-3: Consists of Model W-3M plus Model WA-P2 preamplifier. Shpg, Wt. 37 Lbs. Express only\$69.50

HEATHKIT SINGLE CHASSIS—WILLIAMSON TYPE HIGH FIDELITY AMPLIFIER KIT

The 20-watt Model W-4AM Williamson type amplifier is a tremendous high-fidelity bargain. Combining the power supply and main amplifier on one chassis, and using a special-design output transformer by Chicago Standard brings you savings without a sacrifice in quality. Employing 5881 output tubes, the frequency response of the W-4AM is ± 1 DB from 10 CPS to 100 kc at 1 watt. Harmonic distortion is only 1.5% at 20 watts. Output impedance is 4, 8, or 16 ohms. Hum and noise are 95 DB below 20 watts.

MODEL W-4AM: Shpg. Wt. 28 Lbs. Express only......\$39.75
MODEL W-4A: Consists of Model W-4AM plus Model WA-P2 preamplifier. Shpg. Wt. 35 Lbs. Express only........\$59.50

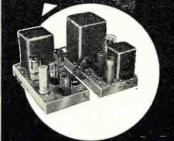
HEATHKIT 7-WATT

This amplifier is more limited in power than other Heathkit models, but it still qualifies as a high-fidelity unit, and its performance definitely exceeds that of many so-called "high-fidelity" phonograph amplifiers. Using a tapped-screen output transformer of new design, the Model A-7D provides a frequency response of ± 1½.

DB from 20 to 20,000 CPS. Total distortion is held to a surpris-

DB from 20 to 20,000 CPS. Total distortion is held to a surprisingly low level. Output stage is push pull, and separate bass and treble tone controls are pro
INCLUDING NEW

vided. Shop. Wt. 10 Lbs. EXCISE TAX\$
MODEL A-7E: Similar to the A-7D, except that a 12SL7 fube has been added for preamplification. Two inputs, RIAA compensation, and extra gain. \$20.35*







HEATHKIT 20-WATT HIGH FIDELITY AMPLIFIER KIT

This high-fidelity amplifier features full 20-watt output using push pull 6L6 tubes. Built-in preamplifier provides 4 separate inputs, selected by a panel-mounted switch. It has separate bass and treble tone controls, each offering 15 DB boost and cut. Output transformer is tapped at 4, 8, 16, and 500 ohms. Designed primarily for home installations, but also used extensions for the properties of the statement of the properties.

tensively for public address applications. True high-fidelity performance with frequency reponse of \pm 1 DB from 20 CPS to 20,000 CPS. Total harmonic distortion only 1% (at 3 DB below rated output).

MODEL A-9B \$3550 Shpg. Wt. 23 Lbs.



HEATH COMPANY

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BENTON HARBOR 15, MICH.

All prices marked with a federal excise tax that now applies to receivers, tuners and some amplifiers, even though they may be in kit form. Since the tax is in effect as of July 5, 1956, we have no choice but to reflect it in our kit prices. This note is just to let you know we are not increasing our prices on some kits, but merely including this new tax in them.

Thank you, HEATH COMPANY HEATHKIT HIGH FIDELITY

Range Extending

- ₩ High quality speakers of special design 15" woofer and compression-type super-tweeter.
- * Easy-to-assemble cabinet of furniture-grade plywood.
- * Attractively styled to fit into any living room. Matches Model SS-1.



\$9995

Shpg. Wt. 80 Lbs.

This range extending unit is designed especially for use with the Model SS-1 speaker system. It consists of a 15" woofer, providing output between 35 and 600 CPS, and a compression-type super-tweeter that provides output between 4,000 and 16,000 CPS. Cross-over frequencies are 600, 1,600, and 4,000 CPS. The SS-1 provides the mid-range, and the SS-1B extends the coverage at both ends of the spectrum. Together, the two speaker systems provide output from 35 to 16,000 CPS within \pm 5 DB. This easy-to-assemble speaker enclosure kit is made of top-quality furniture-grade plywood. All parts are pre-cut and pre-drilled, ready for assembly and the finish of your choice. Complete step-by-step instructions are provided for quick assembly by one not necessarily experienced in woodworking. Coils and capacitors for proper cross-over network are included, as is a balance control for super-tweeter output level. The SS-1 and SS-1B can provide you with unbelievably rich audio reproduction, and yet these units are priced reasonably. The SS-1B measures 29" H. x 23" W. x $17\frac{1}{2}$ " D. The speakers are both special-design Jensens, and the power rating is 35 watts. Impedance is 16 ohms.

HEATHKIT HIGH FIDELITY

SPEAKER SYSTEM KIT



MODEL SS-1

\$39°5

Shpg. Wt. 30 Lbs.

- * Special design ducted-port, bass-reflex enclosure,
- * Two separate speakers for high and low frequencies.
- * Kit includes all parts and complete instructions for assembly.

This speaker system is a fine reproducer in its own right, covering 50 to 12,000 CPS within ± 5 DB. However, the story does not end there. Should you desire to expand the system later, the SS-1 is designed to work with the SS-1B range extending unit - providing additional frequency coverage at both ends of the spectrum. It can fulfill your present needs, and still provide for the future. The SS-1 uses two Jensen speakers; an 8" midrange-woofer, and a compressiontype tweeter. Cross-over frequency is 1,600 CPS, and the system is rated at 25 watts. Nominal impedance is 16 ohms. The cabinet is a ducted-port bass-reflex type. Attractively styled, the Model SS-1 features a broad "picture-frame" molding that will blend with any room decorating scheme. Pre-cut and pre-drilled wood parts are of furniture grade plywood. The kit is easy-to-build, and all component parts are included, along with complete step-by-step instructions for assembly. Can be built in just one evening, and will provide you with many years of listening enjoyment thereafter.

HEATH COMPANY A Subsidiary of Daystrom, Inc. BENTON HARBOR 15, MICH. ORDER SHIP VIA Name. Parcel Post BLANK Address □ Express NOTE: All prices subject to change without notice. ☐ Freight City & Zone ☐ Best Way Enclosed find () check () money order for Please ship C.O.D. () postage enclosed for _____pounds. (PLEASE PRINT) QUANTITY ITEM MODEL NO. PRICE On Express orders do not include transportation charges — they will be collected by the express agency at time of ON PARCEL POST ORDERS include postage for weight show ORDERS FROM CANADA a TKOM CANADA and must include full remit-

Fig. 1. Motor and control unit are mounted directly under tuner. The numbered adjustment screws are tightened to close contacts on unused channels. and loosened on all channels that are active in the reception area.

By PERRY SHENEMAN



UNIQUE and interesting design feature in automatic tuning methods is being used by Admiral Corporation in one model of its automatic power tuning receiver line.

After initial adjustments, each time the automatic tuning unit is energized. the tuner will automatically advance in a clockwise direction, past nonoperating channels, and stop when an operating channel is reached. The automatic tuning unit can be energized by the automatic tuning button located at the receiver, or by a hand operated remote control device.

A 1/400th horsepower, 117 volt a.c. shaded-pole motor supplies the power for the automatic tuning unit. A gear train, in reducing the initial 1750 rpm of the armature, applies a torque of 90 inch-ounces to the tuner shaft and rotates the tuner about one revolution in 4 seconds. The 90 inch-ounces of torque is sufficient, not only to overcome the resistance offered by the tuner detent spring, but to hold the channel selection knob securely enough to prevent the tuner from turning unless forced. After the automatic tuning unit has been energized and the motor is rotating the tuner, an ingenious, yet simple, switch assembly determines where the tuner will stop.

The switch assembly consists of a 12-position wafer type switch mounted on a printed circuit board. A circuit for each contact of the wafer switch, representing the 12 positions of the tuner, is developed on the board by the etched copper process. See Fig. 3. The switch assembly is wired in series with the motor. One side of the motor is connected directly to one side of the a.c. line, whereas the other side of the motor is connected to the contact (common) blade of the switch assembly. The circuit is completed through one or more of the 12 circuits of the printed circuit board. Each of

An Admiral unit automatically seeks active channels. also provides on-off and volume control facilities.

the 12 circuits may be opened or closed by a specially designed printed circuit washer and adjustment screw.

When the initial adjustments are performed for a given area, the adjustment screws are tightened (closing the circuit), for all non-operating channels and loosened (opening the circuit), for all operating channels, therefore, when the tuning button is pressed, the tuner will rotate through the closed circuits and stop when it reaches a circuit left in the open po-

As an illustration of the operating principle of the automatic tuning printed circuit switch assembly, assume the Channel Selector is at rest at the channel 13 position.

The tuner is, for example, to turn automatically through channels 2, 3, and 4 without stopping, and, to stop on channel 5. Since channels 2, 3, and 4 are considered, for the purpose, as "non-operating" channels, the corresponding circuits on the wafer switch must be closed. Therefore, the adjustment screws for these channels are turned counterclockwise until snug. See photo. Channel 5 is the operating channel where the tuner is to stop, so the adjustment screw for that channel is turned about two turns clockwise to open the circuit.

When the automatic tuning button (wired directly to the motor) is pressed, the motor receives an instantaneous yet sufficient surge of voltage to rotate about 3 degrees. This small degree of rotation will shift the contact blade of the wafer switch from channel 13 terminal (an open circuit) to channel 2 terminal.

Since the circuit of the channel 2 terminal on the wafer switch presents a closed circuit because of the adjustment screw setting, the motor continues to turn, rotating the contact blade toward the channel 3 terminal. When the contact blade of the wafer switch has reached channel 3 and then channel 4 positions, the same condition exists as with the channel 2 terminal: the circuits have been closed by the adjustment screw. However, when the motor has rotated the contact blade to the channel 5 position, the motor stops because the adjustment screw for that channel was left in the open circuit position.

The question may arise regarding the reason the motor stops on the channel 5 terminal position at all, since there is considerable space between the contacts of the switch.

Close examination of the contact blade of the wafer switch will disclose that the width of the blade is just sufficient to engage two contacts simultaneously.

Referring back to the hypothetical setup procedure previously described, it is easily seen that the contact blade of the wafer switch in turning from the channel 4 terminal position, which is "live," to the channel 5 position (an open circuit), remains in contact with the channel 4 terminal long enough for the tuner to detent in the channel 5 position before the circuit is broken.

The rotor or armature of the motor is spring loaded to disengage from the

reduction gear train whenever power is not applied to the motor. spring loading or clutch action of the rotor releases the tuner from the drag of the reduction gear train for manual operation of the Channel Selector.

Service Hints on Mechanism

Motor fails to turn: Should the motor fail to run when the automatic tuning button is pressed, check the "automatic-manual" switch located at the rear of the cabinet. The switch should be in the "automatic tuning" position.

Carefully inspect all solder connections on the "automatic-manual" switch, the motor, motor energizing switch, and the printed circuit switch

assembly.

A check of the motor energizing switch is easily made. Place the leads of an ohmmeter across the switch with the selector switch of the ohmmeter set to R x 1 position.

A reading of infinity or "open" will

show on the meter. Pressing the automatic tuning button should cause the needle of the meter to fall to zero. No action of the needle indicates an open switch.

At the same time a check of the motor winding can be made. Place the leads of the ohmmeter across the terminals of the motor windings. A reading of 30 ohms is normal and indicates a satisfactory motor.

Removing the motor: If it is necessary to remove the motor, use the fol-

lowing procedure.

a. Unsolder yellow and orange wires completely from motor energizing switch (above motor) noting the location of each wire.

b. Remove the 1/4 in. self-tapping screws located one on each side of the

motor gear housing.

c. Pull motor straight back. The push rod will remain with the motor. Care should be taken not to bend the

push rod.

Caution: Whenever the motor has been loosened or removed from the mounting plate, it must be replaced in the identical position from which it was removed. If the motor is not aligned with the tuner shaft, binding may occur, which will keep the motor from rotating the tuner over the detent.

If necessary, loosen the ¼ in. selftapping screws holding the motor assembly to the mounting plate and shift motor in the necessary direction.

Check the automatic tuning operation thoroughly before assuming a satisfactory position has been reached.

Removing the printed circuit switch assembly: To remove the automatic tuning printed wiring switch assembly, proceed as follows:

a. Remove the motor according to instructions under heading "Removing

the motor."

b. Remove the two *Phillips*-head type screws and ¼ in. self-tapping screw holding switch assembly.

c. Pull switch assembly directly from tuner shaft.

Important: When replacing the printed circuit switch assembly, the contact wiper of the 12 position wafer switch must be under a terminal corresponding to a similar channel on the tuner. A good procedure to follow is

a. Set Channel Selector to channel 13

b. Position the contact wiper of the 12 position wafer switch under the channel 13 terminal as shown in Fig. 2.

c. Slide wafer switch over tuner shaft and replace screw.

d. Replace motor.

Channel selector difficult to turn manually: Although channel selection by automatic tuning will be the preferred method of changing stations, it is possible to change stations man-

A condition may arise where even though the automatic-manual switch is in the manual tuning position, the operator will find the Channel Selector knob extremely difficult to turn. Should such a situation be encountered, check the rotor of the automatic tuning motor.

The rotor is "spring loaded" to retract from the reduction gear train whenever power is not applied to the motor. Removing the rotor permits "free wheeling" of the tuner for man-

ual channel selection.

If the compression type spring that pushes the rotor away from the gear train is weak, or should the rotor be stuck because of foreign matter, the rotor will remain engaged with the gear train and the tuner will be difficult to rotate manually.



The Remote Control Unit is designed to permit the operator to change channels automatically, control the volume, and turn the set "on" and "off" from distances up to 25 feet from the receiver. The electrical components which make up this Remote Unit are a motor energizing switch, "on-off" switch, and a volume control.

The "on-off" switch at the Remote Unit is in parallel with the "on-off" switch at the set, therefore, the receiver must be turned on and off at the same point. If the set is turned on, and at a subsequent time the Remote is also turned on, then it will be necessary to turn both the set and the Remote off.

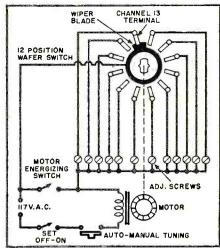


Fig. 2. Wiring diagram to motor that rotates tuner. Depressing the energizing switch starts the motor and rotates the switch to the next channel setting. the adjustment screw for that setting is closed, it completes the circuit as did depressing the motor switch, keeps the motor going till the next position is reached. If the screw is open, no power reaches the motor, automatic tuning stops.

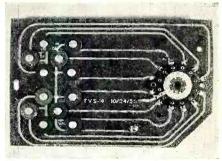
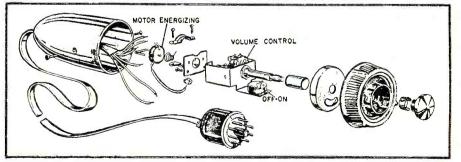


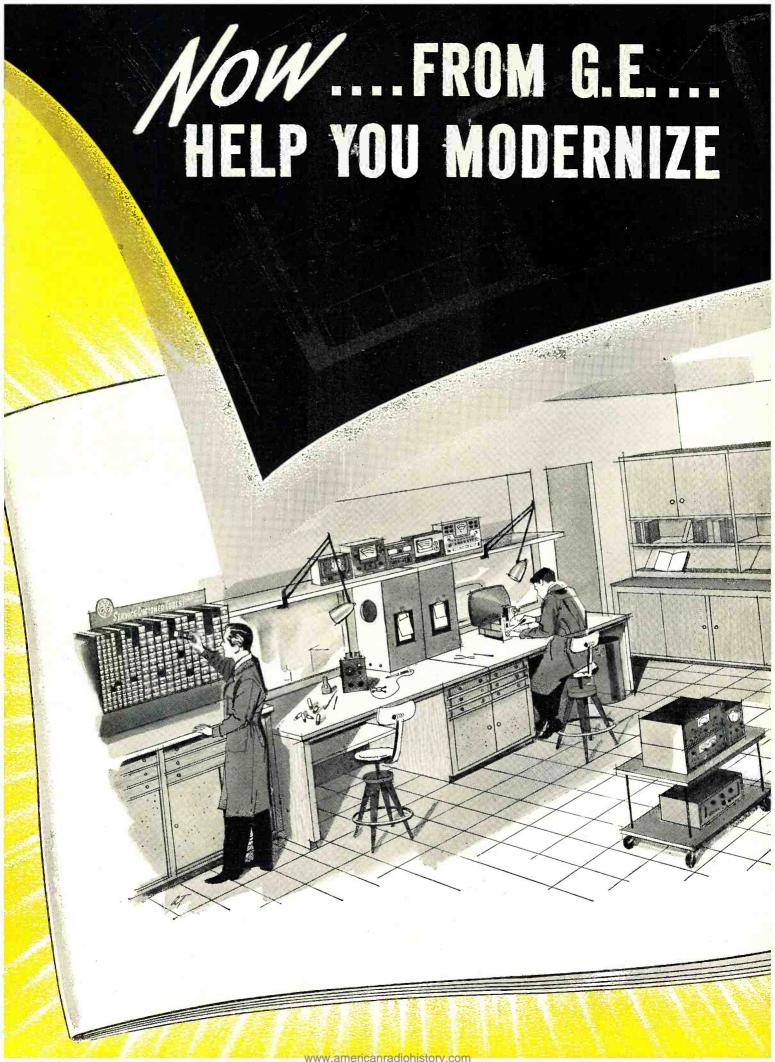
Fig. 3. The reverse side of the screw adjustment board shown in Fig. 1 reveals printed wiring between points on switch assembly and individual adjustment screws.

The volume control at the set is of conventional design. The volume control at the Remote is connected in series with the screen grid of the sound i.f. amplifier, thus, if the Remote volume control is turned to maximum, or all the way to the right, full control over the audio output level will be attained at the receiver.

There is a switch in the socket for the Remote plug which closes and completes the audio "B+" circuit when the Remote Unit is not plugged

Fig. 4. Exploded view of remote assembly shows location of "on-off" switch, remote volume control, channel selecting (motor energizing) control, housing for complete remote unit, extension cable, and plug for interconnecting to TV set.





NEW SHOP PLANS THAT FOR BUSINESS GROWTH!

Today the servicing of TV receivers, plus tubes and parts needed, adds up to more dollars than TV-set sales. In order for you to obtain your share of this fast-growing volume, General Electric has prepared new shop plans that help you handle more service business...more efficiently, more economically.

Giles van der Bogert, American Institute of Architects, drew on the experience of TV-service experts for General Electric's shop layout. It is planned for an average-size service dealer, yet can adapted to your needs.

Efficient work-flow...well-planned bench and counter areas...adequate space for set storage...these and other advantages will improve your servicing facilities, add to your profit opportunities.

easily be expanded or reduced to meet

varying requirements. The plan can be

used as a whole, or individual parts

Study the features below! Then phone your G-E distributor for the complete plans! Electronic Components Division, General Electric Co., Schenectady 5, N.Y.

Layout provides complete facilities for two bench technicians, but can be expanded to accommodate up to ten.

Modular, or unit-by-unit design, permits wide flexibility in adapting plan to your individual needs. Also, you can start with any part of the layout, and complete the plan by easy stages.

Complete dimension drawings and material lists are supplied. Any carpenter or builder can start the job for you immediately upon your request.

Service-bench area includes many new time-and-work-saving features. A TV-test and storage rack with ample dimensions has compartments for portables up to large-size color receivers. There are custom-designed cabinets for technical manuals and service records.

Plan calls for standard-dimension lumber and other easily obtained construction materials, so that cost to you will be as low as possible.

Layout includes separate display and sales area for over-the-counter transactions. Floor and window displays can be accommodated effectively.

There is an enclosed manager's office, which also can be used for TV, radio, and hi-fi demonstration. Coat closet and lavatory room are provided.

The complete shop-layout book you receive has realistic three-dimension illustrations to show how your new shop and store will look. Ask your G-E tube distributor for your copy!

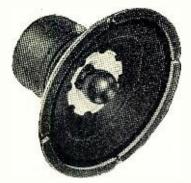
Progress Is Our Most Important Product

GENERAL ELECTRIC

At \$24.75

'An Unqualified Bargain'

Says High Fidelity Magazine



"This little speaker is good! It won't match a fine system selling for hundreds of dollars—needless to say—but it produces sound that, to my ears, is smooth, well-balanced, well-stributed, and satisfying. High-frequency response goes well out towards the limit of audibility without unpleasant bumps; there is no exaggerated middle-range peak often associated with harshness; bass is excellent; full and solid, without boom . . If this speaker sold for \$50, I believe it would still receive my sincere approval. At less than \$25. I consider it an unqualified bargain."

(High Fidelity Magazine)

"...Equivalent to many larger and more costly speakers"

"Extremely low resonant frequency... response held up well to 35 cps, being down only 6 db at that point... offers some unusual features..."

(Audio Magazine)

Above is what the experts of two leading magazines in the Hi-Fi field concluded after testing

the PanaSonic

the 8'' space-saving, extended range speaker incorporating several patented features which result in performance never before achieved by an 8'' unit.

Complete findings of these experts as reported in the above publications and descriptive pamphlet will be gladly sent to you upon request.

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Modifying the Heathkit Linearity Pattern Generator

By J. FRANK BRUMBAUGH

Project Engr., Heath Company

WANT to bring your *Heathkit* Model LP-1 linearity pattern generator up-to-date? It's easy and costs practically nothing. It takes only a few minutes' work to have a brand new LP-2!

The modification is in two parts: making provision for external synchronization and reducing the number of bars visible on the television screen. Only the addition of a "Sync Input" is necessary, since the number of bars displayed is a matter of personal preference

Those of you who have used the LP-1 know that its stability leaves something to be desired. The addition of external sync from the TV set may prevent a lot of black thoughts and purple-tinged air when the pattern slips just as an adjustment is to be made. With the proper sync the pattern will be rock steady during all the knob twisting required to put an ailing TV set back on its feet.

Reference to the schematic diagram of Fig. 1 will readily show the simplicity of the suggested modification. One resistor, one capacitor, a binding post, and a one-lug terminal strip are all the additional parts required.

Actual Modification

First, remove one screw holding the tuning capacitor to the chassis. This should be the screw closest to the panel. Mount a single (ungrounded) terminal over this screw and tighten the screw. Next connect a 10 $\mu\mu$ fd. capacitor between pin 6 of V_5 and the terminal strip. Solder pin 6 of V_5 only.

Now connect a 150,000 ohm, $\frac{1}{2}$ watt resistor between pin 1 of V_3 and K_1 .

Solder pin 1 of V_3 only. Drill a hole in the panel between the "RF Gain" control and "Function" switch. Mount an *insulated* binding post in this hole. Solder a wire to the junction of the 10 $\mu\mu$ fd. capacitor and the one-lug terminal strip and connect to the binding post. Solder a wire to K_1 and solder the other end to the binding post.

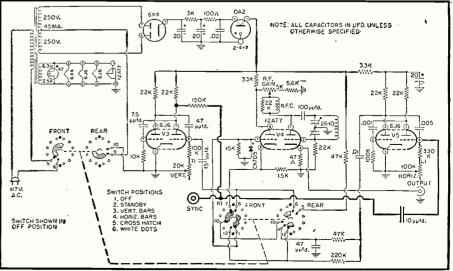
This completes the external sync modification. In use, a length of hookup wire is attached to the "Sync" binding post just installed and the other (insulated) end is poked into the set near the yoke on the TV tube. If the back has been removed from the TV set, the sync wire may be loosely wrapped or tied around the yoke leads. Enough synchronizing pulses to completely lock-in the pattern display will be introduced from the TV set into the linearity pattern generator.

For those who desire fewer bars or dots for display, with the added feature of more vernier horizontal and vertical tuning, the following modification will suffice.

Replace the present horizontal control with a 100,000 ohm potentiometer and change the 220,000 ohm resistor between pin 6 of V_5 and L_1 to a 330,000 ohm, $\frac{1}{2}$ watt unit. Replace the vertical control with a 20,000 or 25,000 ohm potentiometer and change the 47,000 ohm resistor between pin 6 of V_3 and T_1 to a 100,000 ohm, $\frac{1}{2}$ watt

Be sure all connections are well soldered before putting the instrument back in its case. These modifications are simple to do, but a few moments' work with a TV set will be proof of the value of such changes.

Fig. 1. Schematic of LP-1 generator with changes for improving performance. See text.





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	VOLTS	MAXIMUM	CONTINUO
Low Voltage DC	2 ranges 0-15v Full Wave 0-30v Full Wave Bridge	20 amps* 20 amps*	10 amps* 10 amps*
Low Voltage AC	0-24v		20 amps
High Voltage AC	No Isolation 90-140 volts	20 amps 2000 watts	10 amps 1000 watts
High Voltage AC	Model 713 with Isolation 90-140 volts		3 amps 300 watts
High Voltage AC	Model 711 with Isolation 90-140 volts		1 amp 100 watts
High Voltage DC	110-180 volts	1 amp**	.075 amp*

*Depending on voltage.
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Aids for Small Aircraft

(Continued from page 39)

plifier which drives a d.c. motor controlling the pitch of the propeller. If the propeller slows down because of excessive load, the automatic control decreases the pitch angle of the propeller. As the pitch angle is decreased the propeller takes less of a bite into the air and speeds up. The reverse happens if the propeller meets a lighter load, as in a dive, and speeds up excessively. In this way a constant load is presented to the power plant of the aircraft. It follows the old principle of impedance matching to obtain maximum transfer of power. We in electronics should be very familiar with this postulate.

The immediate future holds greater promise of more and more electronics for the light plane. To be released soon by one manufacturer is a v.h.f. transceiver with literally hundreds of channels for simplex transmission and reception. *Tacan* and weather radar

may soon become popular in this field and the apparent goal is completely automatic control from parking place on the ramp, into the air, and back again. We have touched briefly upon some of the more important uses of electronics in small aircraft to give you an idea of the vast range of devices and circuits available. Nearly every aspect of electronic science is touched upon in one way or another.

Because of the critical nature of aircraft equipment, such gear must meet the highest engineering standards. So, too, the men who service and maintain this equipment must be ready to meet the challenge of advanced design and be prepared to learn the new concepts of electronic applications that are so rapidly finding their place in small aircraft.

Take a trip out to your municipal airport and look around. Ask the technicians there about their equipment. If you can see the unlimited possibilities for the future, all you need is a radiotelephone license, second class, and the courage to challenge new frontiers.

BUILT-IN SCOPE VOLTAGE CALIBRATOR

By J. E. STRENK

MOST service type oscilloscopes do not have a calibrated, built-in, variable, peak-to-peak voltage source available for more accurate waveshape analysis.

To provide a source variable from 0 to 100 volts peak-to-peak, a resistor in series with a 100,000 ohm pot, as shown in the diagram, was installed in an early Model O-7 Heath oscilloscope. By use of the formula, (2.8 E_{rms})—100 = R, a value R, in kilohms, can be found for any convenient voltage in any oscilloscope as measured with an ordinary a.c. voltmeter. Note that the 100,000 ohm pot was purposely chosen to simplify the calculation of R for any voltage, E. Also, it provides minimum loading on the power transformer.

In the Heath 0-7 oscilloscope used by the author, 330 volts r. m. s. was measured from one side of the power transformer secondary to ground. Calculating: (2.8 x 330)—100 = 824,000 ohms. The nearest RETMA value (820,000 ohms) was used for R. The potentiometer was mounted in a convenient place on the front panel approximately 234" above the "Sweep Gen.-Hor. Input" switch. The center arm of the pot was brought out to the binding post on the front panel marked "60 Cycle Test" after first having removed the filament voltage connected to it.

The easiest means of calibration (which is accurate enough for ordinary purposes) is simply to measure the voltage from the binding post to ground at 10 volt intervals using an ordinary a.c. voltmeter, remembering of course to divide each peak-to-peak reading by 2.8. Voltage markings should be recorded either directly on the panel or on a paper template glued to the panel. Acrylic plastic spray will protect the calibration marks.

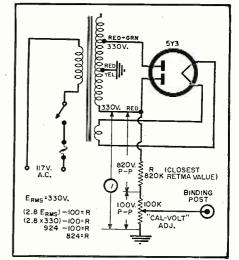
To use the calibrator, the operator merely touches the probe tip to the newly labeled "Cal.-Volt" binding post which is hot all the time. The 100,000 ohm pot labeled "Cal.-Volt.-Adj." is set for any desired peak-to-peak voltage and the vertical gain control set for a

convenient scale deflection. The vertical input is now calibrated and ready for use. An alternative method is to first observe the unknown waveform, noting the amount of deflection. Then touch the probe tip to the "Cal.-Volt." binding post and set the "Cal.-Volt.-Adj." pot for the same deflection. Interpolation between 10 volt markings will be fairly linear.

PEAK-TO-PEAK VOLTS	R.M.S. VOLTS
100	35.7
90	32.0
80	28.5
70	25.0
60	21.4
50	17.8
40	14.3
30	10.7
20	7.0
10	3.6
0	0
(Formula: R.M.S. == Pec	ak-to-Peak/2.8)

Calibration data for use with circuit below.

Schematic of circuit to be added to scope.





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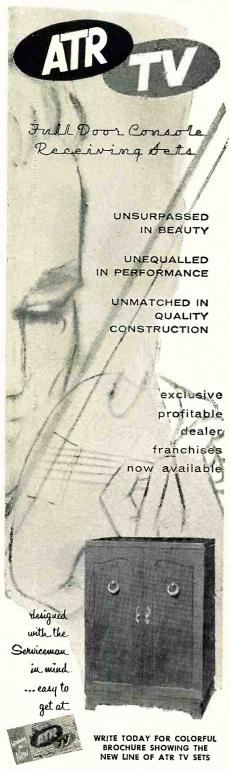
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Labor-Saving Chassis Mounting

By HILTON L. REMLEY

Speed your troubleshooting chores by adopting this method of installing your rack-and-panel mounted radio equipment.

N the usual rack and panel mounting system that is in common use by most constructors, with the standard chassis mounted at right angles to the panel, strengthened in some cases by brackets which are bolted to both the chassis and the panel, servicing is certainly not very convenient without removing units from the rack. This removal also means that we must disconnect the equipment from the external circuit, resulting in the use of jumper wires if the equipment is to be serviced after removal yet kept in the circuit.

A number of us in the commercial field have noted during the past few years, two systems in use by a number of the equipment manufacturers, whereby a unit may be serviced without removal from the rack or disconnection from the circuit.

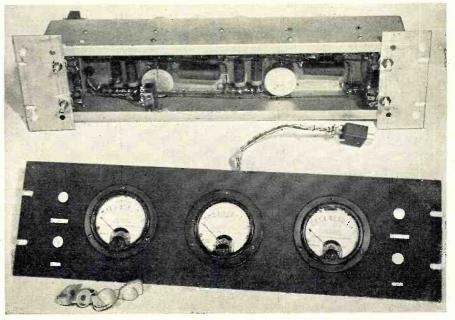
One of these systems involves the hinging of the usual chassis-type panel near the bottom, thus allowing the entire unit to be "folded out" of the rack. The other system was to bolt the chassis, with the underside facing forward, directly to the rack instead of the panel. The panel was then bolted to the rack entirely separate from the chassis. Thus, removal of the panel does not disturb the equipment and yet all wiring is at once exposed in a position such that it may be serviced, right in the rack.

This latter system may be incorporated by the average constructor, as

shown in the photo. Note that any standard chassis that does not exceed the rack clearance of 17 inches wide can be used. The only additions are two pieces of sheet metal, aluminum, or steel (an old panel works well) mounted on either end of the chassis, as shown. Both of these pieces have notches cut in them, corresponding to those in the panel. The chassis is then mounted in the rack with flathead screws, countersunk flush with the surface. All controls are mounted directly on the chassis itself, rather than on the panel, by means of mounting strips or brackets. The panel is then drilled to allow shafts, etc., to project through the panel. Even dial lights may be mounted on the chassis, if desired.

In one case, the meters were mounted directly to the panel only because a standard, three-hole meter panel was available in the junk box. This construction involved the use of a cord and plug arrangement. Even meters may, however, be mounted on the chassis, corresponding holes cut in the panel to line up with the meters when it is mounted on the rack. Note that the panel will be raised above the rack surface by a distance equal to that of the two brackets used. If this type of construction is used throughout the system, then all panels will be flush. It not, then washers or spacers must be used to raise other panels to the same height from the rack in order to make the panels flush.

Photo shows the notched mounting brackets installed on each end of chassis, with the controls incorporated on these brackets. The panel has holes cut for these controls and the meters are connected to the chassis by a cable and plug. See article.

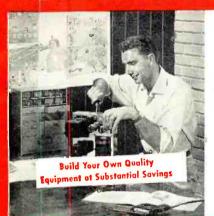


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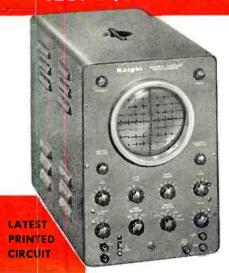
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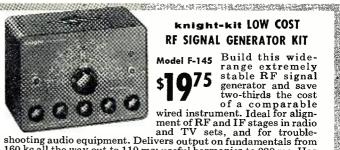


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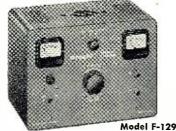
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knight-kit RESISTANCE SUBSTITUTION BOX KIT



Model F-139

Simplifies determination of resistor values needed in a circuit. 36 standard 1 watt resistance values between 15 ohms and 10 megohms with an accuracy of 10%. 18-posi-

tion switch; also slide switch for multiplying values by 1000. Extra switch wafer serves as tie points, eliminating buss bar. 5 x 3 x 2". Complete with test leads and clips. 2 lbs.

Model F-139. Resis. Sub. Box Kit. Net \$5.95

knight-kit CAPACITANCE SUBSTITUTION BOX KIT



Model F-138

Makes it easy to find capacitor values needed in a circuit. Provides

4 To Vides needed in a circuit. Frovides 18 standard capacitor values from .0001 mfd. to .22 mfd., ±20%. Values are 600 volts, except .15 and .22 which are 400 volt. 18-position switch selects all values quickly and easily. In bakelite case, 5 x 3 x 2". Complete with all parts, test leads and clips. 2 lbs.

Model F-138. Cap. Sub. Box Kit. Net . . \$5.95

QUALITY ELECTRONIC TEST EQUIPMENT IN MONEY-SAVING KIT FORM

... easiest to build...you get more...YOU SAVE MORE



41/2" Meter

Model F-128

1000 OHMS/VOLT VOM KIT

Exceptional accuracy and versatility at amazing low cost. Ideal for service shop, lab and Amateur use. Uses 4½" meter (400 microamp movement) with separate scales for AC voltage and current, with separate scales for AC voltage and current, DC voltage and current, decibels and resistance. 38 ranges include: AC, DC and output volts, 0-1-510-50-100-500-5000 (1000 ohms/volt sensitivity); Resistance, 0-1000-100,000 ohms and 0-1 meg; Current, AC or DC, 0-1-10-100 ma and 0-1 amps; Decibels, —20 to +69 in 6 ranges. Uses 1% precision resistors. 3-position function switch and 12-position range switch. Complete kit with bake-lite case, (6¾ x 5½ x 3¾"), battery, pre-cut wire, solder and test leads. Shpg. wt., 2½ lbs.

Model F-128. 1,000 ohms/ volt VOM Kit. Net only \$16.95



Model F-140 knight-kit

20,000 OHMS/VOLT VOM KIT

Outstanding quality and performance at extremely low cost. Features 32 ranges; full vision 4½" meter; accuracy ±2% of full scale; 50 microampere sensitivity for 20,000 ohms/volt input resistance on DC; front panel "zero adjust" Single switch selects function and range. Range: AC function and range. Range: AC, DC and output volts, 0-2.5, 10-50-250-1000-5000; Resistance, 0-2000-200,000 ohms and 0-20 meg.; DC ma, 0-.1-10-100; DC amps, 0-1-10; Decibels, —30 to +63 in 6 ranges. Uses precision 1% multipliers. Moisture-resistant film-type resistors. Complete kit with bakelite case (6¾ x 5¼ x 3¾"), batteries, pre-cut wire, solder and test leads. Shpg. wt., 5 lbs.

Model F-140. 20,000 ohms/volt VOM Kit.

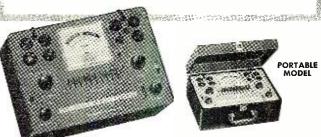


knight-kit VTVM KIT with Printed Circuit Board

Model F-125 An extremely stable, and highly accurate VTVM. Greatly simplified wiring—entire chassis is a printed circuit board. Maximum conven ience in arrangement of scales; 3X AC and DC scale design permits utilization of best portion of each scale for most accurate readings.
Also measures peak-to-peak for
FM and TV work. Ranges: AC
volts, 0-4-14-40-140-400-1400-4000; AC rms volts and

DC volts, 0-1.5-5-15-50-150-500-1500; resistance, 0-1000-10K-100K ohms and 0-1-10-100-1000 megohms; db scale, -10 to +5. AC response, 30 cycles to 3 mc. Low-leakage switches and 1% precision resistors. Balanced-bridge circuit. 4½" meter, 200 microamp movement. Polarity reversing switch. Input res., 11 megs. Shpg. wt., 6 lbs.

Model F-125 Printed Circuit VTVM Kit. Net only . \$24.95 F-126. Hi-Voltage Probe; extends DC to 50,000 Volts \$4.75 F-127. Hi-Frequency Probe; extends AC to 250 mc..\$3.45



knight-kit RESISTOR-CAPACITOR TESTER KIT

Model F-124 Measures capacitance and resistance by accurate bridge method;

checks for opens and shorts in paper, mica and ceramic capacitors; shows power factor of electrolytics.

Large dial shows capacitance and resistance at a glance; balanced-bridge circuit with "magic eye" null indicator measures power factor from 0-50%. Tests capacitors with rated voltages applied. 5 test voltages: 50, 150, 250, 350, 450. Capacity ranges: 10 mmf to 1000 mfd in 5 ranges. Resistance arranges: 1000 mfd in 5 ranges. ity ranges: 10 mmf to 1000 mfd in 5 ranges. Resistance ranges: 100 to 50,000 ohms and 10,000 ohms to 5 megs. Accuracy, ±10%. Automatic discharge feature prevents after-test shock. Blue-finished steel case, 5 x 3 x 2". With tubes and all parts. Shpg. wt., 8 lbs.

Model F-124. Resistor-Capacitor Tester Kit. Net only \$19.50

Model F-149



knight-kit LOW-COST TUBE TESTER KIT

\$2975 Offers high accuracy, top versatility and convenience at lowest cost. Tests 4, 5, 6 and 7-pin large, regular and miniature types, octals, loctals, 9-pin miniatures and pilot lamps. Features test for new 600 ma series string tubes. Tests for open, short, leakage, heater continuity and quality (by amount of cathode emission). 4½" square meter with clear "GOOD-?-REPLACE" scale. With line-voltage indicator and line-adjust control. Choice of 14 filament voltages from .63 to 117 volts. Blank socket for future type tubes. Universal-type selector switches for any combination of pin connections. Single-unit, 10-lever function switch. Entire switch assembly is installed as a single unit—saves time and greatly simplifies construction. Illuminated roll chart lists over 600 tube types. Shpg. wt., 14 lbs.

Model F-143. Counter Model Tube Tester Kit. Net only ... \$29.75

Model F-143. Counter Model Tube Tester Kit. Net only... \$29.75 Model F-142. Portable Model Tube Tester Kit. Net only....\$34.75 F-141. TV Picture Tube Adapter for above. Net only \$3.75



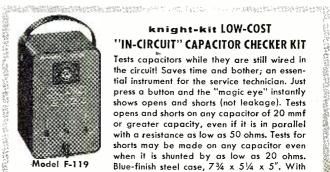
NEW knight-kit TRANSISTOR & DIODE CHECKER KIT

\$8⁵⁰ Checks leakage-to-gain ratio and noise level of all junction, point contact and barrier transistors. Also checks diodes, forward and reverse current conduction of selenium rectifiers; useful for continuity and short checks. Easy-to-read meter. Features: and short checks. Basy-to-read meter. readures. spring-return leakage gain switch; calibration control; separate sockets for PNP and NPN transistors. Headphones or signal tracer may be used with checker for noise measurements. Case, 5 x 3 x 2". With 22½ volt battery. 2½ lbs.

Model F-149. Transistor Checker Kit. Net. \$8.50

EASY PAYMENT TERMS: If your total KNIGHT-KIT order is over \$45, take advantage of our liberal Time Payment Plan -only 10% down. Write for application blank.

ALL PRICES NET F.O.B. CHICAGO



Model F-143

knight-kit LOW-COST "IN-CIRCUIT" CAPACITOR CHECKER KIT

Tests capacitors while they are still wired in the circuit! Saves time and bother; an essential instrument for the service technician. Just press a button and the "magic eye" instantly shows opens and shorts (not leakage). Tests opens and shorts on any capacitor of 20 mmf or greater capacity, even if it is in parallel with a resistance as low as 50 ohms. Tests for shorts may be made on any capacitor even when it is shunted by as low as 20 ohms. Blue-finish steel case, $7\frac{3}{4} \times 5\frac{1}{4} \times 5^{"}$. With tubes, all parts, wire and solder. Easy to assemble. Shpg. wt., 5 lbs.

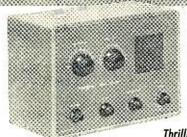
Model F-119. Cap. Checker Kit....\$12.50

order from ALLIED RADIO 100 N. WESTERN AVE., CHICAGO 80, ILL.



ALLIED'S own MONEY-SAVING knight-kits

FAMOUS knight-kits FOR HOBBYISTS & EXPERIMENTERS... FASCINATING, INSTRUCTIVE...



knight-kit

"SPACE SPANNER"
BAND SWITCHING
RECEIVER KIT

Model \$1595

Thrilling Short Wave and Broadcast

Famous 2-band AC-DC receiver in easy-to-build kit form at a very low price. Pulls in thrilling short-wave (6 to 17 mc) and standard broadcast. It's fun listening to amateur, aircraft, police and marine radio. Features highly sensitive regenerative circuit. Bandswitch selects broadcast or short wave. Has 4" PM speaker and beam-power output tube for plenty of volume; headphone connectors for weak signal listening; slide switch cuts out speaker. Uses 12AT7 regenerative detector and audio amplifier, 50C5 power output, 35W4 rectifier. Six controls: Bandspread; Main Tuning; Antenna Trimmer; Bandswitch; Regeneration; Audio Gain. Includes tubes and all parts. 7 x 10½ x 6". Shpg. wt. 4½ lbs.

Model S-243. "Space Spanner" Receiver Kit. Net only \$15.95
S-247. Matching Cabinet for above. 2 lbs. Net \$2.90 Famous 2-band AC-DC receiver in easy-to-build kit form at a very low price. Pulls in thrilling short-wave (6 to 17 mc) and standard broadcast. It's fun listening to amateur, aircraft, police and marine radio. Features highly sensitive regenerative circuit. Bandswitch selects broadcast or short wave. Has 4"PM speaker and beam-power output tube for plenty of volume; headphone connectors for weak signal listening; slide switch cuts out speaker. Uses 12AT7 regenerative detector and audio amplifier, 50C5 power output, 35W4 rectifier. Six controls: Bandspread; Main Tuning; Antenna Trimmer; Bandswitch; Regeneration; Audio Gain. Includes tubes and all parts. 7 x 10½ x 6". Shpg. wt. 4½ lbs.

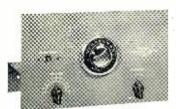
Model S-243. "Space Spanner" Receiver Kit. Net only \$15.95 S-247. Matching Cabinet for above. 2 lbs. Net \$2.90



NEW knight-kit TWO-WAY INTERCOM KIT

New low-cost, easy to build intercom system kit. Ideal for use in home or office. Consists of Master unit and Remote use in home or office. Consists of Master unit and Remote unit, each with press-to-talk switch. Remote unit may be left "open" for answering calls from a distance, for "baby-sitting", etc. Remote may also be connected for "private" operation—cannot be "listened-in" on, but it can be called and can originate calls. Master unit includes high-gain 2-stage amplifier; each unit has 4" PM dynamic speaker. Complete with Antique White cabinets (4% x 6½ x 4% "), all parts, tubes and 50 feet of cable (up to 200 feet of cable can be added). For AC or DC. Shpg. wt., 7 lbs.

Model S-295. Two-Way Intercom Kit. Net only . \$14.75



Model S-740 \$1175 knight-kit

"OCEAN HOPPER" RECEIVER KIT

Tops for exciting broadcast, long wave and short wave reception. Highly sensitive regenerative-type circuit. Excellent headphone reception; can be used with 3-4 ohm PM speaker on strong broadcast band stations. Supplied with plug-in coil for standard broadcast; covers long wave and popular short wave bands with coils below. Pulls in thrilling foreign broadcasts, police, amateurs and aircraft. Controls: Main Tuning, Bandspread, Antenna Tuning. Off-On-Regeneration With all parts and tubes (less extra coils and headset). AC or DC. Shpg. wt., 5 lbs.

\$11.75 Model \$-740. "Ocean Hopper" Kit

medel 3-7-40. Occasi Hopper 12	
EXTRA PLUG-IN COI	LS
S-741. Long Wave, 155-470 kc. N	et
S-742. Short Wave, 1.65-470 kc. S-743. Short Wave, 2.9-7.3 mc.)
\$-743. Short Wave, 2.9-7.3 mc. (Net
S-745. Short Wave, 7-17.5 mc.	each 65 ¢
\$-744. Short Wave, 15.5-35 mc.	_



Model S-735 \$

knight-kit

"RANGER II" SUPERHET RADIO KIT

Thousands have built and enjoyed the "Ranger" Broadcast Band Receiver. Carefully engineered for easy construction and powerful, sensitive performance. Latest Superhet circuit; tunes 540 to 1680 kc; covers entire broadcast band and exciting police calls. Features automatic volume control, tuning condenser. Develops excellent tone quality from Alnico V PM dynamic speaker. Supplied with following tubes: 12SA7GT converter; 12SK7GT IF amp.; 12SQ7GT det.-AVC-audio; 50L6GT audio output; 35Z5GT rest. Complete with bandsome brown elections. rect. Complete with handsome brown plastic cabinet (6 x 9 x 5) tubes, speaker, all parts, and instruction manual. AC or DC operation. Shpg. wt., 8 lbs.

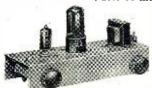
Model S-735. "Ranger II" Superhet



3-WAY PORTABLE RADIO KIT

A low-cost portable radio covering the full standard broadcast band from 535 kc to 1650 kc. Delivers excellent recep-tion on AC or DC current or from self-contained batteries. Sensitive Superhet contained batteries. Sensitive Superhet circuit features automatic volume control, economical operation. Includes powerful 5" Alnico PM dynamic speaker, efficient ferrite loop-stick antenna. Supplied with following tubes: 1R5 converter; 1U4 IF amplifier; 1U5 detector-AVC-audio; 3V4 audio output. Complete with attractive portable case (7½ x 10 x 5½"), tubes speaker all parts and in-5¼"), tubes, speaker, all parts and instruction manual. Shpg. wt., 6 lbs.

Model S-730. 3-Way Portable Radio Kit (less batteries). Net \$19.95 J-651. Battery Kit for above \$2.50



knight-kit LOW COST PHONO AMPLIFIER KIT

Model S-790 It's easy to build this fine-performing, lowcost compact phono amplifier. Ideal for use cost

ampliner. Ideal for use in a portable phonograph—simply add any record player and a 3 to 4-ohm speaker. Amplifier works with crystal or ceramic cartridges. Inverse feedback circuit for rich, clean tone quality. Delivers full 1½-watt output with less than .25 volt input. Includes efficient tone control; has AC outlet, controlled from amplifier switch. Complete with tubes and all parts. Size only 4½ x 7 x 4"—fits into almost any portable phono case. Shpg. wt., 3 lbs.

FAMOUS knight-kit CRYSTAL SET KIT

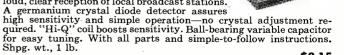
Thousands of beginners have started in radio and electronics

by building the KNIGHT-KIT crystal set. This feature-packed set delivers loud, clear reception of local broadcast stations.

Shpg. wt., 1 lb.

Model S-261

for outdoor antenna.....



Buy with confidence from ALLIED - America's Pioneer in Electronic Kits

finest quality electronic equipment in lowest-cost kit form

EASY-TO-BUILD HIGH PERFORMANCE KITS . WIDELY USED BY MANY LEADING TRAINING SCHOOLS



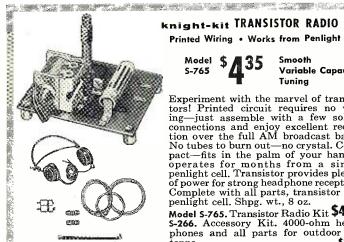
NEW knight-kit **ELECTRONIC PHOTOFLASH KIT**

Model 5-244

New feature-packed photoflash kit—designed for top quality dependability—available at a money-saving low price. Ideal for black and white or color photography. Xenon-filled reflector-bulb assembly gives over 10,000 flashes at less than ½ each! 1/700-second flash freezes the fastest action. Has 50 watt-second output. Provides light approximating daylight in spectral quality; permits the use of outdoor-type film indoors. Film guide number for color (ASA10) is 45. Designed for "X" or "O" shutters only. Requires sync cable (available from any photo supply dealer) and either battery or AC supply listed below. Complete outfit with battery weighs only 3½ lbs. Kit includes all parts, carrying case and easy-to-follow instructions. Shpg. wt., 3 lbs.

Model 5-244. Electronic Photoflash Kit. Net \$22 50

Model S-244. Electronic Photoflash Kit. Net ... \$28.50 S-246. AC Power Supply Kit. Easy to assemble ... \$3.75 J-626. Battery for above (Burgess U-200) \$8.47



knight-kit TRANSISTOR RADIO KIT Printed Wiring . Works from Penlight Cell

Model \$435 5-765

Variable Capacitor Tuning

Experiment with the marvel of transis-Experiment with the marvel of transis-tors! Printed circuit requires no wir-ing—just assemble with a few solder connections and enjoy excellent recep-tion over the full AM broadcast band. No tubes to burn out—no crystal. Com-pact—fits in the palm of your hand— operates for months from a single penlight cell. Transistor provides plenty of power for strong headphone reception. of power for strong headphone reception. Complete with all parts, transistor and penlight cell. Shpg. wt., 8 oz.



FAMOUS knight-kit LAB KITS

6-IN-1 RADIO LAB KIT

Build Any of 6 Electronic **Projects**

A fascinating and instructive kit.
Enables you to build any one of the following projects: Standard
Broadcast Receiver; Wireless
"Home Broadcaster"; Code Practice Oscillator; Code Practice
Broadcaster; Signal Tracer; Sine Wave Generator. Perfect for beginners. Once basic wiring is completed, circuits may be changed without soldering. Safe to build and operate; only tools needed are screwdriver, pliers and soldering iron. The ideal kit for students and beginners in electronics. Kit insludes mounting board, tube, all parts and easy-to-follow instruction manual Less headphone (also

LAB KIT

Model S-265

Build Any of 10 Electronic **Projects**



knight-kit WIRELESS BROADCASTER KIT

Model 5-705
This fascinating unit makes it possible to "broadcast" with phonograph or microphone through any standard radio receiver up to 50 feet away—without any connection to the set. May be used with crystal or magnetic cartridge, or with microphone. Broadcasts a clear, full-toned signal. High-gain stage permits using magnetic cartridge without need for external preamp. Complete with all parts, tubes, wire and solder (less microphone). 4½ x 5 x 6". Easy to assemble. Shpg. wt., 3 lbs. Model S-705. Wireless Broadcaster Kit. Net only \$9.50
S-556. Microphone for above with 5-ft. cable \$3.95



knight-kit PHONO OSCILLATOR KIT

ALL PRICES NET F.O.B. CHICAGO



knight-kit CODE PRACTICE **OSCILLATOR KIT**

Model S-239 Transistor

Penlight Cell

An ideal code practice oscillator. Uses transistor circuit. Extremely low current consumption —powered by single penlight battery. Provides crisp, clear tone (400 to 600 cps). Has input jack for earphone; screw-type terminal strip for key. In compact bakelite case (23/8 x $3\frac{\%}{4}$ x $1\frac{1}{2}$ ") with anodized aluminum panel. Complete with all parts, transistor, battery and easy-to-follow instructions. Shpg.

Model S-239. Code Practice Kit....\$3.95 See Next Page for Amateur Kits

order from ALLIED RADIO 100 N. WESTERN AVE., CHICAGO 80, ILL.



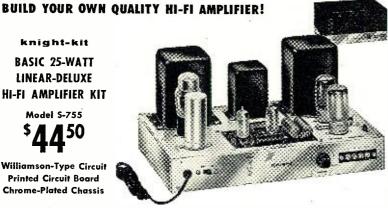
ALLI D'S own knight-kits give you the most for your money

knight-kit **BASIC 25-WATT** LINEAR-DELUXE

Model S-755

HI-FI AMPLIFIER KIT

Williamson-Type Circuit **Printed Circuit Board Chrome-Plated Chassis**



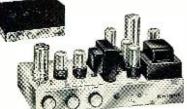
This super-quality hi-fi basic amplifier is designed to satisfy the most critical listener. Intended for use with tuners incorporating built-in preamp or with separate preamp. Incorporates latest Williamson-type circuit and has potted matched transformers. Delivers maximum output of 45 watts. Frequency response is: ± 0.5 db. 10 cps to 120 kc, measured at 20 watts. Harmonic distortion is only .15% right up to 30 watts. Intermodulation distortion is only .27% at 10 watts and only .4% at 20 watts, using 60 cps and 7 kc, 1.4 ratio. Hum level is -85 db below full rated output. Output impedance, 4, 8, 16 ohms. Input voltage for 25-watt output is 1.8 volts. Uses two 12AU7's, two 5881's, and a 5V4. Etched circuit is utilized in voltage amplifier and phase inverter stages to speed assembly. Has output tube balancing control, variable damping control, and on-off switch. Handsome chrome-plated chassis, $14 \times 9 \times 2$ ". Overall height, 7". A deluxe true hi-fi amplifier equal in performance to amplifiers selling at over twice the price. Complete with all parts and tubes. Easy to assemble. Shpg. wt., 27 lbs.

Model S-755. Basic 25 Watt Hi-Fi Amplifier Kit. Net only.

\$44.50

S-759. Metal enclosure for above; black finish. 3 lbs. Net.

\$44.50



knight-kit 10-WATT HI-FI AMPLIFIER KIT

Model S-753

Chrome-Plated Chassis

Model S-753

**Tamous for wide response and smooth reproduction at low cost. Only 0.5 volt views amplifier to full output. Frequency response: ±1 db, 30-20,000 cps at 10 watts. Harmonic distortion less than 0.5% at 10 watts. Harmonic through the standard of the standard phono or tuner. Chromed chassis; punched to accommodate magnetic cartridge preamp. Matches 8 ohm speakers. Shpg. wt., 14 lbs.

**Tamous for wide response and smooth provided that the standard should be sho

Model S-753. Amplifier Kit. Net .. \$23.50 Model S-235. Preamp Kit for above ...\$3.10 S-757. Metal Enclosure. 3 lbs......\$3.95



20-WATT HI-FI AMPLIFIER KIT

Model S-750

Chrome-Plated Chassis True hi-fi for less! Fre-

Own

True hi-fi for less! Frequency response, ±1 db, 20-20,000 cps at 20 watts. Distortion, 1% at 20 watts. Hum and noise level: tuner input, 90 db below 20 watts; phono 72 db below 20 watts. 4 inputs: magnetic phono microphone, crystal phono or recorder, and tuner. Controls: Bass, Treble, Volume, Selector. With compensation positions for 78 and LP records. Built-in Preamp. Outputs: 4, 8, 16 and 500 ohms. 23 lbs.

LOW-COST TOP QUALITY KITS FOR THE HAM



50-WATT CW TRANSMITTER KIT Model S-255

Built-in Pi-Type Antenna Coupler

Check the features packed into this new transmitter kit and you'll see why it's one of the greatest Amateur values ever offered. Compact and versatile, it is the perfect low-power rig for the beginning Novice or seasoned veteran. Features: 50 watts input to 807 final; high-efficiency 6AG7 modified-Pierce oscillator takes crystal or VFO without circuit changes; bandswitching coverage of 80, 40, 20, 15, 11-10 meters; pi-section antenna output matches line impedances from 50 to 1200 ohms—permits use with any type of antenna; no separate antenna tuner required. Crisp, clean, cathode keying of oscillator and final. Power take-off plug supplies filament and B-plus voltages for other equipment. Copperfinished chassis and cabinet interior, filtering, shielding, bypassing, and coaxial SO-239 antenna connector provide excellent TVI suppression. Meter reads either plate or grid current of final. Jacks for VFO, crystal and key. Supplied with all parts and tubes. Less crystal and key. Supplied with all parts and tubes. Less crystal and key. 8½ x 11½ x 8¾". Shpg. wt., 18 lbs.

Model 5-255. 50-Watt Transmitter Kit. Net ... \$43.75



knight-kit SELF-POWERED VFO KIT Model S-725

Complete with built-in power supply! Careful design and voltage regulation assure high stability. Excellent oscillator keying characteristics for fast break-in without clicks or chirps. Full TVI suppression. Has plenty of bandspread: separate calibrated scales for 80, 40, 20, 15, 11 and 10 meters; vernier drive mechanism. 2-chassis construction keeps heat from frequency determining circuits. Output cable plugs into crystal socket of transmitter. Output on 80 and 40 meters. With Spot-Off-Transmit switch for "no swish" tuning. Extra switch contacts for operating relays and other equipment. With all parts and tubes. 8 lbs.

Model S-725. Self-Powered VFO Kit. Net. \$28.50



NEW knight-kit AMATEUR RF "Z" BRIDGE KIT

Model S-253
\$585

Measures standing wave ratio (SWR) and impedance of antenna systems; also for networks for optimum results. Any VOM may be used for null indicator. High accuracy with 20,000 ohm/v VOM. Correction factor info supplied for other VOM's. With coax input and output connectors. Meters both input and bridge voltage. Calibrated dial gives direct impedance reading; includes 1% precision resistor for precise calibration adjustment. With all parts and handy plasticized SWR chart. 1½ lbs.

Model S-253. "Z" Bridge Kit. Net only \$5.85

\$5.85 Model 5-253. "Z" Bridge Kit. Net only



100 N. WESTERN AVE., CHICAGO 80, ILL.



ALLIED RADIO CORP., Dept. 01-M-6, 100 N. Western Ave., Chicago 80, Ill.

Ship me the following KNIGHT-KITS

enclosed. For parcel post	t include posto	age (express is shipped	collect

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RADIO & TELEVISION NEWS



INCENTIVE PROGRAM

The second phase of the *National Company's* "Bonus Bucks" incentive program for high-fidelity products will continue until December 31st of this year. Top prize to be awarded will be an all-expense "Hi-Fi Holiday in Havana." A variety of other awards will also be made, based on a point system for hi-fi units sold during the July 1st-December 31st period. Merchandise awards will include TV sets, home appliances, sporting goods, etc.

Owners and sales personnel of the company's retail outlets can compete as can the firm's sales representatives. "Bonus Bucks" credits will be issued for sales of the company's "Criterion" AM-FM stereo radio tuner, "Horizon" 10 and 20 amplifiers, "Horizon" 5 plugin preamp, and the "Copley," "Copley Square," "Wellesley," and "Synfo-

nette" speaker systems.

"BONDED DEALER" MATERIALS

Raytheon Manufacturing Company, Newton 58, Mass., has announced a comprehensive "Bonded Dealer" advertising and promotion campaign for 1956-57. According to the company, this new business-building program is the most complete and comprehensive ever offered by the firm.

Included in the program is a group of specially designed items to assist the company's "Bonded Dealers" in the



efficient operation of their businesses. Also included is a collection of proven business builders and shop aids to assist dealers in stimulating customer interest and confidence. Among the many colorful and attention-getting display cards and streamers is the newly designed "Bonded Dealer Creed" which colorfully and effectively carries the Code of Ethics subscribed to by such dealers.

The campaign will also include consumer advertising and local tie-in promotions.

"MAKE WAY FOR COLOR"

A new dealer-aid, to assist distributors and dealers in selling and servicing color television is being offered by Sylvania Electric Products Inc.

The new item is a 10-minute film

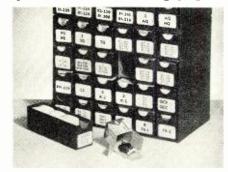
December, 1956

strip entitled "Make Way for Color." The color film and recorded narrative points up selling reasons and outlines the major differences in the composition of black-and-white and color TV sets. It also touches on some of the new terms added to the technical vocabulary as a result of the impact of color TV.

The film may be requested for distributor or dealer meetings by contacting local electronic products sales representatives of the company.

IRC SELLING PROGRAM

International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa., has set up a double-barreled selling program



which is designed to increase dealer sales on the firm's "Resist-O-Cards," parts stocks, and volume controls.

The new "Resist-O-Cards" being introduced cover virtually all values of $\frac{1}{2}$, 1, and 2 watt carbon composition resistors. Standard packages include ten die-cut cards of a resistor type clearly visible from the new and attractive counter displays.

The new dealer parts stocks and the conversion stock will make possible a real bargain in volume control coverage. These stocks provide exceptionally wide coverage of 809 different carbon and wire "exact duplicate controls" and standard single controls.

These new sales aids are now available at all territorial sales offices and from representatives of the company or may be ordered from the manufacturer direct.

FUZE-TYPE RESISTOR CARDS

Clarostat Mfg. Co., Inc., of Dover, N. H., is now packaging its new plugin fuze-type resistors of 5.6 ohms on a special wall display card.

Twelve of the new units are packaged and mounted on a "Fuzohm Card," GL-2. The company is also offering the GL-1 card, which mounts twelve of its 7.5 ohm units.

Write the company for full information on the product and the display.

CLOSED-CIRCUIT TV

General Electric Company's Broadcast Equipment Section and Apparatus Sales Division have started an intensive campaign to promote the sale of closed-circuit television systems.

In addition to a series of nationwide sales meetings, the company will implement the campaign by tie-in advertising for "Intratel." The original promotion will be aimed at the industrial,



He's already an

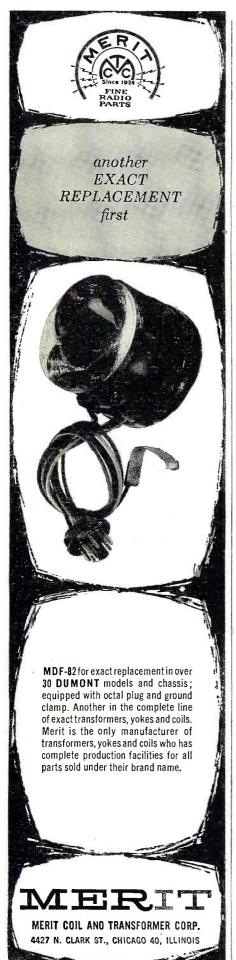
ELECTRONICS ENGINEERING DESIGNER

Out of high school just 2 years ago, this young man has already started a fascinating, highly rewarding career in electronics engineering. No matter whether you are now 18 years old—or 28—a 26-month Embry-Riddle education will prepare you for a quick start in this lucrative professional field.

Electronics Engineering Design course concentrates on essential technical studies and practical projects. With the aid of top flight Embry-Riddle instructors you'll master many absorbing fundamentals - - Microwaves and Radar, Servomechanisms, Industrial Electronics and Television, to mention a few of the subjects.

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transportation, aviation, and defense fields with emphasis on commercial and business applications and the institutional, educational, and municipal fields next year.

GIANT SPEAKER

High Fidelity Associates of Miami, Fla., is not reticent about announcing its business and the products it distributes.

A ten foot steel and aluminum replica of an Electro-Voice loudspeaker ro-



tates atop the company's building, attracting favorable attention to the store and its products.

Hotpoint Co., 5600 W. Taylor St., Chicago 44, Ill., is slanting the advertising on its new TV line to the theme of "family enjoyment" rather than the technical aspects of receiver circuitry,

CHRISTMAS IGLOO

The Radio and Television Division of Sylvania Electric Products Inc. has announced an exclusive Christmas promotion with premiums for consumers and prizes for television dealers.

The promotion has its focal point in the "Igloo," a unique playhouse modeled after the real thing. The igloo is made of durable cardboard and is easily assembled. It is topped by a TV antenna. The toy is given free to consumers with the purchase of one of the company's television receivers during the Christmas shopping season.

A window display contest, using the "Igloo" as a theme, will enable dealers to cash in on the increased sales. Prizes will be awarded on the basis of photographs of dealer displays submitted before January 15th. Winners will be announced in March.

E-V "ROAD SHOW"

Electro-Voice, Inc., of Buchanan, Mich., has taken five tons and \$20,000 worth of hi-fi equipment on a tour scheduled to last until May of next

Employing a Wells Cargo carrier and two panel trucks, the "road show" will display speaker enclosures, "do-ityourself" speaker enclosure kits, speakers, amplifiers, tuners, complete systems, and components.

For information on the tour route and details on scheduling visits, write to Howard Souther, marketing director of the firm.

DISPLAY STANDS

Arlington Aluminum Company, 19011 W. Davison, Detroit 23, Mich., is now

offering an extensive line of pointof-purchase display stands, including the company's unique "triangular" model which features three hole-board panels with aluminum trim and tubular aluminum legs. This particular model is designed to be used for displaying the prod-



uct alone or with literature or bulletins included.

A free, 4-page, 2-color brochure includes information on a versatile display board used for product literature in conjunction with merchandise as well as describing the custom service offered by the company in the fabrication of specialized displays of steel, Masonite, and aluminum. -30-





don't read this!

But, if you're interested in an honest-to-goodness career in the vigorous young electronics industry, here's how you can step ahead of competition, move up to a better job, earn more money, and be sure of holding your technical job even if the brass is firing instead of hiring.

The "how" is CREI training in radio-television-electronics. You don't have to be a college graduate. You do have to be willing to study—at home. You can do it while holding down a full-time job. Thousands have. However, you must have some prior electronic experience, either in military service, professional employment, experimenting, or ham operating. Since 1927 CREI has provided alert young men with the technical knowledge that leads to more responsibility, more job security, more money. More than a quarter century of experience qualifies CREI to train you.

What qualifies you for CREI? If you have a high school education, you're off to a good start. If you have a knack for math, so much the better. If you are currently working

in some phase of the electronics industry, you'll get going faster. But remember this: CREI starts with fundamentals and takes you along at your own speed. You are not held back by a class, not pushed to keep up with others who have more experience or education. You set your own pace. Your CREI instructors guide you through the lesson material and grade your written work personally. You master the fundamentals, then get into more advanced phases of electronics engineering principles and practice. Finally you may elect training at career level in highly specialized applications of radio or television engineering or aeronautical radio.

How good is CREI training? Here are a few ways to judge. Ask an electronics engineer, if you know one. Ask a high-school or college physics teacher. Ask a radio station engineer. Check up on our professional reputation: CREI home study courses are accredited by the Engineers' Council for Professional Development; CREI is an approved member of the National Council of Technical Schools. Ask personnel managers how they regard a man with a CREI "ticket." Look at this partial listing of organizations that pay CREI to train their own personnel: United Air Lines, Canadian Broadcasting Corp., Trans-Canada Airlines, Douglas Aircraft Co., Glenn L. Martin Co., Columbia Broadcasting System, All-American Cables and Radio, Inc., Gates Radio Co., Canadair Ltd., Federal Electric Corp. and U. S. Information Agency (Voice of America). Finally, ask a CREI graduate to tell you about our Placement Bureau, which currently has on file more requests for trained men than we can fill.

What's the next step? The logical one is to get more information than we can cram into one page. The coupon below, properly filled out, will bring you a fact-packed booklet called "Your Future in the New World of Electronics." It includes outlines of courses offered, a resume of career opportunities, full details about the school, and tuition details. It's free.

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"Luck," some may say. "Contacts," others may suggest.

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Tremendous expansion leaves this gigantic industry pleading for trained men. Top manufacturers sold billions of dollars worth of electronic merchandise in 1955. By 1960, the radio-electronics industry should do no less than 15 billion dollars per year, not counting military orders.

Today, there are over 132,000,000 radios in use. There are 38,000,000 TV sets and 477 TV stations in operation. Color TV is coming into high gear. Countless positions must be filled—in development, research, design, production, testing and inspection, manufacture, broadcasting, telecasting and servicing. To fill these posts, trained men are needed—men who somewhere along the line take

time to improve their knowledge, their skills. Men who, today, perhaps, take two minutes to send for a booklet.

"Your Future in the New World of Electronics". shows how CREI Home Study leads the way to greater earnings through the inviting opportunities described above.

However, CREI does not promise you a "snap." With an accredited technical course such as this, you must study to convert your ambition into technical knowledge you can sell in the fabulous Electronics market.

Since 1927, CREI has provided thousands of professional electronics men with technical educations. During World War II CREI trained thousands for the Armed Services. Leading firms choose CREI courses for group training in electronics, among them United Air Lines, Canadian Broadcasting Corp., Trans-Canada Airlines, Douglas Aircraft Co., Glenn L. Martin Co., Columbia Broadcasting System, All-American Cables and Radio, Inc., Gates Radio Co., Canadair Ltd., Federal Electric Corp. and U. S. Information Agency (Voice of America).

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assignments, of personal supervision of a CREI Staff Instructor who knows and teaches you what industry wants. You learn on your own time, during hours selected by you. This complete training is the reason graduates find CREI diplomas keys-to-success in Radio, TV and Electronics. CREI alumni hold top positions in America's leading firms. CREI's Placement Bureau finds better positions for advanced students and graduates. Although CREI does not guarantee jobs, requests for personnel far exceed current supply.

Now is the time of decision. Luck will not propel you forward unless it finds you trained. Contacts won't budge you an inch unless you have the skill to back them up. The answer is: Technical Training . . and willingness to learn. Together they will bring you increased earnings in this new Age of Electronics. Fill out the postage-free reply card and mail it now. We'll promptly send you your free copy of "Your Future in the New World of Electronics." The rest—your future—is up to you.

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AMERICA'S FINEST VALUES IN "LOW COST" HIGH FIDELITY



NEW 1957 MODEL

Push-Pull 6L6 Output Tubes Response 30-15,000 CPS Bass and Treble Tone Controls Input for Xtal or Dynamic Mike Input for Xtal or V.R. Phono

With CU-14Y, 12" Goax Speaker...\$32.95 With P15-CR, 15" Coax Speaker...\$42.95 With Imperial IV System....\$39.95\$48.95 With HF-33GE\$69.95

With Imperial VI. A tremendous High Fidelity amplifier value. Response 30 to 15,000 cps. Electronic bass and troble boost by separate tone controls. Use this amplifier with any record changer having crystal controls. 20 watts power output. Use with any 4 cord speaker or 250 ohm line. 20 watts power output. Use with any 4 or 8 ohm speaker or 250 ohm line. Chassis size, 73½" x 10½" x 7½" high. Complete with tubes: 2—616, 2—604, 12AX7 and 5U46. This is a terrific value. A ready to use high fidelity amplifier at less than the cost of a kit. 5hip. wt. 17 lbs. Model HF-20, 20 watt HI-Fi amplifier. McGee's sale price, \$22.95.

LOW-BOY 3-WAY HI-FI SPEAKER SYSTEM

for apartment size Hi-Fidelity. Available in blond or mahogany finish. Extra value made possible by our use of new TV cabinets. Converted into Hi-Fi speaker baffle with enclosed back. All dimensions may vary slightly. Approximately 19" high plus 8" legs. Over-all height 27", 19\(^4\)\(^4\) deep and 23\(^4\)\(^5\)\(^4\) wide. Equipped with 15" coaxial speaker and a 6" mid-range speaker on one side for augmented mid-range dispersion. Stock \(^4\) GM-416 Mahogany Finish

Stock \(^4\) GB-416 Blond Finish

Model H-4H, HolJywood 4 speaker 3995
high fidelity
Power 20 watts,
Power 20

3 - 1957 MODEL Hi-Fi SPEAKERS • COMPLETE SYSTEMS WITH 4 SPEAKERS

COMPLETE SYSTEMS WITH 4 SPEAKERS
 ACOUSTICALLY LINED ENCLOSURES
The new 1957 Hollywood, 4 speaker high fidelity speaker systems are expressly designed to give realistic reproduction from your Hi-f amplifier or FM-AM radio. Juke box bass response with brilliant, middle and high range response. All a models have genuine, cores to make the context to the 4 or 8 or 10 mm tap on your Hi-fly 20, 30 and 34 high fidelity amplifiers, and all FM-AM chassis in our Radio & TV News offerings. Addition the twin tone and the system to use with our Imperial 20, 30 and 34 high fidelity amplifiers, and all FM-AM chassis in our Radio & TV News offerings. Additing the twin tone centres on the Moravacamplifiers systems you can have fidelity of your own personal taste. All 3 Hollywood models are housed in the same fine cabinet. Choice of either blond or mahogany finishes. Baffles are for the fidelity of your own personal taste. All 3 Hollywood models are housed in the same fine cabinet. All 3 Hollywood models are housed in the same fine cabinet. Systems you can have fidelity of your own personal taste. All 3 Hollywood models are housed in the same fine cabinet. All 3 Hollywood models are housed in the same fine cabinet. Systems you can have fidelity of your own personal taste. All 3 Hollywood models are housed in the same fine cabinet. All 3 Hollywood and accoustically lined. Small enough in the fine period and accoustically lined. Small enough finishes. Baffles are for the fine period and accoustically lined. Small enough finishes when ordering, otherwise we will ship mahogany finish the period and accoustically lined. Specify cabinet finish speaker system. Model 7-47, Hollywood 4 speaker, high fidelity speaker systems will apply the lined finishes. Baffles are fin



McGEE'S NEW 1957 MODEL

25 WATT 12" COAXIAL SPEAKER

- ★ 14½ oz. G.E. 12" WOOFER— ★ 3½" COAXIALLY SUSPENDED TWEETER—
- ALUMINUM VOICE COIL WOOFER—

957 model, GE-120XT, 12" 25 watt high fidelity coaxial PM speaker, mmy pot cover, it's all speaker value. Features a General Electric 12", o V woofer with aluminum voice coil and exponential, molded seamless ter is a specially made 1.47 oz. Alnico V, 3½" speaker which extends ney response to 17,500 cps. It is electrically connected to accept only the office of the voice of the control of the c



McGee's Famous 12 AND 15 INCH COAXIAL P.M. HIGH FIDELITY SPEAKERS

15-Inch Model P15-CR

NEW 1957 MODEL

Push-Pull 6L6 Output Tubes Response 15-20,000 CPS Bass and Treble Tone Controls Compensated Gain for G.E. Cart. Input for Xtal or Dynamic Mike

With CU-14Y, 12" Coax Speaker . \$39.95 With P15-CR, 15" Coax Speaker . \$49.95

With Imperial IV Speaker System \$46.95

Model INP-30

With Imperial IV Speaker System \$46.95
With Imperial VI. \$55.95
With HF-33GE ...\$76.95
New 1957 model 7 tube Imperial 30 wath High Fidelity audio amplifier. A \$100.00
list value for only \$29.95. Features a heavy 4 lb., specially wound high fidelity
output transformer with 15% inverse feed-back; push-pull 616. output tubes and
frequency response from 15 to 20,000 cps. Matches 8 or 16 ohm speakers. You can
center your entire custom music system around think and addition of the state of the system of the

NEW IMPERIAL 24 WATT AMPLIFIER \$39.95

PUSH-PULL EL-34 ENGLISH MADE MULLARD OUTPUT TUBES WILLIAMSON TYPE CIRCUIT RESPONSE 15-20,000 CPS

With CU-14Y, 12" Coax Speaker . \$49.95 With P15-CR, 15" Coax Speaker . \$59.95 With Imperial IV Speaker System . 556.95 With SP12125CR. . \$65.95. With HF-33GE. . \$86.95. Model IMP-34X

New, 1957 model Imperial 34X, 24 watt high fidelity amplifier for the audie enthusiast who want McGee's finest amplifier. This amplifier features push-pull EL-34 English made Mullard output tubes in a Williamson circuit. Heavy duty 6 lb. specially wound Williamson type ultra-linear output transformer in potted case has a response from 15 to 20,000 cps. Matches 8 or 16 ohm speakers. Replifier has input for relicutance to the pre-amplifier for the power power of the property of the property

NEW IMPERIAL SPEAKER SYSTEMS

Imperial IV with 8" G.E. High Fidelity Speaker \$ 1995



3-Way Imperial VI with 12" G.E. Speaker

New 1957 Model IMPERIAL IV, High fidelity speaker system with General Electric 8" speaker. Housed in a high quality leatherette covered plywood cabinet 10" x 10" x 24" long, Fully enclosed; covered on all sides except back. Use as an auxiliary speaker or with any high fidelity radio, amplifier or home music system. The lip PERIAL IV contains a General Electric Model 850 or 9770 Nord curvilinear cone with high fidelity 8" PM speaker with 6.8 or Alectric Model cone with 19.59 voice coil and a 5" kweetter. Response 50 to 15,000 cps. Model IV Imperial 519.59 or 15.000 cps.

\$19.95.

1957 Model Imperial VI. 3-way speaker system. Baffle is of heavy wood, leaf covered. Similar in appearance to the Imperial IV picture 6 above covered and 1 dependent of the property of the property

CONSOLE HI-FI SPEAKER SYSTEM \$49.95

12" G.E. PM WOOFER—10" PM MID-RANGE— 8" G.E. MODEL 850 MID-HIGH RANGE SPEAKER AND 600 CYCLE L-C CROSSOVER NETWORK.

AND 600 CYGLE L-C CROSSOVER NETWORK.

Have Juke Box tone quality in your own home. Strictly High fidelity. Three speakers all connected to a 600 cycle frequency dividing network, so that only 2 wires feed the system from any 4 or 8 ohm radio or amplifier. A variable tone commensating convol incorporated the recular of the first own own have will give you a much wider selection of acoustical arrangements with this speaker system. The 3-way system is shipped ready to connect to your amplifier or hi-fi radio. Equipped with a General Electric 12' woofer, an 8' famous GE. 850 plus a 10' middle choice of cabinets; blonde or mahogany. (Specify finish desired when ordering) 37" high. 24" wide and 20' deep. Ship. wt. 75 lbs. Stock No. HF-33GE. Sale price, \$49.95. Model HF-44GE, console speaker system, same as heavy duty Model HF-55GE, super deluxe quality console speaker system, same as HF-33GE 8' hard cone tweeter. Sale price, \$54.95. (Specify cabinet finish.)

Model HF-55GE, super deluxe quality console speaker system, same as HF-33GE described above, except has 18', 21 oz. Alnico V magnet woofer, 10' mid-range PM speaker and Model 4401 University horn type tweeter. All 3 systems incorporate HF-55GE, 5ale price \$69.95 (specify cabinet finish.)



THEATER QUALITY HIGH FIDELITY SPEAKER SYSTEM \$395

HIGH FIDELITY SPEAKER STSIEM

15" WOOFER PLUS—ELECTROVOICE MODEL 847
MID-HIGH RANGE SPEAKER — 600 CYCLE LC
CROSSOVER.

Speaker system for homes and sound demonstration rooms.
Speaker system for homes and sound demonstration rooms.
Speaker system for homes and sound demonstration rooms.

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Speaker system for homes and sound demonstration rooms.

A theatre quality, powerful speaker system for homes and sound demonstration rooms. This speaker arrangement will connect to any high fidelity audio amplifier (8 ohms impedance) Features a 15" electro-dynamic heavy duty woofer which is equal to a PM speaker with up to 10 lbs. of Alnico V magnet. This woofer reproduces the low audio register from 600 cycles down to 20 cps. An Electro-Voice Model 847 horn type speaker is used for the middle range and high range of audio. These two speakers are connected to a 600 cycle inductive-capacity crossover network. But in the network is the field exciter for the 15" woofer. You could pend or 100 for the network is the field exciter for the 15" woofer. You could pend or 100 for 1

PRICES F.O.B. KANSAS CITY TELEPHONE VICTOR 2-5092

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McGEE's \$100,000 SALE! FM/AM CHASSIS-CHANGERS-

MONEY-SAVING





24 WATT HIGH FI AMPLIFIER

\$39.95

34 WATT HIGH FI AMPLIFIER

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FM/AM TUNER ESPEY 24 WATT

ESPEY I4-TUBE MODEL 7006 MODEL 501G AMPLIFIER

McGeo offers you for only \$79.95 Espey's regular \$119.50 14 tube Deluxe AMFM

McGeo offers you for only \$79.95 Espey's regular \$119.50 14 tube Deluxe AMFM

tuner. (Separate audio amplifier required such as model 501G or 501E.) Prices above

with 14 tubes including rectifiers. Tuner has its own built-in AC power supply

Your savings are almost \$40.00. Espey Model 700G performance features: Sensitivity

3mv on AM, 5mv on FM for 30db queting, AM selectivity 10kc at 6db. FM 240kc

at 6 db. Audio response flat from 20 cps. to 20,000 cps.

distortion with one volt and outcomed assistic front which makes custom installation

distortion with one volt and outcomed assistic front which makes custom installation

assy. Features full tuner RF stages—AFC on FM with defeating switch for easy FM tun
ing. Built-in pre-amplifier for GE variable reluctance phono cartridge, Pickering, etc.

Three-position equalizer switch for—LP, AES or European phonograph records. Separate

bass and treble tone controls with 23db, boost. Chassis is equipped with AC outlet jacks,

auxiliary input jacks for tape recorder, etc. Built-in ferrite loop antenna for AM

The Espey 700G FM/AM tuner is second to none. It has all the features you might

expect even if you paid up to \$200.00 for a tuner.

This 700G FM/AM tuner chassis has all controls on the front which is desirable when

you are using it with any good audio amplifier many of which are designed with no tone

control or preamplifier circuits. We offer the 700G FM/AM tuner at only \$79.95.

\$\$Tipping wt. 20 lbs.

Espey 700G with Model 501E 8-tube Hi-Fi audio amp, both for \$119.90. Stock No.

700G-501G. Shipping wt. 42 lbs.

Espez 700G with Model 501E 8-tube Hi-Fi audio amp, both for \$119.90. Stock No.

Espey model 501G 8-tube ultra linear high fidelity 24 watt audio amplifier matching unit for use with model 700G tuner. Regular 579.95 value—\$59.95 when purchased alone and \$39.95 when ordered with the Espey 700G tuner. This amplifier features less than ½ percent distortion with high fidelity audio frequency response from 10 cps. to 20,000 cps. Hum level so low it can be detected by electrical instruments only. Chassis size—12"x5"x8". Output tubes—4 640GGT in push-pull Williamson high fidelity. Plus 6SN7 phase inverter and 2 5V4G rectifiers. Features an eight-pound potted case \$20.00 value output transformer with grain oriented iron core. Output impedance taps for 4, 8 \$39.95

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ESPEY DEAL-1A

ESPEY DEAL-2

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Espey 700G-501G tuner with 24 watt amplifier plus Garrard RC-98 equipped with a GE RPX-052A car- with general RC-98 equipped tridge.

Net \$194.95

If 34 watt amp is desired in place of 24 add \$15.00.

Each VOSIGN RECOMMENDED

Order any of the following speakers with your Espoy tuner and amplifier: 12" coaxial PM. CU-147-\$10.00 extra 15" coaxial PM. CU-147-\$10.00 extra 15" coaxial PM. PL5-15.—\$20.00 extra 15" coaxial PM. CU-147-\$10.00 extra 15"

BUY YOUR AUTOMATIC CHANGER AT McGEE



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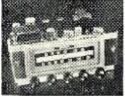
MONARCH UA6U - \$29.95

WEBCOR ON BASE

COLLARO MONARCH WEBCOR GARRARD

456 - \$34,50 UA6U - \$29,95 ON BASE RC-98

4-SPEED COLLARO Plays all 4 speeds, 16, 33, 45 and 78 RPM both automatically and manually. Inter-mixes records of the same speed and shuts off after last record. Fast 6 second change cycle. Automatic disengagement of idler wheels eliminates flat spots that cause wow and flutter. All of the desirable features of the Model RC-35, 1914 4 speed operation. Model RC-456 Collaro 4 speed automatic record changer, less carning apphire and 1 mil diamond stylus. Sale price, \$46.95. Large spindle \$5.30. Monarch Model UACH—new, imported high fidelity a speed automatic record changer. Plays 7", 10" and 12" records automatically. Intermixes records of the same speed namy order. Features a 4 pole high fidelity motor eliminating rumble and wow. Pickup automatically returns to rest and motor turns off after last record has played in any order. Features a 4 pole high fidelity motor eliminating rumble and wow. Pickup automatically returns to rest and motor turns off after last record has played in any order. Features a 4 pole high fidelity motor eliminating rumble and wow. Pickup automatically returns to rest and motor turns off after last record changer. Changer features, at no added cost the regular \$9.90 net value Goldring #500 variable reluctance cartridge for the finest high fidelity record reproduction. Output 10 milimolity for the production of the pr



9-TUBE HI-FIDELITY

20 Watts Audio Dual Tone Controls \$395 LESS PEAKER

RECEIVES BROADCAST 550 TO 1650 K.C.

REGEIVES BROADGAST 550 TO 1650 K.C.

Jackson Model AM9A, 12 wath high fidelity andio ampliffer and broadcast tuner combined, of the state of the sta

-TUBE FM-AM HALLICRAFTERS



PLUS MONARCH RECORD CHANGER WITH RONETTE CERAMIC CARTRIDGE AND 12" COAXIAL PM SPEAKER

\$132.40 ALL FOR \$86

VALUE

A COMPLETE HI-FI SYSTEM HALLICRAFTERS S-78A







WITH 6x9 SPKR.

6-TUBE, 6-VOLT AUTO RADIO

A-TURE 12-VOLT \$29.99

Six-tube, 6 volt universal mounting auto radio. Thin neat construction lends itself to a nice looking underdash installation. Some auto dash panels have room to cut out of the construction lends itself to see the construction lends itself to see the construction lends itself to see the construction of the

NEW 12-VOLT MODEL WITH SPEAKER \$29.99

Model AH-1259, 12 volt universal mounting auto radio. This is the same set as pic-tured above (AH-759), except made for 12 volt model 1955 and 1956 cars. Stock No. AH-1259 with 6x9" or 5x7" speaker, S29.99.

NEW 8 TUBE 6 VOLT PUSH-BUTTON MODEL \$37.95

NEW 8 TUBE 6 VOI

ew model SH-78555-X. 8-tube,
volt universal mounting auto raio with push buttons and 6x9
peaker. Made for Hudson cars,
ut their compact construction
to the term of the state of the



MAGRIC'S best buy in a high fidelity home music system, You get the regular \$89.50, \$5-784 high fidelity home music system, You get the regular \$89.50, \$5-784 high fidelity high fidelity deramic activing and our CU1-4Y, 12% coaxial PM speaker all for only \$86.95. Hallicrafters chassis receives broadcast \$40 to 1700 kc and FM 88 to 108 mc. AFC holds FM stations in perfect tune. Output transformer matches \$00 ohm line as well as the 12% coax, High fidelity response 50 to 200 high fine as well as the 12% coax, High fidelity response 50 to 200 high fine as well as the 12% coax, High fidelity response 50 to 200 high fine as well as the 12% coax, High fidelity response 50 to 200 high fine as well as the 12% coax, High fidelity response 50 to 200 high fine and 10% fine AIR KING **FM-AM TUNER**

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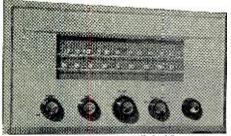
Audio Amplifier \$2499 Use with any

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540 to 1620 ke and FM 88 to 108 mc. Use with any 1
nect it to your TV set for FM-AM reception, Selector sw
Phono-FM and AM. 3 other controls are volume-off-on, to
124T7, 2-6AU6, 6AL5, 5SQ7, and 5V3 rectifier. Chassishigh, Illuminated slide rule dial 71/2" x 2½", with escut

TELEPHONE VICTOR 2-5092 ORDER 1903 McGEE ST., KANSAS CITY, MISSOURI

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RESPONSE FROM 10-22,000 CPS— PUSH-PULL 6V6'S— TWIN TONE CONTROLS— WILLIAMSON TYPE CIRCUIT—INPUTS FOR V.R., CRYSTAL TAPE, RADIO OR TV

SALE \$7995

LESS SPEAKER

ESPEY MODEL HF-250C

WITH MONARCH UA6U CHANGER \$107.95

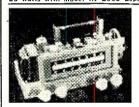
WITH MONARCH UAGU CHANGER \$10.79

1956 model, 14 tube FM-AM chassis. A true Hi-Fidelity receiver built by a naulty famous maker of fine custom chassis. Espey Model HF-250C, 14 tube FM-AM sis with push-pull 646, 10 watt audio, You could spend \$200 to \$250 for a separate r and amplifier and not have the quality of this receiver. Ultra-Linear output used filliamson type circuit gives frequency response of 10 to 22,000 cps. Output taps with the property of the p

frequency.

554.95 list 12" Phillips speaker, response 30 to 20,000 cps, rated at
S54.95 list 12" Phillips speaker, response 30 to 20,000 cps, rated at
Model HF-250C Espey chassis, both for only \$99.95.

Model HF-250C Espey chassis, both for only \$114.95.



HI-FI FM-AM TUNER AND 10 WATT ROTH FOR

P.P. 6V6 AMPLIFIER

IN W. AMP.

9 TUBES-PLUS

2 RECTIFIERS PHONO INPUT

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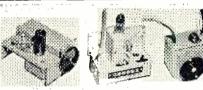
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IRC DATA SHEETS

International Resistance Company, 401 N. Broad St., Philadelphia 3, Pa., has issued three new carbon resistor bulletins of interest to the industry.

Bulletin B-9 provides comprehensive data on construction, application, types, tolerance, resistance element, terminals, etc., for the company's line of molded deposited carbon units. Bulletin B-4 provides the same information on the deposited carbon units while details on the firm's molded boron carbon resistors are contained in Bulletin B-8.

Copies of any or all of these data sheets are available without charge upon written request to the manufacturer.

MAGNETRON BOOKLET

The Tube Division of Radio Corporation of America, Harrison, N. J., has published a 40-page booklet entitled "RCA Magnetrons and Traveling-Wave Tubes '

The booklet describes the theory and operation of magnetrons and travelingwave tubes, their operating considerations and applications, and techniques for measurement of important electrical parameters.

Illustrations show the structural parts of both tube types, typical performance characteristics, test methods, and representative circuit applications. Data is given on four magnetrons and one traveling-wave tube.

The booklet, publication MT-301, is available from the Commercial Engineering Dept. of the Tube Division for 50 cents a copy.

ENCAPSULATED RESISTORS

Cinema Engineering Division of Aerovox Corporation, 1100 Chestnut St., Burbank, Calif., has issued a new catalogue covering its line of encapsulated resistors.

The 20-page booklet covers the firm's entire line of wirewound, fixed, and accurate encapsulated units. The catalogue also includes a military specification table.

The information provided includes line drawings of the units as well as descriptive tabulations.

MERIT "REPL" GUIDE

Merit Coil & Transformer Corp., 4427 N. Clark St., Chicago 40, Ill., has announced publication of its 1957 "Repl" guide.

This is the 9th consecutive all-industry replacement guide issued by this manufacturer. Designated as the #409, the guide contains 128 pages of complete coil and transformer replacement information on approximately 20,000

TV models and chassis. There are 155 brand names represented in the listing.

Copies of the guide are available from electronic parts distributors throughout the U.S.

ALDEN SUPPLEMENT

Alden Products Company, 117 N. Main St., Brockton 64, Mass., has released a 4-page handbook supplement which describes a new series of "IMI" connectors.

These integral molded insulation type units are described in some detail in the data sheet along with application information and photographs of the various connectors.

Copies of this new publication will be supplied without charge upon request to the company.

FUSE RESISTOR DATA

International Resistance Company, 401 N. Broad Street, Philadelphia 8, Pa., is now offering a catalogue data bulletin which carries comprehensive information on the applications, advantages, design, construction, ranges, tolerance, stamping, derating, etc., of its Type FR fuse resistor.

Detailed charts and graphs have also been included. Specify Bulletin P-3 when writing for a free copy.

POWER SUPPLY DATA

Kepco Laboratories, 131-38 Sanford Avenue, Flushing 55, N. Y., has issued a four-page data sheet covering its line of voltage-regulated power sup-

Bulletin B-356 pictures and describes a series of these units, along with pertinent data and electrical specifications.

The data sheet will be supplied without charge upon written request.

FREE REFERENCE CHART

United Catalog Publishers, Inc., has compiled a special industry-wide chart covering panel and flashlight lamps as a service to dealers, distributors, technicians, and others in the field.

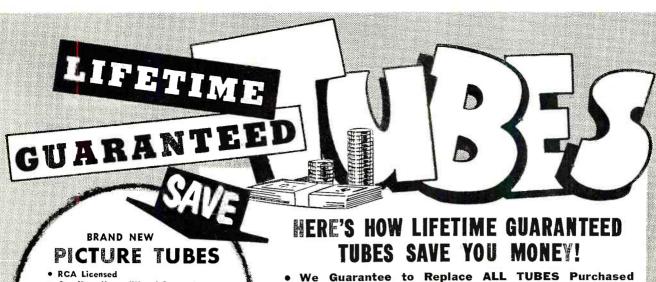
The chart is a composite listing, arranged numerically, of all panel and flashlight lamps manufactured by General Electric, Eveready, RCA, Raytheon, Tung-Sol, and Westinghouse. Simply by checking the lamp number, the user can determine at a glance the respective manufacturer, bulb type, base, voltage, amperage, and bead color. All bulb types are illustrated and physical dimensions are provided.

The chart will be supplied free upon request to "The Radio-Electronic Master," 106 Lafayette St., New York 13, N. Y.

ALNICO MAGNETS

Park Magnet Company, 1557 Green Bay Road, Highland Park, Ill., is offering a single-page data sheet which describes and illustrates a variety of Alnico magnets stocked by the firm.

Horseshoe, rod, bar, disc, and channel types are shown, together with dimensions and rated pulling power. Also



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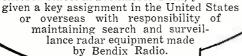
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included are representative costs of cut-to-size segments and details on the firm's line of heavy-duty, high-powered retrieving magnets.

Write the company direct for a copy of Catalogue Sheet #200.

CONELRAD INSTRUCTIONS

As a public service Kaar Conalert, P. O. Box 1320, Palo Alto, Calif., is offering a wall card imprinted with instructions on what to do in case of a Conelrad alert.

Available without charge, the card is designed to be hung on the wall in front of the operator of a base radio station. It outlines the procedures which must be followed to comply with FCC rules regarding such alerts.

Copies may also be obtained from representatives and authorized outlets handling the products of Kaar Engineering Corp.

THRESHOLD INDICATOR
Literature describing its new threshold indicator, Model 91296-1, is now available from Stoddart Aircraft Radio Co., Inc., 6644 Santa Monica Blvd., Hollywood 38, Calif.

The single-page data sheet describes the unit as a signal actuated "go-nogo" accessory which may be used with the company's radio-interference meters to operate a bell, lamp, or other alarm system when radio interference exceeds the limits of military specifications.

The device may be used in any system to indicate when a predetermined audio signal level is exceeded. Monitoring may be performed and the equipment operated by non-technical personnel. All information regarding the indicator and the measuring units with which it may be used is included in the brochure.

SERIES-STRING TUBES

General Electric Company's Tube Sales Department, 1 River Road, Schenectady, N. Y., has issued a revised "Quick Selection Chart" covering its line of series-string receiving tubes.

The chart, publication ETD-1163-C, includes both 600 and 450 ma. controlled-heater warm-up tubes. It classifies 52 tube types in the 600 ma. series and 24 types in the 450 ma. series according to elements, typical service, heater voltages, maximum ratings, and gives average characteristics.

The chart is available upon request to the company.

TRADE ASSOCIATION LISTING

The Trade Association Division of the Office of Technical Services, U.S. Department of Commerce, has released a new directory listing over 2000 national trade associations and related organizations of businessmen.

The directory gives the mailing address and the name and title of the key executive in each organization. An index facilitates the location of associations in particular product or service fields.

The "Directory of National Trade Associations" is available from the Su-

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IN-26-C. 12-tube remote control Navigation Finder and communications receiver. 150 c in 3 bands. 28 V. DC input. Ideal for ial navigation on boats and planes. Complete | comprises: -26-C Receiver, used, with 12 tubes. \$16.50 | 26-C With 12 Tubes, BRAND NEW. \$22.50 | 20-E Rotatable Loop. \$2.55 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 22-250 | 2

MN26Y BENDIX DIRECTION FINDER 150 Kc. to 7 Mc. Complete with tubes, motor. \$26.95 BRAND NEW.
Used, like new. incl. tubes and dynamotor. .\$18.95

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BRAND NEW Completely Assembled

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DM-33A	28V 5A	575V .16A		
	28 V 7A	540V .25A	1.95	3.95
DM-34D	12V 2A	220V.080A	4.25	5.50
DM-37	25.5V 9.2A	625V .225A	5.95	8.95
DM-40	14V 3.4A	172V .138A	1.75	3.45
DM-53A	28V 1.4A	220V.080A	3.95	5.95
DM-64A	12V 5.1A	275V .150A		7.95
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OUTPUT: 1000 V. D.C. @ .350 A.

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-2V. 20 Amp. Hr. Wil-. lard Storage Battery.**\$2.45** -2V. 7 prong Synchronous Plug-in Vibrator Quart Bottle Electro-lyte (for 2 cells) . . . 1.45

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OUR LOW PRICE.....ASB-5 INDICATOR

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Tunes 100 to 155 Mc. Made for Signal Corps. \$34.50
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DYNAMIC HANDMIKE, with "Press-to-talk" Switch cord and plug-BRAND NEW, only......\$2.9 \$2.95 DYNAMIC HEADPHONES, 600-ohm impedance, with large earphone cushions, cord and phone plug. BRAND NEW, special \$2.95

MIC	ROPHONES	Excellent	BRAND
Model	Description	Used	NEW
T-17	Carbon Hand Mike	\$5.45	\$7.95
T-30	Carbon Throat Mike		.69
T-45	Navy Lip Mike		.99
RS-38	Navy Type	2.45	4.95
T-24	Carbon Mike		3.95
TS-9	Handset		4 <u>.95</u>
HE	ADPHONES	Excellent	BRAND
Model	Description	Used	NEW \$4.35
HS-23	High Impedance	\$2.25	\$4.35 4.65
HS-33	Low Impedance	1.99	
HS-30	Low Imp. (featherwi		2.25
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Cavity type, 144 to 235 Mc. BRAND NEW in Mc. BRAND NEW in original factory packing, complete with antenna & operating manual.

PRICE\$8.88

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Aluminum case for BC-221 or TS-164 Freq. Meters. With volt. reg. supply using VR105. 2 ballast tubes, relay, cable, etc. Inside front: $9\frac{94}{2}$ BRAND NEW, $x 7\frac{1}{2} \times 7\frac{9}{6}$ ", Inside front: 2^n deep, packing) Shock-mounted.

Original Crystal for BC-221 1000 Kc BRAND NEW.... \$8.45

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Self-contained automatic unit, reproduces nals recorded on paper tape. By use of provides code-practice signals to one or speeds from 5 to 25 WPM.

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Made for U.S. Armed Forces, by AGFA ANSCO. Actually worth \$150 or more! Has illuminated averaging disc for nighttime use. Complete with carrying case. \$9.95 Only....

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Terrific buy! VHF Transmitter-receiver, complete with all components. 100-156 Mc. 4 channels. Xtal-controlled, Amplitude modulated voice. They're going fast! Excellent condition. SCR-522 Transmitter-Receiver, complete with all 18 tubes.

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Includes 2-8 Excel. Used BRAND NEW ARC-5 MARINE RECEIVER-TRANSMITTER

Type Comm. Receiver 1.5 to 3 Mc BRAND NEW with tubes and Xtal. Transmitter 2.1-3 Mc BRAND NEW with tubes and Xtal. \$12.45

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Four Band. 105 to 9050 kc. Low Freq., Ship, Broadcast—40 to 80 meters. Includes tubes and dynamotor, for 24 volt operation. Easily converted for 110 V., 12 V, or 6 V. Schematic Included. Excellent Condition. Overall: 8½ x x 7½ x 7½ x 15½ x. Wt. 30 lbs.

COMPLETE WITH ALL TUBES,

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LORAN APN-4 FINE QUALITY NAVIGATIONAL EQUIPMENT

Determine exact geographic position of your boat or planel Complete, BRAND NEW installation consists of: ID-6B/APN-4 Indicator: R-9B/APN-4 Receiver; PE-206 Inverter: Set of Plugs: Visor for Indicator: Operation manual: Brand New, Export \$ 129.50 racked. COMPLETE. packed. COMPLETE.....

SPECIAL APN-9A LORAN Receiver less tubes, NEW (demilitarized)..... Indicator \$29.50

BRAND NEW SELSYNS

Operates from 57½ volts, 400 cycles. New tested. Conversion diagram for 110 volts AC included. BRAND NEW. 2J1F1 Selsyn Generator. 2J1G1 Selsyn Control Transformer. 2J1G1 Selsyn Differential Generator. CAPS FOR ABOVE.

R24-ARC/5 NAVY TYPE (Similar to BC-946) BROADCAST RECEIVER

520 to 1500 Kc. 6 tubes: 3—128K7, 128R7, 1246, 1248. For dynamotor operation. Easily converted to 110 or 32 Volt. 2—15 stages. 3-gang tuning cond. Complete with all tubes, in original sealed car-specific conditions of the condition of the condi



complete \$7.88 with all tubes and crystal. BRAND NEW _____ BC-458 TRANSMITTER—5.3 to 7 Me. Complete all tubes and crystal. BRAND NEW BC-459 TRANSMITTER-7-9.1 Mc. complete

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110 VOLT AC POWER SUPPLY KIT

For All 274-N and ARC-5 Receivers
Can be assembled quickly and easily, on predictibed chassis. Plugs into the rear of any model 274-N receiver and delivers 24 volts as well as "B" voltrage. Complete kit \$7.05
SPLINED TUNING KNOB for 274-N RECEIVERS.
Fits BC-453, BC-454 and others.

BC-442 ANTENNA RELAY

Wonderful Value! Consists of 3/4 amp 2" RF Ammeter (antenna current indicator, 0-10 scale, Transmitter-Receiver Switching relay, in aluminum case with associated composts. BRAND NEW...... \$2.24



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NEW LAFAYETTE CATALOGUE

Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y., has just released copies of its Catalogue No. 300, a 164-page listing of hundreds of items of interest to the electronic industry, hobbyists, radio amateurs, and experimenters.

Included are photographs and descriptions on an extensive line of standard and special parts, kits of all types, assembled equipment, audio gear, test instruments, books, Geiger counters, etc.

Copies of this comprehensive catalogue will be supplied on request.

PICTURE TUBE REPLACEMENTS

A wall chart to aid service dealers in selecting picture tube replacements is being offered by General Electric Company through its authorized tube distributors.

The chart, entitled "Television Picture Tube Replacement Chart," lists all of the types available on the market at this time. A feature of the chart is listing of both aluminized and nonaluminized tube replacements, where available, for each of the 223 tubes.

Tubes are classified by size, base, bulb structure, external coating, anode contact, focus method, deflection angle, over-all length, bulb diameter, neck

length, anode kv., and type of ion-trap magnet. Characteristics of color picture tubes are also listed.

TRANSISTOR TRANSFORMERS

Argonne Electronics Mfg. Corp., 27 Thompson St., New York 13, N. Y., has issued a four-page data sheet covering its line of transformers designed especially for transistor circuitry.

In addition to supplying complete specifications on the transformer line, the brochure includes details on a midget variable capacitor, transistor oscillator coils, transistor loop antennas, and miniature dials.

INSTRUMENT CATALOGUE

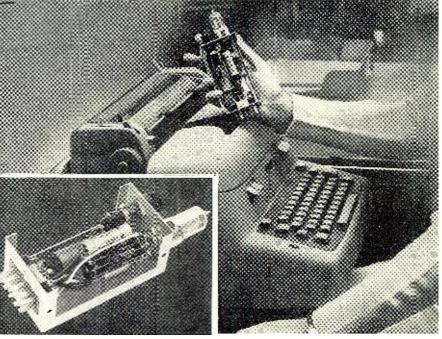
Electro - Measurements, Inc., 7524 S.W. Macadam, Portland 1, Ore., has just released a short-form catalogue covering its line of precision test instruments.

Prices and brief specifications are listed. Included are precision impedance and comparison bridges, decade resistance and capacitance standards, and high linearity decade voltage di-

KAY INSTRUMENT CATALOGUE
Kay Electric Company, 14 Maple Ave., Pine Brook, N. J., has issued a 48-page catalogue covering its line of electronic instruments.

Some 66 laboratory and production line instruments are described in detail along with a photograph of each unit, complete electrical and physical speci-

The new IBM electric typewriter with electronic tabulation is designed to speed the preparation of business forms containing blank fill-in areas. The electronic "reading" feature of the new typewriter eliminates time-consuming tabulating adjustments when using a variety of forms. Vertical lines printed on the form with electrically conductive ink make the form sensitive to electrical impulses. These conductive lines, in effect, program the typewriter. When the tab key on the keyboard is depressed, a tiny sensing unit close to the paper "reads" the form and automatically positions the typewriter carriage at the correct typing point. The electronic unit required for this operation (see inset) is mounted beneath the keyboard and is confined to a small metal container within the case, about 3 x 6 inches in size.



Improving Your Tube Tester

By ELLIOT A. McCREADY

Modification of shorts test provides more exact meter reading in place of an arbitrary neon bulb indication.

AS A SHORTS indicator, most tube checkers use a neon bulb with a sensitivity of about 300,000 to 500,000 ohms. A simple and inexpensive modification of this circuit to permit actual measurement of leakage in ohms expands the checker's usefulness considerably.

The modification described here was added to the *Heathkit* Model TC-1, a conventional checker. Inter-element resistance up to 10 megohms can now be measured with ease and unbalance between the sections of a dual tube

can be spotted instantly.

The circuit consists of an ordinary ohmmeter with a center scale reading of about 250,000 ohms. Power for the meter is obtained from the 100-volt winding of the power transformer, which was formerly part of the original shorts-indicating circuit of Fig. 1. This 100 volts a.c. is rectified, filtered, and applied through a limiting resistor to the tube checker meter (Fig. 2) and thence to the elements of the tube under test. Rectifier output must be negative, with meter connections made accordingly, otherwise emission of the tube being checked would make a resistance check impossible.

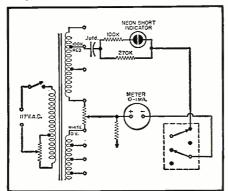
Components originally used for the shorts test—the 0.1 µfd. capacitor, the 100,000 and 270,000 ohm resistors, the neon bulb, and associated hardware and wiring—are disconnected. S_1 , a d.p.d.t. toggle switch, is added to switch the checker meter from the line-adjust test circuit to the shortindicator test circuit. The zero-adjust control R₁ should rarely need adjusting once set. R_2 and R_3 should total about 130,000 ohms. (With none of the values in this circuit being critical, components were selected from the junk box.) Rectifier output is approximately 150 volts d.c., so the total limiting resistance $(R_1, R_2, \text{ and } R_3)$ is adjustable from about 130,000 to 160,000 ohms (for a 1-ma. meter).

S₁ is wired into the circuit so that it puts the meter into the short-indicating circuit when the tester's switch is thrown into the short-test position. After wiring has been completed and checked, the meter face can be marked with some resistance values. Only a few values are necessary: .05, .1, .25, .5, 1, 2, and 3 megohms should suffice. Calibration may be accomplished by connecting a variable resistor to any socket pins on the tester and noting the meter readings as the resistor is varied.

Operation

With a tube inserted in the checker, S_1 is thrown to the "up" position to permit adjustment of line voltage. This switch is then returned to its "short" position, as shown in Fig. 2, and a complete shorts test is made in the manner prescribed for the particular checker. Critical reject values for various types of tubes in various circuits may be determined. Most good tubes will indicate from about 10 megohms to infinity.

Fig. 1. Original shorts test circuit.



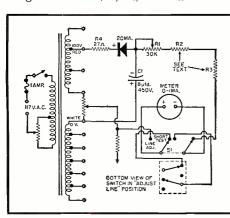
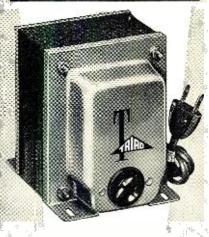


Fig. 2. The revised circuit uses a d.c. voltage and a meter to measure leakage.

R₁—30,000 ohm pot R₂—100,000 ohm, $\frac{1}{2}$ w. res. (see text) R₃—33,000 ohm, $\frac{1}{2}$ w. res. (see text) R₃—27 ohm, $\frac{1}{2}$ w. res. C₁—8 μ fd., 450 v. elec. capacitor S₁—D,p.d.t. toggle switch 1—20 ma. selenium rectifier

TRIAD ISOLATION TRANSFORMERS



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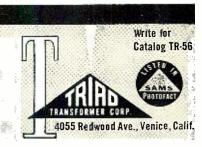
Triad Isolation Transformers are especially designed for isolation of laboratory test equipment . . . reduction of line disturbances . . . elimination of undesired grounds.

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Such construction features as

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Type No.	List Price	V. A. Output	Input Volts	Output Voits
N-51X	\$ 7.10	35	115	115
N-68X	8.95	40	230/115	115
N-53M	14.00	85	115	115
N-54M	17.10	150	115	115
N-67A	16.30	150	230/115	115
N-55M	30.20	250	115	115
N-66A	25.40	250	230/115	115
N-57M	50.70	500	115	115
N-59M	86.50	1000	115	115
N-52M With switch		350 ter for prir tachable co	95 to 130 mary voltage ird.	115 control.



SENSATIONAL IN COMPLETELY WIRED TEST EQUIPMENT AUES! at LESS than the PRICE of KITS!



NEVER BEFORE HAS A COMPLETELY WIRED AND TESTED INSTRUMENT OF SUCH ACCURACY AND QUALITY BEEN OFFERED AT SUCH A PRICE!

FREQUENCY 120 KC TO 260 MC
 120 KC TO 130 MC ON FUNDAMENTALS
 LABORATORY ACCURACY AND QUALITY

A completely wired and tested instrument not to be confused with units sold in kit form at almost the same price, but with a quality and accuracy of instruments 3 to 4 times its price. Six overlapping ranges generate signals of 120KC - 320KC. 320KC-1000KC, 1MC-3.2MC-11MC, 11MC-38MC and 37MC-130MC all on fundamentals with calibrated harmonics from 120MC to 260MC. Selector switch gives instant choice of ranges. Switch gives choice of internal modulation of 400 CPS or use of any external source at other frequencies. For microvolts and jacks are provided for choice of either high or low RF output is in excess of 100,000 by special circuit design. Has a fine adjustment RF control. AF output is 2-8 votts, AF input is 4 plastic bezel. Common AF terminals for EXT-MOD input and 1MT-4F for audio testing the plastic bezel. Common AF terminals for EXT-MOD input and 1MT-4F for suition tests eliminate need for special AF output connectors. Machine engraved panel lettering, Handsome gray metal case with carrying handle. Measures 64% x 10° x 44%". Comes complete with pair of leads, AC line cord and plug. Operates on 105-125V 50-60 cycle AC. Shpg. wt., 8 lbs.

[AFAYETTE LSG-10 SIGNAL GENERATOR]



NEW!

C.R. CHECKER

LAFAYETTE CAPACITANCE-RESISTANCE TESTER WITH "IN-SET QUICK CHECK"

COMPLETELY WIRED AND TESTED

TWO INSTRUMENTS IN ONE CHECKS ELECTROLYTIC, PAPER, MICA AND CERAMIC CONDENSERS 4 DIRECT READING CAPACITY SCALES FROM 00001 MFD TO 1000 MFD CHECK FOR OPEN SHORTS, LEAKAGE AND INTERMITTENTS 2 RESISTANCE RANGES FROM 100 TO 5 MEGOHM

Here is a "must" for servicemen and lab technicians. A completely self-contained AC operated capacitance and resistance bridge, plus a quick check for in the set test-location of the self-contained AC operated capacitance and resistance bridge, plus a quick check for in the set test-location of the self-contained AC operated capacitance and resistance bridge, plus a quick check for in the set test-location of the self-contained self-cont

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CHECKS ALL TYPES OF CONDENSERS FOR
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DIRECT READING SCALES FROM .00001

TO 1000 MFD AND 100 TO 5 MEGOHMS

A stable and accurate bridge type circuit measures capacitance in
4 ranges of .00001-.005 MFD, .001 to .5 MFD, .1 to 50 MFD and
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6 25, 150, 250, 350 or 450 voits available by selector switch.
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MODEL 1C-15

NEW POCKET AC-DC VOM MULTITESTER 2,000 ohm per volt Sensitivity on both DC and AC

160 ua 3" METER 1 % PRECISION RESISTORS SILVER CONTACT SELECTOR SWITCH

FULL SCALE RANGES

FULL SCALE RANGES
DC Volts: 0-10; 0-50; 0500; 0-1000 Volts: — AC
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500 ua and 500 urnens
— Decibels: — 20 to +2;
+20 to 36 db (0d;
+20 to 36 db (0d;
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volts: 0-10; 0-50; 0-500; 0-1000
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Best Buy in Americal A very accurate and sensitive VOM. This Multitester is a complete instrument (not a kit) with pigh quality and sensitive 160 microamp meter; 2000 ohm per volo on both AC and DC. Single selector switch, 1% accuracy and ruggedness. In attractive extreme versatility, with metal bottom for ruggedness and shielding, first capacity range requires 50 volt AC source, Size 41/2 x3/2 x1/3/2. Complete with test leads and batteries. Shipping weight

...... Complete 8.95

HIGH SENSITIVITY 20,000 OHM PER VOLT DC 10,000 OHM PER VOLT AC MULTITESTER

LOOK AT THESE
FULL SCALE RANGES!
D.C. Volts: 0-6; 0-30; 0120; 0-600; 0-1200; 06000 Volts — A.C. VOLTS:
0-6; 0-30; 0-120; 0-600;
0-1200 Volts — RESISTANCE: 0-10K; 0-100K;
0-1 Meg. 0-10 Megohms—
D.C. CURRENT: 0-60 Micromm; 0-6; 0-60; 0-600
Milliomps—DECIBEL: —20
10 + 17 db (0 db—0.774V)
— CAPACITY: 0001-01;
005-15 mfd — INDUCTANCE: 20-2000 millihenry,
0-30; 0-120; 0-600; 01200 Volts;
10 new Latayette high sensitivity Multistrate in the sensitivit Multistrate in the sensitivity Multistrate in the sensitivit multistrate in the sensitivity multistrate in the s



4 AND 6 TRANSISTOR SUPERHET KITS POCKET AND HOME RADIOS FOR SPEAKER AND EARPHONE OPERATION POCKET SIZE: 4"L x 3-5/16"W x 1"D BUILT-IN ANTENNA! REQUIRES NO EXTERNAL ANTENNA OR GROUND!

Lafayette engineers have designed this fascinating 4-transistor superhet receiver kit in a unique and interesting form. It is, by itself, a completely self-contained, pocket sized personal portable set which operates a miniature earpiece so only you can hear; by plugging into the KT-96 kit listed below, it is instantly converted to a util 6-transistor home radio, complete with speaker for the entire family to enjoy. Circuit features use of 4 transistors (2 high frequency and 2 audio type) plus a germanium diode, 2 i.F. stages and built-in high gain ferrite core and antenna. The result is a sensitive, stable and selective set covering the entire broadcast band. Requires no outside antenna or ground connection. The kit is furnished complete with transistors and all parts, including battery and chassis already drilled and punched. The earpiece and carrying case are accessory items, not supplied. All necessary pictorial and circuit diagrams are furnished with simple, easy-to-follow instructions.

2-TRANSISTOR PUSH-PULL OUTPUT KIT WITH SPEAKER SELF-CONTAINED IN BEAUTIFUL PLASTIC CASE.

• CONVERTS 4-TRANSISTOR KIT INTO A 6-TRANSISTOR HOME RADIO WITH SPEAKER

Add a completely transistorized push-pull audio stage to your 4 transistor receiver. Complete stage including speaker and case measures only 3" H x 2\%" W x 1\%" D. Plugs right into 4 transistor kit above. Converts your 4 transistor set to a 6 transistor plus diodes superhet receiver. Performance equal or superior to commercially wired sets selling at more than twice the price. Kit includes 2 transistors, 2 transformers, 2\%" PM speaker, pre-punched chassis, speaker case to hold entire stage, battery, hardware, instructions and diagrams.

DEPT RL-1

Liberty Ave. Write for FREE Bargain Packed Catalog!

100 SIXTH AVE., NEW YORK, N. Y. BOSTON, MASS., 110 Federal St. PLAINFIELD, N. J., 139 West 2nd St. NEWARK, N. J., 24 Central Ave. BRONX, N. Y., 542 E. Fordham Rd.





Packed with the largest selection of Electronic, Radio and T.V. Parts; and equipment, PA, Hi-Fi systems, tubes, antennas, Transistor Kits, parts and components, Test Equipment, new build your own kits, tools, books, Microscope, drafting equipment, Binoculars, Telescopes, All Radio, TV and Ham supplies — ALL AT GREAT SAVINGS — for the economy minded servicemen dealer, engineer and technician. CHUCK, FULL OF BUYS! SEND FOR YOUR FREE COPY TO-DAY.

35 WATT HI-FI AMPLIFIER KIT WITH METERED OUT-PUT AND 4 PUSH-PULL PARALLEL NEW EL84 TUBES

New Lafayette high power amplifier kit with a host of features not in any other single amplifier. Calibrated output meter permits use as either a recording or reproducing amplifier. ELS4 power pendees provide high peak power and low distortion required for better audio quality. Features exceptional control versatility and ample inputs for all associated custom hi-fi equipment. DC operated preamp filaments and balancing adjustment to minimize hum. Meter can be switched to indicate either recording voltage or output level of amplifier. Features rumble filter, loudness control, separate bass and treble controls, sliencing switch, speaker selector switch, output balancing adjustment and monitoring jack.



SPECIFICATIONS

FREQUENCY RESPONSE: ± 1 db 20-40,000 cps. HUM: 85 db below rated output. POWER OUTPUT: 35 waits with 4% total distortion at full rated output. INPUTS: TV Sound, Radio, Magnetic Phono, Crystal Phono, Type. 0 UTPUT IMPEDANCE: 4, 8 and 16 ohms: high impedance for tane recorder. TUBE COMPLEMENT: 3-12AX7, 1-12AU7, 4-EL84, 1-5U4. FEEDBACK: Negative feedback loops virtually eliminate distortion. POWER: 117V, 60 cps. 80/130 waits with auxiliary power receptacles. Removable escutcheon. Size 12½ "Lx 9½" Dx 9½" Dx 9½" Dx 14½" H. A combination of high power, high fidelity, gleaming beauty and advanced engineering features unmatched at even twice the price. Supplied in complete kit form with simplified easy-to-follow instruction sheets. Shpg. w. 25 lbs.

SIMPLIFIED DETAILED INSTRUCTION MANUAL MEETS FCC REQUIREMENTS FOR RADIATION GROUNDED GRID TRIODE AMPLIFIER ARMSTRONG FM CIRCUIT WITH FOSTER-SEELEY DISCRIMINATOR AFC DEFEAT CIRCUIT WITH FRONT PANEL CONTROL he excellence of its design and the quality

•

•

FRONT PANEL CONTROL

The excellence of its design and the quality of its components combine to provide this compact high-fidelity FM-AM tuner with superb characteristics normally found in units costing several times as much, and with performance unbelievable at this low price. Features Armstrong FM circuit with limiter and Foster-Seeley discriminator. Simplified tuning with slide-rule dial and flywheel counterweighted mechanism. AFC defeat circuit combined with tuning control. Attractive etched copper-plated and lacquered finish.

LAFAYETTE'S FM-AM TUNER KIT

SPECIFICATIONS

New!

HIGH FREQUENCY TWEETER WITH ACOUSTIC LENS DIRECT IMPORTATION MAKES THIS PRICE POSSIBLE!

FREQUENCY RESPONSE FROM 2000 CPS TO BEYOND AUDIBILITY
 LOUVERED ACOUSTIC IENS FOR UNIFORM SOUND DISPERSION
 HANDLES 25 WATTS OF POWER
 PRICED EXCEPTIONALLY LOW

New high frequency tweeter featuring a louvered acoustic lens for uniform sound dispersion and capable of handling up to 25 watts of distortion-free power. The directional tendency of high frequency acress to recome by the natural wide dispersion angle of the short hom and the six overcome by the natural wide dispersion angle of the short hom and the six overcome by the natural wide dispersion angle of the short hom and the six overcome by the natural wide dispersion angle of the short hom and the six overcome by the natural wide dispersion and the six overcome by the natural wide detachable for panel mounting, with a separate base for the tweeter furnished for external mounting where desired. Aluminum voice coil has 16 ohms impedance. Sixe: 4'4'' long x 3'' diameter, lens extends 2'4''. Requires a crossover network, preferably one with a level control, such as the LN-2. With full instructions. Shpg. wt., 5 lbs.



CROSSOVER . CAPACITIVE INDUCTIVE NETWORK WITH CROSSOVER AT 2000 CPS BUILT-IN LEVEL BRILLIANCE CONTROL

The frequencies above 2000 cycles are channeled to the high frequency tweeter by means of the high-Q inductance and capacitance comprising this efficient crossover network. The highs and lows are brought into acoustic balance by means of a continuously variable level-brilliance control. Control has a 2½ ft. long cable for remote mounting. Network matches 8-16 ohm speakers with insertion loss reduced to a minimum. Enclosed in metal case 6" L x 2½" H x 2½" D. With full instructions. Shpg. wt., 5 lbs.

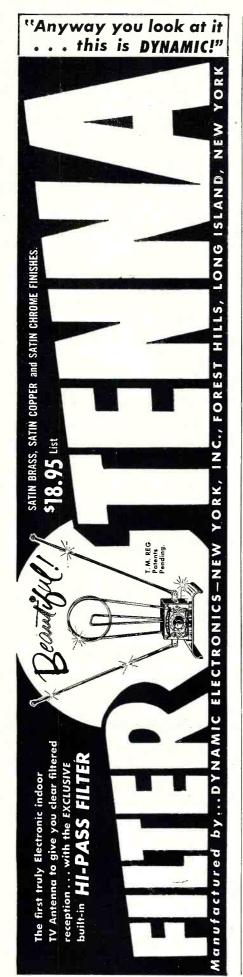


A modest budget need no longer limit your HI-Fi aspirations. The system consists of the G.E. 12" woofer with heavy 14.5 oz. aultoo V magnet and 1½" aluminum voice coil rated at 25 watts; the new metal cased HK-3 cone type tweeter; and the LN-2 crossover network with level and brilliance control. Both tweeter and network are described on this page. The complete 2-way speaker system covers the frequency range 40-16,000 cycles. Shpg. wt., 16 lbs.

SY-87-Complete System......Net 27.50





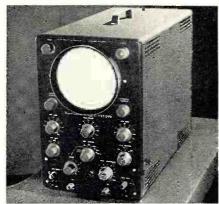




5" SCOPE KIT

Heath Company of Benton Harbor, Mich. has recently released a new and improved build-it-yourself oscilloscope circuit.

The Model OM-2 retains the outstanding features of its predecessor

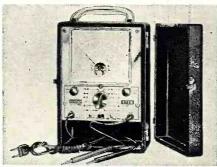


model but provides wider vertical frequency response, extended sweep-generator coverage, and increased stability. A new tube complement and improvements in the circuit make these features possible.

The vertical frequency response is essentially flat to over 1 mc. and down only 11/2 db at 500 kc. The sweep-generator multivibrator functions reliably from 30 to 200,000 cps, almost twice the coverage of the previous model. The deflection amplifiers are push-pull and modern etched circuits are employed in critical parts of the design.

Anchor V.T.V.M.

Anchor Products Company, 2712 W. Montrose Ave., Chicago 18, Ill. has recently introduced a new vacuum-tube voltmeter which accurately measures a.c. and d.c. voltages and resistances.



The instrument has a separate 3-volt a.c. scale for measuring low voltages, zero centering for TV and FM alignment, and a range of 30 cps to 100 mc.

The Model V-500-VTVM uses no batteries. Selection of both range and function is made through a single control. An "on-off" indicator light, polarity reversing switch, db scale, overload protection, and full bridge circuit are additional features.

For literature on this factory wired and tested instrument, write the manufacturer direct.

TRANSISTORS FOR HOBBYISTS

CBS-Hytron of Danvers, Mass. has recently introduced a new line of lowpriced power transistors designed especially for use by experimenters and hams.

The new types 2N255 and 2N256 are p-n-p alloy-junction germanium types which have high power-handling capability coupled with high current amplification. Electrically, the two units are similar. The primary difference is that the 2N255 is intended for use with 6volt supplies while the 2N256 is for 12volt supplies.

Each unit is hermetically sealed for increased protection and will give years of service when operated within maximum ratings.

A booklet on CBS power transistor applications is available without charge



by writing the company's Semiconductor Operations at Lowell, Mass. Please specify Bulletin PA-16.

GENERAL PURPOSE FLUX KIT

Alpha Metals, Inc., 56 Water St., Jersey City, N. J., has revamped its flux assortment and is now offering a newly revised general purpose flux kit which contains 16 of the most recently advanced fluxes for electronic assemblies, printed circuits, tinning and hot solder dipping, stainless steel soldering, and aluminum soldering.

The kit is arranged in compartments with full details on the flux and its application printed in the corresponding position on the cover of the box.

COLOR TV SAFETY DEVICE

General Cement Mfg. Co., 400 S. Wyman St., Rockford, Ill., has announced the availability of a newly developed safety device for color TV set servicing.

Known as the "Color TV Interlock Cheater," the tool is said to render technicians completely safe when the back of the set is removed for repairs.

OLSON RADIO FOR GREATEST BUYS IN RADIO AND TV SUPPLIES

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\$**E** 0 05

Less Than Regular Price! FIDELITY SYSTEM



ALL FAMOUS BRANDS GARRARD GENERAL ELECTRIC Matignal NORELCO . ARGOS



During this sale only

Complete outfit shpg. wt. 70 lbs. Stock No. AS-235 only

While They Last!

You get all of the above nationally advertised high-fidelity components, ready to play. Not a kit, Just mount the speaker in the console enclosure, plus miss together and be have offered and the plus of the plu

- The Norelco 8" Model 9770M High Fidelity Speaker is equipped with coaxial twin cones of the "PRS." (full resonance series). Delivers full bass and treble to 19.000 cps. Made by Philips of Holland for the carriage trade exclusively.

Read What You Get

Read Whot You Get
National Horizon 10 Amplifier with built in pre-amp...

Garrard RC121 Automatic 4Speed Changer with General
Electric REX-050A Cartridge
and mounting base...

Norelco 9770M Twin Cone
Speaker with Ticonal Magnet.

4780S AD-1 Bass Refer Console Speaker Enclosure...

\$22.05

Regular Net Cost \$167.11

The new Garrard RC121 Automatic
4-Speed Changer is equilipped with
a 4-pole motor and switch for playing
records manually. Has a plug-in head
with General Electric RPN-050A variable reluctance pickup. 2 "Clip-in"
supphire needles. line cord, output
cable and mahogany mounting base.

The National Horizon 10 Amplifier has a pre-amplifier built in. Multiposition switch compensates for any record regardless of make or condition. Features include dual wide rang bass and treble controls; input for any tuner or tape recorder: response 1 db from 20 to 20,000 cps. 15 watt max.

45 RPM SPINDLE

For above Garrard changer, if desired, Stock No. RP27.... \$3.43

★ CLOSE-OUT! 12-inch CO-AXIAL SPEAKERS

- Thousands have been sold for \$13.95
- Must make room for the new model



While They Last

188 Stock No. S-226

• Wide Range • 35 to 15,000 cps.

• Wide Range • 35 to 15,000 cps.

Our regular \$32.50 petall hi-fi speaker,
20 wass. We are closing out this speaker,
20 was. We are closing out this speaker
and making room for the new model. Order one or more of these fine speakers
during this sale and save money.
Each speaker consists of a 12" woofer
section driven by a heavy magnet. This
part delivers the bass notes. The built-in
voice coil and magnet system and this
part delivers the treble or high frequency
notes.

notes. The high pass filter is built into the speaker and the entire combination gives you tones you never dreamed possible. Only two wires to connect to any radio or amplifier. Voice coil impedance 8 ohms. Shog. Wt. 10 eoil impedance 8

SPEAKER and BAFFLE COMBINATION

Unbelievable Value



Deluxe modern design sloping front wal-nut finished baffle. Rounded corners, top and bottom. attractive grille cloth. Speak-er is Olson's most popular 8" model. Equipped with Alnico 5 magnet and will deliver 7 watts. Voice coil impedance 3,2 ohms. Shgg. Wt. 7 lbs.

3-SPEED PHONO MOTOR AND TONE ARM



Worth \$9.50 You Get Both For



\$**E**78 STOCK NO. AS-205

Genuine Monarch (Made in England) 3-speed, 331½, 45, and 78 RPM motor and on the metallic Handy lever switches from one speed to another, Rim drive, runnile free.

Tone arm is the famous Webster with Turn-over crystal cartridge, 3 volt output. Equipped with 3 mil and 1 mil osmium tipped needles, 50-7000 eps. Arm is counter-balanced. Shpg. Wt. 5 lbs.

BEL-COM INTERCOM

An Unbelievable Price Thousands Sold at \$9.98



AM-22

Special
Set Solution of the Bel-Com is a self-powered system using batteries, Requires no connection to house mike off hook, press with the self-powered system using batteries, Requires no connection to house the self-power of hook, press with the self-p

EXTRA CABLE FOR BEL-COM

100' 3 conductor Stock No. W-105..\$1.50 250' 3 conductor Stock No. W-106.. 3.50

HOW TO ORDER

Mail your order to 277 E. Market St., Akron 8. Ohio. Send remittance with order (add for postage 5c for each dollar's worth ordered—10c for each dollar's worth ordered—10c for each dollar's worth if you are more than 1000 miles away, OLSON REFUNDS EVERY CENT NOT USED. Or—send no money—we'll ship C.O.D. and you pay mail or expressman for merchandise and postage. ALL MER-CHANDIST. 1000% GUARANTEED, PLEASE—MINIMUM ORDER \$5.00.

BOGEN 30 WATT AMPLIFIER

With Tubes and Cage



Regular \$99.50 List Stock No. AM-1

Olson's Special Price

The famous Bogen "Challenger" 30 watt amplifier with exclusive SELECTONE tone corrector. Tone switch is calibrated for (1) "Deep Bass" for popular records, (2) "Mellow" for climination of scratch on noisy records, (3) "Crisp" for ideal speech reproduction, (4) "Brillant" which accentuates bass and treble for living passence smith 2 inputs for any high impedance microphoties and one input for phone, all of which can be mixed. This amplifier will handle large auditoriums or great outdoor gatherings. Can be used with up to 24 speakers. Output impedance 4, 8, 3, 5 ohms 5 vots. Stock of Cedebard Cal. Ul approved. Operates on 115 volts of Shpg. W. 26 lbs.

COMPLETE BOGEN PA SYSTEM



Nothing More to Buy Stock No. AM-12

30 watt Bogen amplifier as described left, crystal microphone with calle, desk stand, floor stand, 2-12" Alnico 5 TM speakers with 25 Th cables plugs stand plugs that possible crystages which can be speaker baffles. Overall size of case 17 x 13 x 25. Shpg. Wt. 60 lbs,

INDOOR TV ANTENNA



All Channel—UHF—VHF
Regular \$10.95 List
Stock No.
AA-25 each
3 for \$8.00

6 position switch built into base for maximum efficiency on channel being received. Three section brass elements, adjustable, tip proof base. Matches any TV set. Complete with 300 chm lead wire. Shpg. Wt. 5 lbs.

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Thousands of prices reduced on nationally famous brands

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SHIELD RECORDING TAPE

Plastic base splice-free, polish red oxide gu a ra a not teed equal higher priced brands. Available in regular and LONGER

7" Reel, 1200 ft, Standard Play Lots of 6, \$1.79 each Single Ea. \$2.19 Stock No. \$159 X·249, Lots of 12, ea.

7" Reel, 1800 ft, LONGER Play Lots of 6, \$2.59 each ... \$2.99 Stock No. X-583, Lots of 12, ea. \$245

ATTENTION MANUFACTURERS: If you have large quantities of surplus electronic parts you wish to sell, call or write OLSON at once. We pay top prices!

WILCOX-GAY RECORDIO

RECORDER

Automatic Keyboard Push Button Control Dual Track

Records from microphone, radio or TV set

PRICE SLASHED STOCK NO. \$6

WHILE IHET LASI AM-26
Save money on this new 1957 WilcoxGay tape recorder. Beautifully styled
in pale green and gold. IT's easy to
get perfect recordings must time. Has
built-in efficient crase system, removes
old recording automatically while new
recording is being made. Records 3",
500 etc.

The seed of the seed



records ½ hour on each track and 1 hour overall. On 1800 ft. tape records 125 hours event of all functions, stop. record. reverse, playback. Has tone and volume controls, redi-lite and record level lite. Shure microphone cable and pluk and 300 ft. red of tape and empty red included. Renovable fabraches 212 42 × 9°. Shpg. wt. 29 lbs.



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HERE'S EVERYTHING YOU NEED TO KNOW ABOUT OSCILLOSCOP



Service Any Radio-TV ever built EASIER-BETTER-FASTER

Oscilloscopes are gold mines for servicemen who learn to use them fast and accuratelyand here, in a brand new, completely revised 2nd edition, is THE book that really shows you how.

In plain, easily understood language, MODERN OSCIL-LOSCOPES AND THEIR USES teaches you just when, where and exactly how to use

your oscilloscope. You learn how to handle tough jobs easier and faster than you may have dreamed. Every detail is clearly explained—from making connections to adjusting circuit components and setting oscilloscope controls.

Big, New 2nd Edition!

. . . Contains the latest data on oscilloscopes, the handiest, most useful service instrument of all!

More Than 30 **Extra Pictures!**

. . plus 50 additional pages bringing newest details on use of 'scopes in COLOR TELEVISION... Radio - TV Servicing... Industrial Electronics... Teaching...and even in atomic energy work!

Equally important, you learn how to analyze oscilloscope patterns accurately and in far less time. Almost 400 illustrations including dozens of pattern photos make things doubly clear.

This big book is more widely used than any other of its type—because it gets right down to "brass tacks." No involved mathematics. No complicated discussions. You learn exactly what the oscillosco ciscussions. You learn exactly what the oscilloscope is and exactly how to use it on all types of AM, FM and television service (including color)—from locating troubles in a "" locating troubles in a jiffy to handling tough realignment jobs.

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PRACTICE 10 DAYS FREE!

Send in SCOPI EXAM postage and own we pa	adison A new 2nd ES AND HNATIO e) prompt e you not	edition THEIR N. I w tly in fu thing. (S	of MOI of MOI USES ill then ll payme end \$6.5 e 10-day	CO., Inc., 66, N. Y. DERN OSC for 10-day send \$6.50 ant or retur 60 with ord return pr	FREE (plus n book er and
Name.					
Addres	s				
OUTSI	one, Stat	A.—Pric	e \$7.00.	cash only.	Money

The new tool is plugged into the set where it permits entry of a high-voltage probe through its shell.

V.H.F. RECEIVER

Nova-Tech, Inc., 1721 Sepulveda Blvd., Manhattan Beach, Calif., has developed a new, low-cost v.h.f. receiver especially for those interested



in monitoring communications between aircraft, the military test frequencies, as well as ground control approach, tower, flight, and weather transmis-

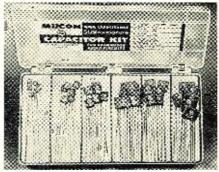
Tradenamed the "Air-O-Ear." the set has six tubes in a superhet circuit with noise squelch control, a selenium rectifier, a.v.c., coaxial tuning, drift compensation, a heavy-duty 6" oval speaker in a case measuring 7½" x 5" \times 4½", and a white dial calibrated 108 to 130 mc. The unit weighs 5 pounds.

Write the manufacturer direct for full specs and price..

CAPACITOR KIT

Mucon Corp., 9 St. Francis St., Newark 5, N. J., has assembled a kit of capacitors for the convenience of engineers and development personnel working with transistor circuits.

The kit of high-capacitance subminiature ceramic capacitors includes six each of the following values: .005 µfd., .01 μ fd., .02 μ fd., .05 μ fd., .05 μ fd., and .1 μfd. These range in size from ¹³/₆₄" square to $^{17}/_{92}$ " x $^{21}/_{32}$ " maximum with thicknesses from .090" to .110" maximum. Rated at 25 working volts, these capacitors have radial #26 leads and



are normally used in environments where the temperature ranges from 5 to 40 degrees C.

Write the company for information on availability and prices.

45-YOLT SELENIUMS Federal Telephone and Radio Company, 100 Kingsland Rd., Clifton, N. J., is now offering a new line of 45-volt selenium rectifiers in standard sizes from $\frac{11}{16}$ " to 2" square.

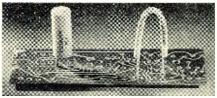
Seven types are already in production with additional types in larger sizes to be available shortly. The cells exhibit high stability and very low reverse or "leakage" current, making them suitable for use in magnetic amplifiers. The rectifiers will permit significant savings in cost and space by reason of the fact that fewer cells will be needed to achieve a desired voltage rating.

· The rectifiers are being manufactured in both commercial and radio-TV types. The company's Components Division will supply complete details on request.

FLEXIBLE POWER RESISTOR

Lectrohm, Inc., 5560 Northwest Highway, Chicago 30, Ill. has developed a new type of flexible power resistor especially for printed circuit applications.

The light weight and flexibility of these resistors offer the advantages of easy assembly and simplicity of making changes in resistance and voltage without changing the holes in the mounting board. The element is wound on a flexi-



ble Fiberglas core. The sleeving, also of Fiberglas, is heavily saturated with silicone to pass requirements for abovechassis mounting.

Currently these resistors are available in values up to 2500 ohms at 5 watts and up to 5000 ohms at 10 watts. Complete information is available from the manufacturer.

NEW RCA TRANSISTORS

The Semiconductor Division of Radio Corporation of America, Harrison, N. J., has announced the availability of three new junction transistors of the germanium *p-n-p* type.

The 2N218, 2N219, and 2N220 have flexible leads which permit soldering or welding into associated circuits. They correspond to the company's 2N139, 2N140, and 2N175 respectively as far as characteristics are concerned.

TV SERVICE INSTRUMENT

Philco Corporation of Philadelphia, Pa. has introduced a multipurpose portable instrument which is said to simplify the servicing of both black-and-white and color chassis CR tubes.

When the Model 8500 "Service King" is used for troubleshooting, it is connected between the receiver output cable and the cathode-ray tube without removing either unit from the cabinet. This setup permits measurement of video drive, K-G1 voltage, K-G2 voltage, and cathode current. When used with three-gun shadow-mask types of color receivers, this information is available separately on each of the three guns. A feedthrough position is provided so that the receiver output can be viewed on the CR tube.

\$135.00 Delco AUTO

9-TUBE Select-O-Matic

Ideal for Cars, Boats, Trucks, Tractors Farms, Summer Camps

Push-pull 6V6 Output! . 9 Tube Circuit Extended Range 6" x9" PM Speaker

Covers Full Broadcast Range Volume, Tone and Sensitivity Controls Signal Seeker and Manual Tuning Too!



VOLTS

3495 Reg. \$125

SHPG. WT. 19 LBS. With tubes, less escutcheon. MA TO SEE SEE SEE SEE SEE

While They Last

GEIGER COUNTERS



CHRISTMAS BARGAINS



A Pocket Size Geiger Counter. Our lowest priced. Measures tiny. increases in radiation. Take it anywhere, includes low cost pen light battery. With earphone head set, battery, radio-active mate-rial for testing purposes and AEC booklet. "Prospecting c buv. SI pounds. Ord

The Concord Custom

"PLAYMATE"

SHATTERPROOF CASE

3 Speed Phonograph \$29.50

ShaiterPROOF CASE, Plays all three speeds, 331/3, 45, 78 rpm.
Trouble-free printed circuit chassis. High fidelity "climatized" pick-up. Full range P.M. speaker with Alnico V magnet.
Famous "shatterproof" case, available in rich platinum grey or attractive pastel blue.
jimensions: 91.6 v 113/

Dimensions: 91/8 x 113/4 x Reg. 41/4". Shipping Wgt. 8 lbs. Stock No. Playmate RN-12. Famou

B
"El Dorado" Geiger How
to Find It." Portable instrument with ultra-sensitive features. Loud clicks on
earphones, bright flashes on
earphones, bright flashes on
earphones, bright flashes on
earphones, bright flashes on
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earphones, bright flashes
earphones

A X In.
Shoulder Includes
table batteries, Weighs
21/2 lbs. Shpg. wt, 4 lbs.

\$16⁹⁵

reg. \$54.50

#745 AMPRO "CAREER" CONCORD'S PRICE

TAPE RECORDER CONCORD SAVES
YOU \$77.70
mpre "Career"
Recorder\$159.50
Rolls of Hi-Fi
Tape Tape (1200 Ft.) @ 2.95 REG. TOTAL 168.35
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Response better
that 17½ 1PS.
Response better
that 17½ 1PS.
Ful Range Tone
Control.
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evel wo Matched ipeakers for Hi-Fi lesponse. asy Action Tape

Shipping Wgt. EE: 3 ROLLS OF HI-FI PLASTIC RECORDING TAPE!

PRINTED CIRCUIT RADIO

5 TUBE SET

• 5-tube superheterodyn receiver; non core I.F.; automatic volume centrol; higherich type bop antenna; printed eircuit components; full band coverage \$40 K.C. to 1620 K.C., direct tuning station selector.

• Sturdy plastic, beautifully styled in mandarin red, worth plastinum gray promodecorations.

Power Supply—115 volts, 50-60 cycles A.C. or 115 volts D.C.

• Dimen.:—6½" L x 4½" H x 2½" D.

PLASTIC

RECORDING

TAPE



HI-FI "TWIN SPEAKER" Changer **Amplifier** reg. \$74.50

"Webcor Changer Portable"

Webcor Deluxe 3 Speed Changer Full Hi-Fi Response 50-12,000 Ops. Matched Twin Hi-Fidelity Speakers 10" & 12" Records Jampmof Feature Hi-Fidelity Crystal Cartridge Dual Styli. Automatic Bass Compensation Last Record Shuts Off Changer & Custom Cabinets

Wgt.: 22 lbs.
Size: 18¹/₂" x 14¹/₄" x 9"
\$46⁹⁵
Stock No. WP3-RN-12

SAME AS ABOVE A:
with Magic-Matic
inges speed automatiy for different speed Stock # WP4-RN12



ISOPHON **ELECTROSTATIC TWEETERS**

The isophon electrostatic tweeters present a radical departure from the control of the control o



Features:
- 30 Effect
- Full Range Reproduction
7000 to 20,000 cps.
- Compact Space Saving Design
- Remarkable Brilliance of Sound

Stock No. STH B7-RN-12. \$295



HANDSOME GENUINE LEATHER BINDINGS. LATEST TRANSISTORS FOR HIGH GAIN. MODERN PRINTED CIR-CUITRY FOR REFORMAN

IGH GAIN.
IODERN PRINTED CIRUITRY FOR PRECISION
VIRING.
PECIAL ALNICO V SPEAKR FOR FINEST RESPONSE.
SES LONG LIFE BATERIES FOR ECONOMICAL
PERATION.

ERFOR FINES: LIFE DOLL TERRIES FOR ECONOMICAL OPERATOR OP in genuine leather is made in a book form. A special automatic switch starts radio when cover is raised. Small enough to keep in your pocket You will treasure this custom made radio throughly for \$5.2 to CONCORD'S LOW, \$2955 LOW PRICE (Less Batteries). Stock No. BUK-RAD-RN-12. Shipping Wgt. 3 lbs. Low of 3, \$28.50 each Batteries for above—z415, \$1.75 (B). #E233, \$1.68 (A)

CRYSTAL MIKES!!!

IMPORTED BINOCULARS 40% to 50% OFF REG. PRICES

1200 Ft. \$169 each • 1800 Ft. \$221 each

NET ECCN 1000 FT. ECCN 1000 FT. Buy A "BAKERS DOZEN" Pay for 12 Reels—Get 13 Manufactured for Concord Radio by one of America's most highly respected Recording Tape Manufacturers. Frequency response at 15,000 cycles with extremely low distortion and maximum signal-to-noise ratio. Wound facing in. Shpg. wt

and maximum signation leaves factors with the state of th

omeordia 200 Ft. \$7.50

IMPORTED BINOCULA

12 Coated Surfaces

All Binoculars Have Deluxe Leather Carrying Case!
Prisms Held Rigid with Steel Straps

6x30 FIELD OF VISION—420 FT, at 1000 YARDS—
Fig. 8. Perfect ALL AROUND binoculars. Feature coated lenses, lignt weight alloy bodies. Center focus. Shipping Wgl. 3 lbs.—

5tock No. B1-RN-12.

69 TX35 FIELD OF VISION—300 FT, at 1000 YARDS—
FIG. D. Here's the right Use, see the operator of the control of the control

Stock No. B3-RN-12.

Wide Angle 7 x 35.

Ty50 FIELD OF VISION—372 FT. at 1000 YARDS—Fig. C. The most wanted binocular, will give good service in SPORTS VIEWING, HUNTING, OUTDOOR USE. Shipping Wgt. 3½ lbs. Specify Type. Center Focus

Stock No. B4-RN-12.
Individual Focus

BX25 FIELD OF VISION—315 FT. at 1000 YARDS—Fig. B. An ideal glass for GAME SPOTTING, BROWNATCHORS, SPORTS, Shipping Wgt. 3½ \$17.95

STOCK No. B4-RN-12.
Individual Focus

S15.25

tock No. 85-RN-12.
dividual Focus
6x50 FIELD OF VISION—183 FT. at 1000 YARDS—
g. C. A high power binocular for LONG DISTANCE
IEWING, as PLANE SPOTTING, MARINE USE,
OUNTAIN VIEWING. CENTER FOCUS. \$31.30













Concord's HI-FI COAX SPEAKERS

15"-\$19.96 8"-\$8.46 12"-\$10.66



UTAH 5" **TWEETER**

reg. \$11.50

Response beyond audibility. Built in crossover network, 5 db. per octave attenuation. 3.16 oz. Alnico V magnet. Binding posts. 8 ohm voice coil impedance. Tweeter B6. Shpg. wt. 2 lbs.

Tweeter B6. Snpg.

Faithful Reproduction of All High Frequencies. 2 for \$12.95...ea.

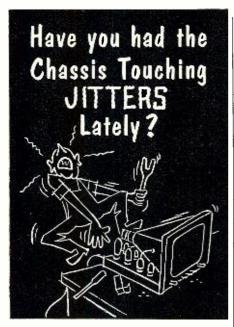
ADDRESS ..

UY . . Model 101-RN-12-

MODEL 101RN-12Die cast case
baked on gray
enamel finish.
floor stand,
table stand,
or hand held
of foot shield
foor stand,
table stand,
table stand,
foor stand,
table stand,
foor stand,
table stand,
foor stand,
table stand,
foor stand,
table stand,
for stand held
or hand held
or hand held
of shielded

YOUR 1957	CATALOG	IS READY	WRITE FOR	FREE COP
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TOOK 1757 OATALOG TO KLADT THE TRAIL TO KINLL OUT				
45 WARREN ST., N. Y. 7 DEPT. RN-12-6				
3				
4—FREE CATALOG				



Adjust-A-Yolt

LR-5 VARIABLE TRANSFORMER

with isolated primary winding lets you service any TV or radio set made without a chance of a "bite" no more chassis touching jitters.



Delivery from stock of your favorite jobber.

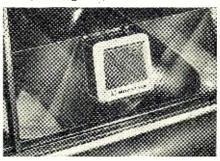
This husky ½ KVA electro-statically shielded unit is "Must" test equipment for thousands of service men. Intermittent operating TV or radio sets are checked by dropping line voltage to 105 V or lower to detect a faulty oscillator. Also used to cook a set at 130-140 V to break down intermittent part. On any application where either isolation or a variable transformer is needed Adjust-A-Volt will do the job. Black wrinkle finish, jeweled pilot light and convenient fuse Write for new 18-page catalog listing all types and sizes.

STANDARD
ELECTRICAL PRODUCTS CO.
2238 E. THIRD ST. - DAYTON, OHIO

Other functions include CR tube testing and rejuvenating, use as a voltmeter and ohmmeter, and for setting up color receivers on installations.

"POWER VOICE" SPEAKER

Motorola Inc.'s Communications and Electronics Division, 4501 W. Augusta Blvd., Chicago 51, Ill. has announced



the availability of a mobile communications type speaker with a built-in transistor amplifier.

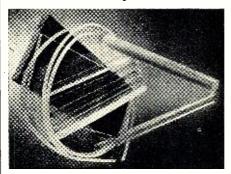
Known as the "Power Voice" speaker, the new unit provides up to ten times the audio output of standard passive speakers in mobile two-way radio installations. The speaker element has a bandpass frequency response tailored specifically for mobile service. It accents voice frequencies but suppresses ignition noise and other interference above and below the basic voice frequency range.

The unit is being offered both as an original equipment and replacement item.

PLASTICS FOR ELECTRONICS

Illumitronic Engineering, 680 E. Taylor, Sunnyvale, Cal. is now offering a complete line of plastics in various shapes and sizes developed especially for the electronics field.

Included are materials of acrylic, polyethylene, polystyrene, and phenolic plastics available as rods, tubing, and sheeting in a wide range of diameters and thicknesses. The technician can thus choose a stock piece that is close



to his requirements and modify it with a minimum of effort. The complete line is packaged for ease of handling and shipping.

Write the company for information on the entire range of items available.

RADIO KNOB KIT

Gee-Lar Mfg. Co., 400 S. Wyman St., Rockford, Ill. is now offering a new line of clock radio knobs for replacement and servicing requirements.

Four different types of clock radio

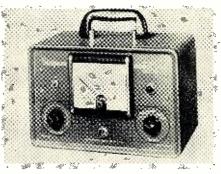
knobs are being supplied, including a metal jacket (double barrier) style in gold. Others are colored plastic (single and double barrier and spring type) in six popular colors.

The knob kit, Catalogue No. 1630, contains an assortment of 25 knobs, said to meet a majority of all replacement needs. The assortment comes packed in a convenient plastic storage box.

MULTIPURPOSE "FLYBACKER"

Simpson Electric Company, 5200 W. Kinzie St., Chicago 44, Ill. has recently introduced a new television tester that combines both an in-circuit horizontal system analyzer and a capacitor checker.

The Model 382 will check an entire TV horizontal deflection system, incircuit, test flyback transformers for opens and shorts, check deflection yokes for opens and shorts, and measure capacitances from $10~\mu\mu\text{fd}$. to .1 μfd . by direct reading. It can also be used as a continuity meter and will



compare various flyback transformers and deflection yokes for relative "Q" by means of a logging scale.

The complete story on this new service shop aid is available from the manufacturer on request.

SPRING-RETURN PLIERS

Xcelite Incorporated, Orchard Park, N. Y. is currently marketing a new transverse cutter model for flush cutoff in miniature and subminiature circuits.

The No. 62 pliers feature a small coil return spring set into the body of the pliers near the leverage axis. The spring is clear of the handles permitting the use of insulating sleeves.

Designed for work in extremely small spaces, the No. 62 is a "long-nose" type with hand-honed, induction-hardened cutting edges.

PUSH-PULL-SWITCH CONTROL

Clarostat Mfg. Co., Inc., Dover, N. H. has developed a new control which permits equipment to be turned on or off at any setting without disturbing the setting.

The new push-pull switch may be combined with any Series 47 composition-element 15/16'' diameter control. The concentric shaft push-pulls for the switching action, and rotates for the control setting, both functions being independent of one another.

The new switch is available in three s.p.s.t. models in various voltages, am(Continued on page 151)

TELEPHONE & CONTROL EQUIPMENT



 CONTROL UNIT RM-53—
(Pictured at left.) Used to operate radio equipment and provide remote control and inprovide remote control and intercom, of such equipment by use of the RM-52 Unit listed below. Up to ½ mile, uses 2 flashlight batt. Internal transformer has High-Low impedance Sw. and Sidetone. Also Mic. & Phone Jack & PL-55 & PL-68 Plugs.

USED: \$3.95 NEW: \$5.95

ORDER

TODAY!

REMOTE CONTROL RM-52— (Pictured at right) Can be used with RM-53 or used as a separate telephone system. Up to ½ mile. Uses 4 flashlight batt. Also can he used as a direct remote control for radio equipment. Provides bias for Mic. & Sidetone to headset. High or Low Imp. Also Mic. & Phone Jacks.

USED: \$2.95 NEW: \$4.95

TS-13 HANDSET for RM-53 or RM-52....Used: \$5.95

EE-8 FIELD TELEPHONE—Ideal for private telephone system for two or more phones, up to 17 miles. Hand ringer, generator with handset, carrying case. Uses 2 flashlight batt. Price—Used, Checked........\$14.95 WIRE—Weatherproof Twisted Pair: 500 ft. \$4.75—135 ft. \$1.00-2500 ft. \$19.95. Per Foot at 1½¢. COMBAT WIRE—Rubber covered W-130..\$.01 per Ft.

CLASSIFIED ITEMS: BC-212G Amplifier—2/6C5 tubes.......NEW: \$ 1.95

BC-216 Amplifier-6E7 & 39/44USED:	1.50
BC-229 / 429 Receiver - 2500-7700 KC w / Coils. U;	6.95
BC.230 Transmitter-2500.7700 KC w/CoilsU:	8.95
BC-347 Amplifier-1/6F8G tubeN: \$3.95; U:	1.95
BC-357 Beacon Rec75 MCN: \$4.95; U:	2.95
BC-367 Amplifier-2/6V6 tubesN: \$4.95; U:	2.95
BC-375 Transmitter	29.95
Tuning Units f/BC-375; TU-5-6-7-8-9-10-26.	
U: Ea,	3.95
Cables f/BC-375/BC-191, PL-61, 64 or 59,	0.75
each end: Ea. BC-442 Antenna Relay Box—w/CondNew:	2.75
	2,95 2 9.95
BC-604 Trans.: FM-30 Watt. 20-28 MC Used:	18.95
BC-500 Trans. & Rec.: 25 Watt, 20-28 MC. New:	
BC-654 Transceiver: 3800 to 5800 KCUsed:	59.50
BC-709 Amplifier—Battery OperatedNew:	34.95 1.95
BC-745 Transceiver: 3 to 6 MC	
BC-924 Trans. FM-30 Watt. 27-38.9 MC. New:	$14.95 \\ 24.95$
BC-966 IFF—160-211 MC. 13 tubesUsed:	
BC-1158 Trans.: 50 Watt. 53.3-95 MCNew:	5.95 39.95
ID-60/APA-10 Panoramic Oscilloscope New: 3	00.00
CD-874 Cordf/HS-30Low Imp., w/PL-55.U:	.59
CD-515 Cable for BC-669	
CD-605 Cord—F/HS-30—High Imp. w/PL-54.N:	2.75
CD-307 Cord—w/PL-55 & JK-26U:	.79
CD-318 Cord—1/PL-68, JK/48, & SW-141U:	.59 .89
GN-45 Handcrank Generator w/Legs & Seat	
R-4/ARR-2 Receiver—234—258 M.C. w/Tubes.U:	9.95
RI/ARR-I Receiver—Converts to 2 or 6 Meters.	4.95 2.95
RT-7/APN-I Altimeter—440 MC	
RT-34/APS-13 Transevr. Comp. less tubesU:	9.95
R-74/CRW-2 Receiver—53-88 MC—6 TubesN:	3.95
T-121 Transmitter—3-4 MC with Coder	9.95
Range Beam Filter, Navy Type: \$1.95; FL-8	7.95
Used:	1.49
RM-12 Radio-Telephone, Remote Control. Used:	19.95
RM-13 Telephone, Remote Control N: \$24.95; U:	19.95
RM-21 Remote Control Box for BC-669	4.95
SCR-625 Mine Detector-Reconditioned	39.95
	55.50
SCR-522 Transceiver: 100-156 MCUsed: \$3	1 05
Rec Chassis only	1.00

Parend Darramed Hand & Obert Oct Obertal of	
Schematic & Conversion Information only. 2.5	
Trans. Chassis onlyw/Tubes: 22.5	ō
less Tubes 9 9	5
Rec. Chassis onlyw/Tubes: 19.9	5

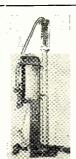
Sound Powered Head & Chest Set-Checked	3.95
Sound Powered Head & Handset f/Mark II. Used:	2.95
TS-9 Handset w/switch. No Plugs: New:	5.95
	3.95
TS-13 Handset w/switch. PL-68 & PL-55. Used:	5.95
HS-30 Headset-Hearing Aid TypeL. N.:	1.50

SCR-625 Famous ARMY MINE-DETECTOR

For Prospectors, Miners, Oil Companies, Plumbers, etc. Portable unit for locating all types of buried metal objects up to 24" or more depending on size and ground condition. Detection by means of a tone. Packed in a chest. Operating weight approx. 15 lbs. Shipping wt. approx. 40 lbs. Complete with hatteries. batteries \$39.95

WRITE US YOUR REQUIREMENTS:

Whatever your needs in Generators, Blowers, Inverters, Motors, etc.—write us. Chances are we have it!



RADAR TRANS.

Transmiter Frequency 143 to 194 MC. using one 3A5 Tube. In plastic case 4½" x 1½" mounted top of 58" Telescoping Antenna with 14" Dipole. Battery Case for hold in g 2/BA-38 103½ v0t "B." Has on & off Sw. Tel. Ant. mounts side of batt. case. Price: \$4.95

COMMAND EQUIPMENT

USED:	NEW:
550 to 1500 REC., Navy\$14.95	\$19.95
550 to 1500 REC., Navy, w/Ant. Loop Sw.	24.95
1.5 to 3 MC. REC., Navy 9.95	
3 to 6 MC. REC.—BC-454	
100 to 156 MC. REC.—R-28	18.95
2.1 to 3 MC. TRANS., Navv	9.95
3 to 4 MC. TRANS Navy 5.95	
4 to 5.3 MC. TRANS.—BC-457 4.95	
5.3 to 7 MC. TRANS.—BC-458 4.95	F 05
7 to 9 MC, TRANS.—Navy	7.95
100 to 136 MG, Thans.—1-25 14.95	



POWER SUPPLY
110 V. For Army/Navy
COMM. RECEIVERS

COMM. RECUITABLE OF THE PROPERTY OF USE W/BC-453-454-455-946 or any sets requiring 24 V. @ I A. & 250 V. @ 50 MA. Ready to use: has 4" MA. Ready to use: has a speaker, volume control, C and on-off switches. Con plete with cord and pli 1/rec. Price....NEW:\$18.95

FM RECEIVERS AND TRANSMITTERS

27 to 38.9 MC. FM RECEIVER

Four Pre-selected Channels & Squelch Circuit. Complete with 16 Tubes and Speaker. Set size: 63". W X 1112" D. Power required 12 or 24 VDC & 275 VDC 150 MA. BC-923 RECEIVER—Used, Checked ... \$34.95 12 V. DYNAMOTOR For BC-923:

12 V. DYNAMOTOR For BC-923:

New: \$5.95; Used: \$3.95

A.C. POWER SUPPLY For BC-923..........\$22.50

KIT of Parts & Wiring Diagram for BC-923....\$17.50

27 to 38.9 MC. FM TRANSMITTER

30 Watt companion to BC-923 Receiver. Four Pre-selected Channels, Voltage regulated M 0 control, using 2/815r 2/6817, I each 68L7, 6V6, 615, 6AG7, & VR-150 Tubes, Size: II" x II" x 18". Voltage required: 12 or 24 VDC & 400 VDC @ 400 MA. BC-924 TRANSMITTER...New: \$24.95; Used: \$14.95 Power & Control Plug 1/BC-923 or BC-924.....\$1.00 Mounting Base FT-237 1/BC-923 & BC-924.Used: \$9.95

BC-603 RECEIVER: 20-28 MC variable tuning: 10 Pre-Set push button channels, squelch circuit, 4" speaker; 10 Tubes: 2/12SG7, 2/6SL7, 1/6V6, 1/615, 3/6AC7, & 1/6H6. Prices: ... NEW: \$30.95; USED: \$20.95 PLUG for rear of Receiver ... St. 00 PVNAMOTOR: 12 V input: Output 220 V 80 MA—#DM-34. NEW: \$4.95; ReISSUE: \$2.95 BC-604 TRANSMITTER: 20-28 MC, 30 Watt. companion to BC-603 Receiver. Crystal control, 10 Preset channels, interphone communication: 8 Tubes 7/1619 & 1/1624 ... USED: \$18.95 PLUG for rear of Transmitter. ... \$1.00 DVNAMOTOR: 12 V input: Output 625 VDC 225 MA—#DM-355... USED: \$9.95 FT-237 BASE for mounting Receiver & \$9.95 Transmitter (No Plugs required)....USED: \$9.95

BC-500 RECEIVER-TRANSMITTER:

BC-500 RECEIVER—TRANSMITTER:

FM Crystal Control on 5 channels. 100 KC separation
20-28 MC. Transmitter: 25 Watt output, 7 Tubes:
1/1625, 1/1286, 3/12817, & 2/128A7, Receiver: 11
Tubes: 1/128L7, 2/128A, 3/128A7, 3/12416, 2/12K8, &
1/12817. Dynamotor Supply: Receiver 28 VDC 1.2 A
input; output 250 VDC 60 MA. Transmitter 28 VDC
4.1 A input; output 550 V 120 MA. Control Panel:
For Local Control & Outlets for Remote also. Heavy
duty 5" speaker. Size: 12" x 25" x 9½". \$59.50
Weight: 65 lbs. Price. ... NEW: \$59.50



NATIONAL DIAL

TYPE "N" Precision 4" vided scale we decimal vernier drive 5-1 ratio. Pla tary drive fits 1/4" shaft, 100-0 sc decimal vermer distribution drive fits \(\frac{1}{4}'' \) shaft, 100-0 scarc. Prices: 3 for \$5.00. Each: \$1.95

RA-20 POWER SUPPLY

110 V. 60 cycle output 230 VDC 90 MA and 12.6 @ 2A. Size: $3\frac{1}{4}$ " x $5\frac{1}{2}$ " x $6\frac{1}{2}$ ". \$9.95

132 SOUTH MAIN ST. LIMA, OHIO

MICROPHONES & HEADSETS

F-1 BUTTON CARBON MIC.

—(Pictured at right) High Gain—
Can be used on desk, car, hand,
or strapped to chest. Complete
with on-off Mom.

PRACTICE CODE TAPE:

SETS: INKED PAPER TAPES—For Code practice and training—for Radio Operators, Hams, Amateurs, Beginners, and Telegraphers. 15 lessons to a Set, on 16mm 400 ft. reels that can be reproduced on TG-34A and TG-10 Keyers. Price: SET of 15 Reels in wood \$18.95 case

TRANSFORMERS and CHOKES

115 V. 60 CYCLE PRI. TRANS.:
600 VCT/100 MA-6.3 V/5 A.: 5 V/3 A\$4.95
240 VCT/35 MA-24 V/.9A; 6.3 V/.6 A; 6.3
V/.3 A
5 V/4.5 A
700 VCT/I50 MA-5 V/3 A.: 6.3 V/4.5 A. CSD 3.95
2500 V/.015 A.; 2.5 V/175 A.; 6.3 V/.6 A 5.95
1890 V/12.6 MA—Tapped 2.5 V 2 A 5.95
1100 V/80 MA—7.5 VCT/3.25 A 5.95
720 VCT/50 MA—6.3V/2.5 A—5V/2 A
662 VCT/110 MA—6.3V/2 A—5V/2 A
16 Velt 35 Amp. 115/230\$24.95; 24V—1 Amp 1.50
9 Volt CT-35 Amp.—Tapped 4.5 V 7.95
12 Volt—Two separate windings—4 amp each 5.95
5 V/2 A.; 5 V/2 A.: 5 V/2 A.; & 5 V/6 A 2.95
6.3 V/2.1 A. and 5 V/3 A 1.75 600-0-600 VAC-200 MA, 12.5 V. 2 A.; 12.5 V.
@ 2 A.; 5 V. @ 3 A.—#H-108—Price 8.95
250-0-250 VAC-50 MA. 24 V. 1 A.: and 6.3 V.
I A.—#H-109—Price 4.95

Choke—12.5 Hy/100 MA\$1.95
Choke-8 Hy/150 MA-200 Ohm-Open Frame 1.25
Choke—8 Hy/130 MA—200 Onni —Open Frame 1.23
Choke—5 Hy/150 MA—85 Ohm
Choke—10 Hy/250 MA—236" x 2" x 3" Potted 4.95
Choke—5 Hy/400 MA—4½" x 4" x 5¾" 4.95
"A" Choke—. I Hy @ I A .7 ohm, Size: 21/4" x
21/4" x 21/4"Price: 1.95
474 × 474

METERS:

WESTON AC AMMETER: WESTON AC AMMETER:

(Pictured) In portable leather case, with Test Leads, 2½", 0-15 \$5.95

AC and 0-3 AC Scale ... \$5.95

DC AMMETER HOYT: In portable metal case, with Test Leads, 4½", Fan Mirrored Scale 0-15 A DC

DB METER—10 to Plus 6, Westinghouse 3", 4.95

DB METER—10 to Plus 6, Westinghouse 3", 4.95

D-15 AM Weston 506; 2½" Rd. NEW 2.95

D-3 RF AMMETER 1S-128: 2½" Rd. NEW 2.95

D-15 AC-DC—2½" Rd.: 1S-122 2½" Rd. 4.95

D-150 MA DC—2½" Rd.: 1S-122 4.95

D-150 V. 60 eytel: Simpson: 3½" Rd. 3.95

D-150 V. 60 eytel: Simpson: 3½" Rd. 3.95

DYNAMOTORS & GENERATORS:

INPUT	0U T P	UT:	STOCK	PRI	CES:
VOLTS:	VOLTS:	MA.	No.	USED:	NEW:
12 VDC	220	80	DM-34	\$2.95	\$ 4.95
12	225	100	D -402	5.95	8.95
12	625	225	D M - 35	9.95	0.00
12	23 0	90	PE-133	4.95	6.95
12'	540	450	DA-12		14.95
12	23 0	100	DA-14		8.95
14	220	70	DM-24	4.95	7.95
14	1030	260			
	515	215	DM-42	4.95	9.95
14	375	150	BD-83	3.95	
14 VDC	330	150	BD-87	3.95	5.95
14	250	50	DM -25	6.95	8.95
14	1000	3 50	BD-77	14.95	
14	230	90	DM-21	6.95	
24	250	60	DY-2/		
			D M - 32	2.95	5.95
24	250	60	PE-86		8.95
28	1000	350	PE-73	8.95	
12 to 24	VDC PM	Dynamo	tor-Suppl	ies 24 V D	C 2 A.
from 12	VDC. also	500 V 5	0 MA. @	6 VDC W	ill sup.

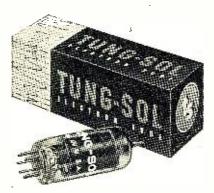
ply 12 VDC & 250 V 50 MA.

Address Dept. RN • \$5.00 Order Minimum, & 25% Deposit on C.O.D.'s • Prices are F.O.B. Lima, Ohio

BEST BUILT



BEST FOR EVERYSE



All Tung-Sol Tubes are engineered to one standard of quality—Blue Chip Quality. Whether they're for famous set makers or leading service dealers, Tung-Sol Tubes are identical in design and performance. Tell your supplier you'd rather have Tung-Sol!

Blue Chip Quality MAGIC MIRROR ALUMINIZED

PICTURE TUBES RECEIVING TUBES

TUNG-SOL ELECTRIC INC., Newark 4, N. J. Sales Offices: Atlanta, Ga., Calumbus, Ohio, Culver City, Calif., Dallas, Tex., Denver, Colo., Detroit, Mich., Irvington, N. J., Melrose Park, Ill., Newark, N. J., Seattle, Wash.

TUNG-SOL makes All-Glass Sealed Beam Lamps, Miniature Lamps, Signal Flashers, Picture Tubes, Radio, TV and Special Purpose Electron Tubes and Semiconductor Products.

Manufacturer's Color Courses

(Continued from page 63)

attend at no charge. For more details concerning starting dates of the courses or separate copies of the book, see the manufacturer's local distributor, through whom the courses are offered, or address Electronic Education Dept., Philco Corp., 2nd and Westmoreland Sts., Philadelphia 40,

Various types of courses in color under the "Television Service Clinic" program have been continuously available from the RCA Service Co. since 1954. An addition to this program over the past year has been the color TV workshops. These provide individual instruction to the technician by field engineers of the service company, involving actual work on color sets in the field with appropriate equipment. No charge is made for this field program, which includes specially prepared technical data. To take advantage of this and other levels of distributor-sponsored training, technicians need only keep in touch with RCA Victor instrument distributors, who will advise on training schedules. For those who cannot attend workshops or clinic meetings, the lecture data is available at nominal cost from Commercial Service, RCA Service Co., Cherry Hill, Camden 8, N. J.

A factory school at the Batavia plant of Sylvania Electric Products, initially open to distributor service managers, will accept dealers and service technicians. Running for six 8-hour days, it is available at no cost to any well-trained monochrome technician who services the manufacturer's receivers. Also, a condensed 24-hour course is expected in the field subsequently. Additional information is available from Don Winters, Manager of the Instruction Group of the Service Dept., Sylvania Electric Products Inc., Batavia, N. Y.

Forthcoming Westinghouse training is expected to follow the pattern of recent courses handled at two levelsat the factory and through the distributor. The 1-week, 8-hour-per-day factory course included practical laboratory work in small classes. Distributor training was at the rate of 4 hours per day. Also factory engineers were being trained to instruct others in the field. For news about upcoming courses, keep in touch with Westinghouse distributors and their service managers.

As we go to press, word has been received that Admiral is conducting special training schools in all cities where color transmissions are provided. The first half of the two-week course consists mostly of lectures, with the second week being devoted entirely to laboratory work.

Other manufacturers have tentative programs in the works, to go into operation when the situation warrants. These include Crosley, Hallicrafters, Olympic, and Packard-Bell.

ISOLATION TRANSFORMER BARGAIN

Fully shielded with line cord and receptacle.

200 WATTS \$4.75 | 300 WATTS \$5.50

POWER TRANSFORMER BARGAIN

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Service Associations

(Continued from page 57)

local dealer stakes his reputation and integrity on every job he does. His roots are right here. Possibly you know him from the veteran's group, fraternal order, or your church. His kids may go to the same school as yours. He's probably pitched in with you on the hospital and community chest drives.

"All in all, it adds up. Do business with the man you know and can trust. Always do business with your local service dealer. Look over this list for

the one nearest you!"

Although TSA had this program prepared for the use of its members in the greater Detroit area, it was offered to and immediately accepted by the Michigan State Service Association when it was presented to delegates at a state meeting.

TSA plans to blanket the service shops in the Detroit area with the several dealer pieces. They will ask their local parts distributors to give out copies of the bulletins and to use the association slugs on their letters, invoices, and envelopes sent to service dealers. In addition, two-man teams, armed with complete brochures of materials, will call on owners of nonmember shops to persuade them to join the Television Service Association of Michigan.

To provide additional impetus in their protest campaign against factory service, the twelve associations that are members of the Michigan State Association held mass meetings of technicians simultaneously in their cities late in October. Following the mass meetings in the individual cities, plans were drawn for a massive statewide meeting in the capital city of

Jackson during November.

The material developed by the Television Service Association of Michigan can be adapted for its own use by any dealer association. The material can be applied to any association simply by inserting that association's name in the various pieces of copy and insignia. TSA announced it would make this material generally available. Information about the program may be obtained by writing to TSA of Michigan, 8225 Woodward Ave., Detroit, Mich. -30-

PICTURE HOOK

By JAMES A. McROBERTS

BENDING of the normally vertical lines at the top of the raster, or hook, was the complaint on the Emerson Chassis 12033. The owner supplied the information that the trouble had developed gradually over a period of a month.

The fact that the trouble was slow in

developing led to the conclusion that the horizontal interference (horizontal in-terference is the cause of all cases of hook, either directly or indirectly) was due to a faulty capacitor that had lost its capacity. The electrolytic, C_{60} , which should have had a capacity of $10~\mu fd$. measured a mere .8 μfd . Replacing C_{60} eliminated the trouble.



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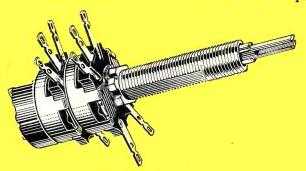
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Spot Radio News

(Continued from page 14)

amplifier, the possibility of lost personnel and aircraft should be greatly reduced.

ANOTHER NEWLY DEVELOPED TUBE, tagged a retarding field oscillator, was said to operate efficiently at a frequency of 70,000 megacycles; a high frequency that permits more accurate radio beam control.

Several rare metals are utilized in making these tubes. Gold is used as a solder. Silver finds various uses because it has a lower electrical resistance than more commonly obtainable materials. Sapphires are used for bearings. Additional metals used include tungsten and tantalum, both of which have very high melting points.

FLOATING ELECTRONIC INSTRUMENTATION stations will soon be plying the waters of the South Atlantic as part of the world's longest missile test range.

ARDC recently announced that contracts amounting to over one-million dollars have been awarded to California concerns to modify several government (small cargo freighter) ships. These craft will be used to receive performance data from missiles soaring over the 3000 miles of the Atlantic between St. Lucia and Ascension Islands. The freighters will supplement the numerous land instrumentation stations of ARDC's Air Force Missile Test Center, which stretch from the Cape Canaveral, Florida, launch site to Ascension Island 5000 miles away.

Upon completion of the modifications, the ships will sail through the Panama Canal and work out of ports on the northeast coast of South America.

THE USE OF NUCLEAR ENERGY for propulsion purposes and its effect on electronic equipment, now under study by the Air Force, received an historic review in Chicago recently during a meeting of Armed Forces specialists.

A key problem, said Colonel William Donics, assistant chief of the communications and electronics division of ARDC, was the effect of radiation on electronic components, in terms of deviation from normal operation, whether that deviation indicated beneficial results or deterioration.

In nuclear-operational tests, the Colonel reported, it has been found that transistors have a very short life. And wire insulation has a reduced resistance in proportion to radiation intensity. Commenting on material breakdown, the air chief said: "Natural rubber deteriorates very rapidly. Insulating materials such as teflon, certain silicone rubbers, polyvinyl chloride, all suffer damage. Polyethylene withstands the radiation in a satisfactory manner, except that when used as a wire insulation, it develops high voltage between the conductor and the shield. Oilfilled capacitors, due to the pressure of the gas which is created from oils, swell and break the seals."

It was also revealed that certain resistors change under radiation, while others, notably wirewound and certain carbon types, appear unaffected. The operation of gasfilled tubes was found to become erratic, and certain types of tube glass envelopes have been found to harden, crack, and break, especially around the base. In a number of instances, glass was found to have a tendency to darken, affecting the transparency of camera and display tubes. An ironic discovery, it was revealed, was that glass used on the cheapest tubes available did not appear affected, other than by discoloration, while the glass on tubes developed especially for reliability under normal conditions hardened and cracked.

A number of different results were obtained with capacitors. Micas, for instance, were found to stand up well; ceramics also stood up. However, the dissipation factor increased on button micas, while the capacity remained fairly stable. Certain paper capacitors survived radiation exposure successfully, except that voltage breakdown was lowered significantly.

Commenting on the future of components in the nuclear age, the Colonel said: "It must be stressed that the advent

of this new environment is not the signal for the whole electronics industry to do an about face and aim every effort at operating under nuclear conditions, to the detriment of other requirements, but rather this is one more environment that must be satisfied by the producers of equipment and components. In this respect, it should be noted that at present there are no facilities available for dynamic testing of components and equipments in a combined temperature and radiation environment. In addition, it is also a stated fact that if the Air Force could use all the space it has available to test equipment from a radiation standpoint only, we would test but an estimated forty per-cent of our planned requirements. Finally, such facilities take about one and a half to two years to build and cost approximately three-quarters of a million dollars."

Noting that the changes which take place due to radiation open up the possibility of taking advantage of these variations, the ARDC expert said that we might capitalize on these revelations by "... designing components, circuits and equipment which will operate more effectively or efficiently when exposed to nuclear radiation... Phenomena can possibly be discovered which will alleviate our problems and instead of fighting radiation effects, it may be possible to utilize them to our advantage. Perhaps materials can be discovered which when subjected to radiation will become semi-conductive. This would mean design concepts quite different than those we are used to; for instance, subjecting equipment to a radiation field before it is placed in operation."

AN AIR-TO-GROUND (500-watt) loudspeaker system, designed to deliver a three- to five-minute tape-recorded message to a ground area during a parachute-braked final phase of its descent, has been developed recently.

The system consists of a lightweight magnetic tape play-back unit, a 500-watt battery-powered audio amplifier and horn assembly, a pressure-initiated control system, and a three-stage parachute arrangement. The complete affair is housed in a three-section, separable bomb-shaped container measuring 118 inches in length and 18 inches in diameter, and weighing 850 pounds.

The operation of the loudspeaker setup is initiated at the moment the missile is released from the aircraft.

When a portion of the missile reaches an altitude of approximately 4000 feet, the sound reproducer system housed here is placed in operation and descends to earth at the rate of 14 feet a second, broadcasting as it goes.

THE FIRST TRANSLATOR grants were issued as this column was being written. Authorizations were given to the *Mt. Grant Television Booster Service Corporation*, Hawthorne, Nevada, to rebroadcast signals from channel 4 KRON-TV, San Francisco, on channel 70; and to *James R. Oliver*, Bishop, California, operator of KIBS, to rebroadcast transmissions from Los Angeles stations KNXT (operating on channel 2) on channel 70, and from KRCA (channel 4) on channel 73.

The Mt. Grant facility (230 miles from San Francisco) will use 98 watts of effective radiated power from an eightfoot antenna. Oliver (225 miles from Los Angeles) will be permitted to use 83 watts *e.r.p.* from 30-foot antennas, for both the channel 70 and 73 rebroadcasts.

Additional station actions are detailed on page 12.

THE INGENUITY, VISION, and persistence, which the amazing research workers in the electronic world have demonstrated on many occasions, once again was on stage during a 50-year tribute dinner to *RCA*'s board chairman.

Described by scientists at the gala event was a noiseless electronic airconditioning system, which comprises large wall panels which become cold under the influence of direct electric current. With a reversal of the electric current, the same panels produce a heating effect. Employing new materials, the system was said to use no motors, fans, pumps, or other moving parts, achieving cooling or heating by both radiation and convection.

What wondrous achievements electronic science brings to our world today for better living tomorrow! L. W.

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A "Densitimer"

(Continued from page 51)

After this basic calibration is completed, and a "Minimum Readable Time" reading is established, the balance of calibration is simple. Since the circuit is linear, the meter reading and various light conditions will be related. That is, the time at a reading of 50 on the regular meter scale will be twice that at 100, 25 will be four times, etc. A few tests with test strips can be made to check this linearity and, if verified, the meter scale can be calibrated for the minimum time of the two ranges (which would be 100 on the regular meter scale).

In actual calibration, the regular 0-100 scale was used, and notes made of the various meter readings at the various exposure times on each scale. When the plastic scale was made, the distance along the scale length was transferred to the plastic with dividers.

After the unit is calibrated, a chart of the settings of the "Paper Speed" control may be made for different photographic papers. For each type and grade of paper, select an average negative, and make a series of test strips until the exact exposure is known. Then, with the enlarger on the same set-up, place the cell in the shadow area of the negative, and adjust the "Paper Speed" dial until the meter reads the proper exposure. This setting is then the "Paper Speed" for the given type and grade of paper.

Over a period of time, calibration should be re-checked, and the established "Paper Speeds" changed if required, as aging of components will cause a decline in response.

"TICKING IN TV SET" By WILLARD S. WEISS

TECHNICIANS often get unusual service complaints but this one was a honey. The customer complained of a steady "ticking" noise emanating from his DuMont TV set which had a metal 19AP4 CR tube (the Model RA110).

The ticking, at one second intervals, sounded like something breaking down in the high-voltage cage. The actual trouble turned out to be a paper tag with a "high voltage" warning on it. This tag was tied to the anode lead from the high voltage cage to the CR tube. The tag, which had a dust coating, was suspended about an inch from the side of the cage.

The tag would accumulate a static charge from the high-voltage wire. As the charge built up the tag would be attracted slowly to the grounded metal cage. When it got close enough, the static charge would spark over.

At this point the card would swing back to its normal position and the whole cycle would start over again, about onee a second. The spark was audible to the customer as a "tick."

We have discovered that almost anything can happen in service work, so we never discount the possibility of a real "off beat" occurrence like this.

Mac's Service Shop (Continued from page 70)

in last week; and while he was here I was asking him if he thought it was a bad coil or a bad condenser that was making my car hard to start these cold mornings. And he told me!"

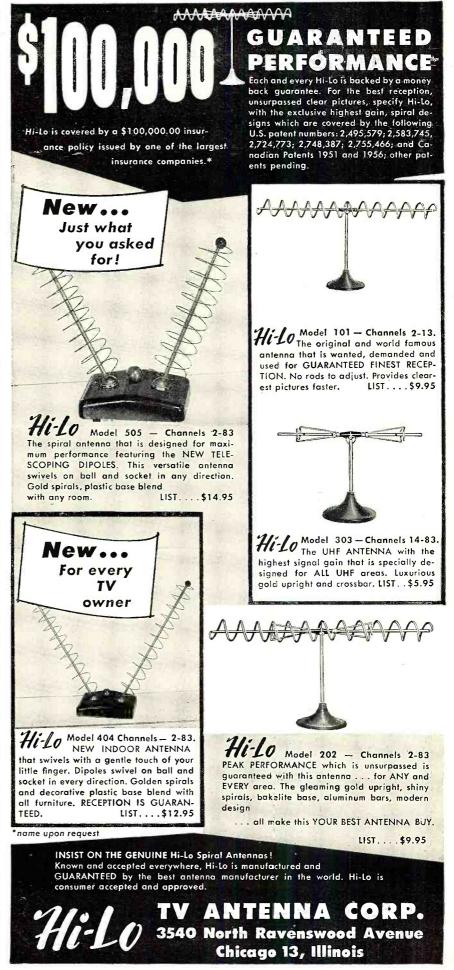
"It's always a lot easier to see when the other fellow is offside," Mac remarked; "but just because we ourselves are guilty of a fault does not make it less a fault. I do not think anyone has a quarrel with a true Do-It-Yourselfer, the person who really does depend upon his own knowledge and what he can obtain from common sources, such as books, for repairing his own equipment. It is the guy who wants to pick the brains of other people, either to escape a legitimate service charge or to make himself appear an electronic genius in the eyes of his relatives and friends, that arouses the ire of most of us.

"At the same time," Mac went on slowly, "I am afraid that in some instances steep service charges may have encouraged the TV Do-It-Yourselfers. At least that is the excuse most of them give. They say they can't afford to pay a stiff service charge just to have a bad tube changed, not if they can change it themselves."

"Right in the beginning there were cases of bad overcharges," Barney chimed in, "but very little of that goes on today. Service organizations, self-policing, and ordinary competition has taken care of that. I'm convinced that the dollar a customer pays for TV service these days brings him as much return in knowledge, training, and equipment as he can buy in any other service field."

"I'll buy that!" Mac exclaimed. "The fellow who says that he tries to repair his own receiver because he is afraid of being gouged by a technician also probably tries to be his own doctor, lawyer, mechanic, plumber, and electrician with the same excuse. Of course, there is this much about it: after he has thoroughly fouled up his set, it is going to cost considerably more than the average service charge to restore it to operation again. He will conveniently forget that his messing with something he knows nothing about has brought on these extra charges and will simply quote the total bill as an example of 'what robbers these technicians are!'"

"Well," Barney observed philosophically, "that is about the only consolation I see to the fact that TV sets are becoming more and more complicated, are harder to service, and require more expensive test equipment. A lot of guys will tinker with an alarm clock, but not many will tackle a wristwatch. Color television is a real challenge to technicians who have been in the game since the early days of radio. I can hardly wait to see how the Do-It-Yourselfers are going to manage with it!"



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THE interest in forming service associations and participating in association activities is at a high pitch among electronic service dealers in all sections of the country. Despite the expansion of factory service, the economic condition of the average well managed independent service shop has improved steadily. The over-all condition of the established service industry is much sounder today than that of the parts distributors.

The biggest obstacle in the path of progress for independent service shops is the continuing lack of competent technicians. As promising new talent is trained in the field, service dealers are constantly jarred by the loss of experienced men because of the inducements of higher wages and fringe benefits offered by manufacturers.

The interest of service dealers in forming associations stems from the growing realization that independent service shops must find the ways and means to accomplish two important objectives to insure a healthy business future for themselves. The first of these is to work with other local organizations to eliminate the gyps and the incompetents from the consumer service industry. The other objective is to get adequate charges for service to enable them to pay their technicians wages comparable to those offered by manufacturers.

As business operating problems increase, service dealers have found it necessary to make an assessment of their associations' basic philosophies. Is the primary purpose of present service associations technical or busi-

In radio service days, the majority of service associations were fundamentally concerned with the technical aspects of servicing radio and sound equipment. There was only a minor interest in business management since it was assumed that a competent technician could get all of the business he could handle.

When television made electronics servicing a two billion dollar industry, it changed the entire complexion of the consumer service business. The need for improved business promotion methods, better customer relations, dealing with unethical competition, and training for technical employees overshadowed the importance of individual technical competence on the part of the service shop owner.

The result is that present service associations are primarily concerned with the management problems inherent in operating a service business in a highly competitive market.

Since there is no single pattern in business types that would apply in every section of the country, there is a wide difference in the types of service associations that have been formed. In some areas where a number of large, successful TV-appliance retailers dominate the market, there is a preponderance of shops that specialize in service and do not handle the sale of TV or radio sets. In those areas, as a general rule, there is no cooperation between the retailers and the service associations.

In other areas, a high percentage of the service shops sell TV and radio sets to provide supplementary income. While service is their major business, they do understand the dealers' sales problems. Where this situation exists, there usually is very good cooperation between the dealers and the local service association.

Because of the basic differences in the structure of individual associations, service groups operating in separated areas may not see eye to eye on what must be done to bring about some measure of stability in the electronic service industry. Where dealers and service operators remain aloof from each other's problems they both lose the benefits they would gain by working together on programs for , their common good.

In the course of the osmotic process that leads successful service dealers to shift their emphasis from the technical to the business side of their operations, the professional electronic service technician has been sorely neglected. There are thousands of men who have made electronic servicing their profession. They do not aspire to operate their own shops but are ambitious to be top-flight professionals in their chosen field.

Early this year an organization of service technicians was formed in Portland, Oregon. Known as the Northwest Electronic Technicians Association, its goal is to build respect for and competence in professional technicians engaged in electronics service work. Their motto, Electra Eta, means electronic efficiency.

In Minnesota, the Minnesota Television Service Engineers Association has set up standards and nomenclature for electronic service technicians.

In Detroit, the Television Service Association of Michigan recently sponsored the formation of the Television Technicians Guild of Detroit. This is an organization of professional service technicians with complete management and control in the hands of its technician-members.

In a recent article Harold Heipel, president of TTG, outlined the philosophy behind this new technical association:

"A square yard is all you need. Or is it? True, a square yard of space is enough in which to earn a living, if it contains a set to be repaired, a technician who knows how, and his equipment.

"We have always thought that the most important ingredient in that square yard, and the most difficult to get, was the know-how. Most of us have worked and studied a long time to achieve it, because we assumed that once we had the skill and the ability we would automatically be an aboveaverage individual whose square yard of space would be best equipped to earn a livelihood.

"Now we are picking ourselves up off the floor and saying in a dazed

voice, 'What happened?'

"What happened is this-while we were so busy preparing our own ingredients for our square yard we forgot a couple of small details. The first is that the most important item in our space is the set to be repaired. If there is no set there the technician may as well eat the pride he has in his profession, because that is all he will have left. The second little thing we have missed is the fact that the world is bigger than a square yard, and it is the things that happen outside our square yard that determine whether there will be a set in it.

"We have been living in a dream world, each in his own square yard. surrounded by a velvet curtain of indifference to keep the ugly world from interfering with the sublime rebirth of the set in our hands. This dream world of ours is now shaking with the rumble of the big business steam roller and we are in for a rude awakening. There will be no set in our square yard tomorrow-unless we do something about it right now!

"It is up to you! Two things you must do if you want to survive. You must get yourself out of your square yard and into the world. You must get yourself a voice that will be heard.

"The things in the world that affect your livelihood are being brought to light by groups of individuals just like you who have joined together to protect their common interests. Service dealers have found in TSA a powerful force for mutual aid. The Television Technicians Guild (TTG) is bringing to service technicians the events of the world which can make or break them. Association with your local group, be it TSA, TTG, or any other, is your only hope of survival. Join! Have a voice in the group. Let your voice be heard. Unite to fight! Or retire to your square yard, draw your velvet curtain, and wait voiceless for the set which will not come."

Your suggestions about how this magazine can be of assistance will be welcomed. Address them to: Service Editor, Radio & Television News, 366 Madison Ave., New York 17, N. Y.-30NEEDED: Key men to command the nerve center of America's Defense

Today, at IBM, engineers are playing new and vastly more important roles. In cooperation with the Air Force, IBM engineers and technicians are guarding America's lifeline with Project Sage, our continent's air defense warning system.

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Superior's New Model 670-A

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FEATURES

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- An accurate direct-reading Capacity meter.
- A Kilovoltmeter.
- An R.F. Signal Tracer.
- An Audio Signal Tracer.
- Giant recessed 6½ inch 40 Microampere meter with mirrored scale assures accuracy and easy-reading. All calibrations are printed in large easy-to-read type. Fractional divisions are easily read with the aid of the mirrored scale.

20,000 OHMS PER VOLT

Includes services never before provided by an instrument of this type.

- The line cord, used only when making Ca-pacity measurements, need be plugged in only when using that service. It is out of the way, stored in its pliofilm com-partment at all other times.
 - A built-in Isolation Transformer automatically isolates the Model TV-60 from the power line when the capacity service is in use.
 - Selected, 1% zero temperature coefficient metallized resistors are used as multipliers assuring unchanging accurate readings on all ranges.
 - Use of the latest type of printed circuit guarantees maintenance of top quality standard in the production runs of this precise instrument,
 - ✓ A new improved type of high-voltage probe is used for the measurement of high voltages up to 30,000 Volts. This service will be required when servicing color TV receivers.
- Simply plug-in the R.F. probe and convert the Model TV-60 into an efficient R.F. SIGNAL TRACER permitting the measurement of stagegain and cause of trouble in the R.F. and I.F. circuits of A.M., F.M., and TV receivers.
- Plug in the Audio probe and convert the Model TV-60 into an efficient AUDIO SIGNAL TRACER. Measure the signal levels and comparative efficiency of hedring-aids, publicaddress systems, the amplifier sections of Radio & TV receivers, etc.

Read and compare features and specifications below!

SPECIFICATIONS

- 8 D.C. VOLTAGE RANGES: (At a sensitivity of 20,000 Ohms per Volt) 0 to 15/75/150/300/750/1500/7500/30,000 Volts.
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 RESISTANCE RANGES: 0 to 2,000/200,000 Ohms, 0-20
- CAPACITY RANGES: .00025 Mfd. to 30 Mfd.
- DECL CURRENT RANGES: : 0-75 Microamperes, 0 to 7.5/75/750 Milliamperes, 0 to 15 Amperes.

 DECIBEL RANGES: 6 db to + 58 db.
- R. F. SIGNAL TRACER SERVICE:

Enables following the R.F. signal from the antenna to speaker of any radio or TV receiver and using that signal as a basis of measurement to first isolate the faulty stage and finally the component or circuit condition causing the

AUDIO SIGNAL TRACER SERVICE:

Functions in the same manner as the R.F. Signal Tracing service specified above except that it is used for the location of cause of trouble in all audio and amplifier

Model TV-60 comes complete with book of instructions: pair of standard test leads: high-voltage probe; detachable line cord; R.F. Signal Tracer Probe and Audio Signal Tracer Probe. Pliofilm bag for all above accessories is also included. Price complete. Nothing else to buy. Only

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MOSS ELECTRONIC DIST. CO., INC., 3849 Tenth Ave., New York 34, N.Y.



Superior's New

BETESTER

* Tests all tubes including 4, 5, 6, 7, Octal, Lock-in, Peanut, Bantam, Hearing Aid, Thyratron Miniatures, Sub-miniatures, Novals, Sub-minars, Proximity fuse types, etc.

Proximity fuse types, etc.

Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-II as any of the pins may be placed in the neutral position when necessary.

The Model TV-II does not use any combination.

The Model TV-II does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible

EXTRA SERVICE — The Model TV-II may be used as an extremely sensitive Condenser Leakage Checker. A relaxation

Newly designed Line Voltage Control compen-sates for variation of any Line Voltage between 105 Volts and 130 Volts.

NOISE TEST: Phono-lack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

to damage a tube by inserting it in the wrong socket. ★ Free-moving built-in roll chart provides com-plete data for all tubes.

The model TV-11 operates on 105-130 Volt 60 Cycles A.C. Comes housed in a beautiful handrubbed oak cabinet complete with portable cover

type oscillator incorporated in this model will detect leakages even when the frequency is one per minute.

Superior's New Model TV-12



TRANS-CONDUCTANCE

TESTING TUBES

- TESTING TUBES

 ★ Employs improved TRANS-CONDUCTANCE circuit. An in-phase signal is impressed on the input section of a tube and the resultant plate current change is measured. This provides the most suitable method of simulating the manner in which tubes actually operate in Radio & TV receivers, amplifiers and other circuits. Amplification factor, plate resistance and cathode emission are all correlated in one meter reading.
- * NEW LINE VOLTAGE ADJUSTING SYSTEM. A tapped transformer makes it possible to compensate for line voltage variations to a tolerance of better than
- ★ SAFETY BUTTON—protects both the tube under test and the instrument meter against damage due to overload or other form of improper switching.

* NEWLY DESIGNED FIVE POSITION LEVER SWITCH ASSEMBLY. Permits application of separate volt-ages as required for both plate and grid of tube under test, resulting in improved Trans-Conduct-ance circuit.

TESTING TRANSISTORS
A transistor can be safely and adequately tested only under dynamic conditions. The Model TV-12 will test all transistors in that approved manner, and quality is read directly on a special "transistor only" meter

The Model TV-12 will accommodate all transistors including NPN's, PNP's, Photo and Tetrodes, whether made of Germanium or Silicon, either point contact or junction contact types.

Model TV-12 housed in hand-some rugged portable cabi-net sells for only

ALSO TESTS TRANSISTORS!

Superior's New Model TY-40



NOT A GADGET-NOT A MAKE-SHIFT ADAPTER, BUT A WIRED PICTURE TUBE TESTER WITH A METER FOR MEASURING DEGREE OF EMISSION—AT ONLY \$15.85

Of course you can buy an adapter for about \$5which theoretically will convert your standard tube tester into a picture-tube tester; or a neon type instrument which sells for a little more and is supposed to be "as good as" a metered instrument. Superior does not make nor do they recommend use of C.R.T. adapters or neon gadgets because a Cathode Ray Tube is a very complex device, and to properly test it, you need an instrument designed exclusively to test C.R. Tubes and nothing else.

Tests ALL magnetically deflected tubes . . . in the set . . . out of the set . . . in the carton!!

EASY TO USE: Simply insert line cord into any 110 volt A.C. outlet, then attach tester socket to tube base (lon trap need not be on tube). Throw switch up for quality test.., read direct on Good-Bad scale. Throw switch down for all leakage tests.

Tests all magnetically deflected picture tubes from 7 inch to 30 inch types.

Tests for quality by the well established emission method. All readings on "Good-Bad" scale.

Tests for Quality by the well established emission method. All readings on "Good-Bad" scale.

Model TV-40 C.R.T. Tube Tester comes absolutely complete —nothing else to buy, Housed in round cor-nered, molded bake-lite case. Only

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FINANCE CHARGES ADDED. If not completely satisfied, return to us, no explanation necessary. (See Approval Form on page 141 for complete details.)

MOSS ELECTRONIC DIST. CO., INC., 3849 Tenth Ave., New York 34, N.Y.

For the first time ever: ONE TESTER PROVIDES ALL THE SERVICES LISTED BELOW!

Superior's

New Model 7



IT'S A

with a range of .00001 Microfarad to 1000 Microfarads (Measures power factor and leakage too.)

IT'S A

with a range of 100 ohms to 5 megohms

IT'S A

speaker of all receivers and to finally pinpoint the exact cause of trouble whether it be a part or circuit defect.

IT'S A

The TV Antenna Tester section is used first to determine if a "break" exists in the TV antenna and if a break does exist the specific point (in feet from set) where it is.

Specifications

✓ CAPACITY BRIDGE SECTION

4 Ranges: .00001 Microfarad to .005 Microfarad; .001 Microfarad to .5 Microfarad; .1 Microfarad to 50 Microfarads; 20 Microfarads to 1000 Microfarads. This section will also locate shorts, and leakages up to 20 megohms. And finally, this section will measure the power factor of all condensers from .1 to 1000 Microfarads. (Power factor is the ability of a condenser to retain a charge and thereby filter efficiently.)

✓ RESISTANCE BRIDGE SECTION

2 Ranges: 100 ohms to 50,000 ohms; 10,000 ohms to 5 megohms. Resistance can be measured without disconnecting capacitor connected across it. (Except, of course, when the R C combination is part of an R C bank.)

As Design Engineers, we the undersigned would like to say that the Model 76 is in our opinion the best combination unit of its kind we have been privileged to design. Although it is comparatively a low-priced tester, it will, after you become acquainted with its multiple services, be your most frequently used instrument.

L. MELENKEVITZ

✓ SIGNAL TRACER SECTION

A built-in high gain pentode voltage amplifier, plus a diode rectifier, plus a direct coupled triode amplifier are combined to provide this highly sensitive signal tracing service. With the use of the R.F. and A.F. Probes included with the Model 76, you can make stage gain measurements, locate signal loss in R.F. and Audio stages, localize faulty stages, locate distortion and hum, etc. Provision has been made for use of phones and meter if desired.

TV ANTENNA TESTER SECTION

Loss of sync., snow and instability are only a few of the faults which may be due to a break in the antenna, so why not check the TV antenna first? The Model 76 will enable you to locate a break in any TV antenna and if a break does exist, the Model 76 will measure the location of the break in feet from the set terminals. 2 Ranges: 2' to 200' for 72 ohm coax and 2' to 250' for 300 ohm ribbon.

Model 76 comes complete with all accessories including R.F. and A.F. Probes; Test Leads and operating instructions. Nothing else to buy.

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MOSS ELECTRONIC DIST. CO., INC., 3849 Tenth Ave., New York 34, N.Y.

Superior's New Model TV-50

GENOMETER



DOT PATTERN GENERATOR (FOR

COLOR TV): Although you will be able

to use most of your regular standard

equipment for servicing Color TV, the one addition which is a "must" is a Dot

Pattern Generator. The Dot Pattern pro-

jected on any color TV Receiver tube by

(3579 Kc. is the color burst frequency.)

A versatile all-inclusive GENERATOR which provides ALL the outputs for servicing:
A.M. Radio ◆ F.M. Radio ◆ Amplifiers ◎ Black and White TV ◆ Color TV

7 Signal Generators in One!

R.F. Signal Generator for A.M.

R.F. Signal Generator for F.M.

Audio Frequency Generator

✓ Bar Generator

✓ Cross Hatch Generator
 ✓ Color Dot Pattern Generator

VARIABLE AUDIO FREQUENCY GEN-

ERATOR: In addition to a fixed 400

cycle sine-wave audio, the Model TV-50

Genometer provides a variable 300 cycle

to 20,000 cycle peaked wave audio

✓ Marker Generator

R. F. SIGNAL GENERATOR: The Model TV-50 Genometer provides complete coverage for A.M. and F.M. alignment. Generates Radio Frequencies from 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics.

Megacycles on powerful harmonics.

CROSS HATCH GENERATOR: The Model TV-50 Genometer will project a cross-hatch pattern on any TV picture tube. The pattern will consist of non-shifting horizontal and vertical lines

interlaced to provide a stable cross-hatch

BAR GENERATOR: The Model TV-50 projects an actual Bar Pattern on any TV Receiver Screen. Pattern will consist of 4 to 16 horizontal bars or 7 to 20 vertical bars.

the Model TV-50 will enable you to adjust for proper color convergence.

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1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc.

THE MODEL TV-50 comes absolutely complete with shielded leads and operating instructions.

Only

\$47⁵⁰

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READ THIS!!

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City. Zone ... State

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An Unusual A.F.C.—High-Voltage Trouble

By RICHARD BLITZER

A defect in the phase detector stopped oscillator action, eliminating high voltage and the raster.

A DEFECT in the horizontal automatic frequency control (a.f.c.) circuit normally changes the frequency of the horizontal oscillator, causing picture tear-out. Lack of raster, due to missing high voltage, is seldom attributed to the a.f.c. circuit.

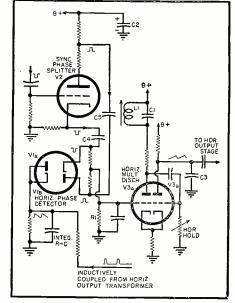
This article describes precisely such a trouble that the writer encountered. The receiver is a *Tele-King* chassis TVJ, employing the a.f.c. circuit shown in Fig. 1. Since an understanding of the circuit theory is required, we will briefly review the operation. V_{34} and V_{38} are a cathode-coupled multivibrator. C_3 , in the plate of V_{3B} , is the charge-discharge capacitor which produces the desired saw-tooth waveshape. The oscillator's frequency is made more stable by the sine-wave tank circuit, L_1 - C_1 , in the plate circuit of V_{34} .

 V_{1A} and \hat{V}_{1B} form the horizontal phase detector circuit which, by controlling the bias at the grid of V_{34} , determines the multivibrator's frequency. The diodes are made to conduct by sync pulses from V_2 , the sync phase splitter. Proper frequency and phase relationship between these sync pulses and the rectangular deflection waveshape from the output transformer, changed into a saw-tooth by the integrating RC circuit, cause V_{1A} and V_{1B} to conduct equally. Plate current of V_{14} flows up through R_1 , making the $V_{3.4}$ multivibrator grid positive. Plate current of V_{1B} flows down through R_1 , making the V_{34} grid negative. These equal and opposing voltages cancel and the grid voltage is zero. Frequency drifting of the horizontal multivibrator changes the phase relationship between sync pulses and deflection waveshape so that either V_{1A} or V_{1B} conducts more heavily. Either a positive or a negative voltage is then developed at the V_{34} grid, pulling the oscillator back to its correct frequency.

The trouble that prompted this article was lack of high voltage. When the receiver was set up on the test bench, an oscilloscope showed a sinewave signal of about 15,000 cycles per second at the multivibrator plates of V_{3A} and V_{3B} . This, of course, was undesirable. The frequency of 15,000 cycles per second was approximate. It was concluded that the frequency was 15,000 cps by the number of cycles seen for the particular setting of the scope's sweep controls. Shorting across L_1 and C_1 stopped the 15,000 cycle sine waves. A d.c. voltmeter check showed about normal voltages on the multivibrator except for negative 10 volts at the grid of V_{34} , whereas this grid voltage should normally be zero. By grounding this grid with a jumper across R_1 , the multivibrator-discharge tube functioned, producing a 15,000 cycle saw-tooth at the V_{3B} plate, and the high voltage and raster came back. However, the raster had a wide black vertical bar on it. This seemed to indicate a 15,000 cycle per second sine wave reaching the video input to the picture tube. Opening the grounded jumper from the grid of V_{34} removed the raster.

The negative 10 volts at the grid of V_{34} could be due to the heavy conduction of the lower phase detector V_{1B} . Since the filament of this tube is in series with the heater of the sync phase splitter V_2 and with others (not shown in Fig. 1), V_1 could not be removed without affecting the others. Connecting the oscilloscope to the cathode of $V_{1:1}$ showed a negativegoing sync pulse of correct amplitude, about 13 volts peak-to-peak. This was measured on the scope which had been calibrated for a 6.3 volt wave from the scope's test jack. At the plate of V_{1B} a large sine wave was noticed superimposed on the positive going sync pulse. This apparently drove V_{1B} into heavy conduction producing the negative voltage across R_1 and keeping the multivibrator V_{34} from operating.

Fig. 1. Poor B+ filtering permitted feedback from the $V_{\rm 3A}$ plate to the $V_{\rm 1B}$ plate.



Opening the coupling capacitor C_4 did not improve operation, but disconnecting C_5 from V_{1B} produced operation of the multivibrator with resulting high voltage and raster. The raster still had the 15,000 cycle-per-second black vertical bar down the center. Restoring C_4 and C_5 to their proper connections again removed the raster. Removing the sync phase splitter, V_2 , had no effect on bringing the raster back. (A dummy tube having a good filament but all other pins cut off was used in place of V_2 since its filament, as noted, was in series with others. A bad tube, which had been saved for just such a job, was used for this purpose.)

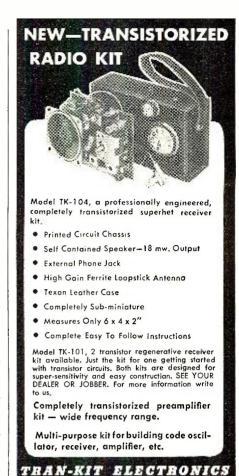
With V_2 removed, the oscilloscope still showed the 15,000 cycle sine wave going through $C_{\mathfrak{b}}$ to the plate of diode V_{1B} . Further, the scope showed this signal at the "B+" point. Here then lay the trouble since an adequately bypassed "B+" could not have a 15,-000 cycle-per-second signal developed there. Checking with an ohmmeter showed that filter capacitor C_2 , 120 μfd., was faulty. Replacing it produced the raster without the vertical black bar.

This trouble, then, consisted of a leaky low voltage "B+" filter capacitor, C_2 , which allowed a 15,000 cycle sine wave from the horizontal multivibrator stability circuit, L_1 - C_1 , to feed through to the phase detector a.f.c. diode V_{1B} . Heavy conduction of V_{1B} biased the grid of V_{3A} , preventing its proper operation as a multivibrator.

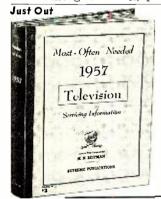
While the defective component that was the ultimate cause of trouble in this instance was in the power supply, similar effects can be produced by breakdowns that are more immediately related to the a.f.c.-oscillator circuits.

In another model using a very similar a.f.c. circuit, a failure of a capacitor in this part of the receiver also resulted in no high voltage. The circuit is exactly as shown in Fig. 1 except that the rectangular deflection wave, which is applied to the plate of V_{14} and the cathode of V_{1B} through the integrating RC network, is coupled through a .05 μ fd. capacitor instead of being inductively coupled. This capacitor couples the deflection waveshape from the horizontal output transformer for phase comparison with the sync pulses, but keeps the "B+" voltage from reaching V_{14} and V_{1B} .

When a receiver using this circuit was on the bench, it was found that the .05 μ fd. capacitor was leaky. Plate voltage of V_{14} was found to be +150volts; normal measurement should have been zero. This positive voltage caused V_{14} to conduct heavily. Plate current, flowing upward through R_1 , placed a positive voltage at the multivibrator grid V_{34} . This was just the reverse condition described previously when the grid was negative. With a positive grid, V₃₄ conducted constantly, preventing multivibrator operation and stopping high voltage.



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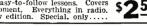


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Within the Industry

(Continued from page 28)

of the Armed Forces Education Division.

He is a member of several business. professional, and fraternal organizations and the author of five textbooks. He makes his home in Alexandria, Va. * * *

DAYSTROM, INC. has announced the formation of a systems division which will design, build, test, and install complete systems for automation applications. Chalmer E. Jones, formerly assistant to the president of Heath Company, another Daystrom subsidiary, will head the new operation in LaJolla, Cal. . . . ALLEGHENY LUDLUM STEEL CORPORATION has purchased PAUL R. REPATH, INC., Los Angeles producer of electrical steel laminations, metal stampings, and deepdrawn transformer cans . . . WATERS MANUFACTURING, INC. of Wayland, Mass. has established a new electronic components division which will be headed by Walter T. Hynes . . . SPRAGUE ELECTRIC COMPANY has acquired a controlling interest in CREAS. Milan, Italy capacitor manufacturer. The move is intended as an aid to reestablishing the overseas market for capacitors in dollar-short areas . NUCLEAR INSTRUMENT AND CHEMICAL CORPORATION has changed its corporate name to NUCLEAR-CHICAGO **CORPORATION** to capitalize on the firm's well-known tradename . . . MICROWAVE ASSOCIATES and TECH-NICAL OPERATIONS, INC. have formed a new, jointly owned company, POWER SOURCES, INC. The new corporation will produce semiconductor power supplies . . . COMPUTER-MEASURE-MENTS CORP. of North Hollywood, Cal. has been merged with HANCOCK MANUFACTURING CO. of Jackson, Mich. The merged firm will retain its identity and present management . . . MAGNECORD, INC. has acquired A-V MANUFACTURING COMPANY . . . R. S. LOHMANN CO. has been established at 13331 Livernois, Detroit 38, Mich. to service jobber and industrial accounts in Michigan.

ALLEN B. DU MONT LABORATORIES, INC. and Chromatic Television Laboratories, Inc. have reached an agreement whereby Du Mont will undertake a program designed at getting the Chromatic single-gun color tube and the color TV set using this tube into production.

It is estimated that preparatory work leading to mass production of the tube and color receivers will be completed within a year. When production begins, the *Chromatic* tube will be available to all set manufacturers as well as for Du Mont receivers.

O. B. HANSON, vice-president of engineering services for Radio Corporation of America, was named winner of the 1956 John H. Potts Memorial Award.

bestowed annually by the Audio Engineering Society.

The citation was made in "recognition of his contributions to better broadcasting systems and facilities." Mr. Hanson was formerly vice-president and chief engineer for $NB\hat{C}$ and a pioneer of nearly thirty-five years in radio and television.

* *

HENRY F. DeLONG has been appointed general manager of General Electric

Company's multimillion dollar Cathode-Ray Tube Department.

He has served as manager of manufacturing for the company's incandescent lamp facility in Ohio since 1952. In



his new position, Mr. DeLong will direct operations of the department from headquarters at Electronics Park in Syracuse, N. Y.

Mr. DeLong has been associated with the company for 20 years. He is a native of Spokane, Wash., and received his B.S. degree in Chemical Engineering from Purdue University.

The company's cathode-ray tube manufacturing facility consists of large plants in both Syracuse and in Buffalo, N. Y. * * *

JOHN F. RIDER PUBLISHER, INC. has moved to new and larger quarters at 116 West 14th Street in New York City . . . ERIE RESISTOR CORPORA-TION of Erie, Pa. has built a new plant at 13010 S. Weber Way, Hawthorne, Calif. The new facility houses the company's rapidly expanding Electro-Mechanical Division . . . SIERRA ELEC-TRONIC CORPORATION is building a new 35,000 square foot building in Bohannon Industrial Park, Menlo Park, Calif. All operations of the company will be located in the new structure by the end of this year . . . CIRCUIT INSTRUMENTS INC., a subsidiary of IRC. Philadelphia, has moved to a modern new plant at 2801 Anvil St., North, St. Petersburg, Fla. The new location provides 12,500 square feet of floor space . . . A three-acre tract has been acquired at Saticoy and Ethel Streets, North Hollywood, Calif. by U.S. ELECTRONICS DEVELOPMENT COR-PORATION and will be used as the site for three new 20,000 square foot buildings the company will construct early next year . . . COOK ELECTRIC COM-PANY is opening a Technological Center on a 15-acre tract in Morton Grove, Illinois. The seven single-story buildings comprising the "center" will provide a total floor area of 158,000 square feet and employ 1000 persons. A heliport and paved parking facilities for 1200 cars are included . . . ALTEC LANSING CORPORATION has broken ground for its third Southern California factory. The new plant at Anaheim will raise to 200,000 square feet the facilities of the audio firm . . . MINNE-

APOLIS-HONEYWELL REGULATOR COM-

PANY has purchased the three-story.

250,000 square foot Hathaway plant in Boston to house its Transistor Division. The division is currently located in Minneapolis . . . SYLVANIA ELECTRIC PRODUCTS INC. has formally opened its new electronics plant in Hillsboro, N. H. . . . NATIONAL ELECTRONICS CORPORATION of Los Angeles has moved its corporate headquarters to its new plant at 11815 Vose St., North Hollywood, Cal. The company will continue to operate its other two plants in Los Angeles and North Hollywood . . . PLASTIC CAPACITORS, INC. has moved to new and larger quarters at 2620 N. Clybourn Ave., Chicago, Ill. . . . OLSON RADIO WAREHOUSE has purchased the inventory, furniture, and fixtures of PAT MALONE, INC. at 123 N. Western Ave. in Chicago and will operate the facility as its seventh outlet. The original Chicago store on Randolph St. will be continued . . . RADIO ELECTRIC SERVICE COMPANY recently opened a 10,000 square foot showroom and warehouse in Allentown, Pa. Located at 1313 Linden St., the new store will handle a complete stock of electronic parts and equipment in addition to high-fidelity and commercial sound gear . . . DAVID BOGEN CO., INC. has opened a new manufacturing plant in Paramus, N. J. ... STROMBERG-CARLSON has purchased the "Style Manor" factory at 1400 N. Goodman St., Rochester from BOND STORES, INC. The plant will be used as an electronic research, engineering, and manufacturing center . . . GENERAL ELECTRIC COMPANY has established a new district sales offices for tubes and other electronic components at the Brown-Marx Building in Birmingham, Ala.

TELEVISION IN ISRAEL

TELEVISION makes its debut in this republic of 1,600,000 in a vast mid-December exhibition sponsored by the Israel Radio and Electronics Association but the advent of normal video service in the Land of the Bible is still in the

early planning stages.

The event is to feature a closed-circuit TV demonstration as a result of an agreement with DuMont to supply the Israeli exhibitors with the necessary apparatus. Cameras will be mounted at the exhibition's entrance, thereby allowing those inside to look at the passing throngs. The set-up marks the first time TV equipment of any nature has been publicly demonstrated in Israel. —30—

RECORDER SERVICE HINT

By JAMES A. McROBERTS
[AILURE of the bias oscillator in the
[Pentron 9T3 tape recorder may result from a defective .003 \(\psi \)fd. capacitor, C₁₃, in the grid circuit of the recorder's erase oscillator.

The failure to erase followed by a

check of the bias generated across this capacitor, which is shunted by the grid leak resistor R₁₀, will indicate failure of

the erase or bias oscillator.

Following a quick test of the voltage and tube substitutions, if available (erase oscillator-power output tube is a 6V6), replace the grid capacitor C_{13} to correct this fault.

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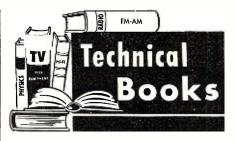
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"VACUUM-TUBE CIRCUITS AND TRANSISTORS" by L. B. Arguimbau. Published by John Wiley & Sons, Inc., New York. 637 pages. Price \$10.25.

This is a fundamental treatise on transistors, FM, inverse feedback, noise, AM, and other pertinent circuitry written for engineers, students, and others interested in the application of vacuum tubes and transistors to electronic equipment of various types.

The subject matter is treated from the mathematical viewpoint and the reader is advised to have his sliderule handy or college math courses well in mind before tackling this text. As a reference work and a basic handbook this volume admirably fills the bill.

"PULSE AND DIGITAL CIRCUITS" by Jacob Millman & Herbert Taub. Published by McGraw-Hill Book Co., Inc., New York. 687 pages. Price \$12.50.

This text for senior and graduate courses provides a description and an analysis of the circuits and techniques common to many of the newer fields of electrical engineering. Such subjects as wave shaping, pulse amplifiers, multivibrators and time-base generators, blocking oscillators and counting circuits, transmission gates and voltage comparators, and digital computer circuits are included.

'MATHEMATICS FOR ELECTRON-ICS" by H. M. Nodelman & F. W. Smith. Published by McGraw-Hill Book Company, Inc., New York. 376 pages. Price \$7.00.

This book has been especially written for the TV engineering student and the practicing engineer. It is designed to provide a correlation between engineering practice and those mathematical topics which are pertinent to the electronics and communications fields.

Since the emphasis is on the practical applications of mathematics, this text is a real boon to electronics men. The introductory chapter outlines the uses of mathematics in electronics and gives copious examples of the function of math in practical day-to-day operations.

The balance of the text deals with specific applications. Five appendices cover common and natural logarithms. trigonometric functions, integrals, etc.

"TV MANUFACTURERS' RECEIVER TROUBLE CURES" by Rider Staff. Published by John F. Rider Publisher, Inc., New York. 105 pages. Price \$1.80. Paper bound. Vol. 8.

In this eighth volume in the current

Philadelphia 6, Pa.

series, the television receivers made by RCA, Sentinel, Sparton, Stewart-War-Stromberg-Carlson, Sylvania, ner, Westinghouse, and Zenith are covered.

As with the earlier books, specific cures are cited as prepared by the service departments of the manufacturers concerned. A cumulative index covering the entire series is also in-

"HANDBOOK OF TUBES AND SEMI-CONDUCTORS" compiled by Tech-Rep Division of Philco. Published by Philco Corporation, Philadelphia. 207 pages. Price \$2.00. Paper with spiral binding.

This practical manual consists of six sections and covers servicing and maintenance aids, tube basing diagrams, a listing of conventional tubes and their ruggedized equivalents, tube characteristics charts, and specifications on semiconductor devices.

The inclusion of data on both semiconductors and tubes in a single manual is a boon to technicians and those who have occasion to consult such information sources regularly in the course of their work.

"BASIC ELECTRICITY" by Paul B. Zbar & Sid Schildkraut. Published by McGraw-Hill Book Company, Inc., New York, for the RETMA. 84 pages. Price \$1.75. Paper bound.

This is a laboratory manual for radio-television technicians as prepared by the teaching staff of the Radio-Electronics-Television Manufacturers Association. The book is divided into 27 "jobs" or laboratory experiments. Each of the experiment sheets lists the objective of the lesson, materials involved, and then the procedures the student is to follow. Each lesson carries its own test questions on the material covered.

This volume is one of a series being put out by RETMA in an effort to upgrade the profession and standardize training practices.

"HOW TO BECOME A RADIO AMA-TEUR" by ARRL Staff. Published by the American Radio Relay League, West Hartford, Conn. 109 pages plus catalogue section. Price 50 cents. Paper bound.

This fifteenth edition of one of the ARRL's most popular manuals has been completely rewritten and revised to make it even easier for the beginner to get started on his license.

Chapters on fundamentals, the construction of equipment, learning the code, getting a license, arranging a station, and getting on the air have been included. Over 100 photographs and illustrations add immeasurably to the value of this book.

"ELECTRONICS DATA HANDBOOK" edited by Nelson M. Cooke. Published by Allied Radio Corporation, Chicago. 64 pages. Price 35 cents. Paper bound.

This is an up-to-date version of the company's "Radio Data Handbook" which for years enjoyed deserved pop-

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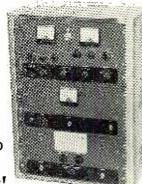
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"TELEVISION SERVICING COURSE" compiled by M. N. Beitman. Published by Supreme Publications, Highland Park, Ill. 192 pages. Price \$3.00. Paper bound.

This book has been prepared as a home-study text for the radio service man who wants to get into television. The emphasis in this book is on the practical aspects of servicing with all extraneous material ruthlessly eliminated. The text is divided into fourteen lessons with the student beginning his studies with an analysis of circuit faults by means of the CRT patterns.

Although the text moves along rapidly, the presentation is clear and easy to grasp. The lavish use of photographs, schematics, and line drawings helps convey the subject content to the student.

* *

"BASICS OF PHOTOTUBES AND PHOTOCELLS" by David Mark. Published by John F. Rider Publisher, Inc., New York. 125 pages. Price \$2.90. Paper bound.

Since these components are enjoying wide popularity in all types of electronic equipment, the subject matter is of interest to a wide segment of the industry.

This book covers the photoelectric effect, photoconductive cells, photo-voltaic cells and phototubes, photocurrent amplifiers, instrument and commercial applications. A bibliography is also appended. Photographs and schematics are an added fillip to the text material.

"HOW TO MAKE GOOD TAPE RECORDINGS" by C. J. LeBel. Published by *Audio Devices, Inc.*, 444 Madison Ave., New York 22, N.Y. 146 pages. Price \$1.50 paperbound. \$2.50 cloth.

A companion volume to the author's handbook on disc recording, this new work should find an even greater audience because of the more widespread popularity of the tape medium.

Written in simple and non-technical language, this is truly a "how-to" volume. The text covers the operation of a tape recorder, the various characteristics of such instruments, how to select a machine and tapes, making a microphone recording, tape editing, stereo recording, putting together a recording show, acoustics of the recording room, and a glossary of tape recording terms.

The chapters on microphone recording, tape editing, and the use of sound effects have been contributed

RADIO & TELEVISION NEWS

by guest experts, who are specialists in those particular fields.

Anyone having a tape recorder will find this a valuable reference and instruction manual.

"TRANSISTOR CIRCUIT HAND-BOOK" by Louis E. Garner, Jr. Published by Coyne Electrical School and distributed by Howard W. Sams & Co., Inc., Indianapolis. 410 pages. Price \$4.95.

If the requests received by this magazine are any criteria, there has long been a need for a textbook on transistor circuitry, written for the experimenter, hobbyist, and the "do-it-yourselfer."

Mr. Garner's writings are well known to the readers of this magazine. They are familiar with his lucid and easy-tounderstand exposition and have enjoyed building his unique and practical transistor circuits.

This book will be welcomed with open arms since there is something for everyone in this volume. Amplifiers, oscillators, special purpose circuits, audio equipment applications, r.f. uses, transistors in test instruments, control circuits, and gadgets.

Transistor characteristics and a discussion of special construction techniques complete the book.

"TV REPAIR QUESTIONS AND ANSWERS" by Sidney Platt. Published by John F. Rider Publisher, Inc., New York. 106 pages. Price \$2.10. Paper bound. (Vol. 5 Sound & L-V Circuits.)

This is the last of the handbooks in this series in which the technique of troubleshooting a television receiver has been reduced to "questions and answers."

Like the earlier parts of this series the material is written for the practicing technician so all extraneous theory and non-essential data has been reduced to a minimum. This volume covers the servicing of the sound sections and low-voltage sections of the TV receiver, thus rounding out the entire circuitry.

Those who have purchased and used the earlier volumes in this series will need no further inducement to invest in this final work.

"MANDL'S TELEVISION SERVICING" by Matthew Mandl. Published by The Macmillan Company, New York. 456 pages. Price \$6.50. Revised edition.

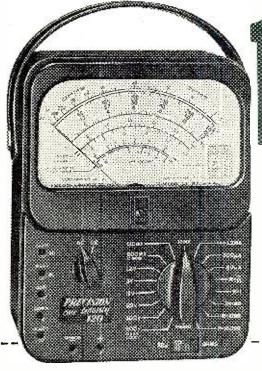
* *

Service technicians who found the earlier edition of this book helpful will welcome this up-to-date revision. The most useful features of the original text have been retained and, in addition, new and pertinent data supplied.

New material included in this edition covers fundamentals of monochrome and color TV, servicing of u.h.f. and v.h.f., operation of cascode tuners and automatically focused tubes, new circuits and tuners. The section on 600 ma. series filament strings has been enlarged; as has the "Master Index to Common Television Troubles. -30

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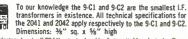
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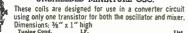
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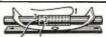
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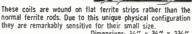
MINIATURE ANTENNA LOOPS



Similar to the #2000 described above but smaller in size

but ext	remely high	Q. Dimensions:	¾" x 3¾"	
Cat. No.	Q @ 790 KC	Freq. Range	Tuning Cond. Max. Capacity	List Price
2001	550	540-1650 KC	365 mmf.	\$2.50

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		Dimens	STORS: 4/4" X 4/4"	X 374"
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2004	500 450	540-1650 KC 540-1650 KC	365 mmf. 125 mmf.	\$2.50

VARIABLE CONDENSERS



Catalog #2110 is a miniature 2-gang variable condenser. The antenna section has a range of 10-130 mmf. Catalog #2112 is a standard size 2-gang condenser having a range of 10-365 mmf. for both sections. Shaft is ¼" dia, x 1½" long,

Cat. No.	Sections	Dimensions	List Price
2110	2	%"×1%"×1%"	\$2.50
2112	2	2%"×11%"×1%"	3.50

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Wide sweep, switchable, with crystal markers for aligning TV tuners, receivers. All 12 VHF channels. \$795.00 value.

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Output signal frequencies; TV RF picture and sound frequencies. Maximum picture and sound carrier output: 250 MV across 72 ohms. All 12 VHF channels. \$495.00 value. Special price. \$495.00 value. \$125.00

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Displays band-pass, single dial tuning from 50 KC to 950 MC. Dial indication of approximate output freq. \$495.00 value. \$125.00

Special price Above Equipment Used, in good condition

RCA VOLTOHMIST MODEL 195A

Used, good condition. \$65.00

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Mfg. by American Television, choice of 21", 24", 27". Completely wired, less tubes. Buy them for replacement parts: flyback worth \$15.00 Std. Coil cascode tuner worth \$20.00, condensers, resistors, controls, etc. \$19.95

resistors, controls, etc. \$19.95

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TV CHASSIS

Same as above except seleniums instead of power transformer and snap type tuner other than Std. Coil. Uses latest type series string tubes. Swell for experimenting on latest circuits.

Special price ea \$15.95

latest circuits.

Special price

Schematics are not available for these chassis: however, with some knowledge of TV they can be put into operation. These require tubes, yoke and alignment.

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Antenna Design

(Continued from page 44)

ohms, one full wavelength-90 ohms. four half wavelengths-130 ohms, and eight half wavelengths-154 ohms. The greatest dispersion from exact coincidence at 300 ohms is at the fourth harmonic, which is about one foot. This does not seem to materially affect operation if an antenna tuner is used to load the antenna.

Connection points which would be generally used are shown in Table 2. These are approximations, within three decimal places, which are close enough for practical purposes. In practice, the antenna is usually operated on frequencies that are above or below resonance so that any mismatch due to feeder point connection will either be improved or made worse, depending on its relation to the standing waves of the antenna.

Radiation Patterns

Any multiband antenna will have some change in radiation pattern between different bands. A horizontal half-wave wire will have the familiar figure-eight pattern with maximum radiation at right angles to the wire. Long-wire antennas will have beam characteristics with the maximum radiation approaching the plane of the wire as the order of harmonic goes up.

This characteristic is a detriment to those who want an all-band, alldirection antenna. If you plan to use your half-wave eighty-meter antenna on ten meters it behooves you to carefully plan the direction which the wire runs, because it will represent a long wire of eight half wavelengths. Table 3 shows the angle from the wire of the main radiation lobes for different wavelengths and disregarding feeder effect

The off-center-fed antenna should give the same results as a dipole of the same length oriented in the same direction. But to get these results it is necessary to get the same power into the antenna from the feedline. It will be much easier to do this if some sort of antenna tuner is used to compensate for unbalances and out-ofresonant conditions that are bound to occur in multiband operation. Fixed impedance matching devices were used by the author to match the coaxial cable output of a "Viking I" to the 300-ohm transmission line and it was found that satisfactory loading and feeder balance was obtained only on frequencies near the optimum values. -30-

Table 3. Angle from the wire of the main radiation lobes for different wavelengths and disregarding the effect of the feeder.

		Power in Major	
Wavelengths	90	1.0	
4	55 37	1.15 1.35	
8	27	2.1	

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with order or 25% deposit on C.O.D. orders. We will ship pre-paid with additional \$3.00 per unit ordered.

What's New in Radio

(Continued from page 128)

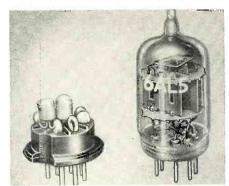
perages, and operating forces. Write the manufacturer direct for full details.

DUAL DIODES FOR TV

International Rectifier Corporation of El Segundo, Cal. has developed a small, compact plug-in selenium rectifier

that is designed to replace the 6AL5 tube in many TV sync discriminator circuits.

The Type 60-7788 subminiatures are said to offer certain advantages over tubes since they are much smaller in size, do not require any heater power, and offer



a high reliability factor, according to company tests. The unit consists of two of the company's 1U1 selenium diodes, mounted and soldered to a plug that fits a seven-pin miniature tube socket. Each diode is designed to deliver 20 volts d.c. at 1.5 ma. for an r.m.s. voltage input of 26 volts max. and may be operated through an ambient temperature range of -50 to 100 degrees C. The diodes are completely encapsulated to protect them from moisture, corrosive atmosphere, and fungus.

Bulletin SD-1B, available from the company at no charge, gives complete details.

TUBE REJUVENATOR

General Cement Mfg. Co., 400 S. Wyman St., Rockford, Ill., is now offering a new picture tube rejuvenator for the service trade.

Tradenamed "Zipt," the new unit is said to burn off picture tube shorts and thus lengthen the useful life of the tube. It takes only two minutes to do the job, repairing grid and cathode shorts without any need for chassis pulling. Electron emission is increased, with consequent restoration of the set's brightness control.

V.T.V.M. KIT

Heath Company of Benton Harbor, Mich., is marketing a new a.c. vacuum-tube voltmeter kit which is characterized by stability, broad frequency response, and sensitivity.

The Model AV-3 has been designed especially for audio measurements and low-level measurements in power supply filters, etc. It uses a cascode amplifier circuit with cathode-follower isolation between the input and the amplifier and between the output stage and the preceding stages.

Response of the AV-3 is essentially flat from 10 cps to 200 kc. and is usable for tests beyond these frequency limits. Increased damping in the meter circuit stabilizes the meter for low-frequency tests. Nylon insulating bushings at the input terminals reduce



leakage and permit the use of the company's 5-way binding post.

Complete information on this new kit unit is available on request to the company.

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AUDIO TUBES
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Many years of research and development have been spent in producing a range of

Audio Tubes to meet the

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reproduction in all respects. This is why MULLARD Audio Tubes are accepted in Great Britain as a standard by which others are judged, and why leading High Fidelity manufacturers in the United States also use MULLARD tubes in their equipment.



EL-34—Recognized as the finest high power output pentode, up to 100 watts in pushpull. Exceptionally linear, requires low input voltage.

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E1-84—9-pin miniature AF power pentode, combining high gain and line arity. Up to 18 watts in push-pull.



Specialized manufacture of Mullard High Fidelity tubes, particularly the EL-37 assures longer life and increased balanced power output. Equivalent to 6L6, 5881, KT66.



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*ECC81/12AT7 Mullard quality

Mullard quality double triodes with low hum, noise and microphonics.

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*EF-86—High gain pentode with low hum, noise, and microphonics. Especially designed for input stages of tape recorders and pre-amplifiers. Equivalent to the 2729 and the 5879.



*GZ34 — Indirectly heated full-wave rectifier with 5v, 1.9 amp heater, 250 ma output. Equivalent to 5U4G/GA without circuit changes with the advantage of lower tube voltage drop due to unipotential cathode.

MULLARD TUBES are available at leading audio distributors throughout the United States. For detailed technical data and application information, write to:

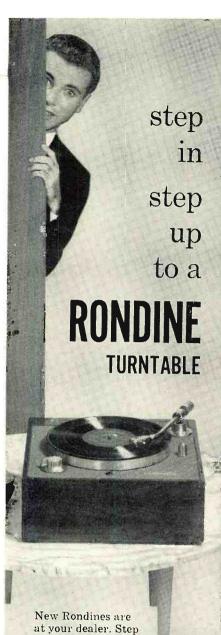
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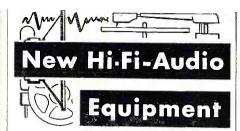
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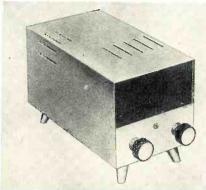
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STEREO TAPE PLAYBACK
David Bogen Co., Inc., P. O. Box 500, Paramus, N. J., recently introduced a simple stereophonic tape playback unit, the Model ST10.

Designed to provide stereo tape playback in hi-fi systems, the unit in-



corporates dual preamplifiers and a 10watt amplifier in a single compact cabinet. When used with a tape playback deck the output of a stereophonic tape head is fed into both preamplifiers of the ST10. One of these drives the built-in amplifier (channel 1) and the other drives an external amplifier (channel 2) from a cathode follower circuit.

2-STATION INTERCOM KIT

Allied Radio Corporation, 100 N. Western Ave., Chicago 80, Ill., has recently released a two-station intercom which is being supplied as a low-cost "do-it-yourself" kit.

The package consists of a master station, remote station, plus 50 feet of interconnecting cable. The master unit combines both the volume control and "on-off" switch in one knob. The remote station includes a "press-to-talk" switch. The remote switch can be left in the "talk" position to permit continuous monitoring by the master station. Because only the master station is connected to a power source, the remote station can be located at any convenient spot.

The kit comes complete with all tubes, 50 feet of cable, solder, wire, all parts, and easy-to-follow instructions. It operates from 110-120 volts a.c. or d.c. The cabinet is finished in antique white.

HEAD MAINTENANCE KIT

EMC Recordings Corporation, 806 E. Seventh St., St. Paul 6, Minn., has assembled a special head maintenance kit for use by owners of tape recorders.

The kit contains "Long Life Cleaner" and "Long Life Lubricant," each



A completely versatile probe microphone of excellent frequency range (60-13,500) that combines ruggedness, beauty and reliability.

Theater-Stage Sound Systems

Versatility: Can be used (1) on a floor stand; (2) on a desk stand; (3) quickly removed for use as a hand-held microphone; (4) furnished with lavalier cord for wearing around the neck; (5) impedance switch permits use as high or low impedance microphone. Accessory on-off switch requires no wiring.

Ruggedness: Built to withstand hard usage and extremes of temperature and humidity.

Beauty: Slender, convenient shape, finished in brushed satin chrome.

Reliability: High efficiency magnetic materials and circuits assure years of consistent high quality performance. Shure quality control techniques result in an exceptionally high degree of uniformity for microphone interchangeability and multiple use.

SLENDYNE Model "530"

This deluxe version of the Slendyne has a frequency range of 50-15,000 cps and is furnished with a Cannon XL-3-11 broadcast connector. Strikingly attractive non-reflecting black and gold anodized finish. LIST PRICE \$110.00



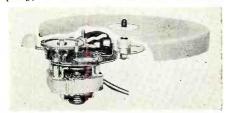
210 HARTREY AVENUE . EVANSTON, ILLINOIS

in the two-ounce size. Special brush applicators are supplied with the kit, as well as a complete head maintenance instruction manual.

The cleaner is designed to keep the tape recorder heads free from gradual accumulations of dirt, grease, dust, and magnetic oxide and binder. The lubricant, when applied to recorder heads, is said to prolong head life up to 200 per-cent. The thin layer of the special silicone lubricant effects the lowest possible friction between tape and head, thereby reducing wear.

COMPACT PHONOMOTOR

The Power Equipment Department of Federal Telephone and Radio Company, 35 Central Ave., East Newark,



N. J., is now offering a lightweight, compact, and rugged three-speed phonomotor equipped with either a metal or a plastic 8-inch turntable and dynamically balanced friction drive.

The new phonomotor is for use in portable and small-sized phonographs. It is available for either 95- or 117-volt operation at 60 cycles. The unit has a unique idler wheel whose outer rim is pierced with tiny holes. Affixed to this rim is a rubber tire whose upper and lower edges are vulcanized to each other through the holes in such a fashion that the tire does not slip on the wheel's rim. This nonslipping feature eliminates flat spots due to uneven tire wear and prevents splitting of the tire. The unit is shock mounted.

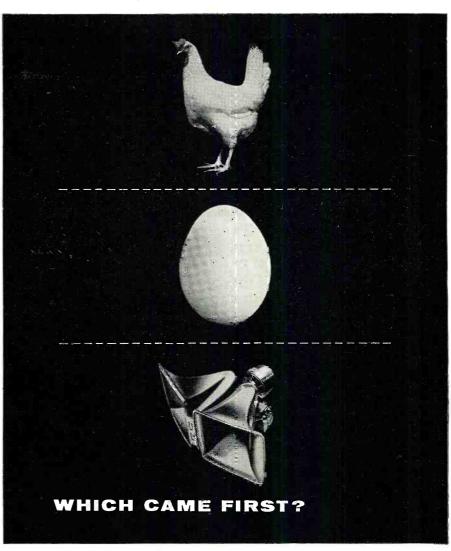
TRANSCRIPTION ARM

The Metzner Engineering Corporation, 1041 N. Sycamore Ave., Hollywood, Cal., has recently introduced a new transcription arm which features an exclusive "double-wrist-action"



head which is counterbalanced and has instant weight adjustment from 4 to 14 grams.

This special head provides minimum mass and insures perfect tracking and reduced record wear while the arm resonance is well outside the audible range, according to the company.



There's a lot of controversy about which came first, the chicken or the egg...but there's no question about the fact that University has been first with many of the most sensational developments in the loudspeaker field.

Merely being first is not enough. We, at University, subject every new product to the most rigorous laboratory tests, placing it on the market only when it has been brought to the peak of perfection. (Our customers have felt it was worth waiting for these "proven-firsts").

We've always enjoyed the challenge of finding new answers to old problems as well as exploring entirely *new* fields in audio engineering. Perhaps *that's* the reason University has become the leading manufacturer of specialized loudspeakers and components.

For the record-here are some of the "firsts" which we have engineered.

University was the FIRST to ...

Pioneer high power reflex trumpets . . , now the industry standard

Introduce radial projectors . . . making full coverage still more economical

Achieve the one-piece integrally cast tone arm, reflector and bell Cobreflex—permitting durable construction of intricate designs

Offer wide-range response, breakdown and weatherproof driver units . . . bringing the best in Sound to public address

Devise "rim-centered" diaphragm/voice coil and magnet assemblies...eliminating need for shims and guides, ensuring shock and vibration-proof reliability

Depart from obsolete, erratic-performing

multi-cellular and slit type diffraction projectors... by introducing the still superior "reciprocating flare" principle for uniform wide-angle dispersion of high frequencies

Make available high efficiency blast and submergence-proof speakers for p.a. and industrial applications . . . opening new markets to Sound installations

Combine driver and multi-match transformer in one unit . . . substantially increasing versatility of application and flexibility of operation

Conceive "progressive speaker expansion" (PSE)... together with specially designed components such as adjustable impedance voice coils, adjustable response woofers, adjustable crossover networks

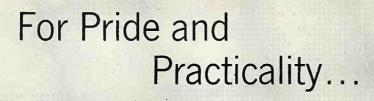
and others too numerous to mention

LISTEN

University sounds better



UNIVERSITY LOUDSPEAKERS INC., 80 SOUTH KENSICO AVENUE, WHITE PLAINS, N. Y.

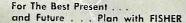


SPECIFY

THE FISHE

SUALLY . . . when a music lover purchases a FISHER high fidelity product, he does so for pride, for quality, for personal satisfaction. On the other hand, it is gratifying to know that—if he preferred—he could have chosen FISHER, the leader in the field, purely on the basis of economy. For it has been proven time and again . . . that FISHER . . . with the best in technological advancement and beauty of style, is most practical to own.







THE FISHER Custom FM Tuner · FM-40

A NEW FM Tuner - traditionally FISHER in quality, performance and design. Only \$99.50...the FM-40 represents the greatest value since the beginning of high fidelity . . . combining FISHER'S progressive engineering and exacting quality control at their superlative best! Center-of-channel meter for micro. accurate tuning. Sensitivity is 3 micro-volts for 20 db of quieting. Brushed-brass front panel. Only 12 3/4" x 7 1/4" x 4" high.

Less Cabinet, \$99.50

THE FISHER

Master Control-Amplifier · CA-40

Features the most advanced audio control with exclusive FISHER ToneScope - you actually see all of the control settings! Full, clean 25 watts with less than 1% distortion! Direct tape-head playback and microphone preamplifier. Cathode follower, tape recorder output. Six equalization settings. Outputs for 4, 8 and 16 ohms. Ten tubes. Only $12\frac{3}{4}$ " wide, $10\frac{3}{6}$ " deep, 5" high. Frequency Response within 0.5 db, 10 to 90,000 cycles!

Write For Descriptive Brochure

FISHER RADIO CORPORATION 21-23 44th DRIVE . LONG ISLAND CITY 1, N. Y.

Finished in black and satin chrome, the "Starlight" arm mounts with a single hole and swivels on precision ball bearings. The arm lifts to a vertical position for easy cartridge replacement, is 12 inches long, and plays all record sizes up to and including 16 inch.

Full details on the arm and the company's companion turntable are available from Dept. 17 of the firm.

DYNAMIC VOLUME EXPANDER

Vidaire Electronics Mfg. Corp. of Lynbrook, N. Y., has added a dynamic volume expander, Model VE-10, to its line of hi-fi accessories.

The unit is designed to restore the original concert hall volume range



from whispered soft passages to powerful swells. Built-in indicators glow brightly when musical crescendos occur.

The unit may also be used as a volume compressor for home recording to prevent overloading or as a constant volume device to keep a constant sound output from the amplifier. The range of volume expansion and compression is up to 40 db.

30-WATT AMPLIFIER

Hermon Hosmer Scott, Inc., 385

Putnam Ave., Cambridge 39, Mass., has recently added a new "Dynaural" amplifier to its audio line.

The Type 210-E has a 30-watt power output on music; provision for two magnetic phono inputs; continuously variable damping control; and an improved dynamic noise suppressor with provision for rumble suppression only, scratch suppression only, or both. The noise suppressor operates without audible loss of music.

Other features of the new amplifier include an input selector switch for three high-level inputs, two low-level phono inputs, and one high-level phono input; an 8-position record compen-

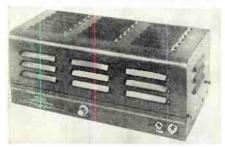


sator; frequency response flat from 19 to 35,000 cps with cut-off beyond to eliminate ultrasonic oscillation, and a special dynamic rumble suppressor that can be switched out of the circuit.

Over-all size is 15¼" x 4¾" x 12½". The unit is supplied with a simple panel for custom mounting. A durable leather-finish plastic accessory case is available for table mounting if de-

MULTIPLEX RECEIVER

Browning Laboratories, Inc., 750 Main St., Winchester, Mass., has de-



veloped a new multiplex receiver especially for background music and storecasting applications.

The main receiver portion is identical to the company's simplex units with the change from simplex to multiplex on any subcarrier frequency accomplished in the field by the substitution of the pre-tuned, plug-in multiplex adapter for the simplex unit.

The company will supply full details on these receivers upon request.

COMPACT SPEAKER ENCLOSURE National Company, Malden, Mass., has recently introduced a low-cost space-saving speaker enclosure system which is being marketed as the "Synfonette.'

Measuring a mere 8" x 14" x 9", the enclosure provides essentially flat fre-



quency response from 90 to 12,000 cps. The units are designed to be used singly in a horizontal or vertical position, wall or ceiling mounted, or may be used in pairs to provide added realism to sound via dispersion.

The units are currently available in blonde, walnut, mahogany, or ebony finishes.

NEW RCA COMPONENTS

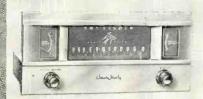
The Theatre and Sound Products Dept. of Radio Corporation of America, Camder, N. J., has released two new components for home-assembled music systems.

The first item is a 12-inch dual loudspeaker (Type SL-123) with a frequency response of 40 to 18,000 cps. The second unit is a 10-watt amplifier (SVP-10-A) which incorporates a preamplifier and input selector.

The new components are electrically



HE FISHER



WHERE QUALITY COUNTS you will most often find THE FISHER components.

BECAUSE in the quality field more people buy FISHER than any other brand.



For The Best Present . . and Future . . . Plan with FISHER



THE FISHER

FM Tuner · Model FM-90

■ The Finest FM Tuner Made! The FM-90 definitely sets the standards for the tuner of tomorrow . . . and outperforms any existing FM tuner! ■ Micro-accurate tuning combined with extreme sensitivity and flexibility. ■ Two meters indicate signal strength and center-of-channel. ■ Extra-wide 1 megacycle bandwidth ■ Full limiting on signals as low as 1 microvolt. ■ 72 and 300 ohm antenna inputs. ▼ Interchannel muting control. ■ Completely shielded and shock mounted. ■ Outputs for Amplifier, tape and Multiplex. ■ Cathade follower permits leads up to 200 feet. ■ Less Cabinet, \$149.50 Less Cabinet, \$149.50

THE FISHER

Master Audio Control · Model 80-C

■ Containing features found only in professional studio consoles — the Master Audio Control matches any power amplifier. ■ Provides professional phono and tape-head equalization. ■ Full mixing and fading facilities for from twa to five channels. ■ Seven Inputs. ■ Two cathade follower autputs. ■ Preamplification and equalization directly from tope playback head. ■ DC filaments for non-measurable hum level. ■ Self-powered.

Less Cabinet, \$99.50

THE FISHER

90 Watt Audio Amplifier · Model 90-A

■ A full 90 waits of gentle power . . . capable of reproduction characteristic only in THE F(SHER. * With less than -½% distortion at full output, the 90-A performs with breathtaking, life-like clarity. * Two power supplies. * Exclusive FISHER Performance Monitar for exacting operating canditions. * Response within 0.1 db from 20 ta 20,000 cycles. * Power-take-off for unpowered ouxiliary equipment. * Exclusive Z-Matic. * Output for 8 and 16 ohm speakers. * Damping factor in excess of 16. \$229.50

Write For Descriptive Brochure

FISHER RADIO CORPORATION 21-23 44th DRIVE . LONG ISLAND CITY 1, N. Y.



* Automatic Intermix—

7. 10 and 12-inch records may be played automatically, in any order and at all speeds-without pre-setting.



For other features and new popular price, see your hi-fi dealer or write Dept. QM-4

ROCKBAR CORPORATION 650 Halstead Avenue, Mamaroneck, N. Y.

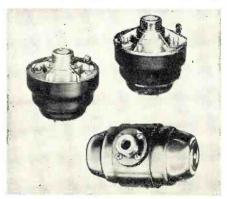


matched and come complete with fittings for direct plug-in use with associated RCA hi-fi sound units. The units are now available from the company's sound products and customized high fidelity distributors.

HYPEX DRIVER UNITS

Jensen Manufacturing Company, 6601 S. Laramie Ave., Chicago 38, Ill., is now offering a new series of "Hypex" driver units which are guaranteed for life.

The new driver units are designed for commercial, industrial, institutional, and p.a. applications. Frequency



range is based on achieving substantially high conversion efficiency, higher power ratings, and improved reliabil-

The D-30 is rated at 30 watts speech and music, the D-40 is a 40watt unit, while the DD-100 is a super-power unit which will handle 100 watts. Write the company direct for full specifications on any or all of the units in the line.

"MUSIC-MONITOR"
David Bogen Co., Inc., 29 Ninth Avenue, New York 14, N. Y., is now offering a combination radio-intercom system which is being marketed as the "Music-Monitor."

This complete built-in system provides radio broadcast reception in six



rooms plus two-way voice communication between the master station and five remote stations.

The system is so designed that a housewife can answer the doorbell from the kitchen station, monitor the nursery, and talk from room-to-room without added steps. The Model RI6 is housed in a modern inconspicuous cabinet whose design blends with any decor.

AUDIO CATALOGUES

MILLS DATA SHEET

Mills Electro-Dynamics Corporation, 4133 Le Jeune Road, Coral Gables, Fla., is offering free copies of its new

RADIO & TELEVISION NEWS

6-page brochure covering a line of hi-fi

The booklet pictures and describes five different models with an accompanying data sheet providing the specifications, prices, and available enclosures. Write the manufacturer direct for full details and a copy.

LANSING LEAFLET

James B. Lansing Sound, Inc., 2439 Fletcher Drive, Los Angeles 39, Cal., has issued a six-page, catalogue-type leaflet which provides descriptive and illustrative material on its line of enclosures, speakers, speaker systems, accessories, and allied items.

Products include dividing networks, several styles and models of enclosures, extended-range speakers, and high and low drivers. The leaflet is available without charge on request.

E-V SPEAKER CATALOGUE

Electro-Voice, Inc., of Buchanan, Mich., is now offering copies of its catalogue 118 for 25 cents each.

Entitled "How to Choose High-Fidelity Speakers and Components," the publication contains detailed information on building-block kits used to improve an existing hi-fi speaker system. The new catalogue supplements the firm's earlier publication, No. 117, "Guide to High-Fidelity Loudspeaker Systems." The two catalogues together provide a complete guide to the selection of speaker systems.

Orders for the catalogues should be sent, along with payment, direct to the manufacturer.

AUDIO-VISUAL CATALOGUE

Audio-Master Corp., 17 E. 45th St., New York, N. Y., is offering, without charge, a new 1957 audio-visual equipment catalogue for various classroom applications.

Printed in two colors, the booklet illustrates and details the company's line. Included in the special designs is a low-priced transcription unit for the playback of records up to 16 inches, an inexpensive record player for kindergarten and classroom use, hi-fi record players for music appreciation classes, as well as hi-fi transcription machines combined with p.a. systems.

ATLAS SOUND BULLETIN

Atlas Sound Corp., 1451 39th St., Brooklyn 18, N. Y., has published a single-page data sheet covering two new mike stands and a mike footswitch.

Bulletin 756 provides complete details on the firm's Model SB-1, NS-1, and FS-1 units. The booklet is free on request.

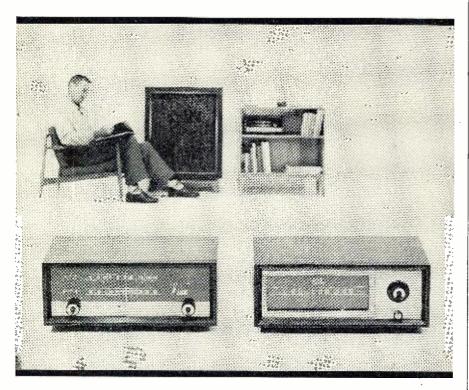
SPEAKER SYSTEM PLANS

Jensen Manufacturing Company, 6601 S. Laramie Ave., Chicago 38, Ill., is offering a new manual of construction plans which is available in two formats and under two manual numbers, 1060 and A-1060.

The contents of both publications are identical and include the selection

Give the BEST for Christmas Which pickup is best? The ESL, reports The Audio League. After impartially testing nineteen leading cartridges, this authoritative report concludes: "... The ESL Professional and Concert Series carrridges are by far the finest phonograph reproducing instruments we have heard." "In A-B comparisons with its closest competitors, even persons who had never previously been exposed to high fidelity reproduction were struck by the superior definition of the ESL." "For sheer naturalness and undistorted ease, the ESL has no peer."* Give the best for Christmas: give the ESL, Your own ears and records deserve this superlative electrodynamic cartridge, too. Join the professionals switch to ESL. Free information upon request. FOR LISTENING AT ITS BEST Electro-Sonic Laboratories. Inc. Dept. R • 35-54 Thirty-sixth Street • Long Island City 6, N.Y. *Authorized quotation No. 54. Please consult The Audio League Report, Vol. 1, No. 6-7 (March-April 1955) for the complete technical and subjective report. Additional information in Vol. 1. Nos. 10 & 12. Subscription: 12 issues \$4. from P. O. Box 262, Mt. Vernon, N. Y.

Altec Lansing Tuners



...Entertainment Unlimited!

With such high quality entertainment available on radio, it pays to select a tuner that will realize the full potential of modern broadcast quality. Altec tuners give this outstanding performance because they are designed and built by the skilled engineers and technicians who produce equipment for these same broadcast stations.

Every Altec Lansing tuner is backed by Altec's exclusive Performance Guarantee, your assurance that the tuner you buy will exceed its published specifications.

Ask to hear tested and guaranteed Altec Lansing tuners at your dealer's, or write Dept. 12-TM.

306A AM-FM BROADCAST TUNER

fm

maximum sensitivity: quieting sensitivity: frequency response: distortion:

1.1 microvolt 2.5 microvolts for 20 db*, 4.0 microvolts for 30 db* \pm 0.5 db, 20-20,000 cps

Less than 0.4% at 1 volt output

am

maximum sensitivity: 3 microvolts

*standard 300 ohm antenna

price less cabinet \$183.00; blond or mahogany cabinet \$15.00

305A AM BROADCAST TUNER

output: 1 volt cathode follower price less cabinet, \$93.00; blond or mahogany cabinet \$15.00





ALTEC FIDELITY IS HIGHEST FIDELITY

9356 Santa Monica Blvd., Beverly Hills, Calif. 161 Sixth Avenue, New York 13, N. Y.

of a kit, hints on speaker enclosure construction, and details for building the company's "Imperial," "Bass Ultraflex" (for 8, 12, and 15 inch speakers), "Tri-Plex," "Concerto-15," "Concerto-12," and "Duette" enclosures. Details on dressing up and finishing the cabinets are also included.

Complete working details and plans are an integral part of the presentation. Each of these booklets sells for 50 cents a copy. Either may be ordered from the manufacturer direct.

"IRISH" DECAL

ORRadio Industries, Inc., Shamrock Circle, Opelika, Ala., is offering an attractive identification decal to its recording tape dealers.

The two-color shamrock decal is designed to be used on store windows or on show cases where the recording tape is displayed. The copy reads "In stock—'Irish' brand recording tape." The company's familiar leprechaun is also included on the decal.



NOVEMBER 28-29

Conference on Human Engineering, Hotel New Yorker, New York City. Sponsored by Manhattan College and Third International Automation Exposition in conjunction with International Automation Exposition at New York Trade Show Building. Defails on Conference available from Richard Rimbach Associates, Room 359, 525 Lexington Ave., New York 17, N. Y. Registration limited to 200.

DECEMBER 5-7

Second IRE Instrumentation Conference, Biltmore Hotel, Atlanta, Georgia. Sponsored by Professional Group on Instrumentation and the Atlanta Section of IRE. Information available from M. David Prince, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Ga.

DECEMBER 6-8

Electronics Fair of Long Island, Exhibition Hall of New York State University in Farmingdale, Long Island. Sponsored by the Radio and Television Guild of Long Island. For information write to the Fair Committee, RTG of Long Island, Box 87, Bethpage, N. Y.

DECEMBER 10-12

1956 Eastern Joint Computer Conference, Hotel New Yorker, New York City. Sponsored by the IRE, AIEE, and Association for Computing Machinery. For registration forms, write 1956 Eastern Joint Computer Conference, Box 1599, Grand Central Station, New York 17, N. Y.

DECEMBER 19-20

RETMA Symposium on Applied Reliability, Bovard Hall, University of Southern California, Los Angeles, Cal. Sponsored by Radio-Electronics-Television-Manufacturers Association. For advanced registration, write RETMA Engineering Office, Room 650, 11 W. 42nd Street, New York 36, N. Y.

Ceramic Cartridge Amp.

(Continued from page 59)

tone control circuit, it can be loaded with a relatively low value of volume control, and it has inherently low distortion.

After the cathode follower come the tone controls. These are conventional type controls with one exception: They cause only one-half as much loss in gain. This is achieved at the expense of about $2\frac{1}{2}$ db of boost on bass and treble, by making the divider ratio of R_7 and R_9 five to one instead of ten to one. The resistors R_{10} and R_{11} are required to make the flat response condition coincident with the mid-position of the controls. This is necessary since the controls themselves have a standard log taper.

The power amplifier section consists of a voltage amplifier stage followed by a floating paraphase inverter feeding two 6V6 tubes. The 6V6 tubes are run as normal beam tetrodes since the choice of load impedance as discussed before enabled the full 12 watts to be obtained with distortion as low as that obtained with screen loading.

The entire power amplifier section is conservatively designed. The output transformer alone weighs four pounds and uses grain-oriented steel. The amplifier will deliver the full 12 watts at any frequency from 20 to 20,000 cycles. As further evidence of the conservative design it is of interest to note that by merely substituting 5881 tubes for the 6V6GT tubes and a 5Z4 for the 5Y3GT the HFA-100 is changed to a 21-watt amplifier having only 0.2% distortion.

Although special custom-made transformers were used in the production models of the HFA-100, individual constructors have substituted commercially available units in home-built versions with excellent results. Both the *UTC* LS-63 (6000-ohm connection) and the *Acro* TO-270 have been used in the output, while the *Stancor* PC-3409 has been used for the power transformer.

ADMIRAL 20A2 HINT

By JAMES A. MCROBERTS

HUM bars appearing on the picture but not on the raster and in the sound as a modulation hum may be due to a defective audio tube in the Admiral 20A2 television receiver.

The audio output tube in this chassis supplies the sound second i.f. and some of the picture i.f. tubes with "B+" in the form of a stacked "B+" arrangement. The heater-to-cathode leakage in the audio output (V_{201} , a 6AS5 in the company's service data on this set) will consequently impose a ripple on the 'B+" supplied to the i.f. tubes via the cathode of the audio output tube.

The remedy is to change the tube and the justification for pointing out this obvious solution is to remind technicians that the audio output is part of the "B+" supply to both sound and picture i.f.'s.

December, 1956



Control point of your home music system

It can truly be said that the "engineer" or control point of your home music system is the amplifier. And only with an ALTEC amplifier do you get the professional quality and superior design that provide years of flawless, trouble-free performance. Every ALTEC amplifier is built to the same high standards for which ALTEC loudspeakers and other ALTEC high fidelity components are world-famous.

Altec invites comparison. Investigation will prove to you that the Altec 440B preamplifier and the Altec 340A amplifier represent the highest development of electronic engineering. They are exceptional in performance, operation and their amazing flexibility of control. Through the use of most expensive professional components it is possible to provide simple circuitry that will continue to meet Altec's stringent specifications for years.

For further information regarding the finest in home music systems consult your Altec dealer or write Dept. 12TM.

340A POWER AMPLIFIER. 35 watts continuous, 30 to 22,000 cycles with less than 0.5% distortion. Frequency response within 1 db. 5-100,000 cps., Intermodulation less than 1.0% at 35 watts, 40 cps and 2 KC, 4:1 ratio...\$159.00

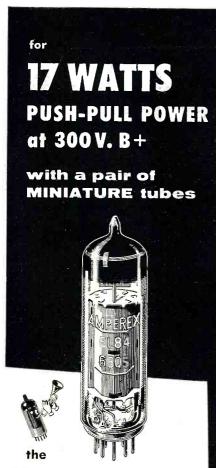
440B CONTROL PREAMPLIFIER. Maximum flexibility with 12 controls, 25 record crossover combinations • five inputs: three high level, two low level • noise level at maximum volume better than 95 db. below 1.5 volts output • 1000 ohms cathode follower matched to 340A power amplifier... Price, less cabinet, \$135.00. Blond or mahogany hardwood cabinet, \$15.00.

These specifications—like the specifications for all Altec Lansing products—are minimum engineering requirements. This is your assurance that Altec products will actually meet or exceed their published specifications.



ALTEC FIDELITY IS HIGHEST FIDELITY

9356 Santa Monica Blvd., Beverly Hills, Calif. 161 Sixth Avenue, New York 13, N. Y.



Amperex EL84/6BQ5

LOW-DISTORTION,
HIGH-GAIN POWER PENTODE

- True pentode characteristics for low distortion and high peak power.
- High gain and sensitivity resulting in reduced driver stage distortion.
- 12 watts plate dissipation in a miniature envelope.
- At 300 volts, capable of 17 watts at 4% distortion (without feedback) in Class AB push-pull pairs.
- 5.7 watts output at 10% harmonic distortion (without feedback) as a single-ended output stage.

OTHER Amperex TUBES FOR HIGH-FIDELITY AUDIO APPLICATIONS:

6CA7/EL34 High-power pentode; 100 W PP
EF86/6267 Low-noise high-μ pentode
ECC81/12AT7 Low-noise medium-μ dual triode
ECC82/12AU7 Low-noise low-μ dual triode
ECC83/12AX7 Low-noise high-μ dual triode
GZ34 Cathode-type rectifier; 250 ma.
EZ80/6V4 9-pin rectifier; cathode; 90 ma.
EZ81/6CA4 9-pin rectifier; cathode; 150 ma.

At All Leading Electronic Parts Distributors

Amperex
ELECTRONIC CORP.
230 Duffy Ave., Hicksville, Long Island, N.Y.

Listening Tests

(Continued from page 41)

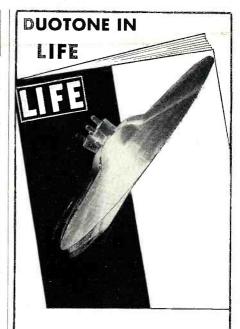
smooth at low volume and also maintain the same clarity without distortion at high volume.

With these listening tests you can usually narrow the choice of speaker systems down to about three or four in your budget and size ranges. If you wish to listen further, the author suggests tests with vocal, piano, organ, and "noise" records.

The voice test is based on the fact that we are all very familiar with the sound of the human voice in normal speech. If a speaker system can really sound like a live person's speech, it is very clean, smooth in response, and free from resonances. Try to pick up an FM station with a local live announcer. If you cannot do that, there are some wonderfully recorded speaking voices on the second side of the Angel recording of "The Merry Widow" (Angel 3501B). Adjust the volume so that it approximates the loudness of normal speech in the demonstration room. As you switch from one speaker to another, note which sounds most realistic. Listen for any trace of sound resembling speaking with the head in a box. The "box effect" is due to resonances. Differences in speaker systems on this test are often quite marked. A good, rugged enclosure is vital in obtaining a good rating on this test.

Now for the piano test. The piano is a very difficult instrument for a speaker to reproduce because piano notes are made up of a very powerful momentary ping followed by a complex harmonic resonance. In other words, the speaker cone must perform a powerful jump followed by a complicated pattern of vibration. The big jump must stop the instant the amplifier commands and the quiet tones must not be affected by the previous excursion of the cone. This is related to the damping characteristic and transient performance of the speaker. Two of the author's favorite piano test records are the London "Concerto in D" by Ravel (LL797) and the Westminster Rimsky-Korsakov "Piano Concerto" (WL 5068). As you compare speakers on piano music, listen for the sharp attack of the notes. The speaker with best transient response will give the best impression of the piano being in the room with the listener. Note the fullness and richness of the bass and the mid-range notes and the ring of the natural resonances of the piano. Try this test at a relatively high volume level.

The organ test is a measure of many qualities of a speaker system related to its ability to reproduce music. Power handling capacity and wide frequency response are important in good organ reproduction. A rather critical test of a speaker system is its capability in recreating the differences in tone color of different organs. On



THE BIG NEWS IS DFF—"Duotone's Fidelity Focus" goes into "Life" and tells millions about the most sensational needle ever designed. DFF brings recorded music out of the shadows, into clear focus. Life readers will make the demand for DFF big. Send for free DFF promotional material today. Especially Duotone's home Needle-Tester. Don't delay. Demand will be great. Get free DFF kit and test cards, today.

THE DUOTONE COMPANY, Keyport, N. J.

Now! RCA Victor Hi-Fi "Mylar" tape—superstrength, extra-long play!



Sells on length alone! Not 1200', but 1800' on a 7-in. reel! Extra-thin—superstrong! Also available: new RCA Victor acetate tape with full frequency performance—to be sold at a special low price! And new RCA Victor acetate tape with full High Fidelity response—same tape used for professional recordings. Sell RCA Victor—and you'll sell more tape!

*"Mylar" is a registered Dupont trademark for its polyester film.



CAMDEN 8, NEW JERSEY

RADIO & TELEVISION NEWS

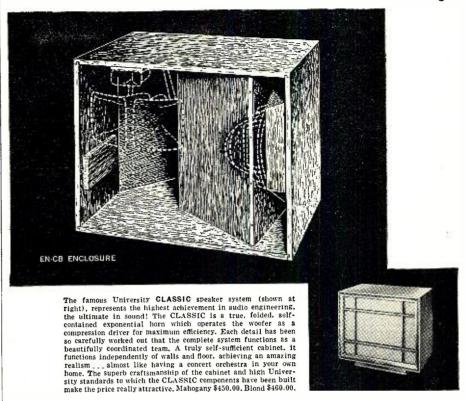
some speaker systems all organ records sound as if the same organ was used; but on other systems fine distinctions of tone are clearly revealed. This is determined by the speaker's ability to reproduce sound signals without imparting to the sound resonances and tone color of its own. For the organ test, the author recommends Columbia's Bach "Toccata in D Minor" played by E. Power Biggs (ML5032). This record is remarkable in that the same selection is played on a number of different organs, allowing just the type of comparison desired for this test. Two other excellent organ test records are the "King of the Instruments" by the Aeolian Skinner Organ Co. and an "Organ Demonstration" record by Turntable Records (HF-2). Listen for clear, clean organ tone. Note which speaker allows you to clearly recognize the difference in tone between the various organs. Listen for clear separation of the pipe tones. On a sustained chord, see how many different pipes you can count as distinct tones. Listen to the bass tones. On low bass organ notes you may notice as you switch back and forth between speakers that one speaker sounds almost as if it were reproducing the tone an octave lower. This is evidence that the lower tone speaker is one which produces less harmonic distortion on the bass frequencies. On a passage with a lot of bass pedal notes, listen for any tendency to overemphasize a single tone. This can indicate a strongly resonant bass frequency. Also listen for any blurring or lack of musical character on bass notes. The better the definition and the separation of the tones, the better the speaker will satisfy your ear on long periods of listening.

There are a couple of "noise" listening tests which are recommended for real hi-fi fans. On side B of the Audio-phile record "Echoes of the Storm" (AP-20) there are some amazing recordings of some common sounds. One is the sound of water dripping and running into a bucket. Since we are all familiar with this kind of sound, it is a simple matter to close one's eyes and decide which speaker gives the best illusion of the real thing. The record also lets you try this on the sound of hammering nails and sawing wood. This noise test is quite sensitive and will often reveal differences in sound from two speakers which sound nearly identical on music for short listening periods. In order to reproduce these noises with a natural realistic sound, a speaker must have a wide frequency response with plenty of power handling ability at both low and high frequencies. It must also be free from resonances and be well damped, or it will sound like it is coming from a speaker in a barrel.

Your ear may be quite numb by this time but you will know more about speaker systems than you will learn in a year of reading specification sheets.

Remember the sound is the thing and the ear is the judge! —\footnote{30}

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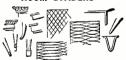
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FM Alignment Made Easy

By HERBERT M. HONIG

ALIGNMENT of FM receiver stages, as found in television sets and FM tuners, is frequently shunned by the service technician and the audio hobbyist because conventional procedures are complicated and require an elaborate set-up of test equipment. The author uses a very simple procedure which requires nothing more than an ordinary d.c. voltmeter (any multi-tester will do) and a few minutes to peak the tuning adjustments. This procedure has been applied to several different types of tuners and TV sets by the author and others, and has always produced a marked improvement in performance. In addition to increasing sensitivity it also eliminates distortion caused by the non-symmetrical response curve of a misaligned re-ceiver. The technique has only been tried on sets with discriminators; it is not applicable to sets with ratio de-

Because the procedure is so simple, it can be followed whenever a tube is replaced. This will insure optimum set performance at all times. Although the technique cannot yield the precise alignment symmetry that a correctly executed conventional procedure will, it has been found that many sets, aligned by conventional techniques with alignment gear which is not quite accurate, were improved when aligned by the method to be described.

Note, when following this procedure, that most i.f. and discriminator transformers have the primary adjustment on top and the secondary adjustment on the bottom. Others have both adjustments on top, with the primary on the input side and the secondary on the output side.

Step 1: With the set connected for normal operation, but with the underchassis components accessible, connect the voltmeter across the first limiter grid leak resistor. (This resistor is usually connected between one terminal of the secondary winding of the last i.f. transformer and ground. It is bypassed by a small mica or ceramic capacitor.) Connect the meter to read a negative voltage, that is with the red (positive) lead grounded. If such connection causes the set to become regenerative, connect a .01 µfd. capacitor across the limiter grid leak resistor.

Step 2: If the set has a.f.c., disable the a.f.c. as follows: If an a.f.c. defeat switch is provided use it for disabling. If not, locate the d.c. connection from the discriminator to the a.f.c. tube (which is usually fed through one or two series resistors that form part of an r.f. filter) and temporarily short the a.f.c. lihe to ground. Do this at a point in the a.f.c. path which is isolated from the discriminator by a series resistor.

Step 3: Tune the dial to several stations and note which station causes

the smallest voltage indication on the meter. Tune in that weak station and set the dial at the point which produces the highest meter reading, even though that point may produce a distorted signal.

Step 4: Starting with the primary i.f. transformer adjustment, and working through to the secondary of the last i.f. (limiter) transformer, tune all adjustments for a maximum meter reading. Repeat the tuning adjustments until no further increase in meter reading can be obtained. (If it is found that the adjustments tune broadly because of high signal strength, disconnect the regular antenna and use a short length of wire at one of the antenna terminals, or use the regular antenna with the antenna terminals shorted together, to reduce signal strength.)

Step 5: The best procedure for discriminator alignment depends upon the set. Accordingly, if the set has a.f.c. use Step 6. If the set has no a.f.c., but uses the type of tuning eye with a double rectangular presentation, use Step 7. For other sets, use Step 8.

Step 6: Tune the discriminator secondary until minimum distortion is heard. Restore normal a.f.c. If the meter reading changes, retune the discriminator secondary for maximum meter reading, disable the a.f.c., and note that the meter reading stays constant. Repeat this procedure until a constant meter reading is obtained as a.f.c. is restored and disabled. Restore a.f.c. and tune the discriminator primary for best a.f.c. action. Repeat the entire step until a constant meter reading, with a.f.c. turned on and off, and good a.f.c. action are both obtained.

Step 7: With the set tuned for a maximum meter reading, tune the discriminator secondary and primary adjustments until both rectangles on the tuning eye have the same height. Check to see that an undistorted output is obtained by the method described in Step 8. If this procedure fails to yield an undistorted output, use the entire procedure of Step 8.

use the entire procedure of Step 8.

Step 8: With the set tuned for a maximum meter reading, tune the discriminator secondary and primary until minimum distortion is heard. Observe the meter as the dial is tuned to one side of the point where the meter peaks and listen for the point where distortion is just heard. Record the meter reading. Tune to the other side of the meter peak until comparable distortion is heard. If the meter reading at this point is not very nearly the same as that previously recorded, the discriminator is not tuned symmetrically and audio distortion will result. Retune the discriminator secondary as required to make the two meter readings the same.

Tape Recorder Amplifier (Continued from page 74)

purpose. This simple oscillator will produce better than 40 db erasure at normal tape saturation. The bias voltage is a factor in the response and distortion of the recorded tape and should be rather carefully determined. This can be varied by choice of the value of C_{15} . The voltage should be at least that which produces maximum level when a 1 kc. signal is recorded on the tape. Professional machines obtain less distortion by using higher bias levels, as great as twice this value. For the usual adjustment, the erase voltage will be approximately 180 volts at 35-50 kc. oscillator frequency, with the recording bias approximately 100 volts. The final section of the function switch, S_{1E} , applies plate voltage to the oscillator tube when needed for recording.

The third use for the amplifier is as a two-channel mixer for public address applications. This feature was included without extra circuitry by making the function switch a threeposition affair. For mixer uses, the mid-position of the switch acts to disable the erase oscillator and record amplifier output, while activating all input connections. Output is taken from the monitor amplifier. The headphone monitor position and level meter are both useful for this application and a signal of over one volt can be furnished to a p.a. power amplifier. The low impedance output of the cathode follower permits separating the mixer and the power amplifier by many feet without frequency attenua-

Construction

The developmental amplifier, as constructed, is shown in the photographs. In this case, an aluminum chassis, $11 \times 7 \times 2$ inches in size with front panel measuring 13 x 7 inches, proved to be of adequate size. All operating controls were brought out to the panel, with emphasis on a reasonably symmetrical layout. Microphone inputs are also available at the front panel, fitted with Amphenol series 75 shorting type connectors. The shorting connectors serve to ground the unused inputs to prevent hum pickup or open grid howls.

The a.c. power switches for the amplifier and the tape transport motor are arranged together with the pilot light and monitor phone jack at the upper left of the panel. The level indicating meter is at the center, with the function switch, equalization switch, and microphone input connectors filling the space to the right on the front panel.

The gain controls are evenly spaced along the lower section of the panel. From right to left, the controls are: mixer gain for channel one, mixer gain for channel two, monitor output gain control, and finally, a playback rolloff control. This latter control is used

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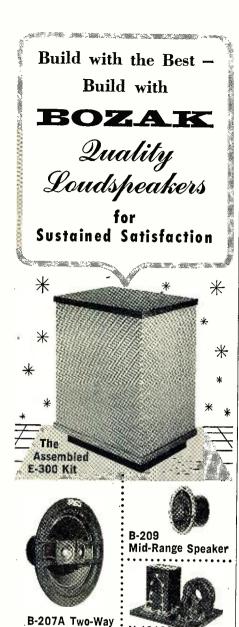
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to reduce high-frequency response when playing noisy tapes, if desired. It consists of a one-megohm tone control, with switch, and a .01 µfd. capacitor in series, connected between grid and ground of the 12AX7 cathode follower stage. The switch is included to remove the control completely from the circuit when not in use. However, the roll-off was found unnecessary in the great majority of cases; consequently, it is not included in the circuit diagram.

Chassis layout is indicated in the photographs. The two 5879 preamplifiers were originally shock mounted, but this proved to be an unnecessary refinement as the tubes are particularly non-microphonic. Tube layout was such that the playback circuit is in line, behind the panel with the record circuit placed at a right angle behind the meter. The power supply occupies the left rear corner and the various electrolytic capacitors fill the remaining chassis space.

This layout proved satisfactory from a wiring standpoint. However, a few precautions might be pointed out to assist those persons who may wish to duplicate the unit. A ground bus is used, with all grounded components going to this bus rather than to the chassis. The bus, in turn, is tied to the chassis at one point only to help prevent ground loop difficulties and hum problems.

The power transformer and filter choke were of the metal encased type, and no hum field troubles were encountered from this end. Shielded wire was used for all input leads and those going to the function switch. Pointto-point wiring was used throughout with tie lugs used to support components where necessary. Parts placement did not prove critical, but it is well to bear in mind that the unit is a high-gain audio amplifier and should be treated as such.

Radiation from the erase oscillator might prove troublesome, and it might be wise to assemble this stage in a small "Minibox" or other shielded subassembly which may then be attached to the main chassis.

Input and output leads are dressed close to one another because of the single record-reproduce head. The switching system disables all circuits whenever they are unused and no difficulties were experienced.

The recording level is monitored by a rectifier-type decibel meter. A surplus telephone-type db meter was used and proved satisfactory. It was necessary to build out the meter slightly to reduce its loading effect on the circuit. One of the small inexpensive vu meters currently available for recording would be better suited, particularly since the meter ballistics are adapted for audio work.

Connections for the a.c. as well as the erase and record head are made with small Jones plugs at the rear chassis lip. A separate ground lead should be used between the chassis and the motor frame. High level inputs, as well as the output connec-



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tions, are made with conventional *RCA* phono connectors. The amplifier is mounted in a metal cabinet for protection and, more important, for complete shielding.

Conclusion

The completed amplifier is remarkably noise- and hum-free, with a reserve of gain. Using a wide-range, high-fidelity system, no hum is noticed when playing tapes that have been recorded with the unit and played back on professional recorders indicate that the response is close to NARTB standards. It is therefore possible to exchange tapes with other standard recorders without further equalization.

At present, there is a trend toward the standardization of tape recorder curves. It should be pointed out that the amplifiers have inherently flat response curves, with additional simple equalization circuits to produce the desired frequency characteristics. It is thus a simple matter to modify recording or playback equalization as needed for a particular head or to adjust to some future standard if desired

The completed amplifier is most satisfactory in all respects and the quality of tapes indicates that good fidelity has been obtained over the range of 50 to 10,000 cycles. Of great importance is the fact that the entire outfit can be duplicated at reasonable cost. -30

VIBRATOR CONSERVATION

By ROBERT C. FALLER

A VIBRATOR used in mobile radio receivers can perform either badly or well depending, to a great extent, on whether or not the proper attention has been paid to the climatic conditions under which it is expected to operate. Exact replacements may or may not be advantageous in all cases.

Hermetically sealed vibrators should be used in regions where the humidity is high. This sealing retards corrosion of

the contact points within the vibrator. Non-hermetically sealed vibrators can be used in dry climates and will provide performance comparable to the hermetically sealed units under less adverse conditions. This type might prove desirable in units with notoriously short vibrator life, such as in mobile radio transmitters.

If it is possible to replace a hermetically sealed unit by one without this feature, it may represent a saving of as much as 50 cents or a dollar on each vibrator. Large organizations could realize a substantial saving if such a substitution could be made without impairing performance.

To check the possibilities of making such substitutions, one has only to look in a parts catalogue listing vibrators to find hermetically sealed and non-sealed units whose other characteristics and basings are the same. Direct substitution can be made easily and simply without any rewiring of circuits or other major alterations.

Of course, the conscientious technician will only make such substitutions when local weather conditions permit without detrimental effects.

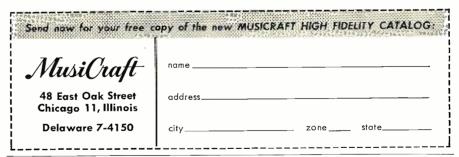


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Experimental Hi-Fi System

(Continued from page 61)

lent on a 16 mm film reel will approximate this inductance. Little acoustical difference will be apparent when crossing over near the 900-cycle region provided each filter crosses over within plus or minus 15 per-cent of this frequency.

The use of a third loudspeaker physically located midway between the high- and low-channel speakers is recommended for the best obtainable quality from this system. The twospeaker combination, however, will satisfy many of the less critical listen-The third speaker for fill-in is particularly recommended where the low- and high-frequency speakers are, of necessity, placed more than 12 feet This speaker is connected through a suitable attenuator to the input of the network and is, therefore, intended to reproduce, at an appropriately lower level, the full range of the reproduced audio spectrum. Whether or not the third speaker is needed for broadcast listening may be determined by simple trial. The placement of a good quality radio set midway between the speakers and tuned to the same station should suffice for this purpose after the proper adjustment of its output level. Attention should be paid to the acoustical phasing of this third source. Interchanging the leads from the output transformer to the speaker terminals may be required to reduce "dead" spots or ear pressure sensation in the listening area.

A three-way dividing network might be used to some advantage but the method just suggested seems to work satisfactorily for home listening and may be accomplished with somewhat less complication and expense than if the more elaborate method were to be adopted.

Military image-orthicon television camera, developed recently by the Radio Corporation of America, is the smallest and lightest as well as the first completely transistorized camera of its type ever designed. The new camera weighs only 31 pounds, operates on less power than is required to light a 50-watt bulb, and is self-contained within a case that is smaller than an overnight bag. It is designed for operation from d.c. power sources normally employed most military aircraft and vehicles.



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RADIO & TELEVISION NEWS

Certified Record Revue

(Continued from page 67)

repetition does not bring boredom. The "oompah ump" of the brass and the mad skirling 'o the pipes still is a thrilling thing to hear, especially when recorded with such star-tling realism. Losh mon, ye'd be daft to o'erlook this disc!

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VIOLIN AND ORCHESTRA Campoli, violinist, with London Philharmonic Orchestra conducted by Sir Arthur Bliss. London LL1398. RIAA curve. Price \$3.98.

London has begun an interesting series of recordings of the works of Arthur Bliss, a contemporary English composer whose works are beginning to be performed with some frequency. Adding authenticity to the occasion, they have Sir Arthur himself in the role of conductor. Campoli, our single-named virtuoso to whom the Concerto is dedicated, assays the difficult violin part with seeming ease and great tonal beauty. The work itself might be described as an odd admixture of romanticism and atonality. Neither element is very obtrusive, the interweaving of these characteristics creating what is certainly a composition modern in concept, but without the harsh contours so often a part of such works. In other words, it is highly listenable and sonically quite exciting. Bliss has incorporated a number of cadenza in his score, which give Campoli a chance to display his nimble-fingered dexterity. Bliss carries off his conductor's duties admirably as testified by the excellent playing he gets from the LPO and the splendid balance he maintains between orchestra and soloist.

The "Theme and Cadenza" is a short piece . . . an interesting trifle used as background for a radio play. The *London* engineers have contributed sound of dazzling opulence. For you lovers of the violin concerto, this is recommended as a stimulating change from the Mendelssohn, Tchaikovsky, et al.

BLISS

A COLOUR SYMPHONY INTRODUCTION AND ALLEGRO London Symphony Orchestra conducted by Sir Arthur Bliss. London LL1402. RIAA curve. Price \$3.98.

More Arthur Bliss from London and this More Arthur Biss from London and this time his highly interesting "Colour Symphony". The four movements are entitled, "Purple, Red, Blue, and Green". The work is somewhat programmatic, Bliss having composed it after reading a book on heraldry and thus he titled each movement according to the symbolism of each color. As you might expect, the scoring is quite exciting and as a hi-fi vehicle doubly so. The orchestration is large, very rich and the London engineers had a fine time recording this. Here, again, Bliss shows his considerable skill at the podium and elicits a bravura performance of his score. Hi-fi fans with jaded tastes will like this and really wake up when the six tympani in the finale go into action! The brief but lovely "Introduction and Allegro" fills out the second side nicely.

FROM THE ROMANTIC ERA Laurindo Almeida, guitarist. Ca P8341. RIAA curve. Price \$3.98. Capitol

A collection of familiar works by Beethoven, Schumann, Chopin, etc. transcribed for guitar, these are very well done, and even those people who generally object to tran-

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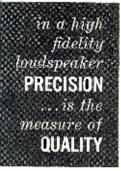
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scriptions of any kind should have no quarrel with this. Almeida displays fastidious taste throughout the disc and it is always a pleasure to hear his warm, clean-toned playing. As is usual with this artist, *Capitol* has afforded him the quintessence of good clean guitar sound coupled with its superbly quiet surfaces.

MOZART
DIVERTIMENTO #7
DIVERTIMENTO #1
TWO MINUETS AND CONTRADANSES (K.463)
Salzburg Mozarteum Orchestra con-

Salzburg Mozarteum Orchestra conducted by Ernest Marendorfer. London LL1427. RIAA curve. Price \$3.98.

This is a perfectly delightful record, conducting is a perfectly delightful record, conducting the salar price of the s

This is a perfectly delightful record, containing 3 miniature Mozart masterpieces. They are all light fare very easy on the ear, beautifully performed and superbly recorded, except for a slightly too large acoustic frame. Marendorfer is completely unknown to me, but if he manages the same fine work in subsequent recordings I predict a wider acquaintance with him.

CHERUBINI

REQUIEM MASS IN C MINOR NBC Symphony Orchestra conducted by Arturo Toscanini with Robert Shaw Chorale. Victor LM2000. RIAA curve. Price \$3.98.

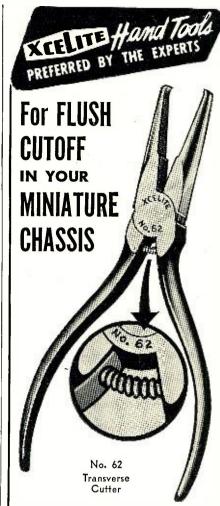
Many the Toscanini enthusiast who has been waiting for this release! Taken from the NBC broadcast of February 1950, the sound has the unmistakable "8H" quality about it although the Victor engineers have tried to help matters of range and acoustics. The Cherubini "Requiem" is a magnificent work and fully deserves both the resurrection and loving performance afforded it by Maestro Toscanini. This is music-making of very high order and belongs on the same exalted plane as the Maestro's Beethoven "9th" and "Missa Solemnis". As noted, the sound is dated but is still more than adequate. This disc deserves an honored spot in the library of any true music lover.

Stereophonic Tape Review

TCHAIKOVSKY PIANO CONCERTO #1

FIANO CONCERTO #1
Emil Gilels, pianist, with Chicago Symphony Orchestra conducted by Fritz Reiner. Victor ECS8 stereophonic "stacked" tape. 7" reel, 7½ ips, NARTB curve. Price \$14.95.

This is a case where superlatives fail . . no description could possibly convey to you the fantastic quality and the incredible musical experience this tape represents. To appreciate what I mean you must hear this! Anyone who says he does not like and can resist the blandishments of stereo after listening to this tape is either deaf or a phony poseur! This is beyond all question of doubt the finest stereophonic tape yet. Somehow, I missed this particular performance on disc and thus the fabulous pianism (admittedly aided by stereo) of Gilels left me breathless with surprise. For my dough this Gilels fellow wins the Tchaikovsky concerto sweepstakes in a walk! This was Tchaikovsky in the old-time grand manner. Such thundering peroration and flamboyant virtuosity I haven't heard in many years. Once again I will confess that it is quite possible my perspective of the performance was greatly colored by the stereo, but this is something I suspect that we will have to accept as part of the process in listening to a really good stereo recording. The directionality of the sound was outstanding, the "hole in the middle" very minimal here. With the superb acoustics of Orchestra Hall, the word for the piano and orchestral sound was big! I have



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never heard such a huge "liveness", yet there was an infinitude of inner detail. You might think with a weary, hard-ridden warhorse like this that you long since have committed to memory every note in the score, but believe me, the stereo revealed not only every note, but shadings and phrasings and nuances of performance, quite impossible to realize on a disc. The piano itself, the strings, brass, and especially the woodwind are reproduced with the fullest, widest frequency and dynamic range yet to appear on tape. Well, I could rave on and on, but let me say this . . . anyone calling himself a music lover should somewhere, somehow try to hear this stereo-

New Emerson Color Sets

(Continued from page 69)

holders located near the power transformer and accessible from the rear top of the chassis protect the power transformer secondary and the four selenium rectifiers. Two more fuses, in the form of loops of #26 wire, are in series with all filaments except the separate winding which supplies the color kinescope. Still another fuse is connected in series with the 400-volt line going to the horizontal damper and "B+" boost circuit. The presence of these fuses can be a great help to troubleshooting, especially when power or h.v. failure is indicated.

A simple a.c. line filter is employed between the a.c. interlock and the power switch and transformer. This filter consists of two capacitors and a resistor, each capacitor going from one side of the line to the chassis.

The new Emerson color TV receivers use the same basic color circuitry as Admiral, Hoffman, and others, but, from the service technician's point of view, many different features are apparent. Mechanical mounting of all major components, especially the picture tube, is quite different. The chassis and picture tube can be removed together from the cabinet for servicing. While still in the cabinet, the removal of the back, top cover, and under-chassis plate, as well as the location of so many of the other adjustments under the front sub-panel will greatly facilitate set-up and troubleshooting procedures in the home. -30-

CROSLEY MODEL 412 HINT

By JAMES A. McROBERTS WHEN weak picture and poor sync showed up in the Crosley Model 412 it was decided that the trouble could be caused by a partial drying up of either of two electrolytic capacitors in the stacked "B+" supply for the 150-volt bus

If either capacitor C_{140A} or C_{140B} (on the manufacturer's service diagram) increases its leakage resistance by an appreciable amount the voltage on the 150volt "B+" bus will be lessened so that the sync and the picture sections of the set will be fed lowered "B+" with weakening of the picture.

The first warning of impending trouble comes from erratic and critical vertical sync which is also fed from this same 150-volt bus. DO YOU WANT A BETTER AMPLIFIER?



A premium kit for the audio perfectionist, the Dynakit sounds better because it is designed for outstanding transient response and stability, for higher power at low distortion, and for complete and accurate reproducibility. The improvement over conventional circuits is immediately apparent to the discriminating listener.

The Dynakit combines unequalled quality with economy and simplicity. It features the finest of parts, like the superb Dynaco A-430 output transformer. At the same time construction is greatly simplified by the Dynaco pre-assembled printed circuit unit which includes the major portion of the wiring.

The Dynakit is sold complete with all parts and the pre-wired printed circuit assembly. Complete specifications are available on request.

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Con. No. 2 14. RIMSKY: KORSAKOFF: Capriceic Espagnol;
Mussorgsky: Intro, to "Khovantchina" 15. DEBUSSY: Quartet
in G; and Sonata for Cello and Piano
"Appassionata" and "Moonlight" Sonatas
("Appassionata" and "Moonlight" Sonatas
("Appassionata" and "Moonlight" Sonatas
(20. MOZART: Symph. No. 40. 34 21. GOLD MARK: Rustic
Symph. 22. BEETHOVEN: Symph. No. 7 23. CHOPIN:
Sonata No. 2 24. HAYDN: "Surprise" and "Millitary" Symphs.
25. FRANCK: Symph. in D 26. STRAVINSKY: Firchird,
and Piano Con. 27. SCHUBERT: Symph. No. 3 28. PRO KOFIEFF& Violin Con. No. 1 and Piano Con. No. 1 29. MENDELSSOHN: "Scotch" Symph. 30. DVORAK: "American" Quar.

December, 1956

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By RICHARD H. DORF

THE writer's mail has indicated that quite a number of RADIO & TELE-VISION NEWS readers have equipped their tape recorders with Veeder-Root counters, as described in the September 1953 issue of the magazine (page 51). In conjunction with the timing graph included in the article it is possible not only to locate sections of tape rather exactly, simply by running until the proper number comes up on the counter, but also to time recorded material by knowing the counter numbers at which the material begins and ends.

A new improvement in tape recording, however, has made the old timing graph obsolete for many users, including the writer. The new 1-mil-thick tapes build up to a different outside diameter on the takeup reel for a given amount of time, so new timing data is needed. It is provided here in the form of a simple gadget which any reader can make from available materials.

The fact that the new tapes are only approximately two-thirds as thick as

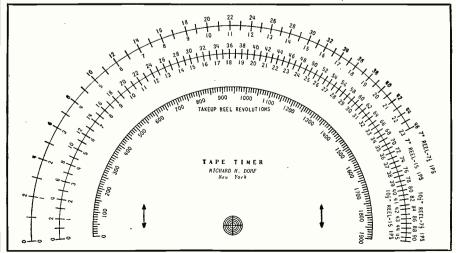
the old 1½-mil-thick tapes means that 50 per-cent more tape can be accommodated on standard 7-inch reels when the new 1-mil tape is employed.

The result is that a 7-inch reel, which formerly would go for only 15 minutes at 15 ips, will now play for about 22½ minutes; a 10½-inch reel is good for 45 minutes at the same speed, which means that just about any musical selection or radio or TV program can be recorded on a single reel with the highest audio quality.

To use the timing device you must have a Veeder-Root counter coupled to the takeup reel. As described in the 1953 article, the easy way to do this is to mount it on a brass rod so it rests near the takeup spindle. Fasten a rubber eyedropper bulb to one end of a short piece of light spring and push the other end of the spring over the counter shaft. Then just slip the rub-ber bulb over the spindle when the counter is to be used.

Since the diameter of the tape winding is always changing with the amount of tape being wound, the time

Template for making timer dial. It should be enlarged (by photostating) so that the distance between the two arrows (shown at bottom) is 3". Refer to the text.



for a given number of turns becomes less as the reel gets fuller. Thus a conversion chart or device is needed to give timing as a function of reel revolutions.

A graph is one obvious way to do this and it was used with the earlier article. However, after long use the writer began to be annoyed with the time and attention required to trace from the vertical and horizontal axes to the graph lines and with the visual difficulties of interpolation. So, when it became necessary to do the job again for the new tape, a simple, almost automatic, indicator was devised.

The necessary "artwork" for the tape timer is reproduced in the illustration. Either cut this out of the magazine or have it photostated; then paste it down flat on a piece of Masonite. Cut down the Masonite so the piece is just slightly larger than the drawing.

Now take a piece of Plexiglas about 1/16 inch thick and around one-half inch wide. Cut it to a length about onequarter inch greater than the distance between the bullseye in the drawing and any number on the outer arc. Scribe a line lengthwise on the piece halfway from each edge and for the full length of the Plexiglas. Fill this with a blackener-India ink will work. (If you want more precise readings, just used the scribed line, but this is a little harder on the eyes when you are in a hurry.)

Now drill a hole to fit a 6-32 screw right on the scribed line and a quarter-inch from one end. Drill a similar hole squarely in the center of the bullseye. Put a 6-32 screw through Plexiglas and bullseye, fastening it on the other side with a nut and spring

washer.

To use the timer rotate the Plexiglas indicator to place the scribed line directly on the appropriate counter number on the inner numbered arc. Then simply read the time from the appropriate scale. The innermost arc covers 10½-inch reels for the two speeds, the outer, 7-inch reels. They are different because of the differing hub diameters.

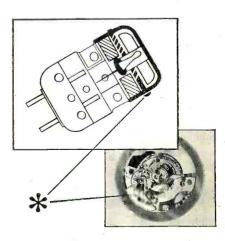
This device is very easy and quick to use. Interpolation is quite simple, both for counter numbers and for times. Accuracy is about 5 seconds each way at 15 ips for recorders which run at correct speed. Where the recorder does not have a synchronous motor and runs at a substantially different speed from the standard, it is a simple matter to paste a cut-out piece of paper over the two outside arcs. draw the arcs on the covering paper with a compass or by tracing, and make new timing marks based on running a tape through with a piece of paper and an electric clock or stopwatch at hand. For best durability, it is a good idea to spray the finished gadget (after pasting the paper on the Masonite but before adding the Plexiglas indicator) with several thin coats of Krylon or another clear plastic. -30-





The marked similarity between the watchmaker's art and the craftsmanship required to produce a precision cartridge can be aptly illustrated by an examination of the famous FAIRCHILD Micradiust Cartridge.

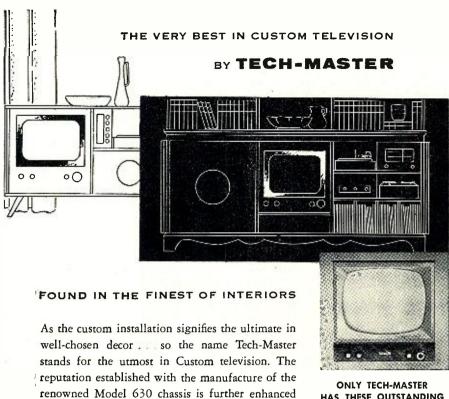
Meticulous care and delicate assembly are basic to both products. In addition, adjustments are provided in the finest of watch movements to regulate performance by compensating for minute differences in manufacturing tolerances as well as variations in material. Similarly the MICRADJUST feature permits regulating the magnetic gap to precisely fit the moving coil assembly.* The result is uniform flux gap, proper centering of stylus arm and correct damping. It assures best possible cartridge performance which is immediately apparent to the critical listener.



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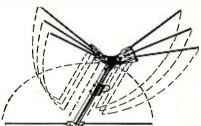
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'QUICKIE" CONICAL

Telrex Laboratories, Asbury Park, N. J., announces its new high-perform-"Conical-V-Beam," which is aimed at the replacement market as a low-priced, simple-to-install, durable antenna. No plastic substitutes are used in the all-aluminum design, which includes aluminum butterfly clamps and doweled tubular elements. The radiator swing clamp assembly automatically positions the elements; a snap-in positioned-reflector assembly provides positive locking. The antenna

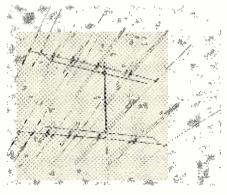


is available in single-bay form (Q-2X), 2-bay stack (Q-4X) or 4-bay stack (Q-8X).

This manufacturer announces three more patent license agreements, with Lance Manufacturing Co., Tenna Manufacturing Co., and General Cement Co., covering the manufacture of conical antennas.

ALL-CHANNEL YAGI

Radio Merchandise Sales, Inc., 2016 Bronxdale Ave., New York 62, N. Y., is currently producing a new antenna, the "Big Big Shot," Model BBS-400. Separate elements are used to develop



maximum gain for low-band and highband operation. This antenna may be stacked for increased gain.

HIGH-GAIN ANTENNAS
Technical Appliance Corporation,
Sherburne, N. Y., is introducing a new series of high-gain broadband antennas, the "Topliners." The streamlined design of these four antennas minimizes wind resistance, requires less mast bracing and guying. Also featured is "Auto-Lok" construction to



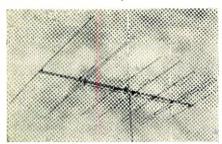
Zone

March States (1975) 1 Committee to seek a seek of the committee of the committee of the

State.



speed installation time. The antennas are built around a new connecting delay line called the "Power-Pack." which maintains optimum impedance match to the transmission line and a single-lobe pattern throughout the v.h.f. band. Essentially, this line is a balanced "T" section composed of inductive series elements and a capacitive shunt element. Mechanically, this section is made up of the antenna elements and four heavy aluminum coils.

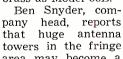


Characteristics are reported as combining high gain, sharp directivity, high front-to-back ratio, plus uniform gain within individual channel bandwidths for good results with color transmissions. Four models, ranging in order from one designed for metropolitan and suburban use to a fourth intended for deep-fringe installations, are the "Topliner" '40 (Cat. 2540); the '50 (Cat. 2550); the '60 (Cat. 2560); and the '70 (Cat. 2570). For stacking purposes, there are factory tuned lines to fit all models.

6-POSITION INDOOR ANTENNA

Snyder Manufacturing Company, Philadelphia, Pa., has a 6-position in-

door antenna on the market that uses a convenient slideswitch in its base instead of the more familiar knob. A criss - cross phasing element and 3-section staffs are used, with an extra-heavy topple-proof base. The antenna is available in aluminum as Model 66A or polished brass as Model 66B.



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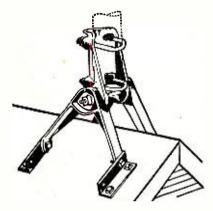
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AUTO ANTENNA PATENT GRANT

Insuline Corporation of America, 186 Granite St., Manchester, N. H., announces the fact that it was issued patent No. 2758151 covering its original universal mount "Ball-Tenna" auto aerial on August 7, 1956. This manufacturer has announced his intention to take legal action regarding other antennas that may infringe on the patent.

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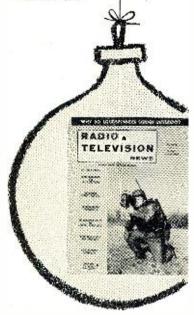
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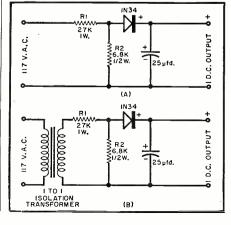
A series of low-voltage rectifier circuits using germanium crystals to provide d.c. voltages for transistor circuits.

LTHOUGH we usually think of transistors as being battery operated devices because of the small power requirements, it is, of course, possible to operate them from a.c. power supplies. This is convenient, especially in experimental work.

Conventional a.c. power supplies may be used, but they usually operate at voltages higher than the potentials needed for transistor circuits and means must be provided to reduce the voltages to the low values required. This, certainly, is an uneconomical arrangement. In experimentation it is also desirable for supply voltages to be made variable.

An extremely simple a.c. power supply is shown in Fig. 1A. A single 1N34 germanium crystal diode functions as the rectifier. With the parts values shown, the d.c. output when powering a transistor oscillator circuit using a single CK722 was recorded at 12 volts. Increasing the value of R_2 with respect to R_1 will result in greater d.c. output voltage, while decreasing R_2 will reduce the output. However, care

Fig. 1. (A) A simple a.c. power supply using a single 1N34 crystal diode as the rectifier. The d.c. power output is approximately 12 volts. See text. (B) An improved version of the circuit of (A) using an inexpensive isolation type transformer.

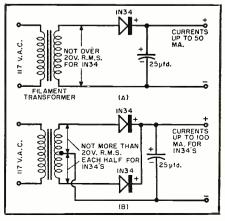


should be exercised to proportion the values of these resistors so that not more than 20 volts a.c. appear across \mathcal{R}_2 in order to avoid ruining the diode. Currents up to 50 ma. can be handled by this circuit. It can be seen that there is little filtering of the pulsating d.c. rectifier output and a hazardous shock condition exists since one side of the 117-volt a.c. line is common to the d.c. output.

A better arrangement is shown in Fig. 1B. Here, an inexpensive isolation transformer is added to the circuit. Such isolation transformers are available as shown or with secondary voltages up to 150 volts. Standard filament transformers can also be used for this purpose and are available with secondary potentials from 2½ to over 20 volts. They may be selected according to the d.c. output voltage required. See Fig. 2A.

In any of these circuit configurations a 1N34 can be employed satisfactorily providing the a.c. voltage across R_2 , or the voltage across the secondary winding of the transformer

Fig. 2. (A) The same circuit as Fig. 1B except that a standard filament transformer is used. Type of unit selected depends on d.c. output voltage required. See text. (B) Circuit which provides smoother d.c. output by means of full-wave rectification.



RADIO & TELEVISION NEWS

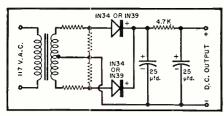


Fig. 3. The use of dropping resistors between the transformer secondary and the diode will reduce the voltage to required value. Additional filtering is also used.

when R_1 and R_2 are not required, does not exceed 20 volts.

When a higher d.c. output is necessary, the transformer secondary voltage may be greater than 20 volts and a diode such as the 1N39 used in place of the 1N34. The circuit arrangements of Figs. 1A and 1B both result in halfwave rectification of the a.c. supply voltage.

If a smoother d.c. output is desired, full-wave rectification is possible with the circuit of Fig. 2B. The secondary winding is center tapped, and if the voltage between the tap and each end of the secondary winding is not over 20 volts, it is safe to use two 1N34 diodes, and currents ranging up to 100 ma. are available from the circuit. Again, with higher secondary a.c. voltages, a higher voltage rating crystal, like the 1N39, should be put in service.

It can be seen that if the secondary voltage of any available transformer is too high, voltage dropping resistors may be used between the transformer secondary and the diode as in Fig. 1B with their values adjusted so as not to exceed the voltage rating of the crystal in the circuit. However, in the case of the circuit of Fig. 2B, four resistors are required. This is shown in Fig. 3, which also includes additional filtering of the d.c. output.

Although only germanium crystal diodes have been considered thus far in this article, the conventional selenium-type rectifier may be substituted in any of the circuits. Because of the small voltages and currents usually associated with transistor work, the germanium diode is especially suited to this application. Its extra small size also compares with the transistor in miniaturization considerations.

As previously mentioned, it is desirable in experimental transistor work to provide means of varying the output voltage. This is not only a convenience, but to be able to start with zero output and slowly increase the voltage supply is a good protective feature when trying unfamiliar transistor circuits.

The simplest arrangement, probably, is to use a continuously adjustable autotransformer in the 117-volt a.c. supply line. However, these variable controls are often out of reach, pricewise, for many experimenters.

A satisfactory, inexpensive method of obtaining variable output is given in Fig. 4. This arrangement may be applied to any of the previously considered circuits. The sum of the resistive value of the variable control

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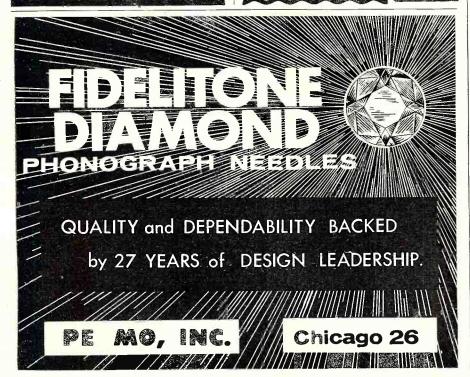
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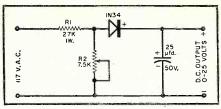


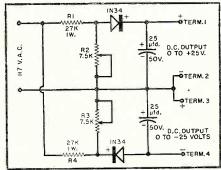
Fig. 4. An inexpensive yet satisfactory method of obtaining variable output. This arrangement can also be applied to other circuits diagrammed and discussed in text.

and the fixed series resistor must be such that the a.c. voltage drop across the variable resistance does not exceed the voltage rating of the crystal diode to be used. The total resistance value of the potentiometer is chosen, as with the fixed resistors, to provide voltages not in excess of the diode rating. As the arm of the control is moved down from its top position, as shown in Fig. 4, the d.c. output voltage increases, reaching a maximum when the arm reaches the bottom, that is, when all the resistance is in the circuit. With the parts values listed, the d.c. output is variable from zero to about 25 volts with a 117-volt a.c. supply.

A circuit arrangement that is useful with experimental transistor circuits requiring two sources of power, such as when utilizing individual emitter and collector circuit supplies, is diagrammed in Fig. 5. It is adaptable to all the foregoing rectifier circuits. Here, the reversed polarities necessary for emitter and collector terminals are available, and individual control is provided for each. As the arm of control, R_2 , is varied from top to bottom, increasing the resistance of R2 across the circuit, the positive potential at terminal #1, say for an emitter, varies from zero to approximately 25 volts. Likewise, as the arm of the variable control, R3, is moved from bottom to top, the negative potential at terminal #4, suitable for transistor collector, increases. The author used Clarostat type 43, 2-watt, wirewound controls.

The experimenter may save himself the sad experience of transistor fatalities during experimentation if he approaches the transistor operating potentials gradually, particularly when operating near maximum ratings. -30-

Fig. 5. A circuit arrangement that is useful in experimental transistor circuit operations. It provides two sources of power to feed the emitter and collector circuits individually, as required by the design.



RADIO & TELEVISION NEWS

Key to Color TV

(Continued from page 55)

plifiers, color demodulators, and the color synchronization circuits. Inoperative bandpass amplifiers can cause no or weak color reception. If the demodulators should fail, one or more colors may be missing from the color picture. For example, using a colorbar generator, the tube may display a normal bar pattern except that all blue color may be missing. This could be caused by a defective tube or component in the B-Y drive to the blue gun of the picture tube.

The color synchronizing circuits can cause two types of defects. If the 3.58 mc. reference oscillator should fail, the picture tube will not display color. If the transmitted burst pulse is not fed to the 3.58 mc. oscillator circuit, possibly due to a defective burst amplifier stage, the color picture information will roll. (This is similar to the effect produced by the absence of horizontal sync in a black-and-white picture.) This condition is illustrated in Fig. 4. It can be seen that red, green, and blue color stripes are running through the picture. By turning the color control off, a normal black-andwhite picture may be seen. A wideband (0-4.5 mc.) oscilloscope is very useful in tracking burst and chrominance signals through the color circuits.

In addition to troubles found only in

the color circuits, defects in the i.f. and video stages can cause improper color rendition. For example, it can be seen in Fig. 3 that the edges of the bars are incorrect. This would show as "ringing" in a black-and-white picture. This effect will not vary with adjustment of the fine tuning control. The cause is an open ground in the video delay line which results in improper termination, thus the "ringing" or transient condition.

Fig. 1 includes a photo taken of the face of a color picture tube showing the peacock used at the end of an NBC color telecast. This picture illustrates the color display potential of a normal color television receiver using a 3-gun color tube.

As in black-and-white servicing, the picture tube presentation can be a valuable aid in analyzing circuit defects. Loss of color sync resulting in the picture of Fig. 4 would indicate immediately that the trouble was occurring in the color sync circuits. Once the trouble has been mentally analyzed the usual service techniques apply. First check tubes, then check for component failure by taking voltage and resistance readings.

After the technician becomes familiar with color receivers, service becomes almost as routine as black-and-white servicing. Probably the biggest challenge to the technician now entering this new field is the initial installation. However, after he has gained some experience, he will acquire confidence and proficiency.



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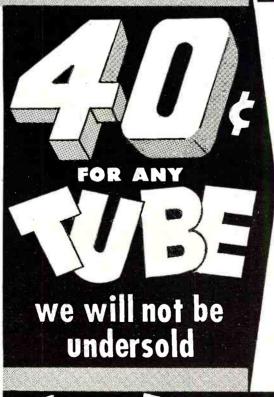
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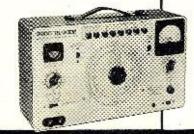
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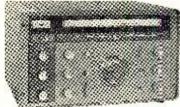
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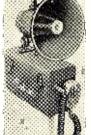
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NEW DEVELOPMENTS Analyzers for Missiles and Jet Pilots 76 Dec. A New Type Circuit Assembly ... 41 Feb. Bell Labs Designs New V.H.F. Transistor124 Apr. Combat Helmet Two-Way Radio.. 180 Oct. Electronic Brain Controls Airborne SAGE System 43 Sept. Giant Paraboloid for Scatter Large Computer Keeps Signal Corps' Records Light Amplification Up to 40,000 Times Now Possible105 Apr. Longest Range Shipborne Radar .. 120 Nov. New Transistor Circuits 98 Sept. Picture-Phone Uses Telephone .. 43 Nov. That Includes Many Receiver Functions105 Nov. TV Programs on Magnetic Tape .. 92 July Radar Used for Electronic Survey-Missiles 45 Dec. POWER SUPPLIES Handy Power Supply for Service SHORT-WAVE Radio Australia Tops with SWL's (Boord)112 Apr. HIGH-FIDELITY-AUDIO **ACOUSTICS** Realistic High Fidelity (Part 1) (Hartley) 39 Apr. Realistic High Fidelity (Part 2) tion-How to Organize Your Listening Room (Part 3) (Hartley). 43 June Room Acoustics for Hi-Fi Listening (Rosenfield) 52 Oct. **AMPLIFIERS** A 50-Watt Power Amplifier (Hafler) 61 June All Transistor Hi-Fi Amplifier (Lowry) 44 Nov. A Portable Audio Amplifier Sys-A Simple Preamplifier for the Home Builder (Boegli & Willis) 66 Aug. A Special Purpose Transistor Pre- amp (Neil) 48 Oct. A 20-Watt Amplifier System 64 July

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New TV Stations on the Air		
New TV Stations on the Air		
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& Rush)		Mar.
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New TV Tuner	40 94	Sept. Oct.
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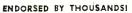
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ERRATA
Stafford E. Davis' call letters on page 192

of the October 1956 issue should have read W5HDM instead of W5HIM, as shown. . . .

A typographical error in the Precise Development Corp. ad (page 11, October issue) listed the Model 116W tester as \$19.95 in factory-wired form. This figure should, of course, be \$119.95.





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5R4WGY . 3.00	5933 1.75	5840 6.00 5879 1.40
64K5W 1.40	813 8.00	5879 1.40
6C4 20	814 4.00	5881 2.35
6C2110.00	815 2.00	591045
614 1.90	816 1.00	591550
6J6W , 1.00	836 1.50	6111 4.95
15E 1.25	837 1.25	6112 4.95
FG32 4.50	83870 845 5.00	6130/
*35TG 2.45	845 5.00	30456.00
VC50/	866A 1.25	6146 4.55
32KV 8.00	872A 1.25	616160.00
RK60 1.35	917 2.00	
RK65 7.00	918 1.50	
HY69 2.50	927 1.50	6201 3.00
RKR72 or	930 1.50	6539 9.00
7340	95435 95535	8008 3.25
F123A 5.00		8020 2.00
VXR-130 . 1.75		900185
203A 2.50		900265
21150	958A35 99125	9003 1.35
250R 2.95		900450
*250TL14.00 HK253 5.00	CK100535	
	many others. Ove	
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	RECEIVING TUBES						TRANS					
0A2	.69	6AD7G	1.50	6L6G	.98	12BF6	.60	0A3/VR7 0B3/VR9 0C3/VR1 0D3/VR1	5 .86	5JP2	6.35	
0A4G 0B2	.95 .65	6AF4 6AF6G	1.23 .85	6L7 6N7	.95 .89	12BH7 12BK5	.89 .95	063/VR9	05.68	5JP5 5LP1	9.95 7.40	
0Z4	.49	6AG5	.72	607	.85	12BQ6GT	1.35	0D3/VR1	50 .68	5NP1	4.95	
1A3 1A7	.68 .52	6AG7 6AH4	.98 .85	607GT 6R7	.79 .85	12BY7 12BZ7	.90 .95	1B22 1B23	1.25 2.68	6AC7W 6AK5W	1.45 1.45	
1AD4	1.20	6АН6	.85	6R7GT	.68	12C8	.69	1B24	4.85	6AL5W	.95	
1AE4 1AX2	.92 .95	6AJ5 6AK5	1.49 .69	654 658 GT	.57 1.05	12CU6 12H6	1.35 .59	1B27 1B35	12.95 3.45	6AQ5W 6A56W	1.70 2.69	
1B3GT	.79	6AK6	.75	65A7	.79	12J5GT	.65 '	1B38	33.50	CDETW	3.45	
1C5GT 1G4	.52 .65	6AL5 6AL7	.58 .95	65A7 65A7GT 65B7Y	.79 .87	12K7GT 12K8	.85 .69	1B40 1B41	3.45 3.75	6C4W 6C21	6.75 14.95	
1G6GT	.49	6AM4	1.50	65C7	.72	12Q7GT	.75	1021	1.89	6F4	2.65	
1H5GT 1J6GT	.58 .69	6AM8 6AN4	1.10 1.50	65F5 65F5GT	.72 .69	125A7 125A7GT	.69 .69	1N21 1N21B	.39 1.45	6J4WA 6J5WGT	4.45 3.90	
1 L.4	.74	6AN5	2.75	65F7	.92	125C7	.75	1N23	.68	e1eM	2.20	
1L6 1LA4	.79 .79	6AN8 6AQ5	1.15 .57	65G7 65H7	.65	125G7 125H7	.79 .65	1N23B 1N34	1.40 .42	6J6WA 6K4	3.90 2.20	
1LA4 1LA6	.85	6AQ6	.57	6SH7GT	.74 .59	12SJ7	.65	1N34A	.48	65N7WG1	1.85	
1LB4	.85	6AQ7 6AR5	1.15 .70	6SJ7	.69	12SK7	.69	1P21 1P22	29.5 0 13,25	6X4W 6X5W	1.20 1.35	
1LC5 1LC6	.79 .79	6AR6	2.15 .70	65J7GT 65K7	.59 .64	125L7 125N7	.85 .75	1P23	1.85	7BP7	4.45	
1LD5	.85	6A55	.70 1.95	6SK7GT	.59	125Q7	.59	1P24 1P25	1.45 64.50	12DP7 15E	14.95 1.45	
1LE3 1LG5	.79 .85	6A56 6A57G	2.35	6SL7GT 6SN7GT	.75 .75	125R7	.59	1P28	8.95	15R	.49	
1LH4	.85	6AS8 6AT6	1.15 .52	6 5 Q7	.59	12V6GT 12W6GT	.73 .87	1P30 1P32	1.95 .95	28D7 100TH	.95 6.25	
1LN5 1N5GT	.79 .59	6AT8	1.05	6507GT 65R7	.59 .55	1444	.95	1P39	1.45	100TL	8.25	
1Q5GT	.95	6AU4	1.05	6557	.75	14A5	1.30	1P40 1P41	1.25 2.45	211 249B	.45 2.95	
1R4 1R5	.65 .65	6AU5 6AU6	1.10 .65	65T7 6T8	.95 .95	14A7 14AF7	.75 .95	1P42	2.35	249C	1.95	
154	.65	6BA7	.85	6U5	.85	1486	.69	2AP1 2B22	4.95 1.95	250TH 250TL	18.95 14.75	
155 1T4	.65 .65	6AV5 6AV6	1.20 .53	6V3	.95 1.25	14C7	.95	2C21	.39	262B	4.95	
1T5	.69	6AX4	.79	6V6	1.10	14E6 14E7	1.05 1.15	2C34 2C36	.25	274A 274B	3.45 .85	
1U4 1U5	.67 .59	6AX5 6B4G	.69 .95	6V6GT 6W4GT	.59 .65	14F7	.85	2C39A	21.50 10.95	304TH	7.95	
1 V	.65	6B8	.67	6W6CT	.79	14F8	1.10	2C40 2C43	9.45 10.25	304TL 307A	9.95 1.10	
1V2 1V6	.59 1.49	6BA6 6BA7	.63 .85	6X4 6X5GT 6X8 6Y6G	.48 .49	14H7 14N7	.85 .85	2C52	2.95	350A	2.65	
1X2A	.85	6BA7 6BC4	1.50	6X8	.95	1407	.85	2C53	10.75 .65	350B 371B	2.35 .85	
2A3 2A6	.95 .59	6BC5 6BC7	.68 1.20	6Y6G 7A4	.89 .79	14R7	1.20	2D21 2D21W	1.95	393A	4.50	
2X2 2X2A	.49	6BD5	1.35	7A5	.69	1457 14W7	1.10 1.25	2E22 2E24	3.15 2.40	WL417A 417A/58	2.95	
2X 2A 3A3	1.35 1.08	6BD6 6BE6	.73 .65	7A6 7A7	.78 .75	19BG6G	1.89	2E26	3.25	4174/56	12.45	
3A4	.50	6BF5	.82	7A8	.75	19T8	.95	2E30 2G21	1.55 2.45	434A 450TH	2.95 47.50	
3A5 3AL5	.64 .65	6BF6 6BG6G	.68 1.75	7AD7 7AF7	1.65 .89	25AV5 25AX4	1.25 1.05	2J31	14.00	450TL	35.00	
3AU6	.70	6BH6	.79	7AG7	.95	25BK5	.95	2J32 2J33	12.50 14.00	575Α 705Δ	9.95 .68	
3AV6 3B4	.60 2.95	6BK5	.69 .95	7AH7 7B4	.95 .75	25BQ6GT	1.25	2J34	14.00	707A	4.95	
3B7	.39	6BK7	1.05	7B5	.65	25CD6G 25CU6	1.75 1.30	2J36 2J51	14.95 97.50	707B 715B	3.95 2.95	
3BC5 3BN6	.80 1.05	6BL7 6BN6	1.05	7B6 7B7	.75 .75	25L6GT	.65	2J55	39.50	715C	10.95	
3BY6	.75	6R06GT	1.15	7B8	.85 .75	25W4GT	.72	2J61 2J62	12.95 12.95	717A	.35	
3CB6 3CF6	.80 .85	6BQ7A 6BX7	1.15 1.20	7C5 7C6	.75	25Z5 25Z6	.75 `	2K23	15.25	721A 723A/B	.65 8.45	
3D6	.39	6BX7 6BY5G	1.25	7C7	.79	30	.65	2K25 2K28	11.95 27.50	725A 726A	2.95 4.95	
3FL4 3Q4	.85 .65	6BZ7 6C4	1.20 .38	7E7 7F7	1.15 .85	32L7	.85	2K33A	56.95	726B	32.50	
3Q5	.75	6C5	.48	7F8 7G7	1.10	35A5 35B5	.69 .68	3AP1 3B24	2.90 .95	726C 750TL	32.50 65.00	
354 3V4	.65 .69	6C5GT 6C6	.46 .49	7 H7	1.10 .79	35C5	.68	3B24W	4.95	801A	.38	
4BQ7A	1.30 1.35	6C8G	.85	7J7 7K7	1.25	35L6 35W4	.65 .44	3B25 3B26	4.95 7.45	802 803	2.45 1.40	
4BZ7 5AM8	1.35 1.05	6CB5 6CB6	4.40 .68	7L7	1.15 1.10	35Y4	.65	3B27	3.45	804	8.85	
5AN8	1.10	6CD6G	1.75	7N7 7Q7	.85 .95	35Z3	.65	3B29 3BP1	5.95 2.45	805 806	3.95 4.85	
5AQ5 5A58	.75 1.10	6CF6 6CG7	.90 .85	7R7	.95	35Z5 41	.59 .75	3C22	59.50	807	1.18	
5AT8	1.10	6CL6	1.10	7V7 7W7	.95 .95	42	.69	3C23 3C24	3.45 1.48	808 809	1.25 2.20	
5AV8 5AW4	1.15 1.10	6CM6 6C56	.85 .75	7X7 7X4	.90	43	.79	3C45	5.95	810	10.50	
5AZ4	.60	ecue	1.30	7Y4 7Z4	.65 .65	50A5 50B5	.68 .68	3D21A 3DP1	2.95 3.25	811 811A	2.75 3.25 2.75 3.25	
5J6 5R4 G Y	.90 1.45	6DC6	.59 .95	12A4	.85	50C5	.68	3E29	9.00	812	2.75	
5T4	.90	6E5	.75	12A6 12A8 G T	.57 .79	50L6	.62	4-65A 4-125A	13.25 18.95	812A 813	3.25 10.50	
5U4G 5U8	.58 1.10	6F5 6F6	.59 .85	12AH7GT	1.05	50X6 50Y6	.85 .78	4-250A	29.50	814	1.95	
5V4G	.88	6F6GT	.69	12AL5 12AQ5	.65 .70	50Y7	.78	4C27 4C28	8.95 17.45	815 816	1.95 1.15	
5V6GT 5W4GT	.70	6F7 6F8G	.85 .72	12AT6	.48	53	1.25	4C35	13.45	826	.65	
5X4G	.65 .75	6G6G	.72	12AT7 12AU6	.92 .62	70L7 75	1.15 .65	4E27 4X150A	7.95 22.45	828 829B	7.42 7.95	
5X8 5Y3GT	1.05	6H6 6H6G7	.59 .49	12AU7	.75	77	.47	4X150G	31.95	830B	.65	
5Y4G	.65	6J4	2.55	12AV6 12AV7	.52 .95	78	.57	5BP1 5BP4	2.35 1.95	832 832A	5.75 7.95	
5Z3 5Z4	.69 .89	6J5 6J5GT	.48 .47	12AW6	.95	80 81	.59 1.85	5C22 5CP1	27.50	833A	42.50	
6A3	.95	6J6	.68	12AX4 12AX7	.85 .78	83	1.19	5CP1A	1.95 8.45	836 837	1.45 1.25	
6A6 6A7	.82 .89	6J7 6J7 G T	.82 .65	12AY7	1.15	83V	.95	5CP7	7.95	838	.69	
648	1.05	6K6GT	.65	12AZ7 12B4	.85	84/6Z4 117L/M7	2.45	5D21 5FP7	7.45	845 851	4.85	
6ABCT 6AB4	.95	6K7 6K7GT	.59	1ZBA6	.60	117N/P7	2.45	5J29	29.50	B60	8.95 2.75	
GAR7	.95	6K8	1.10	12847	.89	117Z3	.68	5/30	17.25	861	12.95	

		TRA	NS	MITI	ING	TUB	ES		
A3/VR7	5 .86	5JP2	6.35	876	.72	5687	2.65	6099	1.35
B3/VR9	90 .73	5JP5	9.95	878	.48	5692	5.10	6101	1.45
C3/VR1	05 .68	5LP1	7.40	884	.95	5693	4.65	6113	1.25
D3/VR1	150 .68	5NP1	4.95	885	.95	5696	.90	6146	4.75
B22	1.25	6AC7W		902	2.45	5702	1.95	6161	69.50
B23	2.68	6AK5W	1.45	918	1.65	5703	.95	6187	3.95
B24	4.85	6AL5W	.95	923	1.25	5704	1.85	6189	2.25
B27	12.95	6AQ5W	1.70	925	1.50	5718	2.75	6263	11.45 11.45
B35	3.45	6A56W	2.69	927	.95	5718A	4.75	6264	11.45
B38	33.50	6BF7W	3.45	930	1.19		2.15	6539	2.95
B40	3.45		6.75	931A	2.95	5725	1.45	8005	4.75
B41	3.75	6C21	14.95	954	.25	5726	.60	8008	3.95
C21	1.89	6F4	2.65	955	.35	5727	1.25	8012	.98
N21	.39	6J4WA	4.45	956	.35	5732	2.95	8013	2.65
N21B	1.45	6J5WGT	3.90	957	.35	5744	1.75	8013A	3.75
N23	.68	elem	2.20	958A	.35	5751	1.45	8014	67.5 0
N23B	1.40	e1eMV	3.90	959	1.32	5762	99.50	8020	1.25
N34	.42	6K4	2.20	991	.29	5763	1.25	8025	1.45
N34A	.48	65N7WG1	1.85	1603	2.95	5783	4.45	9001	.82
P21	29.50	6X4W	1.20	1616	.50	5787CK	4.05	9002	.60
P22	13.25	6X5W	1.35	1619	.30	5794	5.95	9003	1.20
P23	1.85	7BP7	4.45	1622	1.45	5812	2.70	9004	.35
P24	1.45	12DP7	14.95	1624	.95	5814 5819	.95	9005	1.39
P25	64.50		1.45	1625	.29	5819	32.50	9006	.25
P28	8.95 1.95	15R 28D7	.49	1626 1633	.19	5820 5823	495.00 1.35	C1JA	10.95
P30	.95	28D7 100TH			.85		1.35	Cel	7.95
P32 P39	1.45	100TH	6.25	1635	1.48	5829 5840	4.40	CK1005	.32 3.45
P39 P40	1.25	211	8.25	1641	1.35	5840 5841	7.40	CK1006	3.45
P40 P41	2.45	249B	.45 2.95	1654	1.75 1.25	5844	.95	CK1007	.65 4.70
P42	2.35	249C	1.95	2050 2051	.65	5851	3.45	CK1038 CK1039	4.70
AP1	4.95	250TH	18.95	5516	6.45	5876	12.50	F123A	2.75
B22	1.95	250TL	14.75	5517	1.65	5879	1.25	F123A F127A	22.50
C21	.39	262B	4.95	5634	6.95	5881	2.95	F127A	14.95
C34	.25	274A	3.45	5636	2.90	5886	3.25		
C36	21.50	274B	.85	5637	4.95	5894	15.95	FG17	4.95
C39A	10.95	304TH	7.95	5638	7.45	5896	4.45	FG27A	10.90
C40	9.45	304TH 304TL	9.95	5639	8.95	5899	3.95	FG32	3.95
C43	10.25	307A	1.10	5641	5.95	5902	5.95	FG95	17.50
C52	2.95	350A	2.65	5642	.95	5905	8.75	FG105	12.95
C53	10.75	350B	2.35	5643	5.95	5906	14.95	FG172	17.95
D21	.65	371B	.85	5647	3.95	5908	7.85	HF100	6.95
D21W	1.95	393A	4.50	5651	1.35	5932	3.95	HF200	9.95
E22	3.15	WL417A	2.95	5654	1.25	5933	2.25	HF300	17.50
E24	2.40	417A/58	42	5656	7.90	5963	5.45	WL616	47.50
E26	3.25		12.45	5670	1.10	6021	4.45		
E30	1.55	434A	2.95	5675	10.95	6080WA	7.95	RK65	7.50
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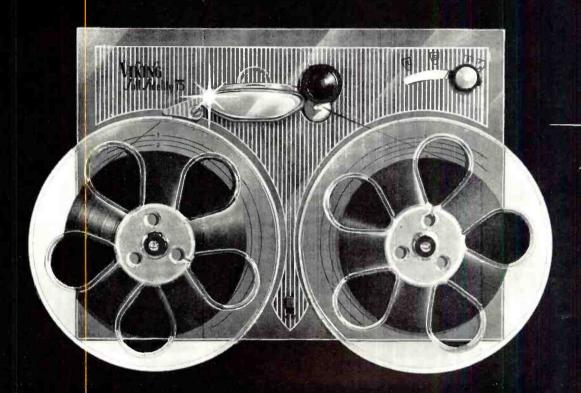
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