RADIO & TELEVISION NEWS

JUNE
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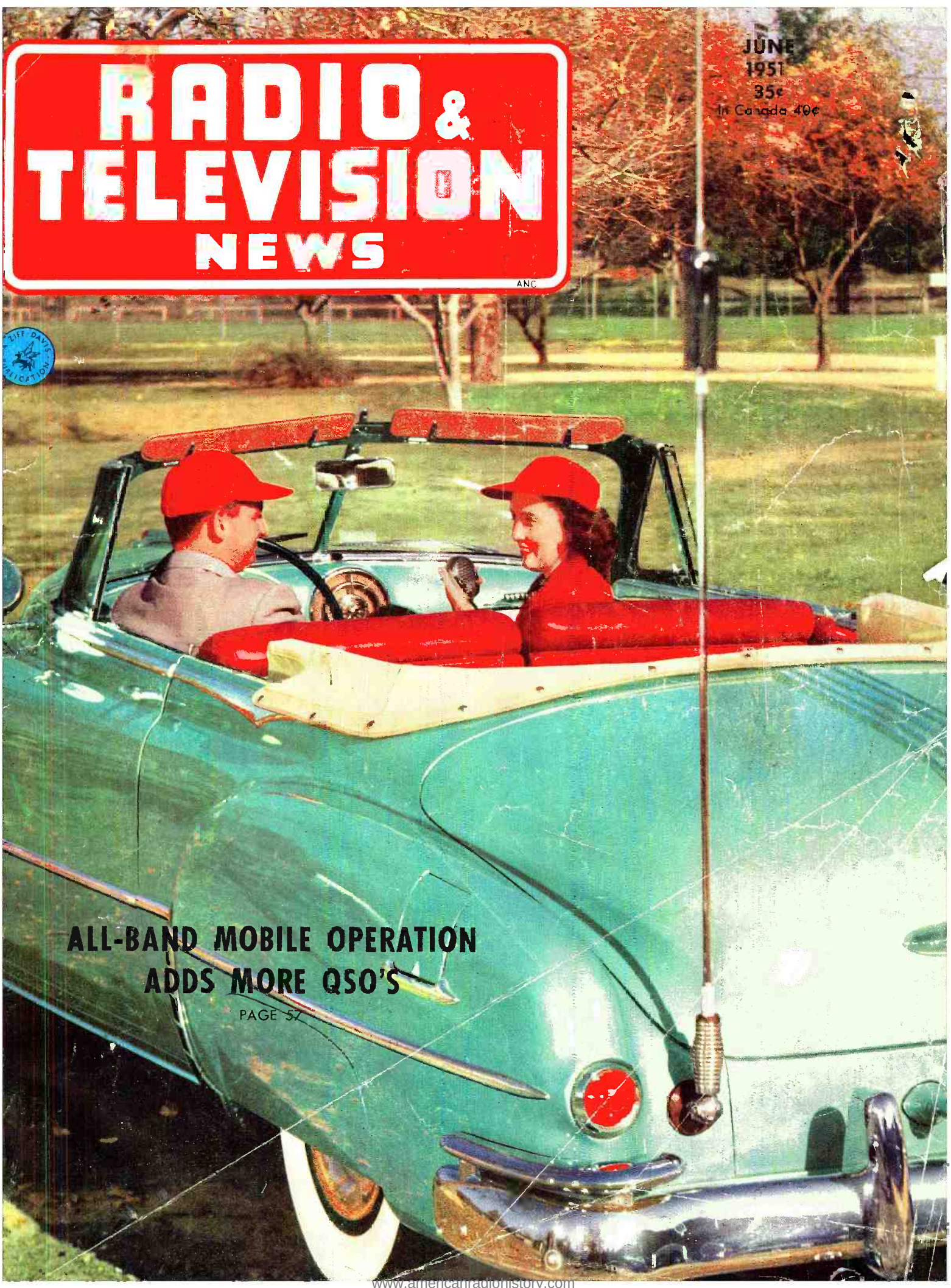

ALL-BAND MOBILE OPERATION ADDS MORE QSO'S

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THE QUALITY OF **RCA** TUBES IS UNQUESTIONED

ANOTHER IMPORTANT RCA *Engineering Advance...*

Once again, RCA engineering has made an important technical advance that benefits the entire industry—by developing an improved method of electrostatic focusing. Electrostatic focusing has now been incorporated in three new RCA rectangular kinescopes.

The new tubes require no focusing coil or focusing magnet. They provide pictures of the same high quality obtained from magnetic-focus types.

It will be a while before you as a dealer or a serviceman will have occasion to stock these electrostatic-focus kinescopes. But . . . because these tubes permit important savings in critical materials, manufacturers can produce more television receivers upon which your future business will depend.

In the meantime, RCA is producing sufficient quantities of its magnetic-focus kinescopes to meet your current replacement requirements.

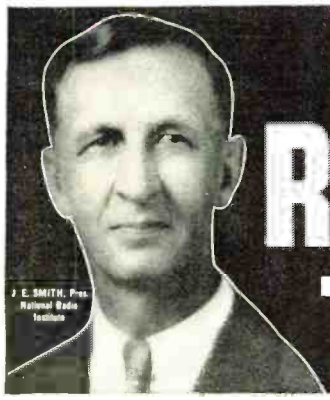
Keep informed...stay in touch with your RCA Tube Distributor

Electrostatic Focusing

for television picture tubes

. . . and how it will benefit you

RCA RADIO CORPORATION of AMERICA
ELECTRON TUBES HARRISON, N. J.



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3. BRIGHT FUTURE

And think of the opportunities in Television! In 1950 over 5,000,000 Television sets were sold. By 1954 authorities estimate 25,000,000 Television sets will be in use. Over 100 Television Stations are now operating, with experts predicting 1,000. Now is the time to get in line for success and a bright future in America's fast-growing industry. Be a Radio-Television Technician. Mail coupon for Lesson and Book—FREE.

I TRAINED THESE MEN

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"Soon after finishing the N.R.I. course, worked for servicing shop. Now I am Chief Engineer of WCUN, WNRN, WSPK, two-way FM Police Radio Installations." S.W. DINWIDDIE, Jacksonville, Ill.

Shop Specializes in Television
"Have my own shop. Am authorized serviceman for 5 large manufacturers and do servicing for 7 dealers. N.R.I. has enabled me to build an enviable reputation in Television." P. MILLER, Maumee, O.

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"When I enrolled, had no idea it would be so easy to learn. Have equipped my shop out of spare time earnings. I am clearing about $40 to $60 a month. Full credit to N.R.I." — J. D. KNIGHT, Denison, Texas.

NRI Graduate Doubles Salary
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$10 Week In Spare Time
"Before finishing your course, I earned as much as $10 a week in Radio servicing, at home in my spare time. I recommend N.R.I. to everyone who shows interest in Radio." S.J. PETRUFF, Miami, Fla.

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"I operate my own shop and have over 500 customers. My profits average about $250 a month. Have had years of successful experience and I still praise N.R.I. training." J. H. ANDERSON, Atlanta, Ga.

Gets First Job Through N.R.I.
"My first job was operator with KDLR, obtained for me by your Graduate Service Dept. I am now Chief Engineer of Police Radio Station WQOX." T. S. NORTON, Hamilton, Ohio.

Regrets Not Enrolling Before
"Am proud of my diploma. I cannot say enough for the N.R.I. course. Regret I didn't take it years ago when I used to see your ads. Now I have a spare time shop." FRANK S. TUCKER, Hilton Village, Va.

I Will Train You at Home

Read How You Practice Servicing or Communications with Many Kits of Parts You Get!

YOU BUILD this modern Radio (above) as part of my Servicing Course. Build this complete, powerful Radio Receiver that brings in local and distant stations. N.R.I. gives you ALL the Radio parts . . . speaker, tubes, chassis, transformer, sockets, loop antenna, EVERYTHING you need. You use material to get practical Radio experience. Make EXTRA money fixing neighbors' Radios in spare time while training.

YOU MEASURE current, voltage (AC, DC and RF), resistance and impedance in circuits with Electronic Multitester (above right) you build as part of my Servicing or Communications Course.

YOU BUILD this Transmitter (right). As part of my Communications Course, I SEND YOU parts to build this low-power broadcasting transmitter. You learn how to put a station "on the air," perform procedures demanded of Broadcast Station operators, make many practical tests.

YOU BUILD this Wavemeter (below) in my Communications Course with parts I send you. Use it to determine frequency of operation and make other tests on transmitter currents. You conduct many interesting experiments.

Keep your job while training at home. Hundreds I've trained are successful RADIO-TELEVISION TECHNICIANS. Most had no previous experience; many no more than grammar school education. Learn Radio-Television principles from illustrated lessons. Get PRACTICAL EXPERIENCE—build valuable Electronic Multitester for conducting tests; also practice servicing Radios or operating Transmitters—experiment with circuits common to Radio and Television. At left is just part of the equipment my students build with many kits of parts I furnish. All equipment is yours to keep. Many students make $5, $10 a week extra fixing neighbors' Radios in spare time.

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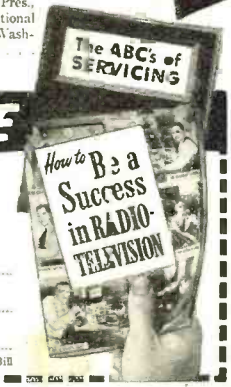
Act Now! Send for my FREE DOUBLE OFFER. Coupon entitles you to actual lesson on Servicing; shows how you learn Radio-Television at home. You'll also receive my 64-page book, "How to Be a Success in Radio-Television." You'll read what my graduates are doing, earning; see photos of equipment you practice with at home. Send coupon in envelope or paste on postal. J. E. SMITH, Pres., Dept. 1FE, National Radio Institute, Washington 9, D. C. Our 38th year.



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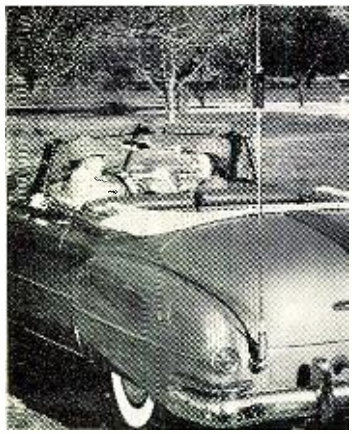

COVER PHOTO: Dr. and Mrs. Dale Hauck of Los Angeles spend an enjoyable afternoon in Griffith Park pursuing their mutual hobby of DX-ing with their neat mobile rig. (Ektachrome by Peter J. Samerjan)

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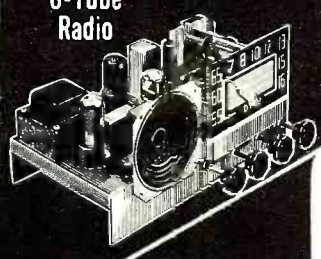
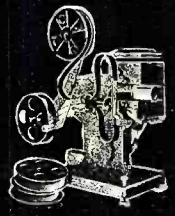


6-Tube Radio



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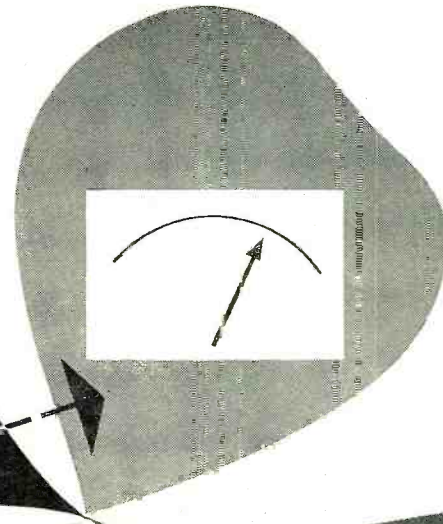
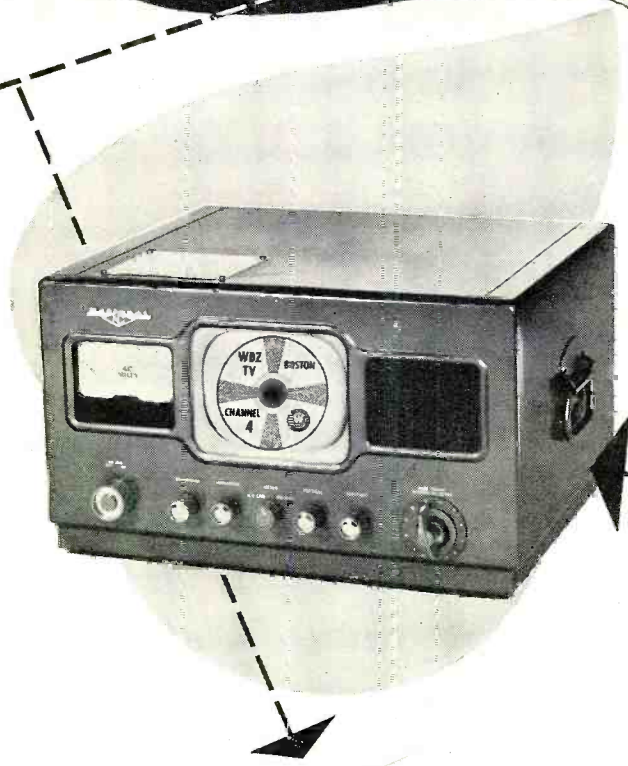
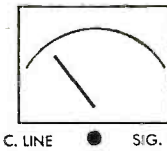


That's why smart power companies and TV servicemen choose the NATIONAL VIDEOMETER





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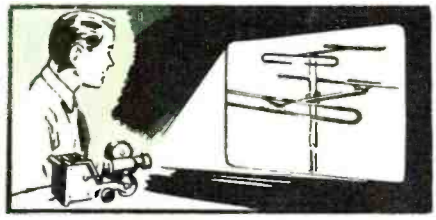

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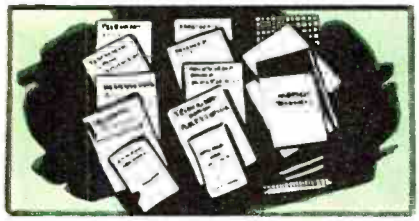

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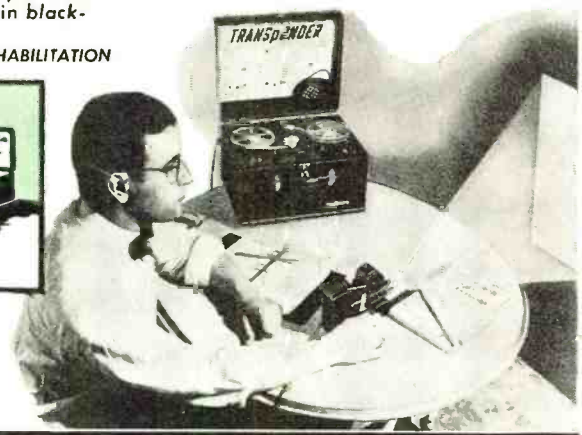

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For the RECORD

BY THE EDITOR

COLOR TELEVISION—TODAY AND TOMORROW

COLOR television is not a dead issue, even though newspaper and magazine publicity on the subject has died down somewhat in recent months. There are many behind-the-scenes developments now in progress which indicate a feverish activity on the part of the principals involved, exceeding even that which was prevalent during the recent hearings before the FCC.

The acquisition by *CBS* of *Hytron* and *Air King* means that this company now has accesss to manufacturing facilities for both TV picture tubes and complete receivers. Since *Hytron* is an *RCA* licensee, it is reasonable to assume that *CBS* will now have available to it all the information concerning the *RCA* tri-color tube, together with the privilege of manufacturing the tube under an *RCA* license. Such a development would give the *CBS* color TV system a big boost, as it would transform it from a mechanical to an all-electronic system. Furthermore, if other manufacturers declined to produce *CBS* color receivers, *CBS* could manufacture them in the *Hytron* plant. Such developments would undoubtedly take place very rapidly in case of a Supreme Court decision favorable to *CBS* in the FCC-*CBS*-*RCA* controversy now under consideration.

Developments in other directions are taking place even more rapidly. *Hazeltine* has more or less taken the lead in proving that it is possible to produce a highly satisfactory color picture using only a 4 mc. bandwidth for the picture information. This picture has definition fully equivalent to our present black-and-white pictures, and the color information which has been added produces pictures as good as our present *Kodachrome,* both with respect to definition and color fidelity, which has met very wide acceptance among the general public. Development of this quality picture in a 4 mc. bandwidth has been made possible by an invention reported by *Bell Labs* in the 1930's and independently rediscovered in recent years by several observers.

It appears that the bulk of the information in a conventional TV picture is carried by harmonics of the horizontal scanning frequency. This leaves "holes" in the frequency spectrum which are wasted in ordinary transmissions. These "holes" are at odd harmonics of half the horizontal scanning frequency. By ingenious methods, such as "frequency interlace", it has been found possible to utilize these "holes" to insert color information for a TV picture without interfering with the black-and-white information. Thus a complete color picture may be transmitted on a 4 mc. bandwidth, and together with the sound channel and guard bands, this picture may be transmitted in a 6 mc. channel.

Intensive research work is now underway on various schemes for accomplishing the principles mentioned above. *G-E* expects to have a transmitter and receivers under test by midsummer, and *RCA* is of course continuing to improve its dot-interlace system. *Hazeltine, Philco,* and others are hard at work on various projects. It should be mentioned that all of these latter systems are compatible, that is, color transmissions can be received in black-and-white on all receivers which have been manufactured to date. This is a tremendous advantage over a non-compatible system, as the broadcasters already have an audience.

Any color television system depends a great deal on the development of a suitable tri-color tube. *RCA* has made great strides in this direction, and has an experimental tube which gives highly satisfactory results. Stanford Research is working on the *Geer* color tube in which the three color phosphors are applied to the sides of tiny triangular pyramids, and then separate guns used for each color. Other companies are working on still other schemes.

With all these developments, it appears highly probable that within a year there will be enough experimental evidence accumulated to enable engineers to determine which of the many systems under test will provide the most satisfactory color TV performance. At least one highly qualified observer has expressed the opinion that when engineers can agree on such a system and can back their decision up with experimental evidence, they will receive a favorable hearing from the FCC, irrespective of the Supreme Court decision in the present controversy. It appears, then, that in spite of the defense emergency, an all-electronic, compatible, high-quality color TV system will be available for the general public within a reasonable period of time.

We have stated many times that the public may be the deciding factor in the final choice of a color television system—and we still believe that to be so, regardless of legal entanglements and publicity gimmicks.

One thing is certain—if the TV set owner has not had the opportunity of witnessing good color television, he has missed the thrill of a lifetime in video enjoyment. . . . . O.R.

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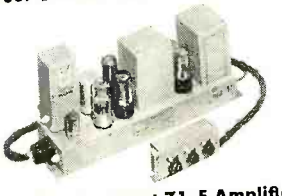
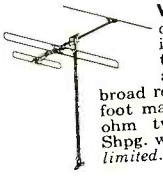


Audio Development 71-F Amplifier. A low-cost remote-controlled amplifier with excellent frequency response, ±.5 db, 40-10,000 cps. Output, 8 watts at less than 2% distortion. With bass and treble boosts. Crystal phono input (use plug-in preamp for magnetic cartridges). Outputs: 4, 8, 16 ohms. Controls on remote panel. Size: 16x6⅞x3¾". Complete with tubes. For 110-120 v., 60 cy. Shpg. wt., 14 lbs. **$49.98**

97-910. Model 71-F. *Only* . .

97-911. Plug-in Preamp for magnetic cartridges. 3 lbs. *Only* **$7.35**



Ward TV Antenna. Unidirectional, efficient in-line all-channel TV antenna. Folded di-pole high and low band elements for broad response. Complete with 5-foot mast, base and 60 feet 300-ohm twin-lead; less insulators. Shpg. wt., 10 lbs. *Quantity limited.* **97-397.** *Only* **$10.75**

Knight Indoor Antenna All-channel, adjustable type for good reception within primary service areas. Each element has 3 telescoping sections, adjustable for best reception. With 10-foot twin-lead. Shpg. wt., 2 lbs. *Quantity Limited.*

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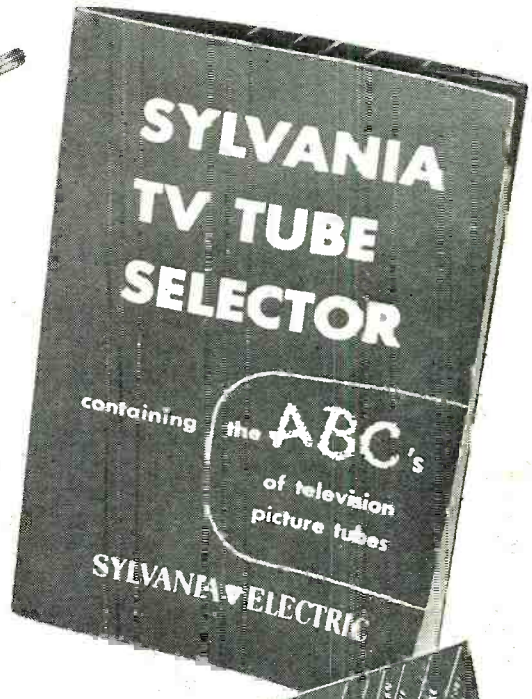

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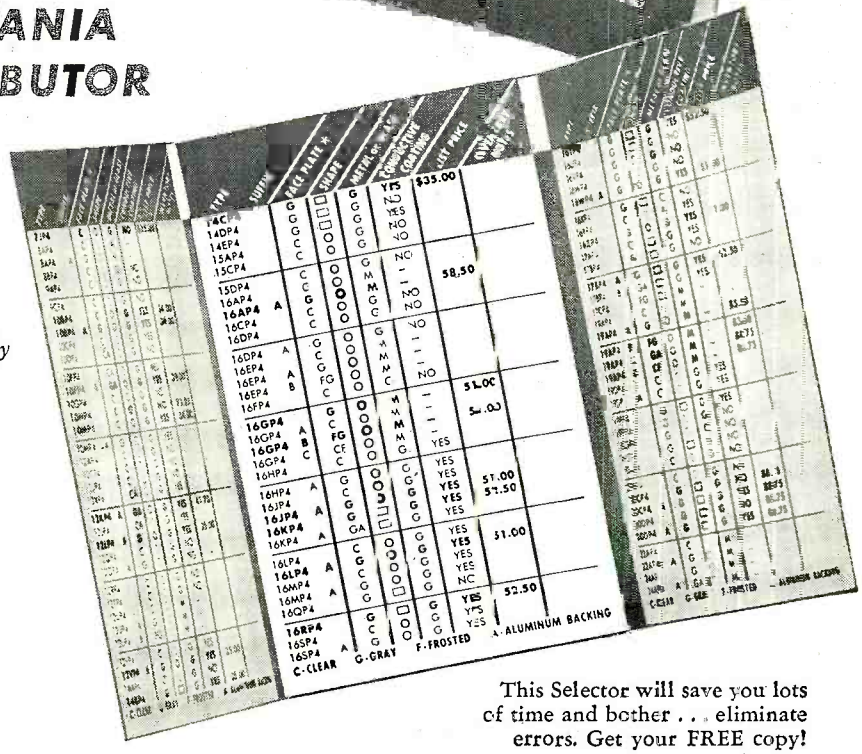
HERE'S the handiest little pocket guide since television came of age!

At a glance, it gives you the information you need concerning 100 different types of Television Picture Tubes.

Especially prepared for service men, it quickly indicates the difference between similar tubes having different suffix letters. More, it gives you facts about face plates, shape, glass or metal construction, conductive coatings, and price. A column is also left for your personal pencilled inventory notes.

Remember this guide is FREE. Your Sylvania distributor has them now. Ask him to give you a "Sylvania TV Tube Selector" when you next stop in or phone for those top quality Sylvania Tubes.



This Selector will save you lots of time and bother . . . eliminate errors. Get your FREE copy!

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SYLVANIA ELECTRIC

Sylvania Electric Products Inc., Television Picture Tube Division, Emporium, Pa.

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

Be Sure of Your Installations –
Get the *Aptitude-Tested* RG/U TRANSMISSION LINE CABLES

RG-5/U
APTITUDE RATING No. 8236

Frequency (Mc)	Attenuation per 100 ft
100.	2.65
200.	3.85
300.	4.80
400.	5.60

RG-8/U
APTITUDE RATING No. 8237

Frequency (Mc)	Attenuation per 100 ft
100.	2.10
200.	3.30
300.	4.10
400.	4.50

RG-11/U
APTITUDE RATING No. 8238

Frequency (Mc)	Attenuation per 100 ft
100.	1.90
200.	2.85
300.	3.60
400.	4.35

RG-54A/U
APTITUDE RATING No. 8239

Frequency (Mc)	Attenuation per 100 ft
100.	2.90
200.	4.20
300.	5.50
400.	6.70

RG-59/U
APTITUDE RATING No. 8241

Frequency (Mc)	Attenuation per 100 ft
100.	3.75
200.	5.60
300.	7.10
400.	8.30

For use with television antenna.

You know what you are doing when you use Belden RG/U Transmission Line Cables—they're aptitude rated. They are designed from the start to provide desirable electrical characteristics, and rigid manufacturing control assures constant, unwavering quality.

You can safely put Belden Wire to work for you, and know for sure how it will perform. You can know, too, that it will have the stamina to stay loyally on the job for years. For trouble-free installations, specify Belden Radio Wires.

Belden Manufacturing Company
4681 W. Van Buren Street
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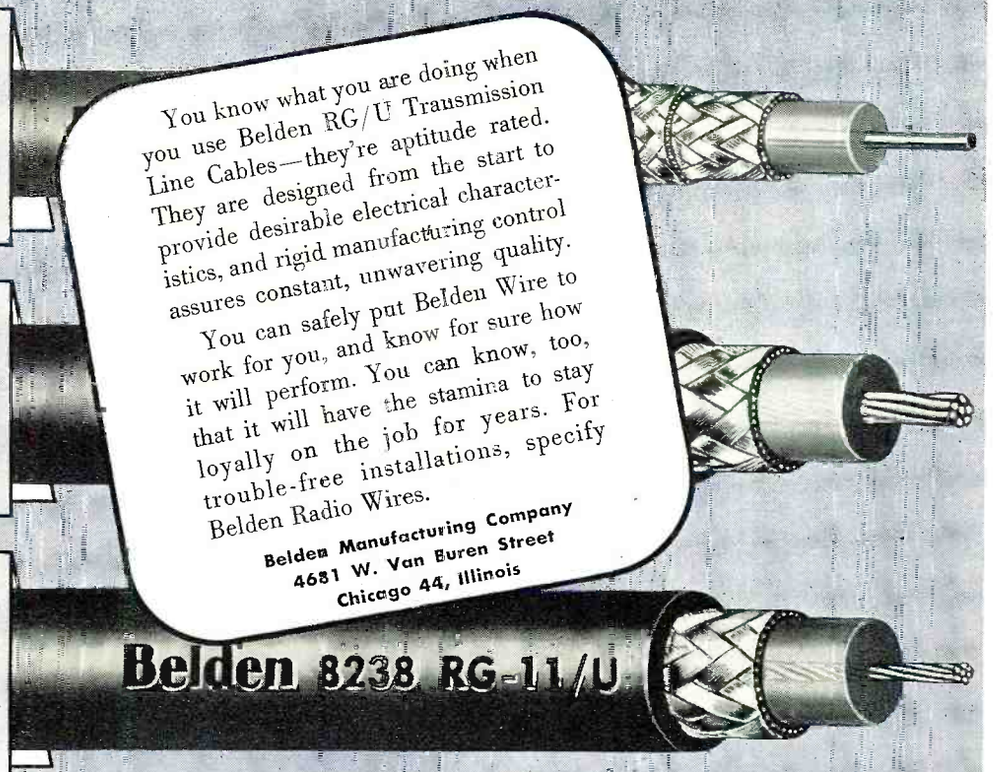


RG-58/U
APTITUDE RATING No. 8240

Frequency (Mc)	Attenuation per 100 ft
100.	4.10
200.	6.20
300.	8.00
400.	9.50

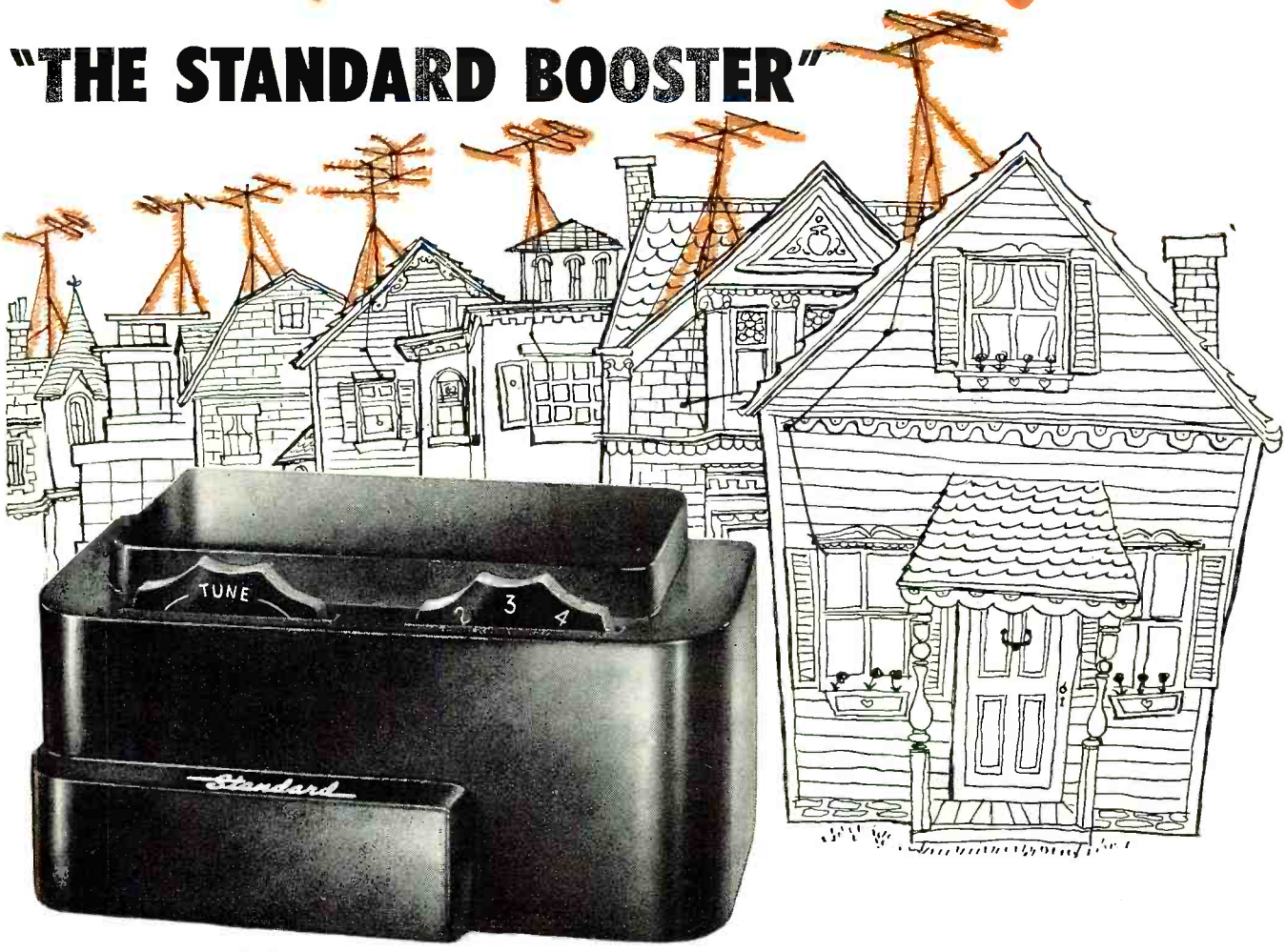
For use with radio frequency transmission, video, test equipment, and pulse transmission.

Belden Radio WIRE

The *Aptitude-Tested* LINE

Everybody's Tuning it!

"THE STANDARD BOOSTER"



Model B-51

in tune with the tuner

The "Standard Tuner" is used by over 75 TV set manufacturers. Nearly 50% of the TV sets made today are equipped with this outstanding front-end.

The new and improved "Standard TV Booster" is daily winning greater acceptance by dealers and customers alike in every Television market.

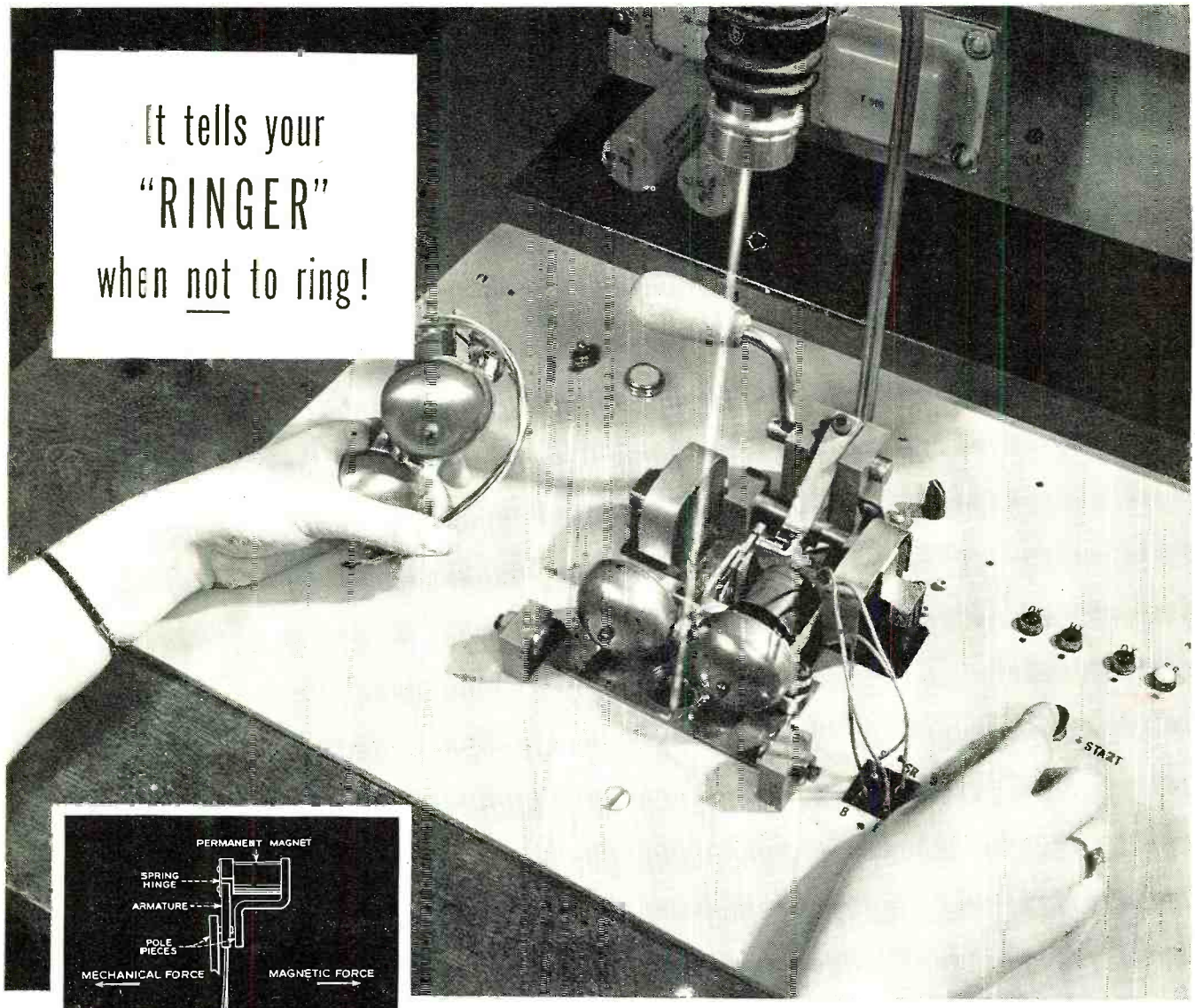
Here is the booster that gives real customer satisfaction, superior performance, trouble-free operation. The Model B-51 is engineered by a company that has demonstrated the greatest TV tuner know-how in the business.

Have your local distributor show you the outstanding features and money-making possibilities of this great new "Standard TV Booster."

Standard COIL PRODUCTS CO. INC.

CHICAGO • LOS ANGELES • BANGOR, MICHIGAN

It tells your "RINGER" when not to ring!



The Bell System's new automatic method of adjusting telephone ringers uses a beam of light passing between the gongs to a photoelectric cell. When test currents are applied to the ringer the machine decides whether to change the spring tension or the magnetic pull. After each change it tests again until the ringer is in perfect adjustment—and the whole procedure takes only 30 seconds.

To YOU, it's your familiar telephone bell. To telephone engineers, it's a "ringer." And it has two jobs to do. It must ring, of course, when someone calls you. And it must overlook the numerous electrical impulses which do not concern it, such as those sent out by your dial.

Ability to respond to some impulses, to ignore others, requires exact adjustment between the pull of a magnet and the tension of a spring. If they are out of balance your telephone might tinkle when it oughtn't, or keep silent when it should ring.

In the past, adjustment was made by hand, little by little until the proper setting was reached. It took time. But now Bell Laboratories engineers have developed a machine which adjusts new ringers perfectly, before they leave the Western Electric Company plants where they are made. And the operation takes just 30 seconds.

This is another example of how the Laboratories work constantly to improve every phase of telephony —keeping the costs low while the quality of service grows higher and higher.

BELL TELEPHONE LABORATORIES

WORKING CONTINUALLY TO KEEP YOUR TELEPHONE SERVICE ONE OF TODAY'S GREATEST VALUES

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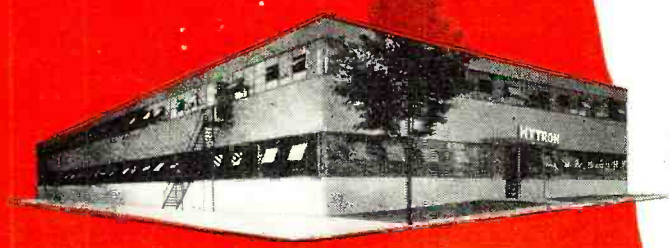

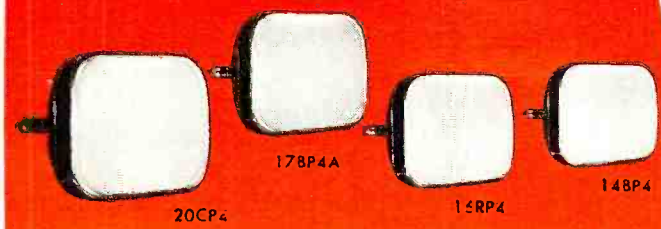

LEADING TV SET MANUFACTURERS PICK HYTRON RECTANGULARS:

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OLYMPIC • SENTINEL • SETCHELL-CARLSON • SPARTON
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AND OTHERS

1. **You get THE ORIGINAL.** The *studio-matched* rectangular tube is Hytron's baby. Its logically designed screen matches the 4 by 3 aspect ratio of the studio picture. Quite naturally, Hytron's new rectangular is fast becoming the most popular picture tube.

2. **You get UNIFORMITY.** Hytron's new picture-tube plant is the most modern in the world. It was designed especially to mass-produce Hytron *studio-matched* rectangulars of uniform dependability.

3. **You get A COMPLETE LINE.** Hytron offers you 14-, 16-, 17-, and 20-inch *studio-matched* rectangulars. All the popular rectangulars (and the popular types of round tubes too).

4. **You get THE QUALITY LEADERS DEMAND.** Nine out of ten leading TV set makers choose Hytron. More and more leading service-dealers pick Hytron. Because their own experience proves Hytron *studio-matched* rectangulars give "amazingly clearer, sharper, more brilliant pictures." Demand this same performance for yourself. Demand original Hytron *studio-matched* rectangulars.

WATCH ALSO FOR THE NEW HYTRON 14-, 17-, AND 20-INCH ELECTROSTATIC RECTANGULARS

OLDEST MANUFACTURER OF RECEIVING TUBES
HYTRON
RADIO AND ELECTRONICS CORP.

HYTRON RADIO TUBES

MAIN OFFICE SALEM, MASSACHUSETTS

Spot Radio News

★ ***Presenting latest information on the Radio Industry.***

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

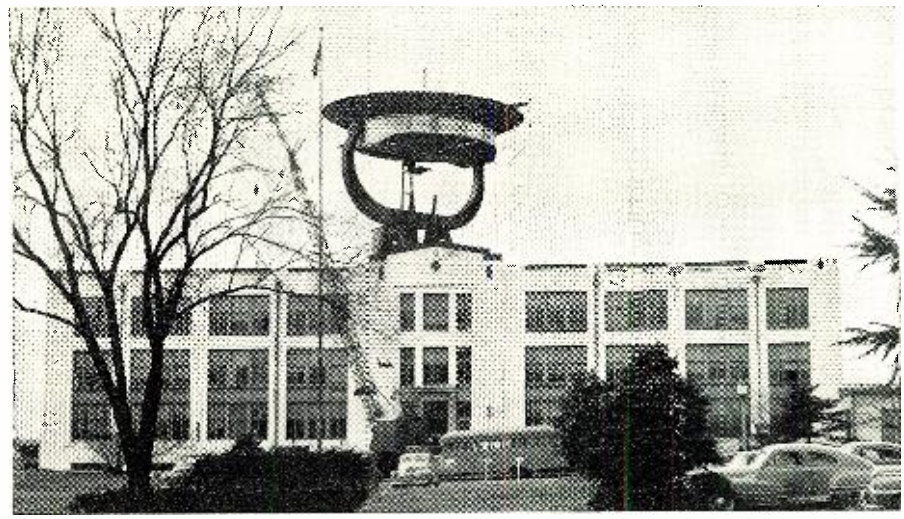
TV, which has been showered with bright predictions for a rosy future, many of which fortunately have come true, now appears to be on the road to even greater triumphs, according to the government's sight and sound-lane watchmen, particularly the headman of the group, Wayne Coy. With the newly proposed high-band plan to support this enthusiasm, he declared during a meeting of National Association of Radio and Television Broadcasters in Chicago, that the ultra-high stations in the future . . . "will be able to cover almost any metropolitan area and a very large part of the rural areas with adequate television service."

Admitting that he was not unaware of the problems on the higher bands, involving the high-power requirements and rough-terrain coverage, which may not be too good, he still felt that the possibilities upstairs were unusual. In his opinion the strong probability of . . . "early assignments in the u.h.f. looks a bit more attractive than the prolonged and costly litigation in various cities of this country for the lower channels available." There will be a substantial flow of receivers equipped to receive both bands, too, viewed the Commission's chairman, by the time new transmitters can be placed on the air. "More than that," he added, "I am quite sure that most all of the manufacturers will have converters available so that present sets can be utilized to receive both types of signals."

Color also gleamed in the scintillating forecast of the FCC chief, who indicated that he was looking forward to the beginning of color broadcasts, which represents . . . "the most exciting and most effective communications medium ever devised." Colorcasting appeared to him to be of . . . "greater service to the American public than any other broadcast system and more than that, it can become the most profitable medium to those broadcasters who will serve the public interest."

Coy's firm beliefs on the reds, greens, and blues, also echoed through another assembly hall, a few weeks prior to the midwest meeting; the chambers of the Supreme Court in Washington. Here, in a series of stormy sessions, the Commission's attorney, Solicitor General Philip B. Perlman, quoting the official decisions for color, opinions by the Commissioners and other specialists, repeatedly declared that the government's final views were just and should accordingly receive full sanction by the court. The request was met by sharp quizzing by the justices, with Justice Jackson particularly active on the information-please front. The justice asked, for instance, just what the Supreme Court must decide and just how technical should its review be. He also wondered if it wasn't true that the

The 600-inch "radio telescope" installation at the Naval Research Laboratory which will be used to study radio "signals" from the sun, moon, and stars. Scientists expect to use this newest research tool to extend man's knowledge of the universe and to put the new information to practical use in long-range weather forecasting and radio communication. See page 114 for further details.



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RAYTHEON TELEVISION PICTURE TUBES will please *you* because they are mechanically and electrically perfect. 101 basic quality tests, checks and inspections made during the various steps of a Raytheon Tube's construction — components, chemicals, processing, assemblies — assure unexcelled performance. You can make conversions and replacements with complete confidence that your skill plus RAYTHEON quality will result in superb picture reproduction.

Your customers will be delighted with Raytheons because they'll be receiving the finest TV picture they've ever seen. It will be a

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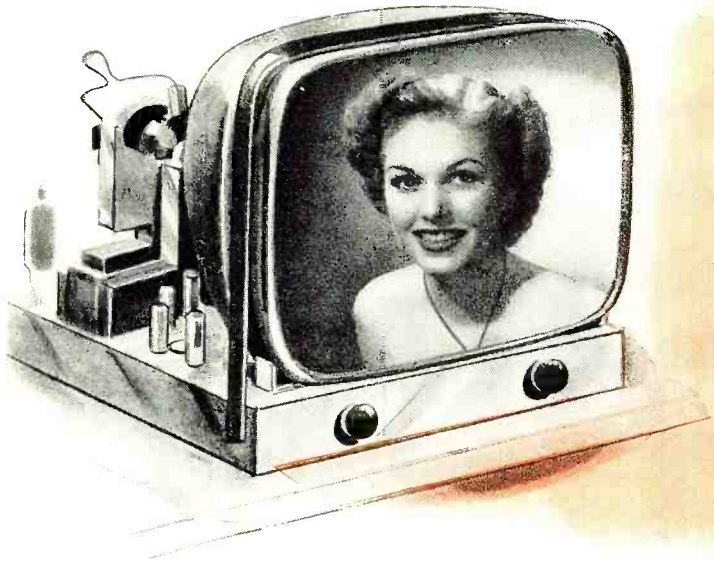

crisp, clear, contrasty, longer-lived picture — thanks to the superior quality of Raytheon Tubes — a quality that could only result from the knowledge gained through Raytheon's more than 25 years of experience in the pioneering and manufacture of all kinds of high fidelity electronic tubes.

Team your skill with Raytheon Quality. You'll find it pays in many ways. See your Raytheon Tube Distributor today.

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RADIO AND TELEVISION RECEIVING TUBES, CATHODE RAY TUBES, SPECIAL PURPOSE TUBES, SUBMINIATURE TUBES, MICROWAVE TUBES

jurists in the lower court, the U. S. District Court in Chicago, were somewhat bewildered by the mass of technical data and the 10,000-page transcript on the subject and accordingly believed that a higher court should really render a final decision on the matter.

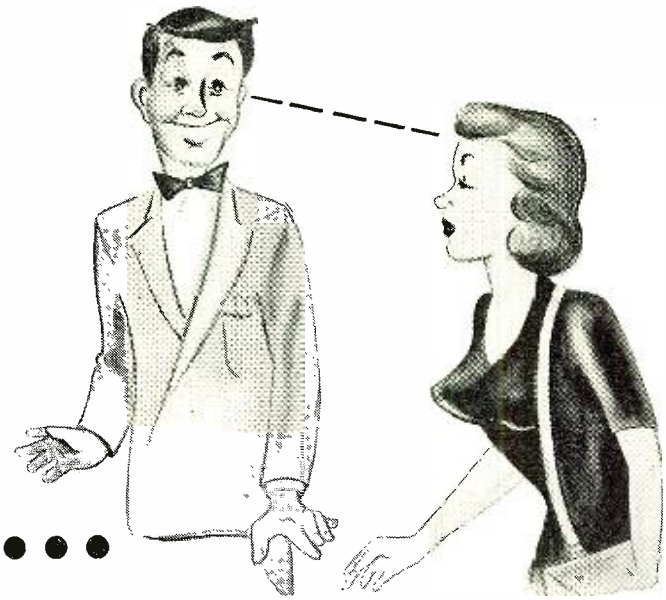
The members of the highest legal tribunal in the land were told by Judge Simon Rifkind, attorney for *Emerson Radio,* who with *RCA* was contesting the decision, that the FCC order was invalid because the findings did not support the premise that the time is ripe for any TV color system, and in addition the findings did not support the conclusion that one, rather than a multiplicity of systems should be approved. The Judge also felt that the order was an unlawful attempt to regulate the industry. The Commission's ruling was also attacked by Alfred Kamin, attorney for the CIO Brotherhood of Electrical Workers, who declared that the decision had been based on an assumption that present chassis could be easily converted, assuming that only small picture-tube models would have to be considered, a situation which does not hold today, for not only are the majority of sets now in use equipped with larger tubes, but the bulk of the models now being sold all feature tubes of the 17, 19, and 20-inch size. The impracticality of converting to such large tubes was illustrated in an exhibit.

The question of monopoly was also raised during the appeal for a reversal of the Chicago decision. Justice Frankfurter asked *CBS's* counsel, John Rosenman, if the FCC decision did not create a condition in which a possible monopoly might develop if the incompatible system were adopted. The *Columbia* attorney declared that this was not so. The Commission's apparent decision to close the door also prompted Justice Frankfurter to raise another vital point which, in part, questioned the authority of a government commission, not composed of experts, to foreclose, partially or completely, scientific development in a rapidly-expanding art such as television.

If the mechanical system is approved, there'll be quite a few new terms and definitions with which we'll have to become familiar. According to the FCC, the term *field* will apply to scanning through a picture area once in the chosen scanning pattern and in a single color. In a line-interlaced scanning pattern of two-to-one, this means that we have scanning of the alternate lines of a picture area once in a single color. In the color field, we have scanning through the picture area once in the chosen scanning pattern and in each of the primary colors. Thus, in the line-interlaced scanning pattern, we have scanning of the alternate lines of the picture area once in each of the primary colors. *Color frame* will also be used frequently, if and when *CBS* wins, and in this instance, we'll be considering the scanning of all of the pic-

(*Continued on page* 110)

NO EYE STRAIN...



WITH A Sheldon "Telegenic" Picture Tube

where

BLACK IS BLACK - WHITE IS WHITE -

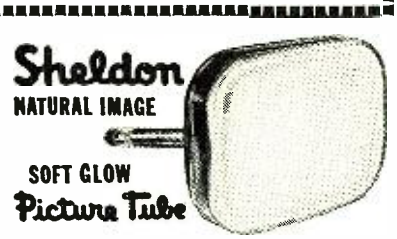
and between

ALL THE NATURAL INTERMEDIATE SHADING!

PLEASANT, visual-comfort, continuous viewing without eyestrain can only be had on a picture tube screen that has neither "tints" nor color to befog the picture. A "yellow" or a "blue" screen tube compels the viewer's eyes to compensate for the inequalities and exaggerations in picture tone values, such as muddy "off" blacks and glarey or tinted highlights. Anyway you look at it, this causes eyestrain.

That is why SHELDON was the first to standardize on a "black and white" screen. Its picture tube screens cause NO EYESTRAIN and NO GLARE . . . they give the utmost in picture quality.

To You in the Television Industry,
TRY A SHELDON TUBE IN YOUR OWN SET FOR SEVEN DAYS
— and BE CONVINCED!



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PHOTOFLOOD & PHOTOSPOT LAMPS • SPRING-ACTION PLUGS • TAPMASTER EXTENSION CORD SETS & CUBE TAPS • RECTIFIER BULBS

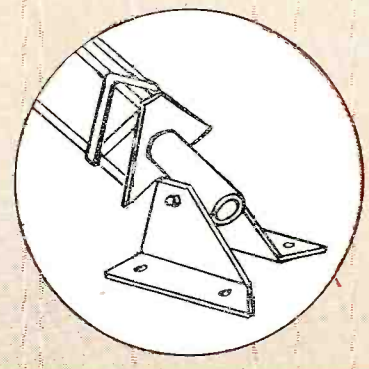
At EVERY YEAR A "BANNER" YEAR IN

← 1949 PENN TOOK THE LEAD with Teletower . . . World's Best Seller!

In 1949, Penn got the jump because of engineering and construction advances offered by Teletower. Among these are universal motor mount easily adaptable to *all* antenna rotors . . . exclusive long-life Telecote finish . . . built-in climbing rungs . . . semi-automatic pilot-hole alignment . . . improved T-X section.

BUILT-IN BASE. Permits Raising Tower on Slope *After* Fastening Base to Roof. 1950 ↓

Big boon to installers . . . Penn's introduction in 1950 of a new type built-in base. Heavy plate takes thrust of tower welded to section of pipe. Tower can be raised on severest slope *after* base is fastened to roof. Installation time is saved . . . hazards reduced. Base is permanently attached and non-removable. Protected by Telecote.



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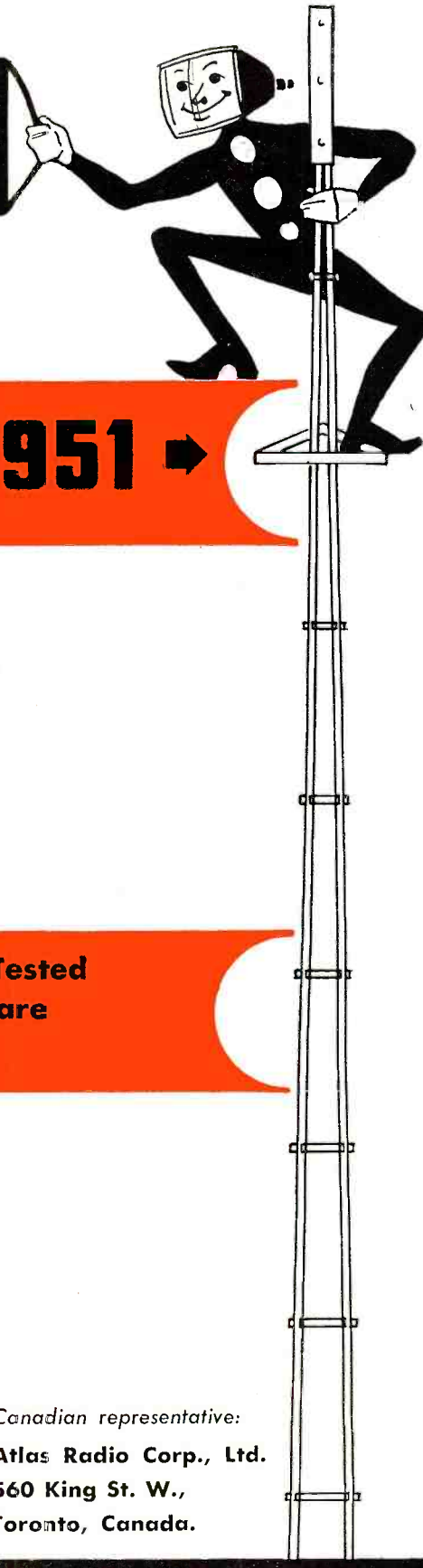

NEW TOWER. Supports 250-lb. Head Load Without Guying

1951

A truly revolutionary development in antenna supports . . . Penn's new tower that maintains 250-lb. head load without requiring a single strand of guy wire. Erection time: 30 minutes! Sensation of the recent RTMA convention at which it was exhibited. Get the facts on this one while it's "hot" . . . write Teletowers.

1950

COMPLETE LINE of Tested Tenna-Mast Hardware

In 1950, Penn introduced its popular Tenna-Mast Hardware. Pole-base mount illustrated is made of durable aluminum. Special construction permits mounting on peak of roof so that erection can be made from either ridge or side. Penn various models of Base mounts accommodate pipe or tubing from 1" to 2".

Canadian representative:

Atlas Radio Corp., Ltd.
560 King St. W.,
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PENN *Teletowers Thriftowers Tenna-Mast*

PENN BOILER & BURNER MFG. CORP.

With every $2.00 purchase of WALSCO products or $10.00 worth of antennas . . .

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Each item in this attractive GIFT package will be useful to you. And it's yours at *no extra cost!* All 5 handy items in this package are from the famous line of WALSCO quality products. Every radio and TV service man will want one. Get yours today!

FREE GIFT PACKAGE *available at your local parts jobber. Get yours today!*

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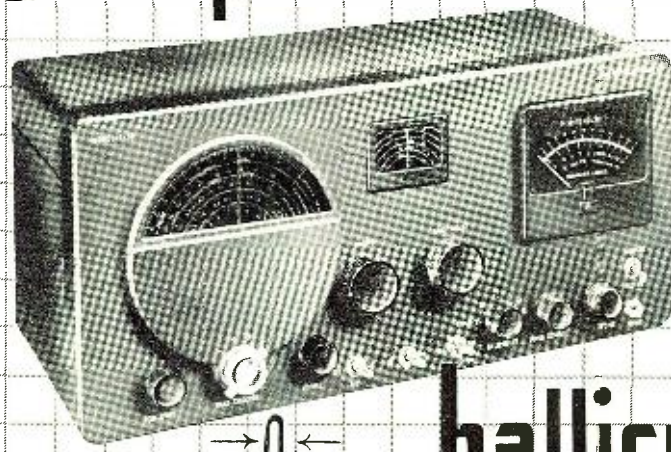
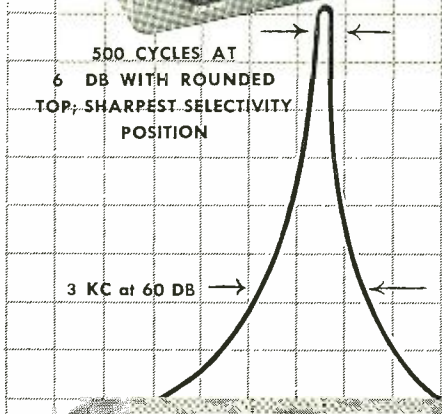
On top for SELECTIVITY!





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50 kc 2nd I-F GIVES MORE OF WHAT YOU WANT THAN ANY OTHER SET ON THE MARKET REGARDLESS OF ITS PRICE CLASS

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GIANT 4-IN "S" METER calibrated in microvolts and "S" units. Four bands 538—1580 kc, 1720 kc to 32 Mc. Calibrated electrical bandspread, 5 position selectivity, average sensitivity 2 microvolts with ½ watt output. 9 tubes plus regulator, rectifier . . .

R-46 SPEAKER—New 10" PM in matching satin black cabinet with 500-ohm transformer **$19.95**

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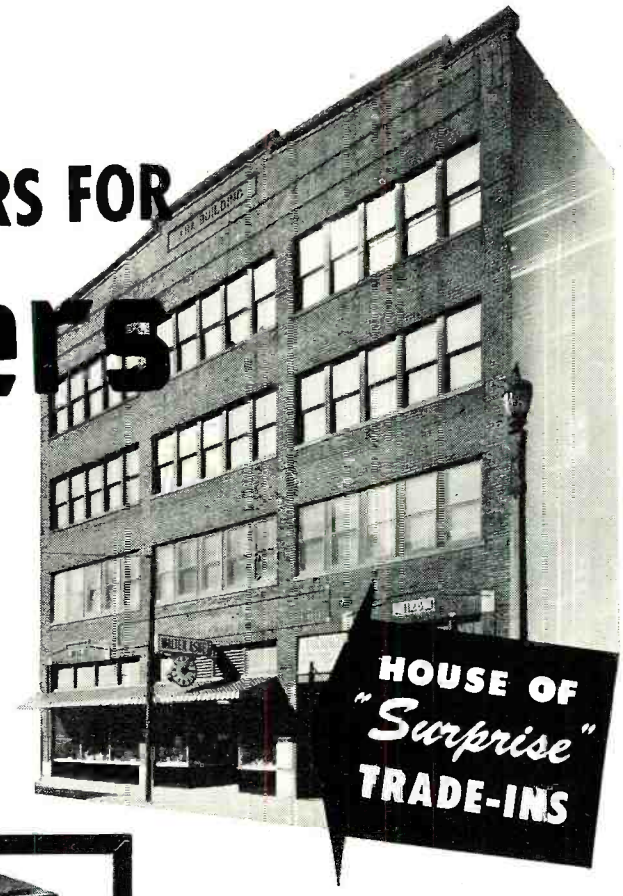
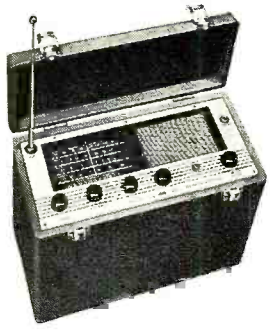


Whether you are a beginner or an old-timer, Hallicrafters is the equipment for you and Walter Ashe is the place where you can buy it at a record-breaking saving with a "Surprise" trade-in allowance. Trade used factory-built test or communication equipment now. What have you got to trade? Wire, write, phone or mail the handy coupon today.

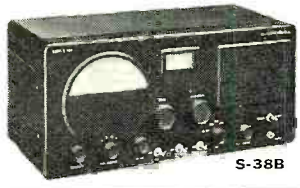


Hallicrafters S-72

Long Range Portable. Wherever you may roam, preserve the home ties with this extra-sensitive, portable broadcast-shortwave radio. Can be used on 110-120 volt AC or DC or self-contained batteries. Shpg. wt. 16 lbs. Only

$109.95 (Less batteries)

For the very thriftiest way to buy your new S-72, trade your used equipment. Profit with a "Surprise" trade-in.



S-38B

Hallicrafters S-76

New dual conversion Receiver with 50-KC 1-F. The most-wanted features at the lowest possible price. Shpg. wt. 44 lbs. Only

$169.50 (Less speaker)

R-46 speaker.....**Only $19.95**

Apply our liberal "Surprise" trade-in allowance against the above price.

Hallicrafters S-38B

Shpg. wt. 14 lbs. Only $49.50. Buy it for less with a "Surprise" trade-in. What have you got to trade?

$49.50

Hallicrafters SX-71

Eleven-tube, double conversion receiver 538KC to 35MC 46-56MC. Crystal filter. Shpg. wt. 33 lbs. Only

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R-46 speaker.....**Only $19.95**

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Service Clinic!

Engineering information to help you better service Raytheon

THE SYNC. SEPARATOR circuit (shown in Fig. 1) is designed to separate the picture video and noise interference from appearing along with the horizontal, vertical, and equalizing sync. pulses used for picture synchronization. This separation is essential to prevent mis-synchronization or picture displacement resulting from varying picture video information and noise interference. A triode section of a 6SN7 tube is operated at a low plate voltage (approx. 25V) to permit an early and sharp Ip cut-off.

THE PLATE VOLTAGE divide and dynamic load (R45 & R114) is designed to be of low impedance so as to minimize hang-over due to circuit capacities. R42 and C103 allow the grid current to limit on the sync. tips and to bias the picture video beyond the cut-off portion of the dynamic plate voltage curve, as illustrated in the graph section of Fig. 1. This produces an amplified video-free sync.

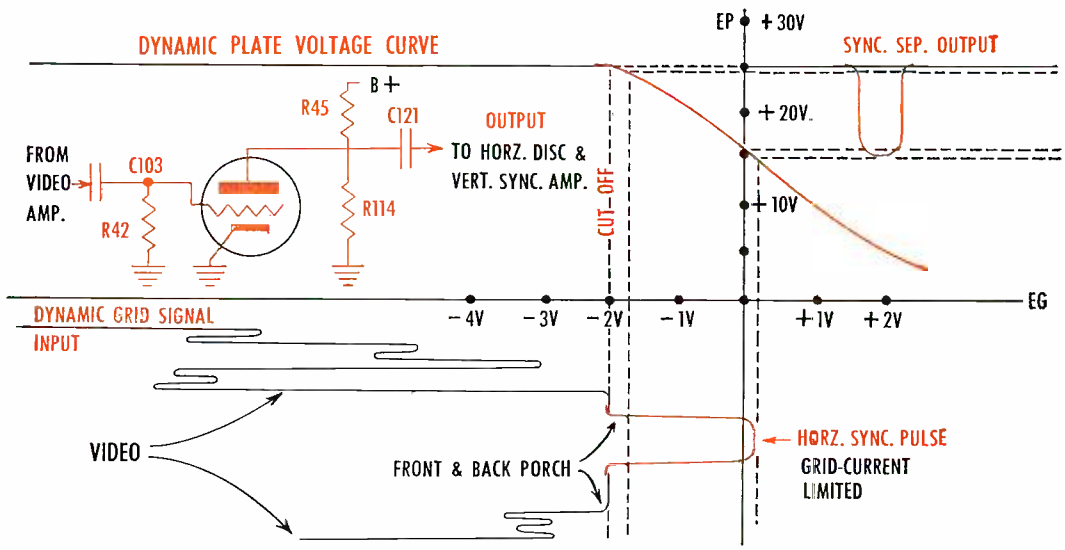


FIG. 1 SYNC. SEPARATOR

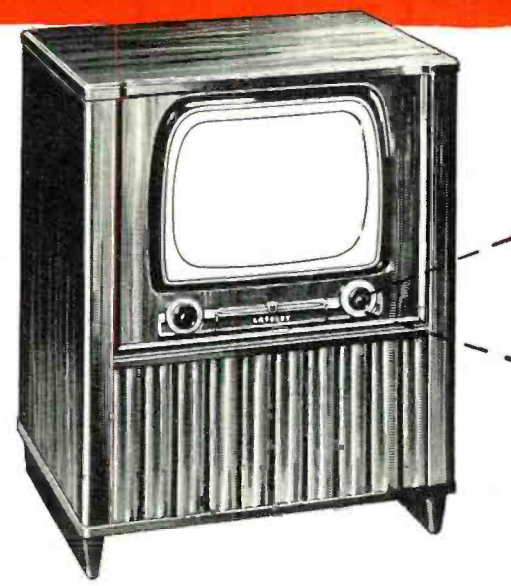
IMPROVED CIRCUITRY such as this is one of the many reasons why you can feel free to recommend Raytheon TV to a friend or a customer.

EDITORS ARE SHOWN HOW EASILY TV OWNERS CAN CONVERT SETS FOR UHF

Practical Demonstration Proves Present Sets Not Outdated for Ultra-High Frequency Reception

By ROCKY CLARK

Radio & Television Editor, Bridgeport Post



BRIDGEPORT, CONN., April 11.—If you own a screwdriver, you can convert your TV set for ultra-high frequency reception so easily, so quickly that the job is usually done in two or three minutes—if you own the right type of set.

A large audience of leading newspaper and magazine science editors witnessed this amazingly simple method of UHF conversion here today at the first public demonstration of ultra-high frequency reception on a current model TV set.

The editors learned how easily and inexpensively a TV owner can convert his present set if the manufacturer has foreseen the coming of ultra-high frequency and has prepared the set for its reception.

The Federal Communications Commission recently announced plans for licensing 1,807 new television stations—most of them in the ultra-high frequency transmitting channels—in addition to the 107 VHF stations now in operation.

Ever since this announcement was made, present and prospective TV owners have been fearful that their sets might be obsolete, or that the expense and trouble of conversion might be prohibitive.

Their fears on both counts were allayed by today's demonstration, sponsored by the Crosley Division of Avco Manufacturing Corp. Transmitted from the National Broadcasting Company's experimental station KC2XAK at Success Hill, Conn., an ultra-high frequency program was viewed by the members of the press on the screen of a current model Crosley TV Set taken at random from the stock of a Bridgeport television and appliance store.

The program was received with striking clarity and fidelity, completely fulfilling the promise of interference-free pictures received in the UHF television band.

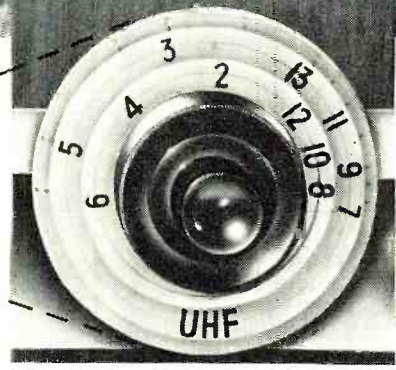
Conversion troubles? Heavy expense? A newspaperman from the audience at the Hotel Barnum was handed a screwdriver and asked to do the conversion job. Loosening two wires leading from the back of the set, attaching them to a simple, inexpensive device known as the Crosley Ultratuner, and connecting the Ultratuner to the set, he did the trick in less than three minutes.

He then tuned the Ultratuner to the UHF telecast as simply and precisely as selecting a program on VHF channels. Placed on top of the TV receiver, the Ultratuner is housed in an attractive cabinet no larger than a small table radio.

The secret of this simplified conversion method was explained by Crosley engineers, who said that provision for UHF reception has been made in the design and construction of all Crosley sets built in the past two years.

As a result, he explained, conversion does not require dismantling the set and replacing or adding new parts in the TV receiver, and no service or expert electronics help should be needed.

Leading newspaper and magazine science editors witness Crosley's amazingly simple method of UHF conversion in its first public demonstration.



Here's why Crosley TV is No UHF Conversion Problem

As far back as early 1948, Crosley started preparing for the coming of ultra-high frequency television—in two ways:

1. In the Chassis. In every Crosley TV Set built in the past two years, provision has been made in the circuit for the reception of UHF. It's so easy that with a screwdriver, your customer can do the complete job himself—just by hooking up two wires on the outside of the set—in two or three minutes. His only outlay will be the cost of the inexpensive Ultratuner when and if UHF telecasts begin in your area. No adjustments, no removal of chassis, no unnecessary service calls needed. No parts need be changed or added in Crosley-built sets. Your customer simply takes the Ultratuner home under his arm and installs it with about as much ease as putting a bulb in a reading lamp. It's just that simple.

2. In the Tuner. Crosley employs *continuous tuning* with its famous Unituner. In the picture above, you will note "UHF" marked on the dial between Channels 6 and 7. At this point (122-132 megacycles) is located the best selection for a UHF interference-free conversion channel. Most other manufacturers' television sets—with tuners of the "click" or "jump" type—have not provided for this channel.

YOU CAN SELL CROSLEY TODAY—with even *greater* confidence! You can assure your customers that they are buying a set today that is built for the future—not one that will be obsolete or too expensive to convert to UHF reception.

Again, Crosley sets the pace in electronics by being first with an easy UHF conversion method. We have given these facts to the public through the editorial press and full-page newspaper announcements which we think will help to clarify the confusion on UHF to the advantage of all television dealers.

The Crosley Ultratuner will give every Crosley owner a full range of UHF channels and a full range of VHF channels without sacrificing a *single VHF channel.*

You'll get it *all* completely, clearly, economically on a Crosley. For further details about the Crosley TV line, write us for the name of your nearest Crosley Distributor: Crosley Division, AVCO Manufacturing Corporation, 1329 Arlington St., Cincinnati 25, Ohio.

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CINCINNATI 25, OHIO

COMING FROM CROSLEY!

CROSLEY
Family Theatre
TELEVISION

Within the INDUSTRY

D. W. GUNN has been named equipment sales manager of the radio and television tube division of *Sylvania Electric Products Inc.*

Formerly assistant to the company's general sales manager, he will now be responsible for administering the equipment sales organization and will also supervise and direct activities of the company's district offices throughout the country.

Mr. Gunn has been associated with *Sylvania* since 1932, transferring to the radio tube division in 1934. He is a graduate of Northwestern University and is a member of the IRE and the Sales Executives Club.

* * *

BRIG.-GEN. GEORGE I. BACK, General MacArthur's Signal Officer in Tokyo since 1947, has been nominated by the President to be Chief Signal Officer of the U.S. Army. He will succeed Major General S. B. Akin who served as Chief Signal Officer from April 1, 1947 until his retirement from the Army on March 31st of this year.

During World War II, from September 1944 to November 1945, General Back served in the Mediterranean Theater of Operations as Deputy Chief Signal Officer of the Allied Force Headquarters, and as Chief Signal Officer of the Mediterranean Theater.

General Back has had a long and distinguished career in the Army and holds the Distinguished Service Medal, the Legion of Merit, the Order of the British Empire (Commander), the Order of the Crown of Italy, and the Brazilian War Medal.

* * *

CHARLES E. KRAMPF has been named executive vice-president of *Aerovox Corporation* by that company's board of directors. He succeeds Bert Conway in the post.

In addition to his new duties, Mr. Krampf will continue to serve as president of the *Electrical Reactance Corporation*, the ceramic division of *Aerovox*. As executive vice-president he will have supervision over the *Aerovox* plants in New Bedford, Massachusetts and Hamilton, Ontario. He will be in charge of the over-all operation of the corporation and its subsidiaries and directly responsible to the president, W. Myron Owen.

Mr. Conway, who resigned his post as executive vice-president, will remain with the company on a consulting basis and continue to serve on the board of directors.

* * *

HYTRON RADIO AND ELECTRONICS CORPORATION and *Columbia Broadcasting System, Inc.* have concluded an agreement whereby the assets and business of *Hytron* will be acquired by *CBS* through an exchange of stock.

When the transaction is consummated, the television and radio tube manufacturing business of *Hytron* and the television and radio set manufacturing business of *Hytron's* subsidiary, *Air King Products Co., Inc.* will continue under the management and direction of its present officers.

Lloyd H. Coffin and Bruce A. Coffin, chairman and president respectively of *Hytron,* and David H. Cogan, president of *Air King,* will be among four representatives of *Hytron* who will become directors of *CBS.*

Under the agreement the stockholders of *Hytron* will receive thirty-one shares of *CBS* stock for each hundred shares of *Hytron* stock.

* * *

LEONARD F. CRAMER, vice-president and director of *Allen B. Du Mont Laboratories, Inc.,* has been named to head the firm's newly-formed government liaison department.

The new department will be responsible for *Du Mont's* defense mobilization planning and will work with government officials on armed forces contract negotiations.

During World War II, Mr. Cramer had charge of the company's negotiations with the government and planned the firm's war production, from its first contract with the Signal Corps. Organization and personnel for the new department are expected to be announced shortly by Mr. Cramer.

* * *

THE WORKSHOP ASSOCIATES, INCORPORATED of Needham, Massachusetts has become a wholly-owned subsidiary of **THE GABRIEL COMPANY** of Cleveland. The antenna company will continue to operate in substantially the same manner as it has in the past . . . **BERGEN-PASSAIC ELECTRONICS, INC.** has recently entered the consulting engineering field, specializing in service engineering. Headquarters are at 325 Elm Avenue, in Bogota, New Jersey. Eugene Ecklund and Gregory Coutoupis are the principals in the new firm . . . **CANNON ELECTRIC DEVELOPMENT COMPANY** of Los Angeles has changed

TONE ARMS— STYLI

...still available
...still tops

PRODUCT shortages? Sure. But there's *never* a letdown in the *quality* of G-E phono-accessories . . . and the items shown above are still available to manufacturers, jobbers, dealers and servicemen.

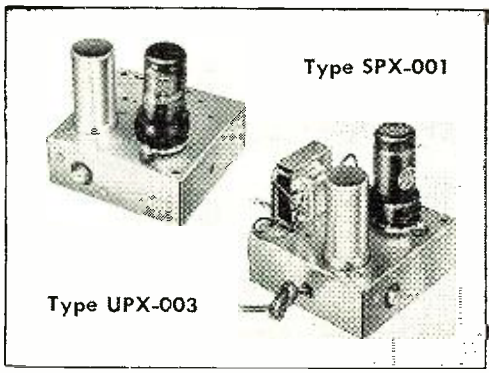
The G-E tone arm is built to accommodate the famous G-E Triple Play Cartridge (also in stock). It's equipped with ball bearings for smooth lateral movement . . . special light weight alloy keeps the arm mass to a minimum . . . stylus pressure is *constant at 6-8 grams for all three speeds* to reduce record wear. Plainly marked selector knob projects through the top of the arm—a single twist places either stylus in playing position.

General Electric's high compliance Baton Stylus with diamond or sapphire tip is unsurpassed in its field. Stock it in quantity—give your customers listening quality that lasts.

MANUFACTURERS: Your production requirements of General Electric phono-accessories can still be filled. General Electric application engineers have suggestions that will help you design a better product. Call or wire us today for details. *General Electric Company, Parts Section, Electronics Park, Syracuse, New York.*

HERE'S PLUS BUSINESS!

Use G-E phono Preamplifiers to sell *modernization* to your customers. Self-contained for easy installation, these units are ready to operate when connected to a power source. They provide sufficient amplification to enable the Variable Reluctance Cartridge to be used with any standard phonograph.



General Electric Company, Section 961
Electronics Park—Syracuse, N. Y.

Please forward information on the G-E phono accessories checked:

☐ Variable Reluctance Cartridges ☐ Replacement Styli ☐ Phono Preamplifiers ☐ Tone Arms

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GENERAL ELECTRIC

the name of the company to **CANNON ELECTRIC COMPANY** in the interest of simplicity and brevity. The company is continuing to operate as a division of **CANNON MANUFACTURING CORPORATION** . . . Richard R. Hayes has announced the formation of a new engineering firm, **RICHARD R. HAYES & ASSOCIATES.** The new company, which specializes in FM, AM, and TV engineering, has headquarters at 1608 Mardell Avenue in San Antonio.

* * *

STANLEY F. PATTEN has been named director of mobilization planning for the government department of the *Allen B. Du Mont Laboratories, Inc.*

Mr. Patten, who retired from the Navy in 1947 with the rank of Rear Admiral, will be responsible for the maintenance of master production control and plant loading of all *Du Mont* plants as well as security matters and federal controls. He has been with the company as assistant to the organization's president since July 1947.

During his Navy service from 1917-1947, Mr. Patten specialized in electronics and communications. He took his post graduate work at the U.S. Naval Academy and at Yale University.

* * *

THE CITY OF NEW ORLEANS will have live television by the middle of 1952, if present plans materialize.

Coaxial cable facilities to provide direct transmission for WDSU-TV in New Orleans have been ordered through the *American Telephone and Telegraph Company* by the *National Broadcasting Company* and the *American Broadcasting Company.*

Until cable facilities are extended, WDSU-TV will continue to bring televiewers in the New Orleans area network programs by means of kinescopes and special films.

* * *

FRANK D. LANGSTROTH, formerly general manager of sales and commercial relations of the *Lansdale Tube Company,* a wholly-owned subsidiary of the *Philco Corporation,* has been named president of *Starrett Television Corp.,* succeeding R. D. Burnet.

Mr. Langstroth has been connected with the radio industry for the past 25 years in both tube and radio manufacturing. He began his career in California in the sales and service branch of the *Grigsby-Grunow Co.* He has been associated with *Arcturus Radio and Tube Co.,* and *Sylvania Electric Products Inc.* during his career.

During World War II, Mr. Langstroth served with the U.S. Signal Corps as a Major and was chief of the

(*Continued on page* 106)

Everybody

benefits from picture tube shells of U·S·S Stainless Steel

Set owners, dealers and servicemen alike are enthusiastic over picture tubes with shells of U·S·S 17-TV Stainless Steel. For good reason, too, because this outstanding development in tube construction offers real benefits to everybody concerned.

SET OWNERS like the sharp, clear pictures that metal shell construction makes possible. Since the face plate is made separately from the shell, it can be made from drawn glass having better optical qualities than that used in other tubes. Owners also appreciate the strength and safety of Stainless tubes. The compression fit between the face plate and shell provides greater resistance to outside atmospheric pressure.

DEALERS are sold on the light weight of tubes with Stainless Steel that makes them easier to store and easier to handle. Stainless shell tubes weigh one-fourth to one-third less than ordinary tubes . . . the 17″ rectangular tube shown here weighs only 10 pounds.

SERVICEMEN appreciate the safety and light weight, too. And they say that the clearer pictures mean better-satisfied television customers.

Tube manufacturers are putting these advantages of Stainless Steel construction into both rectangular and round tubes. And they are finding U·S·S 17-TV Stainless Steel—developed particularly for this job—the ideal picture tube material. So put your sales efforts behind the new sets with metal shell tubes of U·S·S Stainless Steel, and make it a point to recommend them for replacements, too.

AMERICAN STEEL & WIRE COMPANY, CLEVELAND · COLUMBIA STEEL COMPANY, SAN FRANCISCO
NATIONAL TUBE COMPANY, PITTSBURGH · TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM · UNITED STATES STEEL COMPANY, PITTSBURGH
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SHEETS · STRIP · PLATES · BARS · BILLETS · PIPE · TUBES · WIRE · SPECIAL SECTIONS

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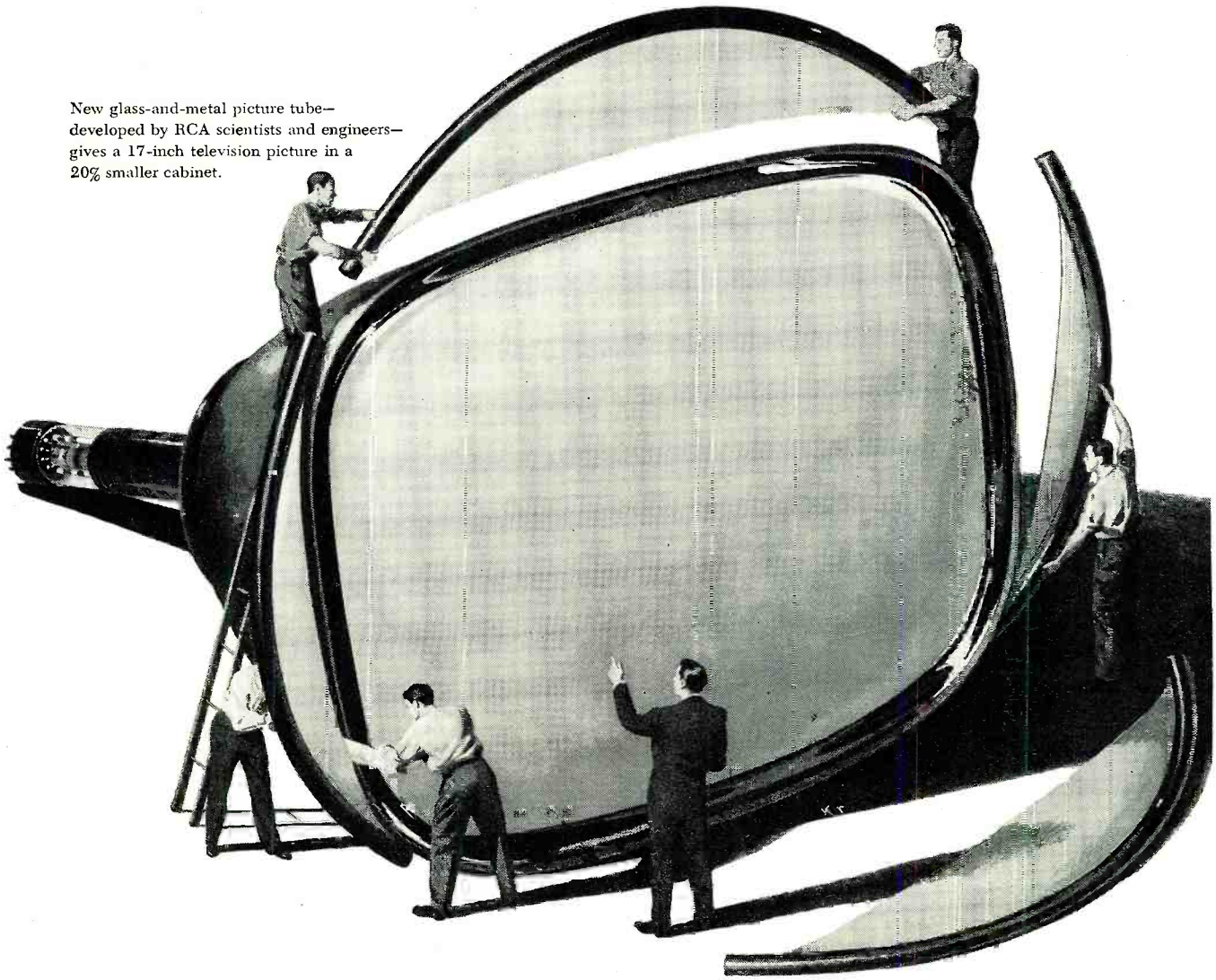


New glass-and-metal picture tube—developed by RCA scientists and engineers—gives a 17-inch television picture in a 20% smaller cabinet.

Now—television "squares away" with a Bigger Picture—smaller tube!

Ideal for mass production, compact, and lower in cost, RCA's glass-and-metal picture tube was a major advance in television history.

Now comes still another important RCA engineering advance, *rectangular* glass-and-metal kinescopes. Engineered for the big 17-inch pictures you want in a receiver that takes up *less* cabinet space—as much as 20% less—the new kinescope gives you finer pictures than ever before . . . in sharp and brilliant focus over every inch of your screen.

And, as yet another step ahead, RCA's new picture tube offers an improved type of Filterglass faceplate—frosted Filterglass—developed on principles first investigated by scientists of RCA Laboratories, to cut reflection, and give you sharper picture contrast.

* * *

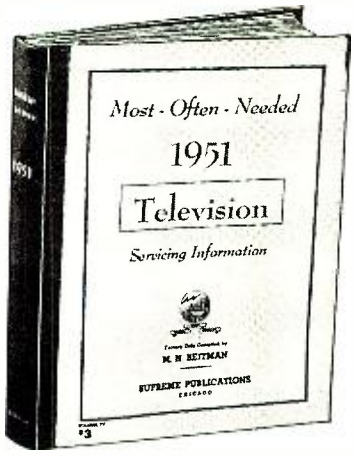
See the latest advances in radio, television, and electronics at RCA Exhibition Hall, 36 West 49th Street, N. Y. Admission is free. Radio Corporation of America, RCA Building, Radio City, New York 20.

See the new RCA Victor home television receivers—with the 17-inch rectangular picture screen—at your RCA Victor dealer's today.

RADIO CORPORATION of AMERICA

World Leader in Radio—First in Television

New SUPREME 1951 TV Manual



New 1951 Television Manual

This newest giant volume of the series covers 1951 factory data on all popular television sets of all makes. There are circuit explanations, 192 pages of alignment procedure, test patterns, response curves, pages of waveforms, voltage charts, service hints, and dozens of large double-page circuit diagrams. Manual style binding. At your parts jobber or by mail, special price, only.... **$3**

1950 TV Manual. Includes service information on all popular TV sets of all makes from Admiral to Zenith. Large size: 8½x11", plus ten mammoth 11x15" blueprints. Amazing bargain at only..... **$3**

1949 TV Manual. Similar to the volume listed above. Has 192 extra-large pages, plus 9 double-spread giant blueprints. To order see coupon below, only..... **$3**

1948 TV Manual. Earlier volume has material on all popular TV sets of this period. Large size: 8½x11". Remarkable value, including 8 fold-out blueprints, only... **$3**

1947 FM and TV Manual. Data covers all needed FM and television sets including popular R.C.A. 630TS. Size: 8½x11". Service material on 192 pages. Only.... **$2**

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The new 1951 TV manual has complete service material on every popular television set of every important manufacturer. Here is helpful, practical, factory-prepared data that will make servicing and adjustment easy for you. This new giant manual, as well as the previous volumes listed at left, has complete circuits, alignment facts, test patterns, response curves, service hints, voltage charts, waveforms, recommended changes for improvement, and many double-spread diagram blueprints. Here is your TV service material to help you become an expert, and at only $3 and $2 per manual.

FIND—FIX ALL T-V FAULTS

Use the new 1951 TV manual and the earlier volumes (see listing at left) to help you with all TV repairs. Cuts hour-wasting jobs to pleasant moments. Use test patterns for quick adjustment, or look up probable cause of trouble in the pages of hints after simply observing fault in video picture. No equipment needed with these tests. Or use your voltmeter and compare values with many voltage charts included. With an oscilloscope you can get waveforms similar to hundreds illustrated using test points suggested and in a flash locate what once used-to-be a hard-to-find fault. Order at our risk for a 10-day trial. Use coupon at bottom of page.

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The new **1951 TV** manual is the most remarkable value offered by **Supreme Publications** in their 17 years of business. This giant-size television servicing manual at only $3, or the TV manuals for previous years for only $3 and $2 each, are amazing bargains and defy competition. There is nothing else like them. Each manual is a virtual treatise on practical television repairs. By normal standards, each such large manual packed as it is with practical facts, hundreds of illustrations, diagrams, charts, photographs, and expensive extra-large blueprints, should sell for $10—but as SUPREME special values they are priced at $3 and $2 each. Only a publisher who sold over one million television and radio manuals can offer such bargains based on tremendous volume-sales.

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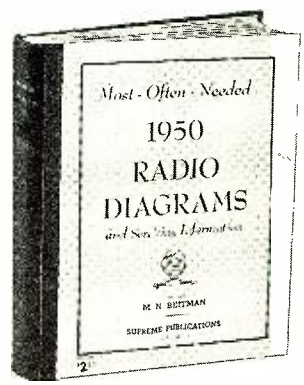
Be ready to repair any TV set by having in your shop all five **Television Manuals** described at left. Or try the new **1951 TV** manual to see what an amazing bargain you get for only $3. Order on no-risk trial by using coupon at bottom of page.

All **Supreme Publications** TV and Radio manuals are compiled by M. Beitman, radio engineer, teacher, author, and serviceman.

SUPREME RADIO MANUALS



New 1950 Radio Diagrams

Now you can benefit and save money with Supreme amazing manual scoop. This one giant volume has all the service data you need on all recent radio sets. Here you have clearly printed large schematics, needed alignment data, parts lists, voltage values, and information on stage gain, location of trimmers, and dial stringing illustrations. This is the help you need to find tough faults in a jiffy. The new 1950 radio manual is a worthy companion to the 9 previous volumes used to an advantage by over 128,000 shrewd radio men.

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Wise servicemen know that Supreme Publications manuals have all the material needed at the lowest prices. For the remarkable bargain price (only $2 for most volumes) you are assured of having on hand needed diagrams and all other essential repair facts on almost all sets you will ever service. Every popular radio of all makes, from old-timers to new 1950 sets is covered. Select manuals wanted, see list below.

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The complete training of these 53 large lessons is really THREE distinct courses on: (1) Practical Radio, (2) Applied Electronics, and (3) Radio Servicing. The lessons are clear, practical, easy to master and use. Early lessons will make fundamentals clear even to a beginner, while other lessons will give you the practical "know-how" of an expert. Notice in the illustration of the manuals, at top, that the wide column on each page has the text, while the narrow column contains pertinent explanations usually supplied by a teacher. These teacher comments guide you over the hard parts, stress points of importance, tell you how to perform practical experiments using any home radio. There are hundreds of review self-testing questions, 427 drawings, pictures, diagrams, and over a thousand service hints.

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Just send no-risk coupon, at right, and receive the **3-volume COURSE** for a free examination. Use all this material a full 10 days in your own home. Read a few lessons, examine the hundreds of illustrations, apply some of the hints to fix a couple of radios. Only then, if you are pleased, the complete course of 53 lessons, in three volumes, is yours to keep for only $3.95, full price; otherwise, it costs you nothing for the use and examination. Fair enough? Please rush coupon or ask your jobber while your special price is still only..... **$3.95**

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☐ **1948 TV, $3.** ☐ **1947 TV & FM, only $2.**
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Pick Up Those PROFITS From PORTABLES

By
A. W. BERNSOHN
Managing Director
National Appliance & Radio Dealers Assn.

Ward off that mid-summer sales and service slump by instituting an agressive "portable" campaign. This seasonable merchandise is a real gold mine.


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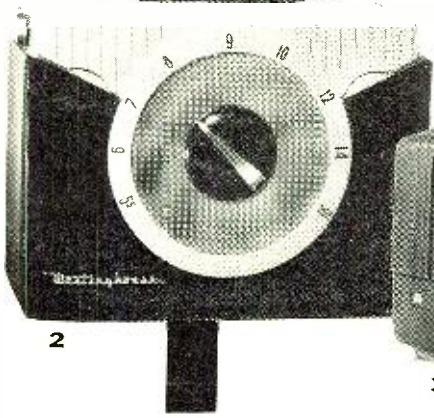
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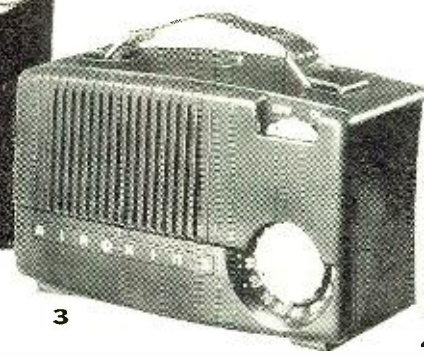
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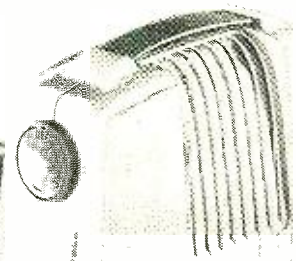
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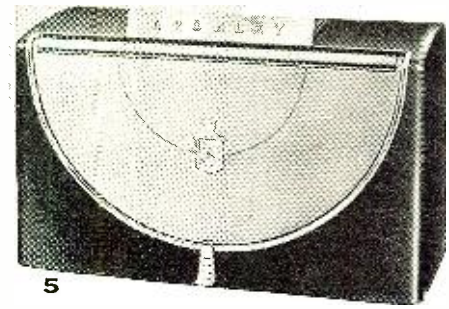
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(1) Stewart-Warner "Turnabout," a.c.-d.c.-battery, 4 tubes plus rectifier. Color: forest green. Price $39.95. (2) Westinghouse Models 342P5, 343P5, a.c.-d.c.-battery; 5 tubes plus rectifier. Colors: red-black (342P5), brown-tan (343P5). (3) Air King Model A-520A, a.c.-d.c.-battery, 4 tubes plus rectifier. Color: Ivory. Price $28.95. (4) Arvin Model 446-P, battery, 4 tubes. Colors: sun tan, burgundy. (5) Crosley "Riviera," a.c.-d.c.-battery. Colors: New Brunswick and Salvador blue; meadow and sea mist green; fez red and sport beige; saddle brown and beige; black. Price $44.95.

AS THE brightest hope for relief from the traditional summer slump in radio service and sales, pick up those profits from portables!

Every year the servicing and sales fraternity is reminded of this profitable source of revenue but the man who goes out and gets his full share of the business is as rare as winning a five-horse parlay.

Here's a check list of ideas. Not all of them will apply to your business but chances are that you'll find some that will fit and others that will start you thinking of adaptations that can be made to tailor them to your requirements.

There are 8½ million portables in use today, ranging in age from this season's purchases to receivers that have passed their fifth birthday. Not many of the receivers made before 1947 are still around but that doesn't mean that there isn't plenty that can be done along the servicing line even with these newer sets. This large number of portables in the hands of the consumer means almost unlimited service opportunities for the summer months, since such check-ups usually result in battery sales, tube replacement, and both major and minor service jobs. It is business well worth going after!

Since the portable is going places and will be subjected to the roughest treatment given almost any receiving equipment in civilian use. it is important that all solder joints be firm and the whole repair job be heavy duty. If you do a creditable job on repairing portables, you'll get plenty of business—word-of-mouth advertising is a powerful sales medium and a satisfied customer can give your portable business a real shot-in-the-arm.

The technician's selling job also includes the task of persuading the vacationer that since his portable will be his good and constant companion throughout the summer it is deserving of a thorough check-up at the same time that his fishing tackle and golf clubs receive their seasonal going over.

One of the most effective methods of attracting portable business is to offer a flat-rate service charge, listing all of the features of such a check-up. Such services could include thorough tube, battery, and wiring inspection, a complete operational test, and cleaning. Some service dealers make arrangements with their neighborhood shoe repair men to replace the worn leather handles on portables.

EDITOR'S NOTE: *Unless otherwise stated, all portable receivers shown in this article cover the standard broadcast band. Prices, where quoted, do not include batteries and are those prevailing in the central and eastern sections and are subject to change. For southern and Pacific Coast areas, prices may be higher because of the differential in shipping charges prevailing.*

Don't forget that the more attractive and comprehensive you make this list, the greater your chances for attracting volume business.

Ways of presenting this message to prospects are only limited by the ingenuity of the technician. A postcard mailing to all past portable customers is good for the medium sized, self-servicing dealer, especially if a double postcard is used so that all the customer needs to do is check a square and sign his name.

Advertisements in the vacation and travel section of newspapers can be effective if imaginative themes are used in setting up the ad. These same ads can stimulate portable sales as well as offer your servicing. Consider such ideas as bold headlines featuring the name of some radio favorite on the air during the summer, for example:

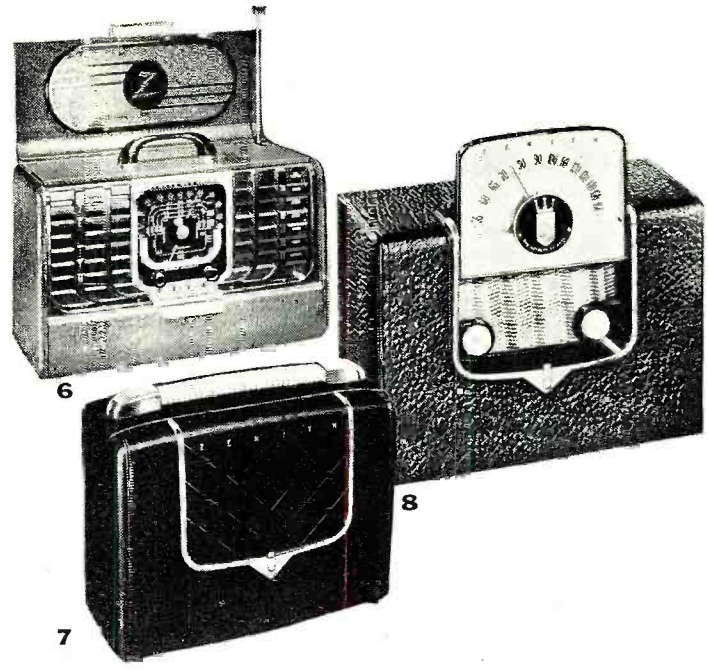
TAKE BING CROSBY ON YOUR VACATION

You'll have him and all your other radio favorites as companions when you take along a portable set—kept in perfect condition by

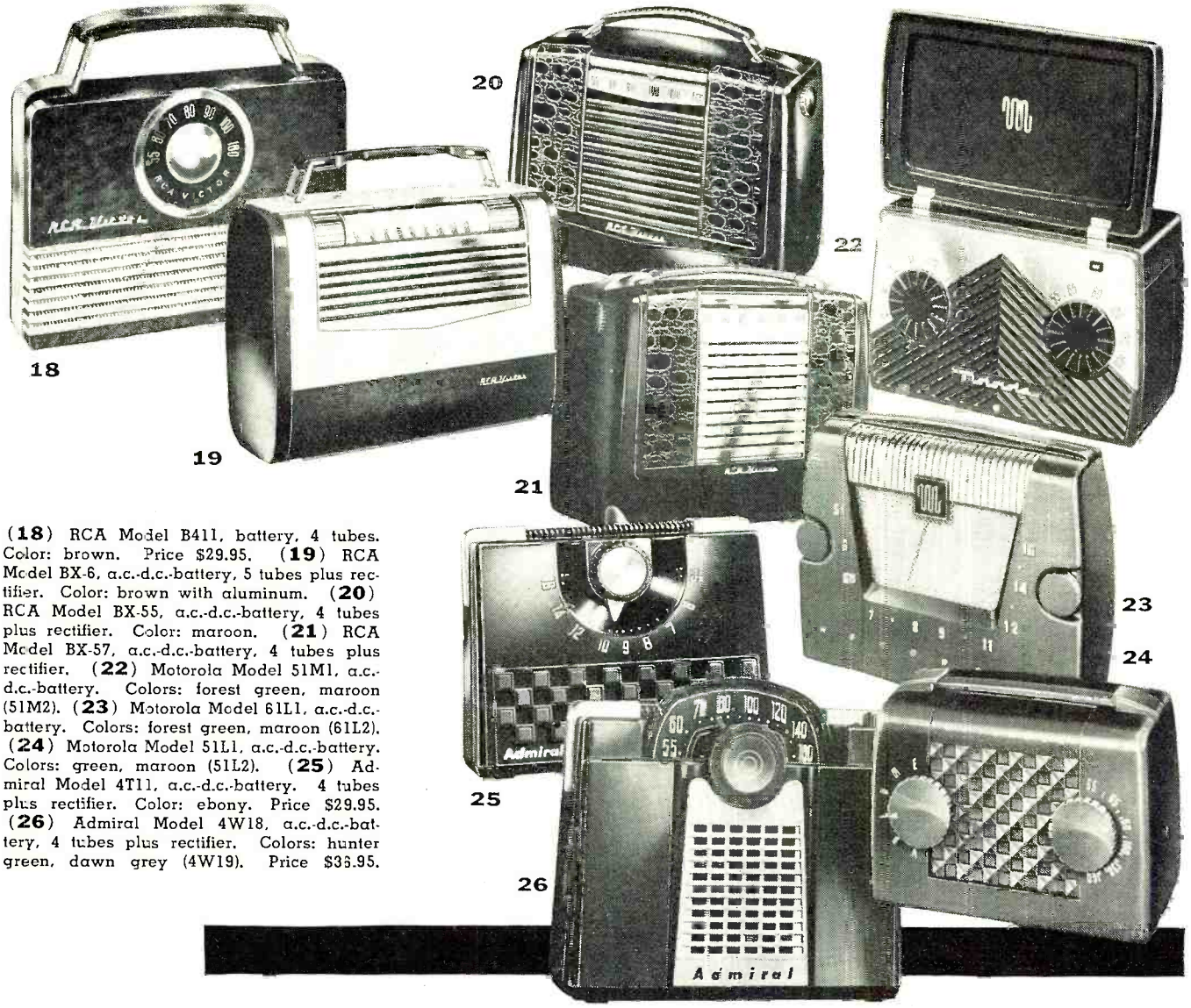
YOUR NAME AND ADDRESS

P.S. If you haven't selected your portable radio as yet, you can get one here for as little as $00.00.

A large sign in your shop window advising prospective customers that you are equipped to handle portable sales and service is an inexpensive way of stimulating business



(**6**) Zenith Model G500, a.c.-d.c.-battery, b.c.-s.w., 5 tubes plus rectifier. Color: black. Price $114.25. (**7**) Zenith Model G503, a.c.-d.c.-battery, 5 tubes plus rectifier. Colors: brown, black. Price $49.95. (**8**) Zenith Model 4G903, a.c.-d.c.-battery, 4 tubes plus rectifier. Colors: blue, grey, black. Price $39.95. (**9**) Hallicrafters Model 5R24, a.c.-d.c.-battery, 4 tubes plus rectifier. Color: oyster grey. Price $34.95. (**10**) Hallicrafters Model S-72L, a.c.-d.c.-battery, all-wave, 8 tubes plus rectifier. Color: brown. Price $119.95. (**11**) Emerson Model 646, a.c.-d.c.-battery, 4 tubes plus rectifier. Colors: maroon, saddle tan, green, ivory. Price $29.95. (**12**) Emerson Model 656, a.c.-d.c.-battery, 5 tubes plus rectifier. Colors: maroon, sand. Price $39.95. (**13**) Emerson Model 657, a.c.-d.c.-battery, 5 tubes plus rectifier. Color: simulated alligator. Price $44.95. (**14**) Philco Model 631, a.c.-d.c.-battery, 4 tubes plus rectifier. Colors: teal green, maroon, Caribbean blue, Swedish red. Price $39.95. (**15**) Philco Model 633, a.c.-d.c.-battery, 5 tubes plus rectifier. Color: genuine cowhide. (**16**) Philco Model 629, a.c.-d.c. battery, 4 tubes plus rectifier. Colors: teal green, maroon. Price $34.95. (**17**) Philco Model 632, a.c.-d.c.-battery, 4 tubes plus rectifier: Color maroon plastic with brass trim. Price $49.95.



(18) RCA Model B411, battery, 4 tubes. Color: brown. Price $29.95. **(19)** RCA Model BX-6, a.c.-d.c.-battery, 5 tubes plus rectifier. Color: brown with aluminum. **(20)** RCA Model BX-55, a.c.-d.c.-battery, 4 tubes plus rectifier. Color: maroon. **(21)** RCA Model BX-57, a.c.-d.c.-battery, 4 tubes plus rectifier. **(22)** Motorola Model 51M1, a.c.-d.c.-battery. Colors: forest green, maroon (51M2). **(23)** Motorola Model 61L1, a.c.-d.c.-battery. Colors: forest green, maroon (61L2). **(24)** Motorola Model 51L1, a.c.-d.c.-battery. Colors: green, maroon (51L2). **(25)** Admiral Model 4T11, a.c.-d.c.-battery. 4 tubes plus rectifier. Color: ebony. Price $29.95. **(26)** Admiral Model 4W18, a.c.-d.c.-battery, 4 tubes plus rectifier. Colors: hunter green, dawn grey (4W19). Price $36.95.

and has the additional advantage of cutting down on pick-up and delivery expense. Handbills and postcard mailings to names in the telephone directory are also good catch-alls, although admittedly less effective than pin-point selling.

Look over the advertisements being run by the manufacturers on their new portables. You can adapt many of their proven ideas to the selling of service.

One critical consideration in portable servicing is your tube supply. Before setting up any large scale campaign, check it carefully and secure tube substitution charts from the manufacturers covering tubes in short supply. Lack of these replacements may prove to be your principal handicap and the more fully you anticipate these difficulties, the less likely is it to impede a successful campaign.

In reviewing portable servicing possibilities, remember to remind your vacationing customers to take along an extra set of batteries. Failure to do so may cost you a good customer in case his receiver gives up the ghost in some remote spot. When the customer is having his portable reconditioned is the perfect time to make this suggestion.

Rentals

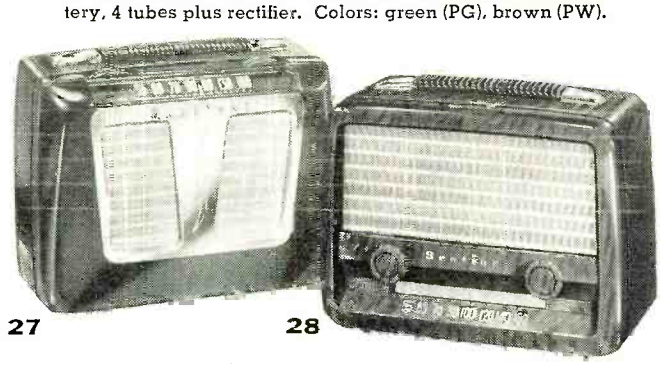
Since many portables are listed at less than $50, the restrictions of Regulation "W" covering rentals and sales do not apply. This means that there is nothing to keep you from renting portables if you wish and then later converting them to sales by permitting the prospect to apply the rental fee as a down payment or full purchase price on the set.

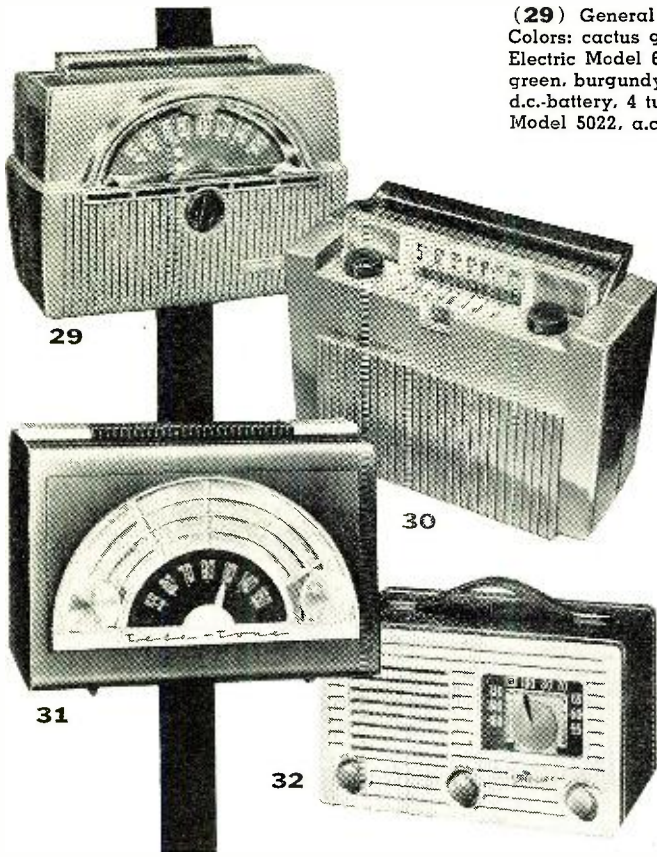
Most vacation spots, public swimming pools, parks, and hotels offer some rental possibilities to the enterprising service dealer. Before jumping into this type of business, however, work out a binding arrangement so that you don't lose the benefit of your risk to the concessionaires at these locations. Criteria for selecting a profitable location for rentals include:

1. There must be sufficient prospect for demand to justify tying up the merchandise for the season.

2. There must be some way to prevent theft of the portables or loss through irresponsible treatment of the set by the renter. In hotels, arrangements may be made to have the portable returned and checked at the time the guest checks out. Similarly, you are reasonably safe at watering places where the renter has a locker or at country clubs where he is a member. For rentals in public places,

(27) Sentinel Model 335-P, a.c.-d.c.-battery, 4 tubes plus rectifier. Colors: white (PI), brown (PW), forest green (PG), red (PM). **(28)** Sentinel Model 312, a.c.-d.c.-battery, 4 tubes plus rectifier. Colors: green (PG), brown (PW).





(29) General Electric Model 606, a.c.-d.c.-battery, 4 tubes plus rectifier. Colors: cactus green, burgundy red (605). Price $36.95. (30) General Electric Model 611, a.c.-d.c.-battery, 5 tubes plus rectifier. Colors: cactus green, burgundy red (610). Price $46.50. (31) Tele-tone Model 228, a.c.-d.c.-battery, 4 tubes plus rectifier. Colors: maroon, green. (32) Trav-Ler Model 5022, a.c.-d.c.-battery, 4 tubes plus rectifier. Color: red and ivory.

it is best to demand full identification and/or substantial security.

3. There must be sufficient free time for the renter to make use of the portable. In some areas, such as camps and hotels with pre-planned activities, adequate leisure is too much of a rarity to make portable renting profitable.

4. There should be a large enough number of sets in use to make the project worthwhile from the collection, bookkeeping, and maintenance standpoint, to cover the inevitable losses on some rentals and to pay a reasonable percentage of the receipts (seldom less than 25 per-cent and often as high as 50 per-cent) to the attendant to whom the rental receivers have been entrusted.

Don't overlook the possibilities of handling rentals from your place of business as it brings likely prospects into your store.

When you go into the rental business prepare for night work and early morning deliveries unless you have a good stock of replacement sets on hand. These must be kept in good condition otherwise you will discourage the agencies which handle the renting of your portables and the whole business will go to pot in a hurry.

Consignments

Frequently the outlying retailer or the small service shop can bring in extra revenue by placing a few portables on consignment in outlets which would not normally have sufficient demand for this type of merchandise to warrant their carrying a full line of receivers.

Typical of these outlets are luggage shops, travel agencies, hotel lobby gift stands, concessions in railroad stations, and gasoline stations.

Warning: The vendor will expect a good part of the profits on consignment merchandise, so use this selling method only when you have a generous supply of portables and personals on hand.

Civil Defense

While the appeal of this activity fluctuates with the success of our armies in the Far East, it does present an exceptional opportunity for portable sales when and where there is the greatest interest in civilian defense.

Most official publications recommend that the civilian defense worker have a portable, battery-operated radio receiver in case of power failure. The widespread use of such receivers gives the civilian defense activity its most efficient means of mass communication.

Check with your local defense program. Find out who is in command and what local interest has been aroused. Post a special offer for civilian defense workers, offering a free receiver to the defense unit that purchases a certain number of receivers. It could provide a lively and profitable source of business.

Special Promotions

Ever since they first became a significant factor in the radio business portable receivers have constituted a good source of revenue. In the past four years these little receivers have been responsible for more than a quarter-billion dollar's worth of retail volume! Hardly a sum to be ignored.

There are various ways of stimulating portable business. In one major city during the World Series, *Western Union* messengers were equipped with portable receivers, playing at a healthy volume and carrying a punchy advertising message of course, and turned loose on the city streets, walking slowly where the sidewalk traffic was the heaviest. These "live" advertising messages attracted surpris-

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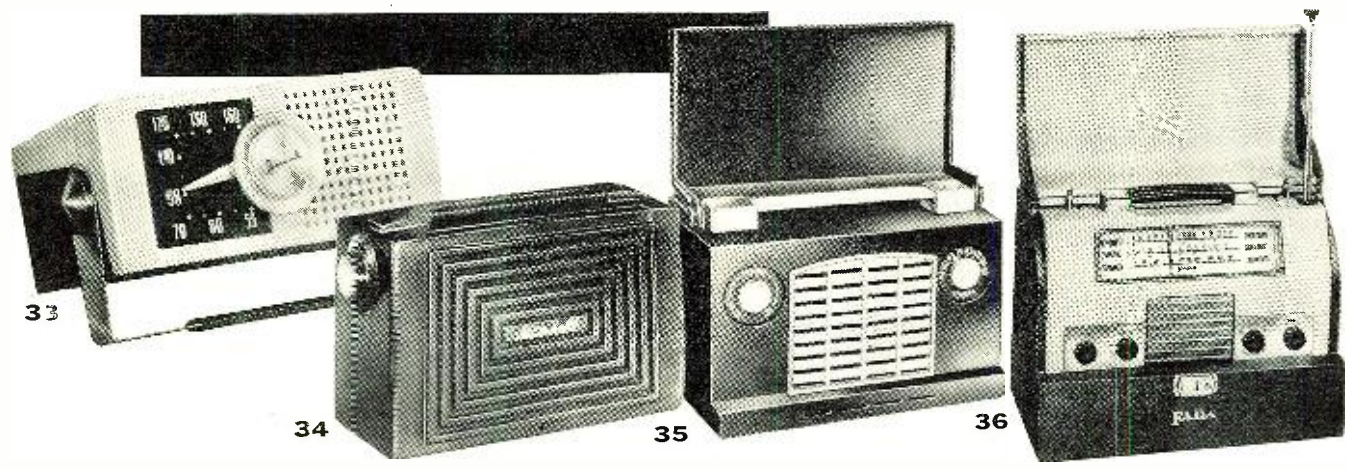


(33) Jewel Model 5050, a.c.-d.c.-battery, 4 tubes plus rectifier. Color: ivory and maroon. (34) Mitchell Model 1256, a.c.d.c.-battery, 4 tubes plus rectifier. Color: maroon. Price $39.95. (35) Fada Model P111, a.c.-d.c.-battery, 4 tubes plus rectifier. Colors: ebony (E), maroon (M), ivory (V). (36) Fada Model P-130, a.c.-d.c.-battery, 3-bands, 4 tubes plus 2 rectifiers. Color: two-tone simulated leather.

CONVERTING The ADMIRAL MODEL 4H16S

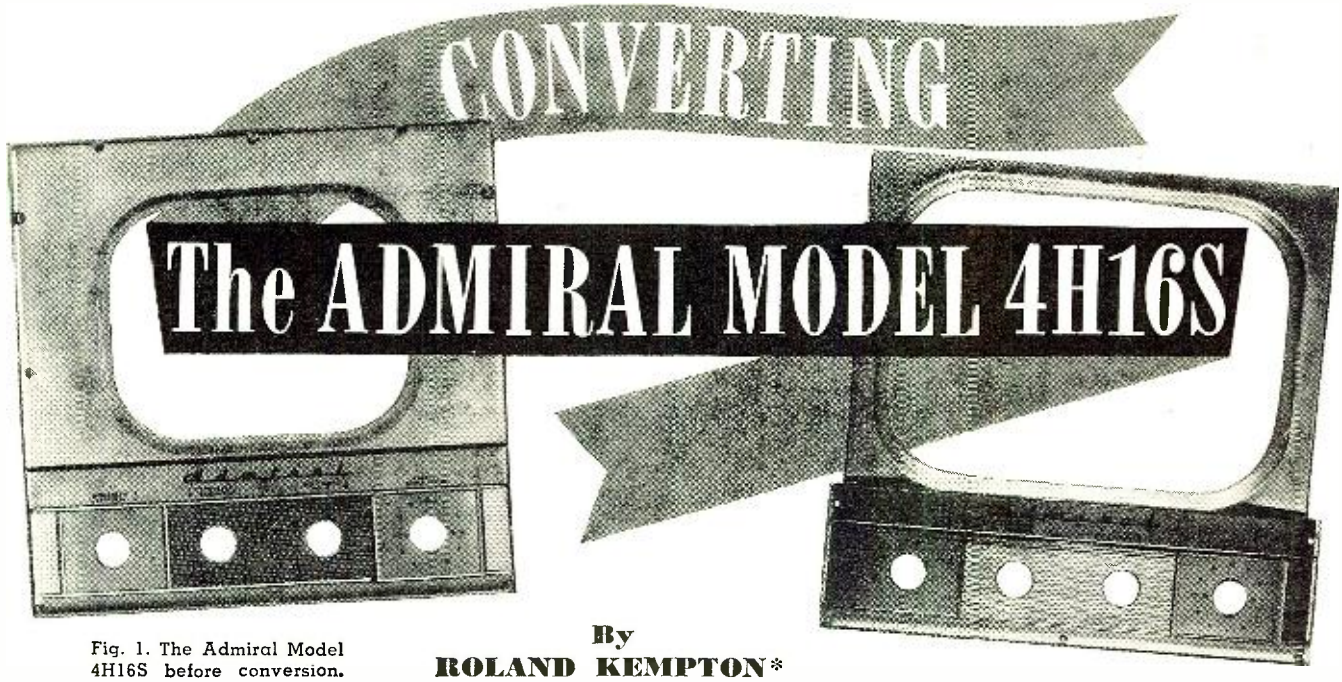


Fig. 1. The Admiral Model 4H16S before conversion.

By
ROLAND KEMPTON*
Editor, "Techni-talk"

Fig. 2. Front panel of set converted to use 14CP4 tube.

Complete circuit and cabinet change data for modifying a popular receiver for a 14" tube.

LAST month we provided complete details on how a 10 inch *General Electric* Model 811 television receiver could be converted to operate either a 12 or 16 inch tube. In this article we will consider adapting the *Admiral* Model 4H16S, a set using a 10 inch tube, for 14 inch tube operation.

As mentioned previously, while these suggested changes have been carefully planned and tested by *General Electric Company* engineers, such changes cannot be guaranteed and may, in many cases, invalidate the manufacturers' warranties on such sets.

The *Admiral* Model 4H16S is a 10 inch combination. Because the interior cabinet space is limited the set was converted to use a 14CP4 picture tube. The front panel of this receiver before conversion is shown in Fig. 1 while Fig. 2 shows the converted set.

There are several other model numbers using the same chassis and front panel and the same conversion information will, of course, apply to these models. As is the case with many of these receivers, it will be necessary to remove the radio chassis as well as the television chassis in order to operate on the television section.

* These conversion notes originally appeared in the October-November 1950 issue of General Electric Company's copyrighted publication "Techni-talk."

Chassis Changes

The first step in converting this set is to remove the picture tube. A 1 inch long piece of rubber cushion is then fastened to the top of the tube support brackets. This provides a shock mounting for the front portion of the 14CP4 tube. The deflection yoke and focus coil should then be removed from the mounting bracket. Loosen the two screws which hold this bracket to the chassis and insert a ½ inch spacer, which may be made up of washers or oversize nuts, between the bracket and the chassis. This raises the rear of the picture tube and keeps it level. Move

(*Continued on page* 128)

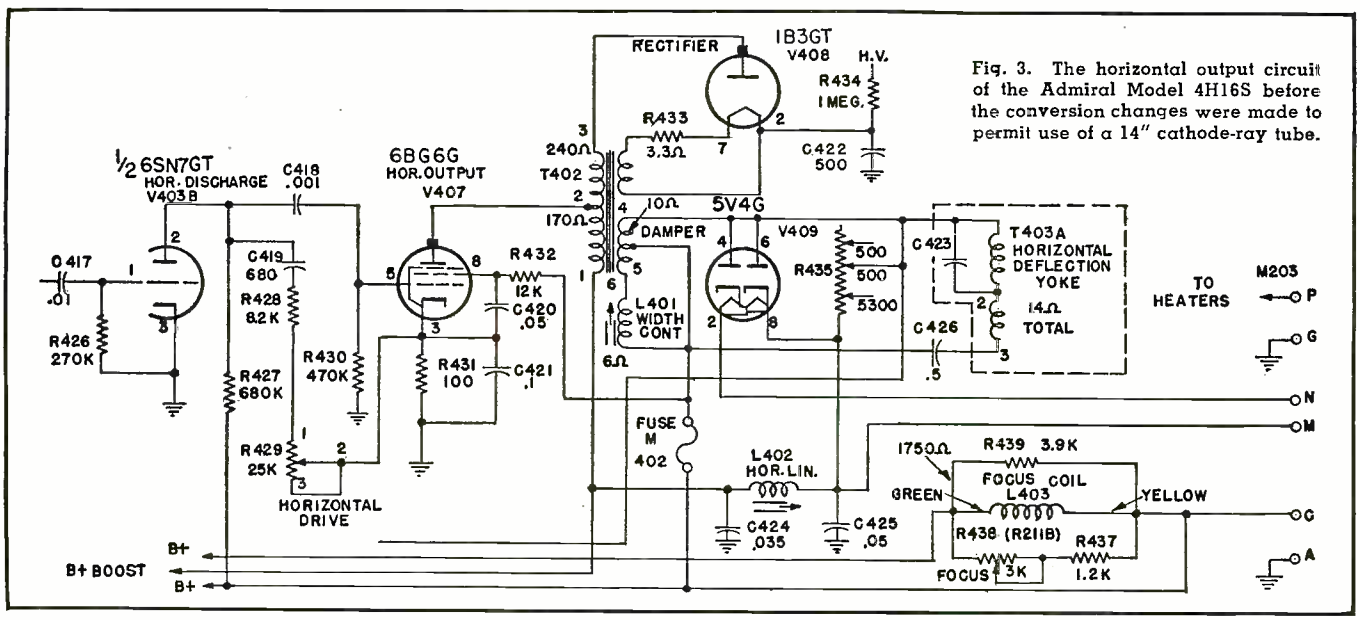
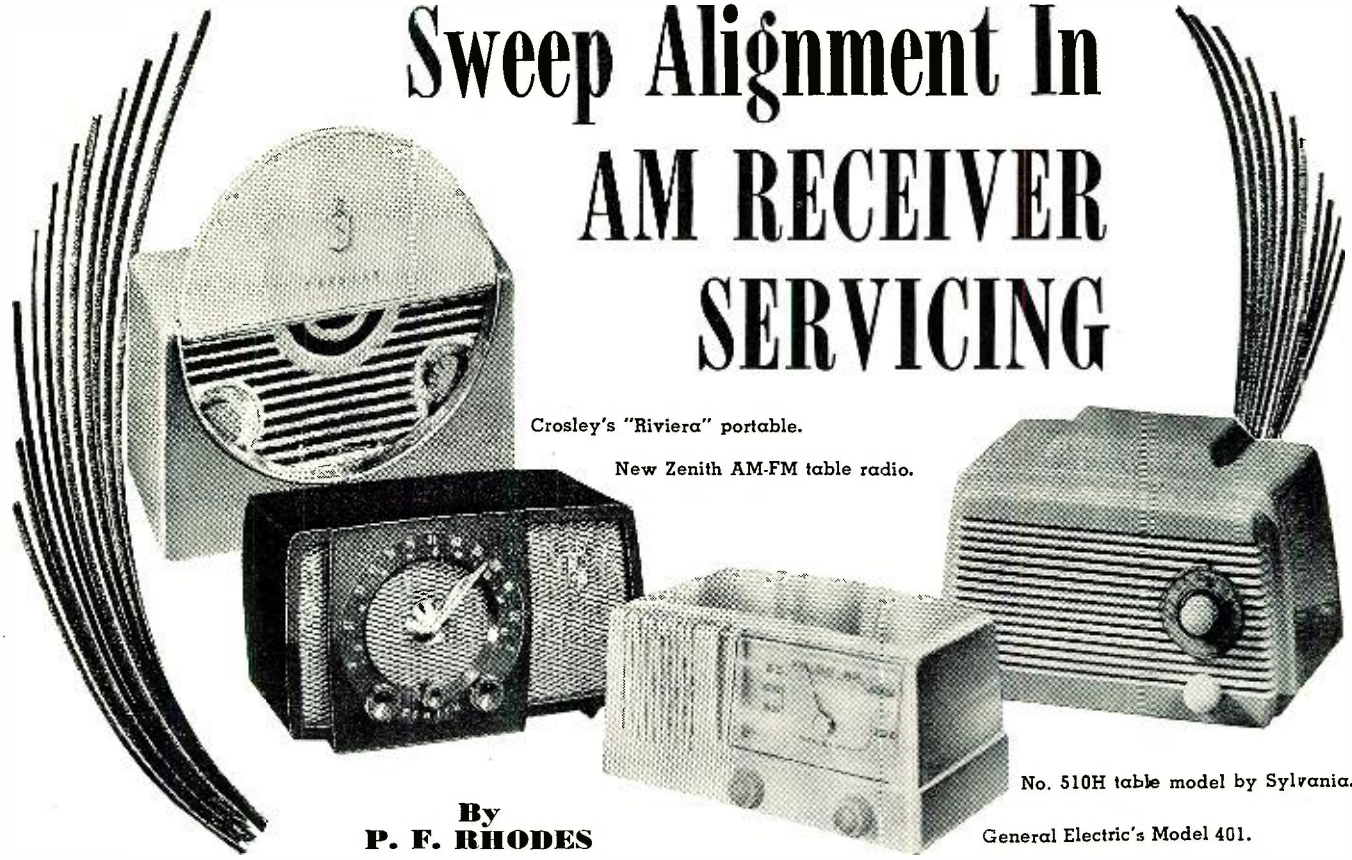


Fig. 3. The horizontal output circuit of the Admiral Model 4H16S before the conversion changes were made to permit use of a 14" cathode-ray tube.

Sweep Alignment In AM RECEIVER SERVICING



Crosley's "Riviera" portable.

New Zenith AM-FM table radio.

No. 510H table model by Sylvania.

General Electric's Model 401.

By
P. F. RHODES

Part 1. Obviously the sweep method of aligning AM receivers is profitable and efficient but it also provides the uninitiated with an opportunity for practicing sweep generator techniques on relatively simple sets before tackling television receivers.

SPORADIC attempts have been made in the past to demonstrate the value of the oscilloscope in AM receiver servicing. These attempts have been somewhat ineffective for three reasons. (1) Scopes and sweep generators are relatively complex instruments, and cannot be successfully used without out considerable study. (2) There are certain pitfalls which lie in wait for the beginner, and these have not been sufficiently stressed in the past. (3) Human nature is resistant to change, even when the change is for the better.

There are many advantages to be realized by "sweep aligning" AM radio receivers. First, the padder can be "rocked in" much more rapidly than by other methods. Second, the gain and bandwidth of the receiver can be quickly checked over the entire tuning range. Third, the receiver can be rapidly adjusted for the best compromise between fidelity and sensitivity and, finally, there is no guesswork in the alignment job because the complete response curve is visible at all times during adjustment.

Aside from the technical advantages, increased customer confidence is a plus which shouldn't be regarded lightly. The public is properly impressed by an organization that evidently knows what it is doing and makes use of the most up-to-date techniques.

Furthermore, the day is soon coming when the "screwdriver mechanic" will be as dead as the dodo. If the tidal wave of television activity hasn't reached your community as yet, rest assured that it is coming and that sooner or later you will have to contend with instrument applications as never before. There is no easier way to "break in" on automatic curve tracing equipment than to become familiar with its application in standard AM radio receivers.

After you have gained confidence in using these instruments for AM jobs, the next step would be to tackle FM receivers. You will find the sweep alignment technique even more valuable in the rapid alignment of wideband FM receivers.

The first objection to the use of sweep alignment equipment is becoming of lesser concern, because many radio technicians realize that they must prepare themselves for television servicing, and they have accordingly "studied up" on sweeps and scopes. It is also becoming apparent that there is no better way to get acquainted with sweep-alignment equipment than to make use of the instruments in routine radio servicing. Not only does learning take place faster, because familiar jobs are being done in a new and much better way, but *the working problems are fewer at broadcast frequencies*. Practical application of the sweep and scope on the AM radio service bench not only means more income for the shop, and better work, but also prepares the technician for the inevitable—the advent of TV in his community.

Insofar as pitfalls are concerned, it is the purpose of this article to describe and illustrate these pitfalls in a graphic manner. We will attempt to show the radio technician not only the paths that lead to trouble, but also the way to keep out of trouble. That is, this is not a "theory" article written by a dreamy-eyed academician, but a practical how-to-do-it article.

Although sweep alignment is both profitable and efficient, these advantages are frequently discounted by the human equation, or perhaps human nature, which is basically resistant to change. This limitation inevitably remains the personal problem of the reader, who should recognize that he is fortunate indeed if he has an open mind, and the will to succeed by improving his technique.

Fig. 1 shows how a sweep generator and oscilloscope are connected to a radio receiver to obtain the over-all response curve from the antenna to the second detector. Fig. 4A shows the display that is often obtained on the scope screen. This is a voltage versus frequency curve which is the response characteristic of the receiver.

Now let's go back to Fig. 1 and see what we have. The sweep-frequency generator produces a "wobbulated" or frequency-modulated signal which sweeps back and forth over the pass-band of the receiver 60 times a second (power-line rate). If the receiver is tuned to receive a 1 mc. signal, then the sweep generator must be adjusted to put out a sweep signal having a center frequency of 1 mc.

As we know, a radio receiver is intended to operate with an antenna having certain average characteristics. These characteristics load the input circuit of the receiver in typical fashion, and influence the character of the response. So, to do a realistic job, we provide a coupling network between the generator and the receiver. This network not only provides a normal load for the generator, but also loads the receiver normally, as mentioned previously.

The output from the coupling network is delivered to the antenna input system of the receiver, so that the receiver is energized in a normal fashion.

The output voltage from the receiver can be taken anywhere along the line from the second detector to the speaker voice coil. However, as we shall see, there are frequently advantages to be realized in taking the output from the second detector (volume control). The oscilloscope is adjusted to sweep at 60 cycles-per-second (power-line rate) to match the sweep-frequency generator, thus avoiding any sync problems.

A.G.C. Bias Problems

There's a very interesting story behind the a.g.c. bias override. Offhand, it might seem as though the receiver could be aligned with the a.g.c. operative. However, this is not so. The reason is that the a.g.c. system has certain *recovery characteristics* which interfere with the smooth operation of the sweep equipment. As the sweep signal rises in frequency, the output voltage from the receiver also rises, and the a.g.c. circuit "jumps in" and tries to resist this rise. Because the a.g.c. system partially succeeds in its effort, the result is a distorted curve, as seen in Fig. 4B. This type of distortion is very typical, and is a dead giveaway which should be immediately recognized by every technician.

To keep the a.g.c. system from defeating our purpose in obtaining the true response curve of the receiver, we must override the a.g.c. control voltage and stabilize it with approximately three volts of d.c. bias. Flashlight cells can be used for this purpose, as shown in Fig. 2. Now, with this override bias in use, we see that the trace and retrace have almost exactly the same shape, as shown in Fig. 4C.

Let's return for a moment to consideration of the take-off point in the receiver for connection of the scope. We *could* take this voltage from any point along the audio line, even from across the voice coil terminals. Unfortunately, it does not always happen that the output transformer in the receiver has good low-frequency and phase characteristics. As a result, it is quite possible that the transformer will distort the response curve, as shown in Fig. 4D.

It should be stressed that these are not unusual or "doctored" situations. These are response curves obtained from a standard receiver, using exactly the test conditions described, with good, standard service instruments. This is just the sort of thing that the radio technician runs into, and which frequently becomes so confusing to the beginner. (We might even include a few oldtimers!)

How about the coupling network? The standard artificial antenna is easily constructed, as shown in Fig. 3A. To prove to yourself that antenna characteristics do influence the receiver response, watch the scope pattern as you short out the artificial antenna—in most cases, considerable change in curve shape will result.

The 50,000 ohm resistor in series with the scope input lead serves two purposes. First, it reduces the loading of the scope on the receiver circuits, and second, it improves the display of the response curve, as we shall see when we come to the discussion of markers.

Operational Factors

Next, a few operating notes concerning this basic test setup shown in Fig. 1. The sweep generator should be adjusted to give a normal operating output, so that the receiver circuits are not overloaded. Overloading shows up as an artificial flattening of the tops of the response curves. The rule is to back off on the output control of the sweep generator, and to watch the top of the response curve. If the top changes shape and becomes more curved, it must be concluded that the receiver is running into overload.

The sweep width control of the generator is adjusted to give a pattern which occupies most of the base line on the scope screen. If the sweep width is too great, the response curve will be too narrow for easy inspection, as shown in Fig. 4E. If the sweep width is too little, only a part of the response curve will be displayed, as shown in Fig. 4F. Of course, the center frequency of the generator must be the same as the dial indication of the radio receiver, to center the visual

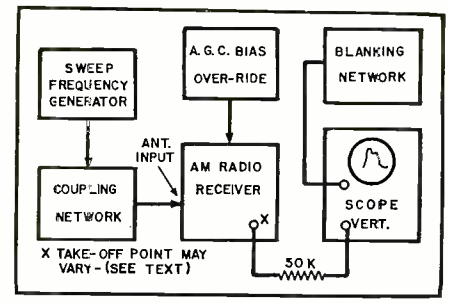


Fig. 1. Basic sweep alignment test setup for use when checking AM radio receivers.

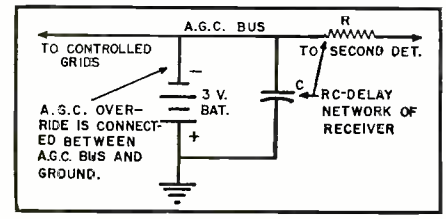


Fig. 2. To override the a.g.c. system, —3 volts of fixed bias must be provided.

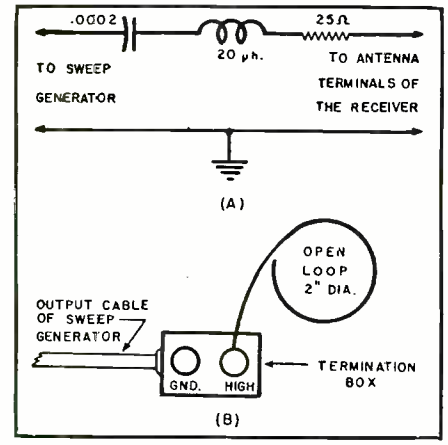
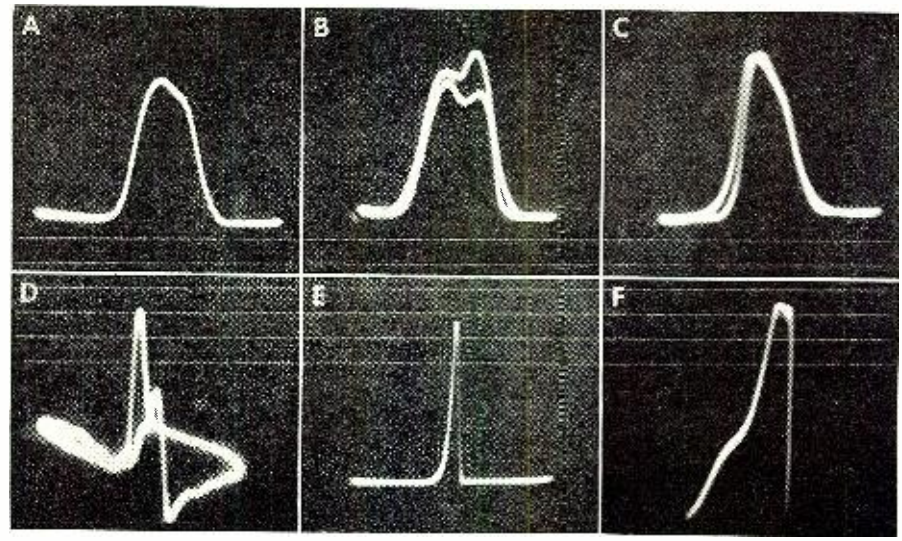


Fig. 3. (A) An artificial antenna of the type shown here is a "must" in good alignment practice. (B) If the receiver operates from a loop antenna, this coupling system should be used during servicing.

Fig. 4. (A) Typical response curve obtained on scope, using test setup shown in Fig. 1. (B) Trace and retrace may have different shapes if operator allows a.g.c. to "run wild." (C) Bias override causes curve to stabilize. Trace and retrace now have same shape. (D) This distortion is caused largely by poor low frequency and phase characteristics of the output transformer. (E) Don't use too much sweep width or the curve will be very narrow as shown. (F) Too little sweep width will cut off part of display.



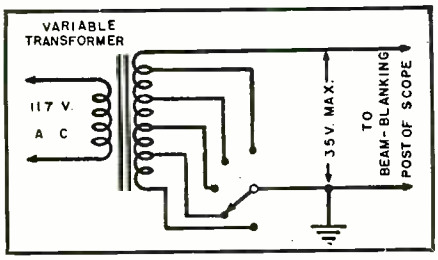


Fig. 5. A simple and practical network for blanking out retrace on the oscilloscope.

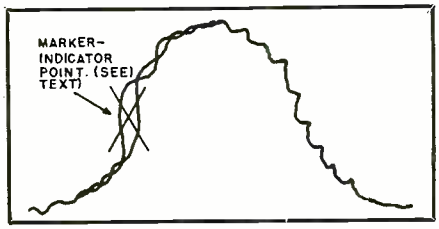


Fig. 6. How to determine the frequency by using the marker on the response curve.

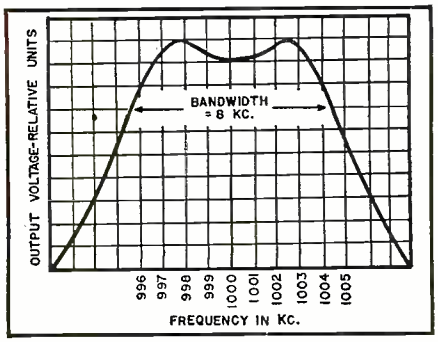


Fig. 7. How to measure the bandwidth of a receiver by using the response curve.

response curve on the scope screen.

The oscilloscope is adjusted for satisfactory height of pattern on the screen. For general work, the required sensitivity is about 0.2 volt-per-inch.

As was mentioned before, two traces appear on the scope screen when 60 cycle deflection is used. Most scopes have a *phasing control* by means of which the trace and retrace can be superimposed, in order to effectively produce a single trace. The influence of the phasing control is shown in Fig. 8A.

Because of minor operating variations, it may be found that the trace and retrace are almost superimposed, but not exactly. If the two traces fail to coincide exactly, there is a small double-image effect which may be found annoying. To eliminate this double image, the technician may prefer to use a *blanking network* as shown in Fig. 5. As will be seen, the blanking network is effectively a source of 35 volt, 60 cycle a.c. which is applied to the beam-blanking post of the scope. Thus, the blanking network may be a small stepdown transformer, or a 35 volt a.c. source from your tube tester obtained from a dummy tube base. If the blanking is not satisfactory when first hooked up, reverse the 117-volt power plug to reverse the blanking phase.

As a result of the blanking voltage, the double trace becomes a single trace, as shown in Fig. 4A.

Using Frequency Marker

We have seen how to obtain the receiver response curve without distortion, and have therefore accomplished a very great deal, since this is usually the most difficult hurdle in making a visual alignment. Now, we want to see how we can tell what frequency is represented by any chosen point along the response curve.

Frequency determination is made by means of frequency markers. To get a frequency marker on your response curve, couple the output of a straight signal generator loosely to the receiver input. This can usually be done most easily by merely placing the output cable from the generator near the antenna posts of the receiver. In general, the trouble consists of putting in too much marker signal, in which case the marker output cable should be moved farther away.

Now, when the marker generator is tuned near the operating frequency of the receiver, a "wiggle" appears on the response curve, as indicated in Fig. 6. Note that the "loop" of the wiggle is the frequency-indicating portion of the marker. Undoubtedly you are wondering why we did not show a photograph of the marker, and although we should have liked to do so, the marker revolves on the curve in such a manner that photography is quite difficult.

Some of you fellows who have been doing television work will be rather surprised to see this type of marker indication, and you may wonder why a sharp compressed marker is not obtained. Remember that we are not dealing with circuits having bandwidths of several megacycles, but with circuits having bandwidths of only a few kilocycles. In effect, the narrow passband of the AM receiver *expands* the marker, whereas the wideband TV circuits *compress* the marker.

Thus, we look for the wide loop in the marker and associate this point, indicated in Fig. 6, with the dial reading of the marker generator. As you tune the marker generator, you will see the looped portion of the marker "slide" around the curve, as you would expect.

The *bandwidth* of the AM receiver response curve is defined as the number of kilocycles between the half-power points, as shown in Fig. 7. As far as the response curve is concerned (because the response curve is a *voltage* display) this means that the bandwidth is measured between the 71%-of-maximum points on the curve. Therefore, to measure the bandwidth of the receiver, adjust the marker dial as required, to determine the 71% voltage frequencies indicated typically in Fig. 7. Subtract these two readings on the marker generator dial, and the result is the bandpass of the receiver.

As far as controlling the character of the marker is concerned, you can try using different values of isolating resistance in series with the scope lead. Try using values from 10,000 to 250,000 ohms. If the higher values do not tend to distort the shape of the response curve, you may prefer the marker which is obtained with this greater filtering action.

You will probably be surprised when you have the receiver dial set to the low-frequency end, to find that a new response curve can be obtained when the sweep generator is tuned to approximately 455 kc. Upon reflection you will realize that you are now looking at the i.f. response curve alone.

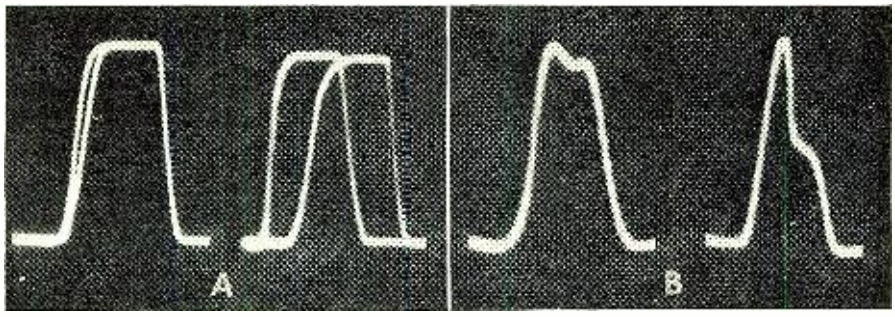
In other words, enough of the i.f. frequency is being passed through the front end so that the i.f. strip is now energized at its own operating frequency. Of course, this is not the approved way to sweep the i.f. strip, but the fact is noted because it is a frequent source of confusion. The difference between the over-all and the i.f. curve of a typical small receiver is shown in Fig. 8B.

It must be emphasized that the end result of alignment is a good over-all curve, although you may find it easier to develop this curve in two steps. As a first step, you may want to adjust the i.f. strip by itself, and then proceed to work on the front end to obtain a satisfactory over-all response.

The technique of actual alignment is a complete topic in itself, and is reserved for Part 2. At this point, you should be able to make a correct test equipment setup, and to obtain a response curve without the distortions which are so maddening to many beginners in the field.

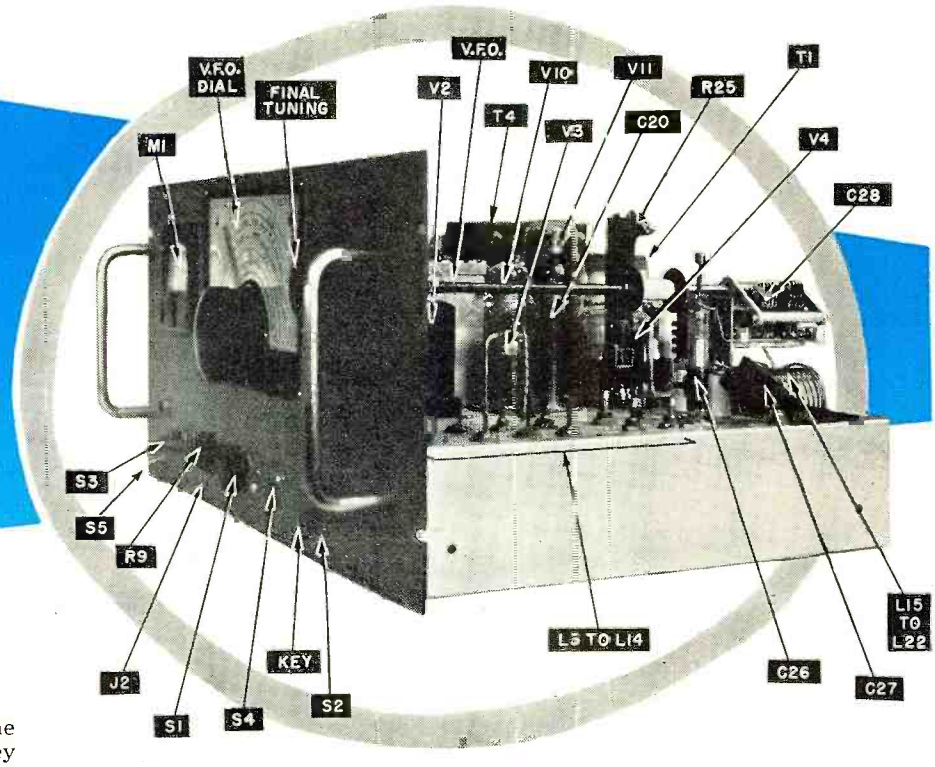
(To be continued)

Fig. 8. (A) The phasing control permits the trace and retrace to be superimposed by the operator. This curve shows evidence of overloading. (B) A check may show that the i.f. and over-all curves differ in shape. The one at the left is the i.f. amplifier curve while the one at the right shows the over-all response curve of receiver under test.



100 WATTS On The Table

By
D. V. R. DRENNER,
WØLQS



Over-all view of transmitter. See page 44 for identification of components.

A compact 100-watt, single-dial control transmitter. Bandswitching provides 80-40-20-10 meter coverage.

HAM transmitters are like the latest model automobiles: they undergo revision, minor or major, at least once each year. The all-band, single-tuned exciter described by the author a while back ("A Bandswitching V.F.O.-Exciter Unit," RADIO & TELEVISION NEWS, September, 1949) did pretty well, all things considered, making WAC with only 35 watts on 20 meters. The going got a little tougher on 75 phone, and with this, and other things in mind, a new model seemed in order.

One of those "other things" goes by the innocuous-sounding initials "TVI"; and if you are suffering from this popular malady you know what we mean! There seem to be a lot of cures, but prevention weighs less.

Attacking both problems from the end we decided on a triode final. Kicking around in the junk box were a couple of surplus 826's, and the new rig was designed around one of them. This gives a modest 100 watts and eliminates some competition on 20 and 75 phone. Since a triode was born to be neutralized—and what tetrode is?—we figured a little bias for stability was all the extras needed to make the thing stable. And it turned out just that way.

To have stability in the final, of course, you have to have stability at the front end. If you drive even a triode with a lot of harmonics it will deliver them to the antenna. This type of thinking led straight to the Clapp oscillator. Here we have stability of frequency, with proper precautions, and a chance to do something about harmonics.

The schematic digram shows the grid circuits—which are the only frequency determining components—switched on the fundamental; the plate circuit of the oscillator doubles at all times. This idea is not original with this rig. The 6AG7 Clapp oscillator is followed by another 6AG7 functioning as a buffer-doubler. We had planned this stage as a buffer on all bands, but it was one of those things that, on 20 and 10, just wouldn't work as planned. So on these bands it is a doubler, being driven by the second harmonic from the oscillator. Since all this doubling is at very low power we have managed to confine the unwanted harmonics where they belong.

The 826 takes a little more drive than we like, but the 2E26 is a natural to provide it. The 2E26 itself takes very little—a fact we did like, and insisted upon—and unlike the 807 is easy to tame. A grid suppressor and a tubular condenser from the plate to ground made the thing act like our old 71-A on 40! And Channel 4 hereabouts doesn't even know we are on the air!

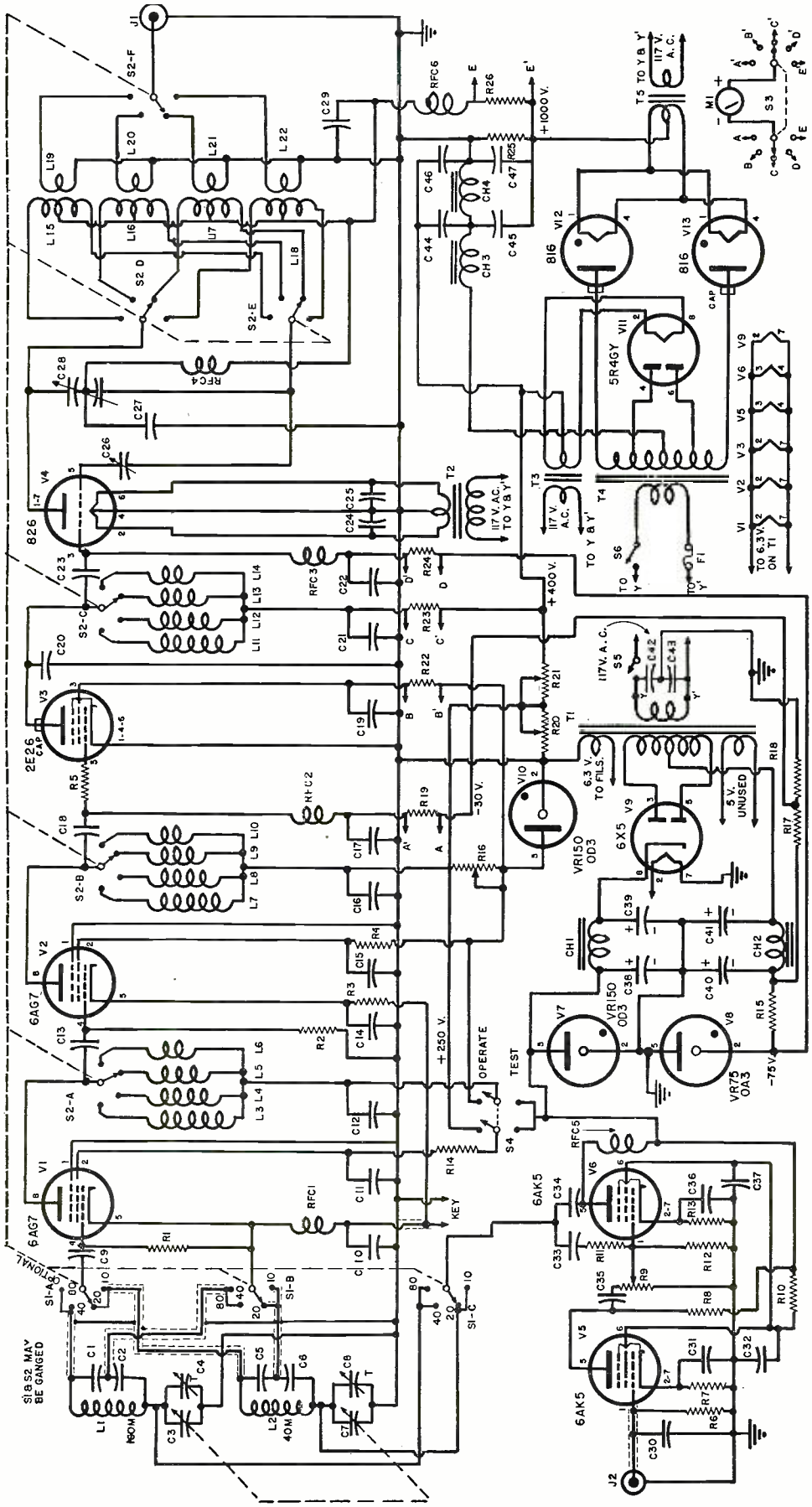
Going back to the Clapp oscillator, we found that mechanical stability is a must. Not only should the grid coils have high "Q" if you want the thing to work, but they must be physically solid. Ceramic forms are OK but air-wound coils give a little better "Q." We used some *Millen* "Hi-Q" forms because they were handy, and they work very well. Whatever the material, wind the wire *tight* and apply plenty of dope to cement the turns solid. The padding condensers for the two grid circuits are *APC* type variables, 140 $\mu\mu$fd. for the 160 meter oscillator grid circuit and 100 $\mu\mu$fd. for the 40 meter circuit. The tuning condensers are ganged and consist of an 11 plate midget for the 160 meter coil (about 35 $\mu\mu$fd.) and a 3 plate one for the 40 meter coil. The actual values will depend on the bandspread you want and some cut-and-try is inevitable. The unit used in this rig is a *Cardwell* dual 35 $\mu\mu$fd. with double bearing shaft—a "must" for further stability in the Clapp circuit.

The switching lines to the grid circuit are RG 29/U, with the ground leads of the tuning condensers and the .001 silver micas connected back to the oscillator socket through the coaxial cable outer shield. A common ground bus is used and no connections are made to the 13 x 17 x 3 chassis except at *one* point, near the oscillator socket. In addition to this, all a.c. and low voltage leads are made with shielded wire. The average wire of this type offers a very low impedance to ground at r.f. and is another means of combating TVI.

A third section of the grid switch serves to place the NBFM on the proper grid coil for the frequency in use. The leads from the switch, and to the NBFM reactance modulator are also made with RG 29/U. A little care in placing the coax will result in a fairly neat job. Length is not important.

In the plate and screen circuit of the 6AG7 oscillator is a d.p.d.t. toggle switch, designated "Operate-Test." This allows the oscillator to be energized from the 150 volt supply of the

Complete schematic diagram of the compact, 100 watt, table-top transmitter for the 80, 40, 20, and 10 meter bands.



R_1, R_9—47,000 ohm, 1 w. res.
R_2—30,000 ohm, 1 w. res.
R_3, R_{15}—270 ohm, 1 w. res.
R_4, R_{11}—2200 ohm, 1 w. res.
R_5—47 ohm, ½ w. res.
R_6—1 megohm, ½ w. res.
R_7—1000 ohm, ½ w. res.
R_8, R_{10}—220,000 ohm, 1 w. res.
R_{12}—1 megohm pot., ½ w. res.
R_{13}—10,000 ohm, ½ w. res.
R_{14}—5000 ohm, 25 w. wirewound res.
R_{16}—5000 ohm, 25 w. adj. wirewound res.
R_{17}—10,000 ohm, 25 w. wirewound res.
R_{18}—4000 ohm, 25 w. wirewound res.
R_{19}, R_{22}, R_{23}—10 ohm, ½ w. res.
R_{20}—15,000 ohm, 25 w. adj. wirewound res.
R_{21}—4000 ohm, 50 w. adj. wirewound res.
R_{24}—60,000 ohm, 50 w. wirewound res.
R_{26}—Shunt to make meter read 0-200 ma. full scale (A few inches of nichrome wire can be used.)

C_1, C_2, C_3, C_{17}—.001 μfd. silver mica cond.
C_4, C_7—35/35 μμfd. var. air cond. (Cardwell ER35AD—See text)
C_5—140 μμfd. var. air padder (ADC type)
C_6—100 μμfd. var. air padder (ADC type)
C_{10}, C_{13a}, C_{28}—100 μμfd., 500 v. mica cond.
C_{11}, C_{12a}, C_{32}, C_{19}, C_{21}, C_{32}—.01 μfd., 500 v. ceramic disc cond.
C_{13}, C_{20}—500 μμfd., 500 v. mica cond.
C_{20}—10 μμfd. tubular cond. (See text)
C_{24}—.0047 μfd., 500 v. mica cond.
C_{25}—2.5-12 μμfd. neutralizing cond. (Millen 15002)
C_{27}, C_{30}—.002 μfd., 2500 v. mica cond.
C_{28}—100/100 μμfd. var. air cond. .026" spacing (National TMS-100D)
C_{29}, C_{33a}—50 μμfd., 500 v. mica cond.
C_{31}—10 μfd., 25 v. elec. cond.
C_{34}—.02 μfd., 200 v. paper cond.
C_{37}—.05 μfd., 200 v. paper cond.

C_{38}, C_{39}, C_{40}, C_{41}—40 μfd., 250 v. elec. cond.
C_{42}, C_{43}—.01 μfd., 250 v. feedthrough cond. (Sprague "Hy-Pass")
C_{44}—4 μfd., 1000 v. oil-filled cond.
C_{45}, C_{47}—2 μfd., 1500 v. oil-filled cond.
C_{46}—5 μfd., 600 v. oil-filled cond.
RFC_{1}, RFC_{29}, RFC_{30}, RFC_{36}—2.5 mh., 50 ma. r.f. choke
RFC_{2}, RFC_{6}—1 mh., 600 ma. r.f. choke
CH_{1}—8 hy., 75 ma. filter choke
CH_{2}—16 hy., 50 ma. filter choke
CH_{3}—3.5-13.5 hy., 150 ma. swinging choke
CH_{4}—7 hy., 150 ma. filter choke
J_{1}—Coaxial jack
J_{2}—Phono jack
L_{1} to L_{22}—See Coil Table
F_{1}—3 amp fuse and holder
M_{1}—0-100 ma. d.c. meter
S_{1}—3-pole, 4-pos. rotary sw.
S_{2}—6-pole, 4-pos. rotary sw.

S_{3}—D.p. 5-pos. rotary sw.
S_{4}—D.p.d.t. rotary sw.
S_{5}, S_{6}—S.p.s.t. rotary sw.
T_{1}—Power trans. 300-0-300 v. @ 70 ma.; 6.3 v. @ 3 amps; 5 v. (unused)
T_{2}—Fil. trans. 7.5 v. @ 4 amps. c.t.
T_{3}—Fil. trans. 5 v. @ 3 amps. c.t.
T_{4}—Power trans. 2160 v. @ 125 ma. c.t.; 1000 v. @ 150 ma. c.t. (1080-500-0-500-1080) (Merit P3158)
T_{5}—Fil. trans. 2.5 v. @ 5 amps. c.t.
V_{1}, V_{2}—6AG7 tube
V_{3}—2E26 tube
V_{4}—826 tube
V_{5}, V_{6}—6AK5 tube
V_{7}, V_{8}—VR150/0D3 tube
V_{9}—6X5 tube
V_{10}—6X5 tube
V_{11}—5R4GY tube
V_{12}, V_{13}—816 tube

bias pack—which runs whenever the filament switch is "On"—so that a frequency can be spotted without swishing a signal, via the final, across the band.

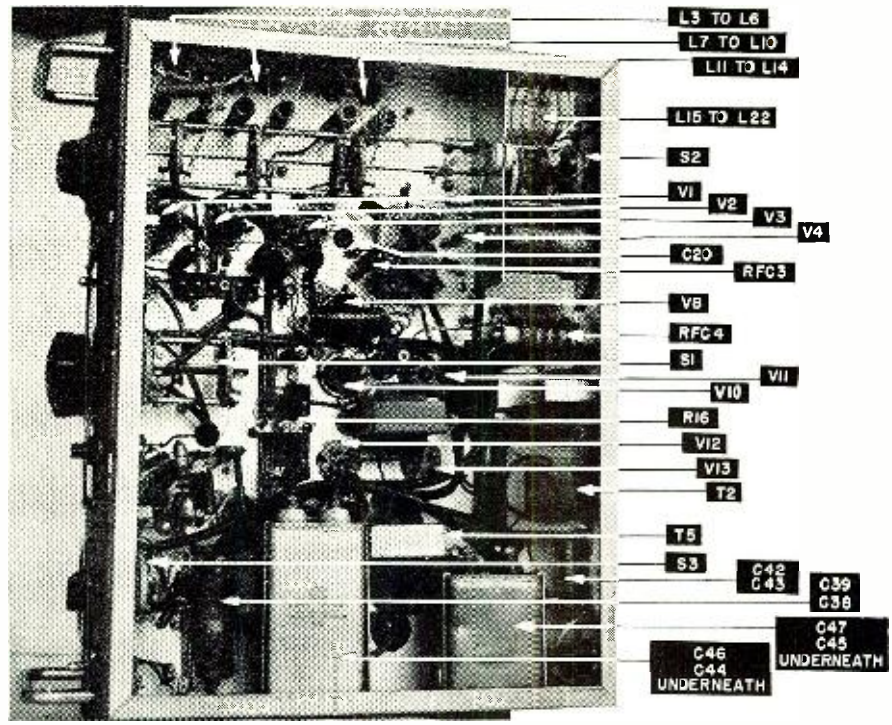
Both the plate circuit of the oscillator and the second 6AG7 buffer utilize similar coils. A commercially available type is the *Cambridge Thermionic Corporation* LS series, already wound. The ones used here are surplus forms and slugs which we laboriously wound and rewound, and if you like the work just follow directions! The twelve coils for the oscillator, buffer, and driver plates are arranged along the outer edge of chassis, as shown in the photos, with the slugs projecting through to the topside for easy adjustment. The coils for the 2E26 plate circuit are wound on *Millen* 69045 forms which are ceramic units with copper slugs.

The plate and screen bypass condensers for the oscillator, buffer, and the screen of the 2E26 are ceramic disc types, with the leads worked to be as short as possible. In this same connection, to minimize harmonic radiation, a tubular bypass connects the plate of the 2E26 to cathode, *i.e.,* to the ground. This condenser can be of a commercial variety, or a homemade affair such as we used. A 4" piece of ½" copper tubing with the center of ¼" rod, suitably insulated, gives about 6 to 8 $\mu\mu$fd. The end of the ½" tubing, which is grounded, has a small plate of copper bolted and soldered over a hole in the chassis to provide a patch direct to the cathode. This condenser, plus the 47 ohm resistor in the grid lead of the 2E26, gives, in our rig, absolute stability at all frequencies. It just won't "take off" on its own. Maybe we were lucky, but after a year's experience with a stubborn 807 we felt mighty good about the whole thing.

The 826 final gave a little trouble despite our fond hopes. Trying to neutralize the thing so it would stay neutralized on all bands was the problem. This was solved the easy way, by using a balanced tank circuit. The "easy way," in our case, meant carefully center-tapping the coils we had on hand—coils which weren't center-tapped when we got them for the previous model exciter. The coils used are 75 watt *Millen* units. You might expect them to run a little hot with a 125 watts input and they do on FM phone, but a fifteen or twenty minute rag chew doesn't raise the temperature to the point where the polystyrene ribs soften, so they seem quite safe. Larger capacity coils would require too much space, so they weren't even considered. On c.w. there is no apparent heating at all. The links shown in the photos as being at the ends of the coils have since been moved to the center.

The NBFM unit is quite standard. The 6AK5's have quite a high transconductance and give adequate swing on 75 and 20, with plenty to spare on 10.

The two power supplies crowd things a little on the chassis, but provide four separate functions. The bias supply gives minus 30 volts for the 2E26 and minus 75 for the 826, and a positive 150 for the NBFM and for the oscillator in "Test" position. In addition the 6.3 volt a.c. winding goes to all filaments execept that of the 826, which requires 7.5 volts at 4 amps from a separate transformer. The bleeder/divider network providing these voltages is stabilized by a VR150 and a VR75.



Under chassis view of unit. Although compact, there is no undue crowding of parts.

The high voltage supply utilizes a dual-purpose transformer, to give 1000 volts and 400 volts. The 400 volt section also utilizes a bleeder/divider resistance section, with another VR150 to give a fixed and stabilized 150 volts to the screens of the oscillator and buffer 6AG7's, and to the screen of the 2E26. About 250 volts is fed to the plates of the 6AG7's while the full 400 volts is fed to the plate of the 2E26 driver. A common set of chokes is used in the negative lead.

In the matter of TVI reduction we have a low-level oscillator section, isolation in the buffer, and shielded leads. The disc bypasses and the tubular condenser help out. We have used a triode in the final, with a balanced tank circuit, and coax output to the antenna tuner. In the a.c. leads, which are the only leads besides the key and mike outside the chassis, we have used two "Hi-Pass" (*Sprague* 48P9) condensers. The key lead is run in RG 29/U, and the mike lead is bypassed with a 50 $\mu\mu$fd. feedthrough. We can't find any r.f. on either of them. Then the whole rig is shielded with copper screen well-soldered inside the *Parmetal* cabinet. As we said before, Channel 4 (the only one used in this vicinity) is quiet as a television channel should be when a ham rig is on the air.

What about results? Well, both the TVI reduction and what gets into the antenna for a QSO depend upon design, construction, and good operating. The photos and the schematic give a good idea of parts placement, and if followed will allow decent wiring procedures despite the bulky RG 29/U and

(*Continued on page* 151)

Specifications for winding the twenty-two coils used in the 100-watt transmitter.

OSC. GRID COIL

L_1	125 t. #28 en., closewound, $1\frac{5}{16}$" dia.
L_2	20 t. #14 en., closewound, $1\frac{5}{16}$" dia.

OSC. PLATE COIL

L_3	80 m.—150 t. #30 en., closewound on ½" dia. iron slug-tuned form
L_4	40 m.—70 t. #28 en., closewound on ½" dia. iron slug-tuned form
L_5	20 m.—18 t. #22 en., closewound on ½" dia. iron slug-tuned form
L_6	10 m.—14 t. #18 en., closewound on ½" dia. iron slug-tuned form

BUFFER-DOUBLER PLATE COIL

L_7	Same as L_3
L_8	Same as L_4
L_9	Same as L_5
L_{10}	Same as L_6

DRIVER PLATE COIL

L_{11}	80 m.—140 t. #28 en., closewound on Millen 69045 form
L_{12}	40 m.—77 t. #28 en., closewound on Millen 69045 form
L_{13}	20 m.—20 t. #22 en., closewound on Millen 69045 form
L_{14}	10 m.—15 t. #18 en., closewound on Millen 69045 form

FINAL

L_{15}, L_{19}	80 m.—75 watt center-link unmounted coil (Millen 43081)
L_{16}, L_{20}	40 m.—75 watt center-link unmounted coil (Millen 43041)
L_{17}, L_{21}	20 m.—75 watt center-link unmounted coil (Millen 43021)
L_{18}, L_{22}	10 m.—75 watt center-link unmounted coil (Millen 43011)

A Practical Crystal NOISE GENERATOR

Both hams and experimenters will find this instrument a valuable adjunct in checking signal-to-noise ratios of radio receivers.

By

WILLIAM I. ORR,
W6SAI/FP8AC

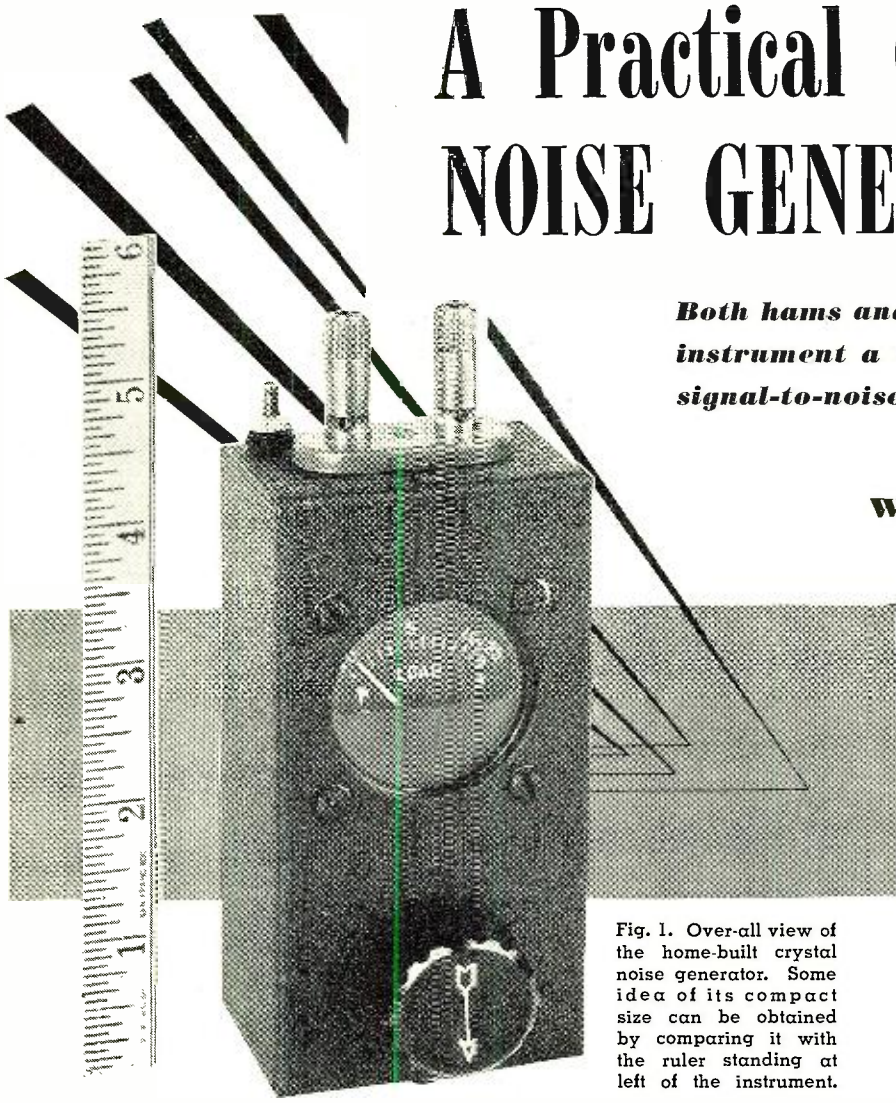


Fig. 1. Over-all view of the home-built crystal noise generator. Some idea of its compact size can be obtained by comparing it with the ruler standing at left of the instrument.

WITH the war-born interest in high-frequency equipment, many man hours of time and untold thousands of dollars have been expended in the search for a higher order of signal-to-noise ratio in receiving equipment. This has brought a real technical bonus to the amateur radio enthusiast. The information on how to obtain heretofore undreamed of results in receiver performance is at hand; and the tools to perform this work are here.

The term "signal-to-noise ratio" must not be confused with receiver gain. The gain of a receiver is entirely independent of the signal-to-noise ratio. Gain has been defined as the ratio of output signal to input signal. However, some receivers having an abundance of gain will produce a copious amount of output with absolutely no input at all to the receiver!

This internal noise generated in the receiver is the limiting factor in weak signal reception, particularly at the higher frequencies where external noises and static are quite low in intensity. Part of this noise is caused by minute variations of the electron stream and is present in all tubes.

Regeneration in the circuit will also increase the noise level beyond an acceptable value, thus close attention must be paid to ground returns and particularly to undesired coupling between circuits.

The term "signal-to-noise," for purposes of discussion, may be defined as the amount of signal necessary to overcome the internal receiver noise by a standard amount.

Determination of This Ratio

An acceptable method of determining the signal-to-noise ratio is to measure the audio output of the random receiver noise at a given frequency, then to inject a calibrated, minute noise signal until the combination of receiver noise and signal noise doubles the audio output of the receiver.

The noise signal necessary to perform this test will be of the order of a few microvolts, and the signal requires quite a different generator than the customary signal generator employed for checking receiver gain. This special noise generator is a device that will produce random noise similar to that noise produced by the receiver tubes. The amount of this noise is proportional to the current required by the generator. The reading of the generator current when the externally generated noise is equal to the internal receiver noise is then plotted against the audio output of the receiver. This provides a reference value of signal-to-noise that is useful as a standard in judging changes in, or alignment of, the receiver circuit.

Diode Tube Generator

The usual form of noise generator consists of a vacuum tube diode operating in a temperature-limited condition; that is, the plate voltage is high enough to make the available emission from the filament the factor limiting the diode current. The diode acts as a constant-current noise generator because of the fluctuation in the number of electrons leaving the cathode. This type of generator is very effective. It operates at a low r.f. level so that shielding and leakage problems are minimized. The circuits are simple, readily operated, and the unit is small in size. In addition, the available power is proportionate to the current that passes through the diode. (Fig. 2) However, it has a few bad faults: it needs a filament supply and a plate supply. The filament supply must be variable so as to control the amount of noise generated. The choice of proper diode tubes is limited—only one or two of them (the most expensive ones) will work above approximately 50 megacycles. The diode tube generator is also susceptible to power line noises picked up via the a.c. line and fed to the diode through the filament and plate supplies. This added noise is serious and will actually obliterate the zero noise point at which the measurements are started.

Crystal Noise Generator

This article will describe the design and construction of a crystal diode noise generator.

Certain types of crystal diodes, notably the silicon series, have the unique property of generating considerable

r.f. noise when a direct current is passed through them in the reverse direction of highest resistance.[1, 2]

These crystal diodes have been used as noise generators up to 3000 mc. They require only a few volts to produce usable quantities of noise. This voltage may be obtained from a flashlight cell, thus eliminating the problem of a filament and plate supply for a diode tube.

The crystal diode noise generator is a relatively high impedance noise source, whereas the diode tube can be used as a low impedance constant-current generator. This limits the application of the crystal diode in some instances. If all comparative measurements are made at the same load value of impedance, the crystal generator will be satisfactory. No direct comparison can be made at different values of impedance. This is a small price to pay for such a compact and handy measuring device!

A typical circuit for a silicon crystal noise generator is shown in Fig. 3. Condenser C_1 serves as a low impedance r.f. bypass for both the meter and the variable voltage supply. The resistance R_1 limits the maximum diode current to 1 milliampere and also provides a means of varying this current. A non-inductive resistor (a small ½ watt composition one will do) with a value that corresponds to the input impedance of the receiver is connected across the generator output so as to match the generator to the particular receiver impedance.

The complete generator may be built into a small metal box measuring 1½"x2"x4" if a meter of sufficiently small size is used. The meter used, and shown in the photograph, is a 1¼" war surplus meter with a range of 0-1.25 milliamperes.

A silicon crystal must be used. The 1N34 type will not be satisfactory. The 1N23 silicon radar crystal, available for under a dollar on the surplus market, is excellent for this purpose.

Care must be taken if wires are soldered to the crystal. If the soldering is done quickly, with a hot iron and the crystal cooled instantly after the wires are attached to it, no harm will come to the crystal. The crystal and condenser C_1 are mounted to the terminals of the connecting strip with very short leads to keep the loop resonant frequency of the generator as high as possible. The flashlight battery has a very long life since only 1 milliampere is passed through it and so it may be soldered directly into the circuit. It will last for over a year with normal usage of the generator. The ends of the battery are covered with insulating tape to prevent a short-circuit to the metal box.

A ground stud is bolted to the box next to the terminal which is connected to the battery negative. This terminal is grounded to the stud when the instrument is used in an unbalanced condition, such as feeding a coaxial input stage.

Application

The test set-up for a signal-to-noise check of a receiver with the crystal noise generator is shown in Fig. 4. Resistor R is a non-inductive composition resistor with a resistance equal in value to the input impedance of the receiver.

The noise generator is connected to the antenna terminals of the receiver and the case of the generator is grounded to the chassis of the receiver. An output meter is connected to the speaker or earphone terminals of the receiver. With the noise generator turned off, adjust the receiver as follows:

1. Turn off the a.v.c.
2. Turn off the beat-oscillator.
3. Advance the r.f. gain control full on.
4. Advance the audio control to provide an index reading on the output meter. (This reading is noted as the zero measurement reading.)
5. Turn on the noise generator and advance R_1 until the reading of the output meter is doubled.
6. Read the meter in the noise generator. This reading is used as the reference signal-to-noise value.

The lower the reading of the noise generator meter to accompilsh the above test, the better the signal-to-noise ratio of the receiver being tested.

The meter used for the measurement of the receiver output may be almost any type of meter capable of measuring audio voltage.

A db meter will be the most convenient, if available, as an increase in reading of 3 db will indicate double power. If a rectifier type a.c. meter or a v.t.v.m. is used, the input from the noise generator is simply increased until the initial voltage shown is doubled.

The point of connection of the meter for measurement of the receiver output will depend to some extent on the receiver and meter used. In some cases the meter will be connected across the headphone jack, while in other receivers the most satisfactory point will be the speaker voice coil terminals. It is relatively easy to determine the correct point by experiment.

In the case of a receiver with a coaxial input stage the terminal nearest the ground post is jumpered to ground with a heavy lead and also connected to the receiver ground. The free terminal is connected to the center coaxial terminal of the receiver (Fig. 5).

The crystal noise generator will perform satisfactorily up to at least 160 mc., thus taking in the 2 meter amateur band. No means were available to check operation at frequencies higher than this.

Some surprising facts may turn up during a receiver check. During a check run made on an expensive amateur receiver several interesting points were discovered:

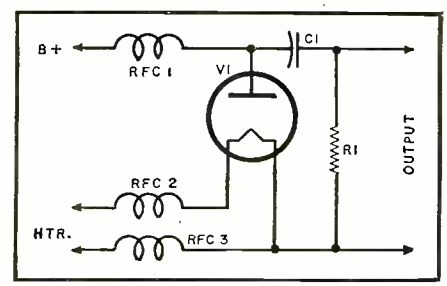
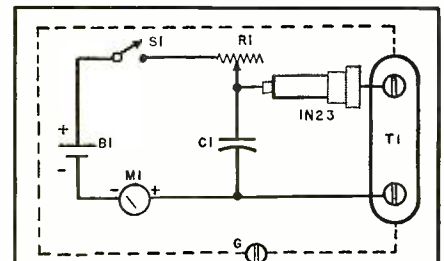


Fig. 2. Simple diode tube noise generator.



R_1—10,000 ohm linear pot., with switch S_1 (Mallory U-18 with US-26 switch)
C_1—.001 μfd. midget ceramic cond. (Erie #811)
M_1—0-1 midget d.c. milliammeter
B_1—Midget 1½ v. penlight cell
T_1—Terminal strip (National FWH)
G—Ground bolt (6-32)
S_1—S.p.s.t. sw. (on R_1)
1—1N23 crystal
Box—Bud CU-3002

Fig. 3. The crystal diode noise generator.

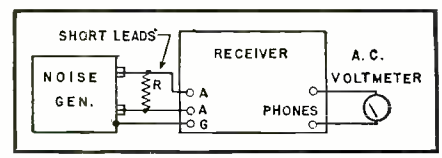


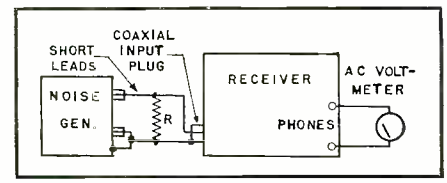
Fig. 4. Test setup for making signal-to-noise checks using the crystal noise generator described. Resistor R should be non-inductive and have a resistance equal in value to input impedance of receiver.

1. Although the *gain* of the receiver varied considerably with frequency, the signal-to-noise ratio was relatively constant over the same range.
2. Maximum signal-to-noise ratio was *not* coincidental with maximum background noise in the receiver. If the receiver was aligned by ear, it would not be aligned for best signal-to-noise ratio.
3. Careful alignment at both ends of each amateur band was necessary. Quick spot alignments were "out."

You, also, will find out some interesting facts about your receiver when you use this small unit! Its cost is small—it is easy to build. Once you use it, you will never be without it! Build one and see!

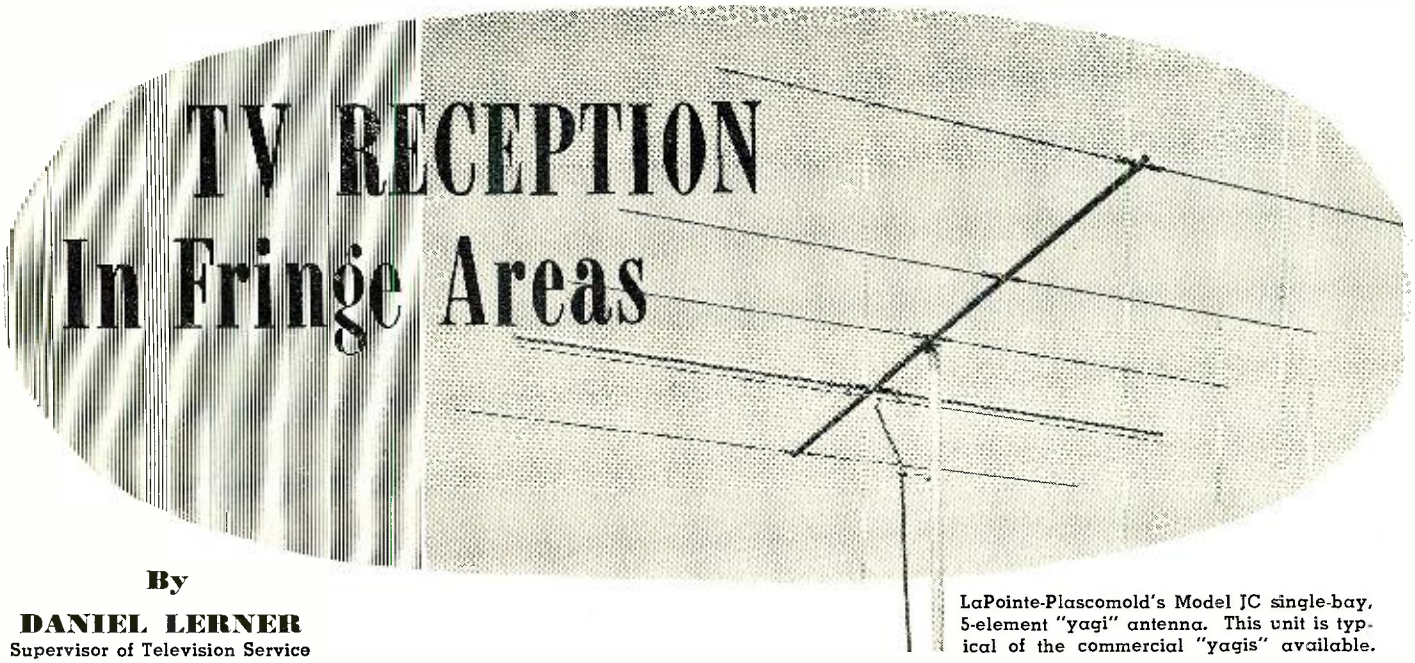
—30—

Fig. 5. Test setup for signal-to-noise checks on receiver having coaxial input stage. Note connections made on ground side.



[1] Houldin, J. E.; "The Crystal Capsule as a Generator of Noise?", G.E. Report #8237 (Great Britain), July 9, 1943.
[2] Van Voorhis, S. N.; "Microwave Receivers", Vol. 23, Radiation Laboratory Series, McGraw-Hill Book Co., New York.

TV RECEPTION In Fringe Areas



LaPointe-Plascomold's Model JC single-bay, 5-element "yagi" antenna. This unit is typical of the commercial "yagis" available.

By

DANIEL LERNER
Supervisor of Television Service
Philco Corporation

Practical TV service tips on circuit adjustments for improved video reception in low signal areas.

AS MANY television technicians can testify, there is no sure cure or all-around remedy for making a strong television signal out of a very weak one. Nevertheless there are several expedients which can improve reception in the so-called fringe or weak signal areas. The ever increasing pace of competition in television development and production has resulted in television receivers with greater and greater sensitivity. The so-called fringe has been extended considerably, so that now it is at least twice as far out as it was in the early part of 1948. When a manufacturer designs a television receiver, he designs its characteristics so that it will give good performance in an optimum or average location. He does not design the television receiver specifically for one particular area, whether it be a weak or strong signal area. Some manufacturers do produce custom receivers made for these particular fringe areas. The problem is: What can be done to the r.f. system, antenna system, i.f. circuits and sync circuits to convert a so-called average set into a fringe receiver. The writer has seen many cases where a simple modification in a sync circuit has made the difference between selling 1000 sets or selling none at all.

Antenna Systems

To start with the first things first, what can be done to an antenna system to make it perform better in a fringe area? The trend in antennas nowadays is towards a broadband multi-element type like the biconical array. This may take the shape of 2, 3, or maybe 4 spines, (see Fig. 1) in the driven element, but nevertheless it is essentially a broadband antenna. While this type of antenna has proven to be invaluable in areas such as Philadelphia and New York where quite a few television channels may be received, it has several distinct disadvantages when used in a fringe area. A broadband antenna, while maintaining a fairly uniform gain over the entire television spectrum, has a comparatively low figure of gain when compared to a narrow-band or high *"Q"* antenna system such as the "yagi" type. This is mere common sense for the antenna system can be considered as a tuned circuit and naturally the *"Q"* of the tuned circuit, or the figure of merit, determines the gain which may be obtained from the tuned circuit.

Recently in a field trip to a real fringe area, Pottsville, Pa., the author had an opportunity to see many kinds of antenna systems and to get a fair idea of their worth. This city is located in extremely uneven terrain. Channels 3 and 6 can be received from Philadelphia, but vary in signal strength from 10 to 200 microvolts depending upon the season, weather conditions, and time of day. Almost invariably the type of antenna system used is either a single or a double-stacked yagi or even a four-stacked biconical array. When a "yagi" is used in this city it is cut to a particular channel and another "yagi" array must be used for the other channel. The "yagi" theoretically is the antenna array which gives the highest gain at a particular channel. Most commercial "yagis" give a gain over a dipole in the order of 7 to 10 db.

Table 1. Details of a 3-element "yagi" array. Dimensions are given for all channels.

CHANNEL	FREQUENCY	DIPOLE LENGTH	REFLECTOR LENGTH	REFLECTOR SPACING	DIRECTOR LENGTH	DIRECTOR SPACING
2	54-60 mc.	98¼"	103¼"	40"	93½"	25"
3	60-66 mc.	90"	94"	36"	85"	22"
4	66-72 mc.	81½"	85¾"	33"	78"	20"
5	76-82 mc.	71"	74¼"	29"	67½"	18"
6	82-88 mc.	65"	69½"	26"	64¼"	16½"
7	174-180 mc.	31¾"	33½"	13"	30"	8"
8	180-186 mc.	30¾"	32¼"	12¼"	28¾"	7¾"
9	186-192 mc.	29¾"	31¼"	11¾"	28"	7½"
10	192-198 mc.	28¾"	30¼"	11½"	27"	7¼"
11	198-204 mc.	28"	29¼"	11¼"	26¼"	7
12	204-210 mc.	27"	28½"	11"	25½"	6¾"
13	210-216 mc.	26¼"	27½"	10¾"	25"	6½"

R.F. Tuner (Front End)

There are scores of different types of tuners on the market. They range from such varieties as the continuous-type tuner used by *Du Mont* to the turret-type tuner used by *Philco, Zenith, Emerson,* and many others.

No matter what kind of tuner is used, they all have one general problem. That is, how to amplify the received r.f. to a level usable at the 1st i.f. stage and also to keep the noise generated in the tuner low enough so as not to mask the received signal. This becomes quite a problem in a fringe area, for the received signal may be in the order of 30 microvolts and the noise generated in the tuner in the order of 20 microvolts or more.

In tuners using a 6AG5 for an r.f. amplifier, the author has had some success with tube substitutions. The 6BC5 and 6CB6 may be used in place of the 6AG5, and higher gains may be

obtained. In one case a 6AK5 proved to give almost a 50% increase in gain. The pin connections are the same for all four of these tubes except that the 6CB6 has an external connection. Another field expedient which gives remarkable results involves removing the a.g.c. voltage applied to the r.f. amplifier grid, by grounding the r.f. grid return resistor. This has proven to be one of the most valuable aids in the fringe area. It not only increases the blackness (inkiness) of the picture but also seems to make the snow content less grainy and finer in nature.

If the tuner is of the turret type and the antenna and r.f. plate coils are removable, the coils may be spiked for greater gain. For real accuracy a good sweep generator and oscilloscope must be used in the process. "Spiking" involves separating the primary and secondary windings (loose coupling) to obtain a narrower bandpass, but higher sensitivity. Spiking is a tedious process and is not recommended to the beginner in television service.

Some wonderful results have been obtained in the fringe area by the actual substitution of one kind of tuner for another. In areas where the high frequency channels are in the fringe, the use of a tapered-line input tuner has often resulted in gains of 2 to 1 over the original tuner. Recently *Philco* designed a tuner (semi-incremental type), having a lower noise figure and higher signal-to-noise ratio than practically any other type. It uses a new low capacity triode, a 6BQ7, with one section as a grounded-grid r.f. amplifier. It uses a 12AV7 twin triode as the oscillator mixer. The use of this tuner in any receiver will result in better fringe performance.

In some areas, television reception is limited to one television channel. This means that the tuner can be peaked up to give its best performance for this channel. A very practical way to accomplish this is simply to turn the r.f. plate and grid trimmers and antenna trimmers for maximum signal at the video detector. Of course an oscilloscope connected to the video detector output is necessary to view the changes in amplitude.

I.F. System

Quite a bit of extra gain can be obtained in the i.f. system. But here extreme caution is urged, for too enthusiastic realignment may result in an unstable, regenerative i.f. system. There is a practical method for fringe alignment of an i.f. system, and it consists of the following:

1. Connect sweep generator to mixer grid and sweep through i.f. range.
2. Connect oscilloscope to video detector output.
3. Connect bias jig (see Fig. 2) from a.g.c. bus to ground.
4. Connect 20,000 ohm-per-volt meter to a.g.c. bus and adjust for –3 volts.
5. Repad i.f. system until bandwidth is reduced to approximately 2.5 mc., the amplitude is increased, and the video i.f. carrier is at approximately 80% of the response. See Fig. 3. During this realignment procedure carefully reduce the applied bias until the final curve is obtained with an a.g.c. voltage reading of approximately zero. It should be noted that the sweep generator output will also be lowered and the vertical gain control on the scope increased as the final curve is approached. The final curve will naturally be full of scope grass but its shape should be easily apparent.

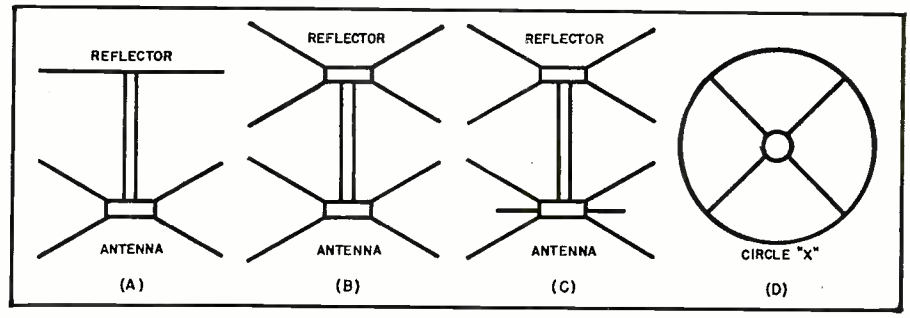


Fig. 1. Element arrangements of various types of broadband antennas.

In some areas the received signal may vary from 30 microvolts in the daytime to about 200 microvolts at night. A well designed i.f. system has the characteristic of maintaining its response shape even though the a.g.c. applied to the i.f. grids may change from –.5 volt to –3.0 volts. In real fringe areas this characteristic is not desirable, for as the input signal decreases in a fringe area, it would be ideal for the video i.f. carrier automatically to shift up on the response curve. See Fig. 4. This may be difficult to obtain with some i.f. systems but nevertheless careful realignment may accomplish the job. The author has obtained good results in i.f. fringe area work by simply replacing a low gain i.f. tube, 6AG5 or 6AU6 with a hot 6BC5 or 6CB6. The i.f. system naturally will have to be repadded after such a tube replacement.

A.G.C. System

Recently tests have shown that manual control of the a.g.c. voltage may have beneficial effects in fringe area work. A circuit shown in Fig. 5 was used successfully recently in the fringe area. Reducing the a.g.c. voltage has several good effects. It increases the gain of the i.f. system, giving a blacker (inkier) picture. It also helps in clipping noise in the i.f. system.

Sync Circuits

Most of the sync circuit difficulties in the fringe area involve trying to hold sync in the presence of extreme noise. In cases of certain types of sustained noise, grounding the grid return resistor of the 3rd i.f. tube and using the manual a.g.c. control previously described allows for clipping of noise in the i.f. system. See Fig. 6. In this figure it can be seen that with normal a.g.c. voltage (–3 volts) applied to the i.f. tube it will operate on the I_p-E_g curve so that both the normal video signal and the accompanying noise

(*Continued on page* 122)

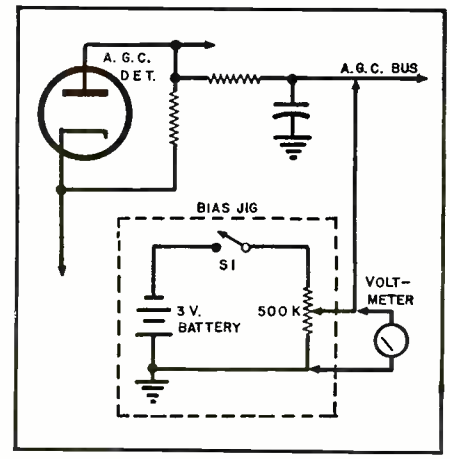


Fig. 2. Basic jig for readjusting i.f. system.

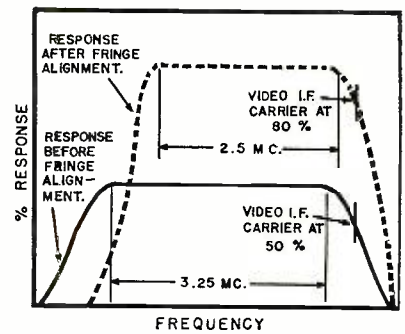


Fig. 3. The i.f. response curve. Reduced bandwidth and higher gain are ultimate goals.

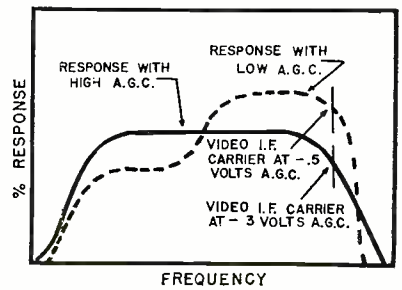
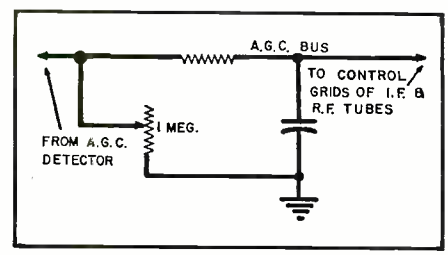
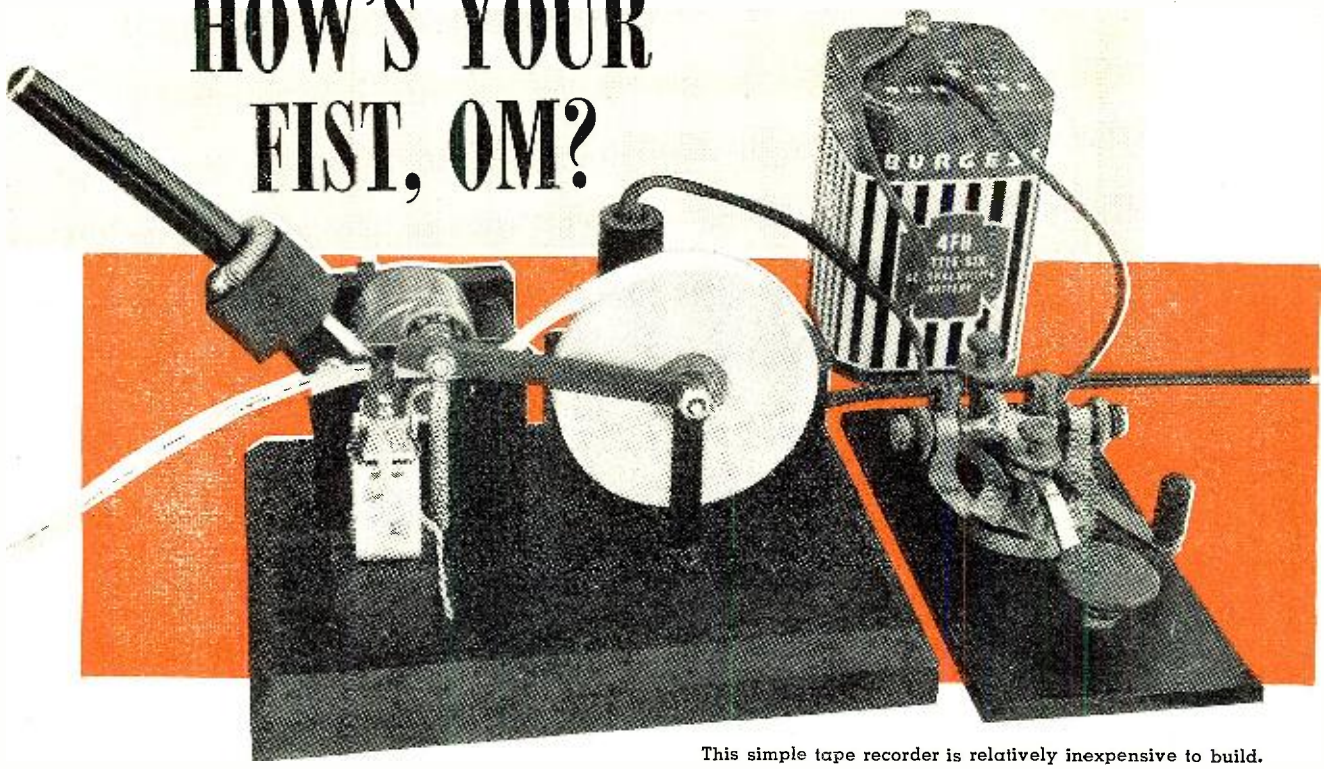


Fig. 4. The i.f. response with a.g.c. voltage change. Careful realignment helps.

Fig. 5. Manual a.g.c. control circuit.



HOW'S YOUR FIST, OM?



This simple tape recorder is relatively inexpensive to build.

You can check your sending technique with this automatic code recorder. A 1 rps clock motor is used to move tape over the armature of relay. When relay is energized, tape is lifted in contact with pen, making a record. Suitable for up to 35 wpm.

By
STEWART BECKER,
W7AYB

THE code recorder to be described was built for the express purpose of providing a means of showing "brass-pounders" just how good their keying really is. For the beginner it can show him how his keying improves weekly with practice and for the experienced operator, it can show him just where his keying needs improvement and then will show him how his keying does improve as he concentrates on his weak points. For the radio club, it can act as an impartial judge in keying contests. A few minutes of listening in on any amateur c.w. band will convince anyone of the need for improving the "fists" of amateurs in general. Many an amateur would receive quite a shock if he were shown a tape of his average code conversation over the air! Here's a device which will help you to improve your fist.

This recorder consists essentially of a ¼ inch paper tape which is pushed over the armature of a relay by means of a rotating friction wheel driven by a clock motor. When the relay is actuated, the paper tape is lifted into contact with a pen and a record is made. Don't shy away because any of the parts of this recorder may seem unfamiliar to you. Any amateur with a few tools can easily make one.

Let's tackle the recording tape first since this, at first, seemed to offer the greatest difficulties but actually turned out to be a very simple problem. First obtain a roll of adding machine paper. If you own a circular saw, the rest is easy. If you don't own such a saw, you probably know someone who does and he will be glad to slice it for you. A miter saw will probably do the job too. Cut the roll up into slices ¼ inch wide. Use a planer saw blade if possible so the edges will be smooth. If you don't have a planer saw, use a cross-cut or combination saw and then smooth up the edges of the roll by lapping the slice on a piece of fine sandpaper laid flat on a table top. It is essential that the edges of the tape be clean, not ragged, or it will not push through the paper guide on the relay armature. Paper tape suitable for use in this recorder may also be purchased from various companies selling code machines, if you do not care to cut your own.

Now for the relay that raises the paper against the pen. Any relay will do, it just depends on what you have available and how much voltage you want to use to key the recorder. The one shown in the photographs was taken from some war-surplus equipment and originally required 24 volts d.c. to key it. However the coil was rewound full of No. 22 d.c.c. wire and now 1.5 volts d.c. keys it very nicely. The contact mechanism was removed from the armature and on the end away from the coil (so it will be *raised* when the armature is actuated) a tape guide was fastened. The paper not only has to be raised into contact with the paper so a bottom plate on the tape guide is required, but also the tape must be lowered from the pen so a top plate is also essential. If a top plate is not used, the tape will have a tendency to stay in contact with the pen and both dots and dashes will be too long. Also, since the tape as it leaves the tape guide has a wet ink line on it, the top plate must be in the form of a saddle raised in the middle to clear the wet ink but low on each side so as to lower the paper from the pen as soon as the relay armature is released. In the one shown in the photographs the pen writes through a hole in this top plate. Use thin aluminum for this tape guide because you will want to be able to key up to 35 words-per-minute and, if this tape guide is too heavy, it will not move fast enough to give clean records at the higher keying speeds. Little ears turned up on the bottom plate keep the tape from "walking" from side to side as the paper is pushed through. Three layers of paper tape made into washers are about right for spacing the top plate from the bottom plate. This gives a clearance of twice the paper thickness and seems to be about right.

Next comes the mechanism for pushing the paper over the relay armature. The one shown in the photographs is a one revolution-per-second clock motor

but many other motor and gear combinations will do. It is the linear speed of the tape that counts so let's examine that. Eighty inches-per-minute seems to be a good average speed. Calculations show that this requires a roller with a diameter of 0.425 inches rotating once every second. If you find you want to either increase or decrease this tape speed, the formula for a roller rotating one revolution per second is:

$$\text{Roller dia.} = \frac{\text{Tape speed in in./min.}}{188.5}$$

The drive roller is very simple to make. Start with an "E" eraser for a *Sheaffer* "Fineline" pencil. It has a metal collar on one end which is very conveniently drilled with a small hole in the center. This makes it possible to drill it true without a lathe. Drill this eraser to fit snugly on the drive shaft. The eraser is too small in diameter to use directly with a one revolution-per-second clock motor but its diameter can be very easily increased by winding ½" wide adhesive tape on it until the desired diameter is reached. The adhesive tape is too smooth on the outside to drive the paper but a "tire" consisting of one layer of ordinary black friction tape on top of the adhesive tape pushes the paper tape without slipping. As your keying speed increases, just add a little more tape to increase the size of the roller and thus drive the paper faster.

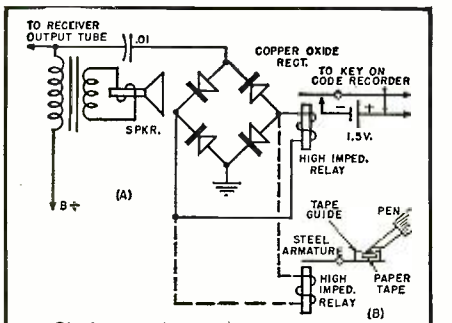
Note the additional paper guide between the drive roller and the roll of paper tape. This is essential to prevent sidewise walk of the paper tape and also to keep the tape at the proper height as the diameter of the tape roll decreases with use. The reason why the tape is pushed into the tape lifter on top of the relay rather than pulled through is that on the other side of the tape lifter the tape contains a wet ink line and so if the tape is pulled through, the idler roller, which will be described next, has to be shaped to straddle the ink record to prevent blotting.

The idler roller on the model shown is just a ball bearing assembly mounted on an arm and pulled down against the drive roller by means of a very light spring (tension one ounce). Make this spring detachable so the idler roller can be lifted out of the way while loading the paper tape. This spring was not used at first but a weight consisting of a one ounce fishing sinker was fastened to the arm carrying this idler roller. For appearance sake this sinker was discarded in favor of the spring but it worked just as well. Space the friction roller and this idler just above it as close to the relay armature as possible or the paper will buckle instead of pushing through the paper guide.

In the photographs, the paper roll is shown without plates on each side. Actually it is better to use plates to prevent the outside turns of tape from falling off the spool. These plates can be made of ⅛ inch Masonite with a circle cutter or the top and bottom of an ordinary tomato can are just right for this, 3¼ inches in diameter.

The pen holder consists of a block of wood mounted on the motor bracket by means of a strip of galvanized iron. A spring, as shown, makes it easy to adjust the pen so the paper will just touch the point of the pen when the paper is raised. An ordinary fountain pen with a stub point works very well but better tapes can be made using a lettering pen and drawing ink.

Besides using this recorder for checking your "fist", by connecting a copper oxide rectifier to the output transformer of the receiver, the output of this rectifier can be used to key the recorder on received signals. With this arrangement you can record signals as they come over the air. The relay, as wound with No. 22 d.c.c. wire, is not suitable for use with a copper oxide



1—Clock motor (1 r.p.s.)
1—Relay with contact mechanism removed and paper guides added
1—Pen holder make from block of wood and spring
1—Drive roller made from pencil eraser with diameter increased by adhesive and friction tape
1—Idler roller made of a ¾" ball bearing assembly
1—Light spring or 1 oz. fishing sinker to increase pressure between driver roller and idler roller
1—Open circuit jack for connecting key and battery or receiver output
1—S.p.s.t. sw. for tape pusher motor
1—Roll ¼" wide paper tape made from adding machine paper

Fig. 1. (A) Keying from receiver with auxiliary relay and (B) without using relay.

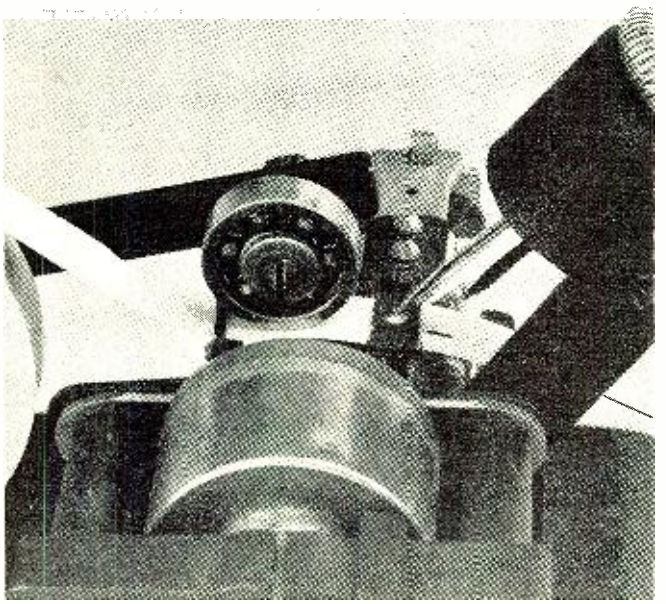
rectifier because it requires too much current. The relay with much finer wire should be used in this application. Fig. 1A shows a circuit using an auxiliary high impedance relay suitable for use with a bridge type rectifier. Fig. 1B is an arrangement for using the code recorder directly provided a high impedance relay is used in the recorder itself.

It is probable that the low impedance relay together with the rectifier could be connected across the voice coil of the output transformer, allowing the use of a lower voltage rectifier.

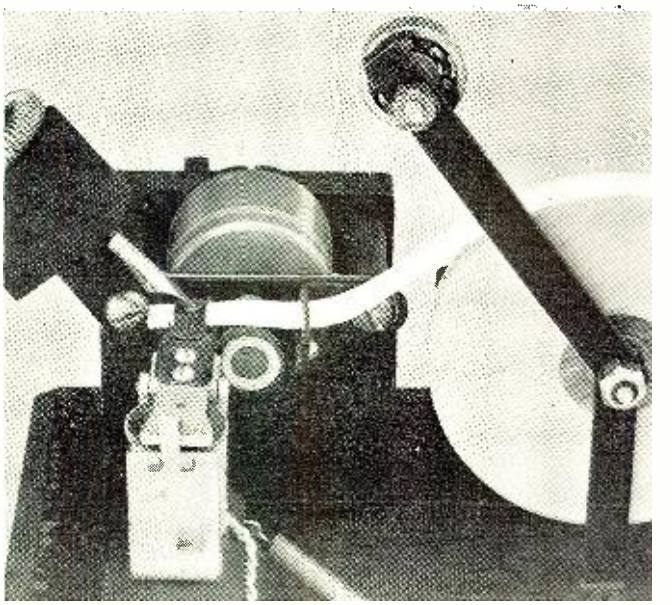
In one test a battery trickle charger was used with the normal primary of the transformer connected in place of the output transformer. The relay was then connected across the d.c. output of the trickle charger.

—30—

Close-up of code recording mechanism showing tape feed and pen.



Over-all view of unit showing idler roller lifted from the tape.



AUDIO MODULATION TESTS

Over-all view of test unit. It is home-built and easy to duplicate.

By
GLEN SOUTHWORTH

Complete analysis of a modulated wave technique used in checking performance of audio equipment.

IN SEEKING to improve the performance of audio equipment, the trend in recent years has been to use increasingly complex waveforms in analyzing the characteristics of audio devices, thus providing a closer approximation of the conditions found when actually reproducing speech or music. Examples of this are to be found in the intermodulation technique, wherein two or more frequencies are used simultaneously for test purposes, and in the use of square or clipped waveforms, rich in harmonics.

A technique somewhat analogous to the intermodulation test is to apply a modulated wave train to the equipment under test and observe the alterations resulting. Waveforms of this nature commonly occur in natural sound, and if nonlinearity exists in the reproducing system, partial rectification of the modulation envelope may occur with the result that a spurious tone of the same frequency as the modulation envelope will appear in the output and may be easily detected by means of a low-pass filter. In addition, this method appears to recommend itself in making aural tests of fidelity and in the observation of loudspeaker characteristics. The reason for this is that the low frequency tone is not harmonically related to the carrier frequency and usually being of a widely separated nature, such as a carrier of 8000 cps and a modulation of 100 cps, is relatively easy to detect aurally. This is in contrast with the intermodulation technique wherein the distortion products may be masked by the carrier as well as the relatively high-intensity lower frequency. Similarly, in testing loudspeakers by the modulated wave method the distortion products resulting appear to be less affected by the acoustic environment than those occurring in intermodulation.

A second test of interest is that of observing the dynamic characteristics of amplifiers and other equipment. This is advantageous in that the mode of operation of a particular device may vary with the intensity of the signal applied. In the case of audio amplifiers, voltage variations, regenerative instability, and secondary emission from tube elements may cause dynamic distortions that may go unnoticed in the case of steady-state measurements. Examples of this are shown in the accompanying oscilloscope photographs. In the case of electroacoustic transducers, such as loudspeakers, the problem of changing modes of vibration may be considerably more severe, as will be further noted in the following paragraphs.

Although the problem of transient distortion has produced considerable interest in recent years, at the present time there appear to be no standards set for making comparative measurements of audio equipment. In observing the type of transient distortion that leads to "ringing" or "hangover" the modulated wave technique seems to be an easily reproducible method of making comparative measurements. If a wave train modulated 100% by some lower frequency is applied to a device in which transient distortion of a ringing nature occurs, then a deformation of the modulation envelope will result which causes the carrier to be demodulated, in the sense that the percentage of modulation is no longer as great. The amount of demodulation produced is dependent upon the amplitude and duration of the ringing distortion and upon the frequency of the modulation tone used. An example of this is shown in the accompanying oscilloscope photos in which a 600 cps carrier, modulated 100% by a 60 cycle tone was applied to a parallel *LC* circuit resonant at the carrier frequency. The sensitivity of this method of measurement is increased by raising the frequency of the modulation envelope and decreased by lowering it. Thus, the amount of transient distortion of this nature which is present at any frequency may be stated by giving the amount of demodulation produced as well as the modulating frequency.

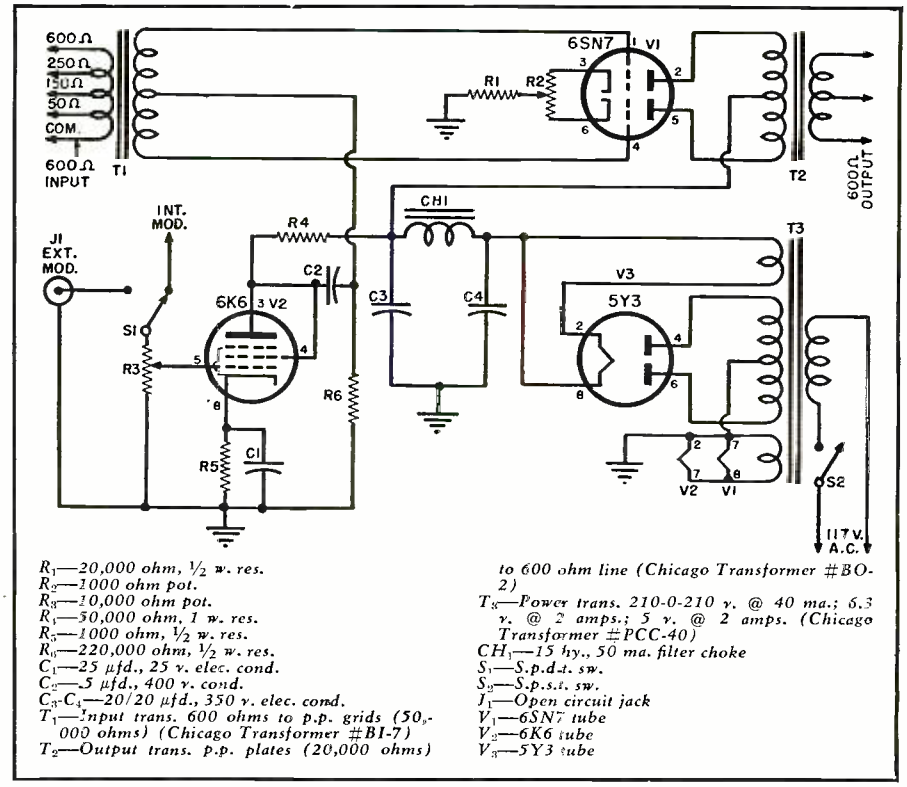
Up to the present there have been three main methods of analyzing transient distortion; square waves, pulses, and interrupted wave trains. The modulated wave technique appears to have several advantages over the others mentioned. As the buildup and decay of the carrier frequency is relatively slow there is less hazard of shock-exciting adjacent resonances, thus permitting a less complicated analysis of a particular frequency to be made. Another factor of importance is that there is no appreciable time delay between the occurrence of one modulation envelope and another, such as occurs in other transient testing techniques. This is desirable, not only from the standpoint of the convenience of measuring the demodulation produced, but also due to the fact that the spurious transient produced may have a varying phase characteristic that can produce serious interference with the subsequent modulation envelope. Similarly, as noted previously, the mode of vibration of a device such as a loudspeaker can alter

greatly under conditions of dynamic variation, with resultant envelope distortion and interference products being generated. This factor can be of some importance in sound reproduction where natural or spurious modulations of up to several thousand c.p.s. may be encountered.

Another factor closely related to the subject of transient distortion is that of the decay time of the room acoustics in which a reproducing system is used. In essence, reverberation represents a form of ringing transient distortion in which the sound persists after the initial excitation has ceased. The main difference between this effect and the distortions found in reproducing equipment is that acoustic hangover is relatively smooth with regard to frequency, being greatest at low frequencies and decreasing in the high frequency region where the sound absorbing properties of most materials are superior. On the other hand, transient distortions in devices such as loudspeakers usually are produced by sharply peaked resonances which tend to lend objectionable aural emphasis to certain frequencies. As in the case of testing reproducing apparatus, the modulated wave technique offers opportunities of observing the acoustic characteristics of rooms having relatively short decay periods. In general, the same factors mentioned in transient testing hold good and an oscilloscope photo of the demodulation caused by room hangover is illustrated. Experiments of this nature indicate that the objectionableness of certain forms of distortion in audio equipment, such as intermodulation distortion, may be appreciably modified by the associated room acoustics. Presumably "dead" acoustics would tend to make intermodulation more noticeable, while a live listening environment would tend to lower the apparent depth of modulation produced.

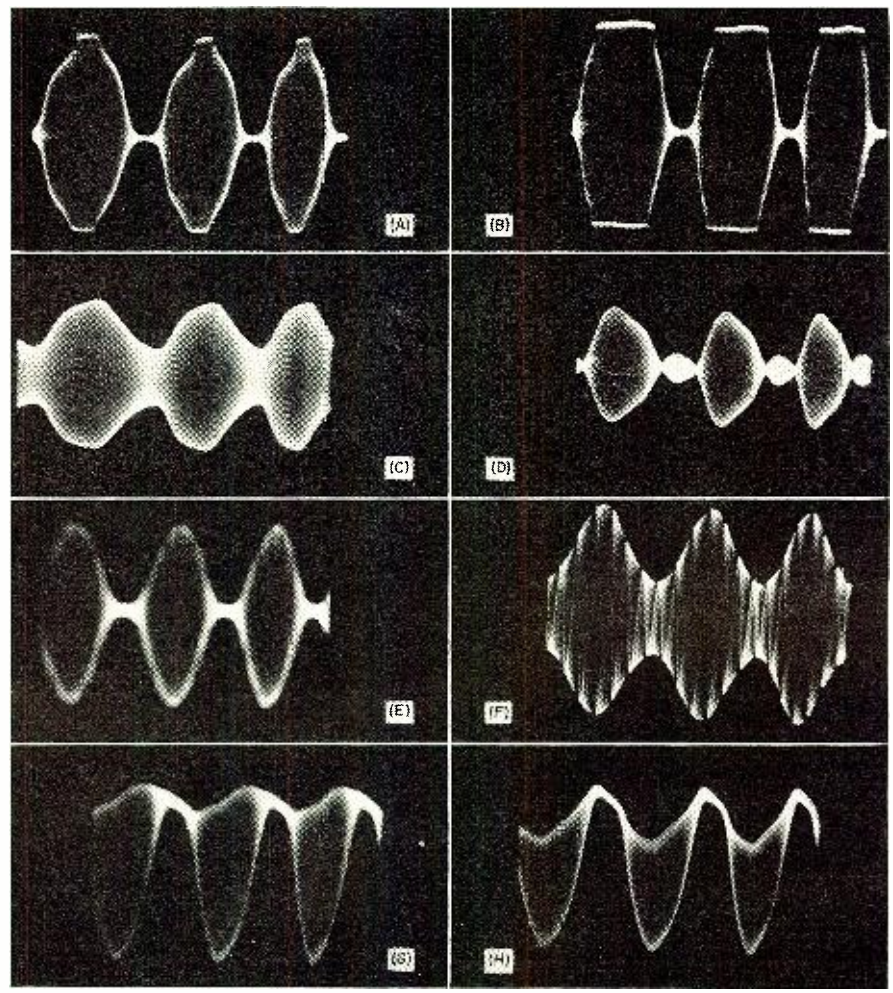
A fifth application of modulated wave trains is in making phase shift observations. In this instance, the modulation envelope is used as a ref-

(*Continued on page* 102)

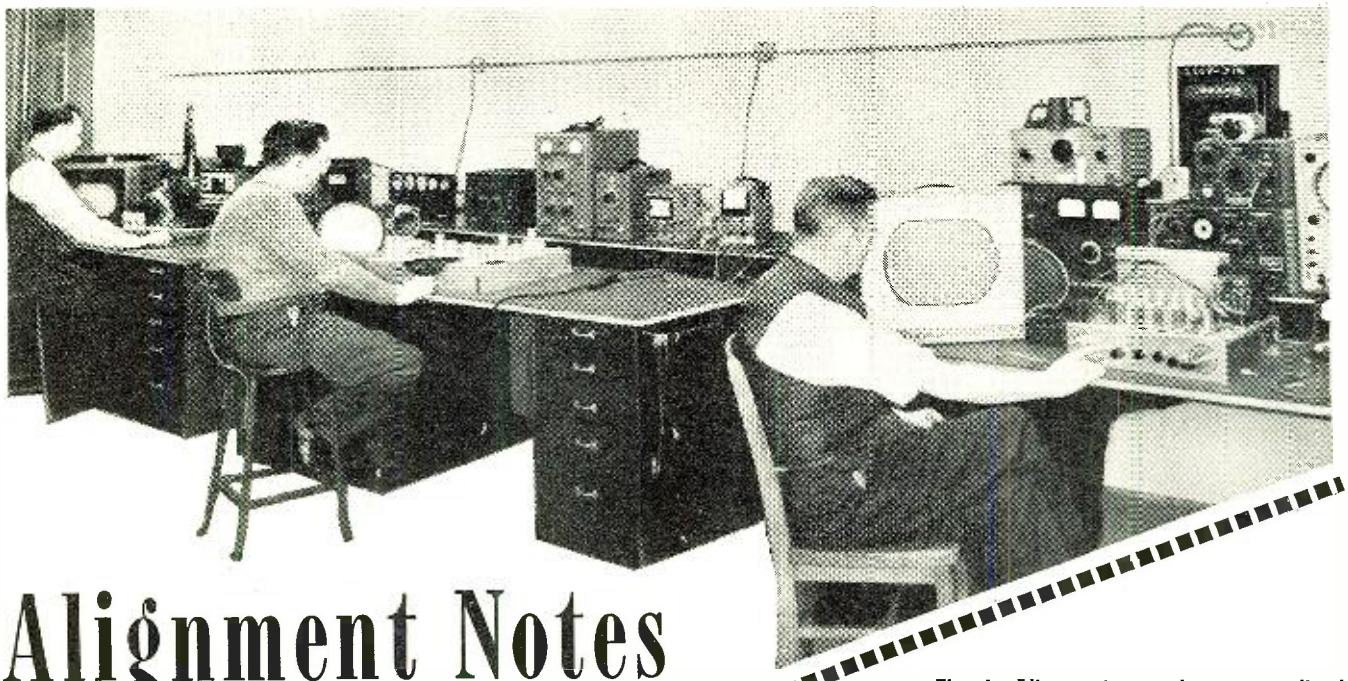


R_1—20,000 ohm, ½ w. res.
R_2—1000 ohm pot.
R_3—10,000 ohm pot.
R_4—50,000 ohm, 1 w. res.
R_5—1000 ohm, ½ w. res.
R_6—220,000 ohm, ½ w. res.
C_1—25 μfd., 25 v. elec. cond.
C_2—.5 μfd., 400 v. cond.
C_3-C_4—20/20 μfd., 350 v. elec. cond.
T_1—Input trans. 600 ohms to p.p. grids (50,000 ohms) (Chicago Transformer #BI-7)
T_2—Output trans. p.p. plates (20,000 ohms) to 600 ohm line (Chicago Transformer #BO-2)
T_3—Power trans. 210-0-210 v. @ 40 ma.; 6.3 v. @ 2 amps.; 5 v. @ 2 amps. (Chicago Transformer #PCC-40)
CH_1—15 hy., 50 ma. filter choke
S_1—S.p.d.t. sw.
S_2—S.p.s.t. sw.
J_1—Open circuit jack
V_1—6SN7 tube
V_2—6K6 tube
V_3—5Y3 tube

Schematic diagram of the modulator test unit used by the author in checking audio equipment. High quality transformers should be used to permit observations at the extremes of the audio spectrum. Provision is made for internal 60-cycle modulation or the external modulation of variable frequency. The "Int. Mod." lead goes to the ungrounded side of the 6.3 volt heater.



Oscilloscope patterns of results obtained with modulated wave techniques. (A) Envelope deformation caused by lightly loaded power amplifier using push-pull 6L6's at near maximum output. (B) Same amplifier overdriven during peaks. (C) Demodulation of a 3000 cps carrier produced by acoustics of a fairly "live" room with microphone placed 4 feet from speaker. (D) Transient distortions introduced by 6" loudspeaker at a carrier frequency of 3500 cps and modulation frequency of 60 cycles. (E) Open circuit waveform of output of modulator at 600 cps carrier frequency and 60 cps modulation frequency. (F) "Hangover" produced by applying signal of (E) to simple LC circuit resonant at the carrier frequency. (G) Pattern produced by introducing slightly out-of-phase signal of same frequency as modulation envelope. Note apparent assymmetry. (H) Same pattern as (G) with strength of low frequency component increased somewhat.



Alignment Notes On TV RECEIVERS

By
JOHN B. LEDBETTER
Engineer, Station WKRC-TV

Servicing TV sets is not difficult but a definite procedure, as outlined in text, should be followed.

Fig. 1. Alignment procedure, as outlined in text, can be divided among several service technicians. Service shops can thus operate on a "production line" basis, thereby reducing the over-all cost of doing business.

SPECIAL alignment problems posed by particular makes and models of television receivers can be minimized if the *general order* of alignment is remembered. This order, as recommended and discussed in the following paragraphs, will vary with special circuits, but will remain fundamentally the same when used as a basic or "skeleton" outline.

Test Equipment

For aligning and servicing any TV receiver the following *minimum* equipment is recommended:

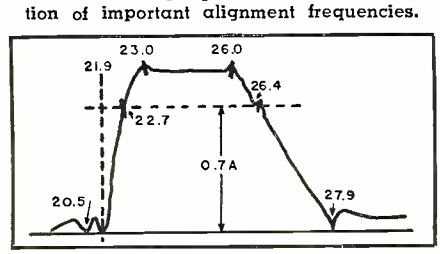
(1) *Oscilloscope.* Vertical amplifier should have flat frequency response, with good low-frequency response and sensitivity of at least .07 volt-per-inch deflection. The vertical amplifier should include a low-capacity probe and calibrated attenuator.

(2) *Sweep Generator.* Frequency range should cover 18 to 50 mc. (for i.f. alignment), and 50 to 90 mc. and 170 to 225 mc. (for r.f., converter, and oscillator alignment). Sweep width should be variable to 10 mc. Generator output should be at least 0.1 volt, with constant output over the sweep width. Output should also be uniform over each frequency range.

(3) *Marker Generator.* Should cover frequency ranges from 4 to 50 mc., and 50 to 225 mc., with crystal-calibrated or equally accurate frequency of 4.5 mc. for sound i.f. alignment. (An extremely accurate marker indication also is required for fixing the exact frequency of the video center frequency and for sound trap adjustments). The marker generator may be incorporated as part of the sweep generator, or it may be a separate unit, such as special marker generator, calibrated signal generator, or heterodyne frequency meter with crystal calibrator. Generator output should be at least 0.1 volt.

(4) *Vacuum Tube Voltmeter.* Should include a diode probe for high-frequency measurements and a high-voltage multiplier probe for kinescope and sweep-circuit high voltage measurements.

Fig. 2. Conventional television i.f. alignment curve. "Pip" type markers show position of important alignment frequencies.



(5) *Tube Tester.* Good mutual-conductance type. Supplement with substitution method of tube testing.

(6) *Bias Battery.* Three-volt "C" battery or two 1½-volt flashlight cells in series. (Usually required as substitute for regular a.g.c. bias when receivers incorporating rectified a.g.c. are being aligned.)

Marker Operation

The importance of an accurately calibrated marker generator can be seen by noting the typical i.f. alignment curve shown in Fig. 2. (This curve is recommended for the *Motorola* VK101). The marker is first set to the sound i.f. carrier (21.9 mc.) where the *i.f. sound trap* is adjusted; then to 20.5 mc. for the *low-frequency rejector trap* adjustment. (This trap takes care of any sound "leakage" that was not eliminated by the i.f. sound trap). The marker is moved next to 27.9 mc. for the *adjacent channel trap* adjustment. The 22.7 mc., 23.0 mc., 26.0 mc. and 26.4 mc. frequencies are checkpoints specified by the manufacturer of this particular receiver. (26.4 mc. is the video i.f. carrier; note that it is exactly 4.5 mc. higher than the sound i.f. It is also located at a point 0.7 down the high-frequency side or *skirt* of the curve. This is done in order to pass all high, low, and middle video frequencies equally. (Other receivers may specify the video frequency amplitude be adjusted to 0.5 or 50% instead of 0.7, depending on the design and response characteristics of the receiver).

"Pip" markers are used in Fig. 2. The same curve, marked with an inexpensive "dip" or absorption-type marker, is seen in Fig. 3.

Usually, manufacturers include de-

tailed alignment notes with their receivers or supply such information on request. These instructions should be followed, step-by-step, when at all possible, otherwise alignment should not be attempted unless the circuit deficiency of misalignment is fully recognized. Although a good scope and TV signal generator will make adjustments much easier, it is important that you know the exact or recommended order of adjustments.

Generally, television receivers should be aligned in this order: (1) video i.f. sound traps, (2) video adjacent channel traps (when employed), (3) video i.f. amplifiers, (4) sound i.f. stages and discriminator, (5) r.f. amplifier, (6) converter, and (7) oscillator. (Note that all trap adjustments are made *before* the i.f. stages or other circuits are aligned. Any *other* order of alignment may upset previous adjustments, particularly in the case of video i.f. stages and i.f. sound traps.

Video I.F. Sound Traps

In video receivers, both the picture and sound channels beat against a common oscillator. For this reason, the sound channel, which is only 4.5 mc. away from the picture channel, can be picked up by the video i.f. stages and passed on to the picture tube. Audio from the sound channel will then modulate the video carrier and cause the picture to lose synchronization. Less severe modulation may not affect sync but will produce a beat pattern in the form of dark horizontal lines or streaks. Interference from this source is eliminated in some receivers by parallel-resonant traps located in one or more of the video i.f. stages and tuned to the sound i.f. frequency.

Sound Trap Alignment. Adjust the marker oscillator to the sound i.f. frequency of the receiver and feed a signal into any convenient point ahead of the sound traps. (Usually, connection through a .001 μfd. condenser to the mixer grid or to one of the video i.f. grids will do). For these adjustments, turn the generator sweep *off* and adjust the sound traps for *minimum* output. The output indicator may be a v.t.v.m. or scope connected across the video detector load resistor (see Fig. 5). Since the scope normally is connected across the video load resistor during all video adjustments, it can be used with no extra connections required. When the scope is used for trap adjustments, the horizontal amplifier should be turned *off* and the marker oscillator modulated with 400 cycles or other available audio frequency. A thin vertical line representing the sound trap output will then be seen on the scope. Traps should be adjusted for minimum height of this line.

In some instances, the local oscillator in the receiver may beat against the signal generator oscillator on one or more channels. If this occurs, the scope pattern will change as the channel selector or tuning control is varied. This interaction can be eliminated by removing or temporarily disabling the receiver oscillator tube. It should also be made a practice to turn the oscillator "fine tuning" and contrast controls to their mid-range or center positions before making adjustments which affect these stages.

Adjacent Channel Traps

There have been some cases of interference between the sound channel of one station and the video channel of another station operating on the adjacent higher channel. The sound of a station on Channel 4, for instance, could interfere with the video of a station on Channel 5. If adjacent channel traps are included in the receiver, set the receiver channel selector to Channel 5 and the generator marker oscillator to Channel 4 and adjust the adjacent channel trap of the latter for minimum output. This procedure should be carried out on each of the channels likely to be affected and, like the sound trap adjustments, made *before* i.f. alignment of the video stages.

Video I.F. Amplifiers

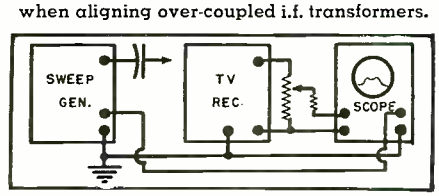
The 6 mc. bandwidth of video i.f. amplifiers is made possible by employing either *over-coupled* or *stagger-tuned* transformers, along with suitable compensating networks. The response or bandwidth of over-coupled transformers is dependent on the amount of coupling between the primary and secondary windings. When this coupling is increased past a certain critical point, a double hump or broadband response curve is produced (see Fig. 4B). Bandwidth can be increased further by adding damping resistors across the windings. This method is limited, however, by the fact that resistance does increase bandwidth but at the same time reduces the gain. This effect is seen in Fig. 4. Curve A is obtained with ordinary transformers, curve B with over-coupled transformers, and curve C with overcoupled transformers *resistive loaded.* Note the decrease in output in the latter case.

The wide-band response of *stagger-tuned* video i.f. stages is obtained by using ordinary single-tuned i.f. transformers and peaking each stage at a slightly different frequency. This provides the required broadband response curve without the usual loss in output.

Alignment of Over-Coupled I.F. Transformers

The set-up in Fig. 6 is recommended for alignment. The vertical plates of the scope are connected through a 10,000 ohm isolating resistor to the video detector load resistor, and the horizontal plates of the scope are connected

Fig. 6. Recommended test setup for use when aligning over-coupled i.f. transformers.



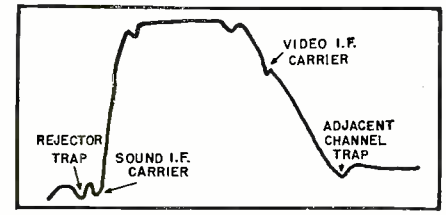


Fig. 3. This curve is similar to that of Fig. 2 with the exception that a dip or absorption type marker generator is used.

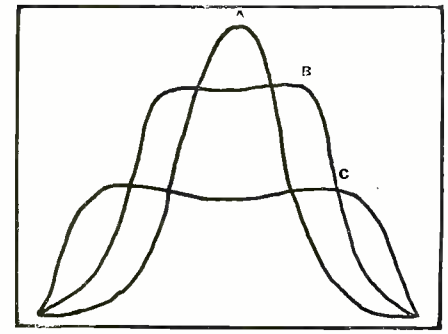


Fig. 4. Either over-coupling or staggered tuning in the i.f. stages is used to obtain proper bandwidth. Gain is sacrificed in both cases to get broadband operation.

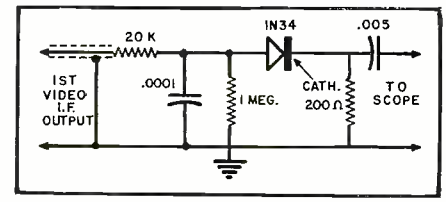


Fig. 5. Wiring diagram of scope detector network used to align first i.f. stage.

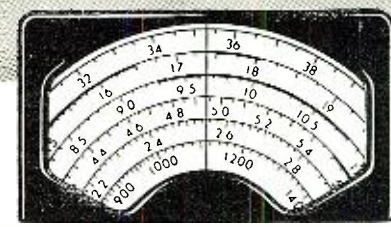
to the horizontal sweep terminals of the sweep generator (or to a separate sweep-frequency oscillator if your regular generator has no sweep. In setting up this equipment, *be sure* the receiver, generator, and scope have a *good common ground.* A poor ground system may result in erroneous readings and overly-critical adjustments.

After suitable warm-up time, set the signal generator to the *center video i.f.* frequency of the receiver and adjust the sweep of the generator to about 10 mc. To avoid overloading the video stages, use the *minimum* output from the generator which will give a clear pattern on the scope. Scope gain can then be increased further if a better indication is desired. For each adjustment, set the marker oscillator at the frequency specified by the manufacturer, using the minimum generator output (or injection voltage) which will give a satisfactory trace. Since the marker frequency settings will vary with different receivers, the manufacturer's alignment notes must be followed closely.

After the signal generator has been adjusted to the correct center i.f. frequency, connect its output through a .001 μfd. condenser to the grid of the last i.f. stage. The secondary of the last i.f. stage is aligned first. After the secondary has been aligned for max-

(*Continued on page* 98)

International SHORT-WAVE



Compiled by **KENNETH R. BOORD**

IT IS a pleasure to dedicate *ISW DEPARTMENT* this month to Gronlands Radio, Godthaab, Greenland, which is now sending out widely the following mimeographed letter, signed by Jacob Selvested Grove, in answer to reports dating as early as 1949—or earlier:

"Gronlands Radio wishes to thank you very much for your letter. We regret that circumstances have prevented us from answering you sooner, but we can promise you a prompt answer when you send us your next reception report. This valuable information from our world audience is very helpful to our operations and therefore gratefully received.

"Our broadcasting studio and transmitters are located in Godthaab, the capital of Greenland. We are on the air every weekday from 1830 hours to 2045 hours local time (2130-2345 *GMT*; 1630-1845 *EST*), and on occasional Sundays, when religious services are transmitted. Our daily programs consist of news in Danish and Greenlandic, talks on various subjects, stories, and music. Since our Greenland audience has shown a preference for light music, we limit our classical selections and play mostly dance and folk tunes.

"Although there are approximately 22,000 inhabitants in the whole of Greenland, the great majority live along the western coast. About 1050 radio sets are in operation in West Greenland, most of them being battery-powered since central electric plants are found only in the larger villages. Gronlands Radio broadcasts from Godthaab with a power of 1000 watts and relay stations at Godhavn and Frederikshaab re-broadcast the signal to North and Southwest Greenland. *It is planned to increase the size of our transmitter in the near future to permit a better coverage of Greenland.* Our frequencies at present are—2130-2345 *GMT* (1630-1845 *EST*), 633 kc.; 2130-2250 *GMT* (1630-1750 *EST*), 5.9425; 2255-2345 *GMT* (1755-1845 *EST*), 6.676 (*measured* 6.677 by Oskay, N. J., recently at 1810 *EST*).

"Your interest in Gronlands Radio is greatly appreciated and we will be happy to hear from you again. Please tell us how well you are receiving our broadcasts, how you like our programs, and any other information which might enable us to improve Gronlands Radio."

* * *

ISW for the Shut-in

International short-wave radio long has been a great boon, hobby, and pastime for the shut-in. Here is the story of just one instance:

From a ranch in California, outside the town of Patterson (population about 2000) and where the nearest neighbor is more than a half-mile away, *ISW DEPARTMENT* Monitor Sylvia C. Grischott, bed-ridden rheumatic fever victim, keeps in constant touch with the four corners of the earth by means of short-wave radio.

A resident of Yonkers, N. Y., until 1947, when she moved to the West Coast in the hope of regaining her health, Miss Grischott first became interested in listening to distant radio stations while a patient in the University of California Medical Center. Previously, she had enrolled in Modesto Junior College as a pre-medical student.

Now at home, her room has been converted into a completely-equipped listening post, featuring two communications receivers (one is a *Hallicrafters* S-16), a frequency standard, and a 40-ft. inverted "L" antenna. With this equipment, Sylvia has logged and verified reception of more than 1000 stations in all sections of the world. She considers the logging of 25 Japanese and Chinese transmitters in less than one hour of dialing to be her greatest radio achievement to date. Evidently, her location must be a DX-er's paradise since she writes that stations from all over the earth are received with a high degree of consistency. For example, during the first two months of 1951, Sylvia logged 140 stations in 41 countries (exclusive of USA).

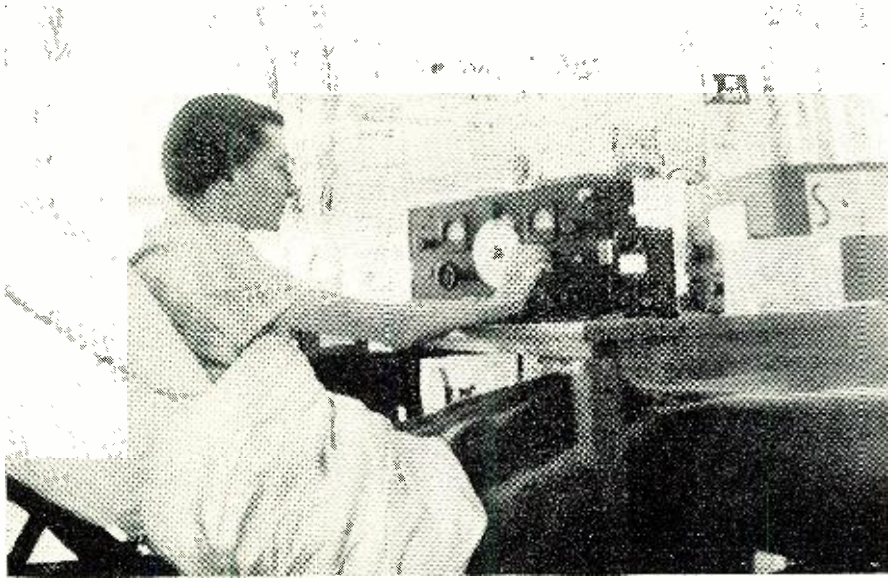
Sylvia's radio listening is done at all hours of the day and night and frequently while she is wearing an oxygen mask to help her breathing. She answers correspondents and stations with an attractive SWL card which she designed herself.

Currently studying for her amateur radio ticket, Sylvia looks forward to the day when with her own transmitter she will be able to talk to her many radio friends over the airwaves. Her radio activities are augmented by a correspondence course in short-story writing, which she is taking at the University of California.

One morning, Sylvia was unable to sleep and tuned in a radio program at

(*Continued on page* 130)

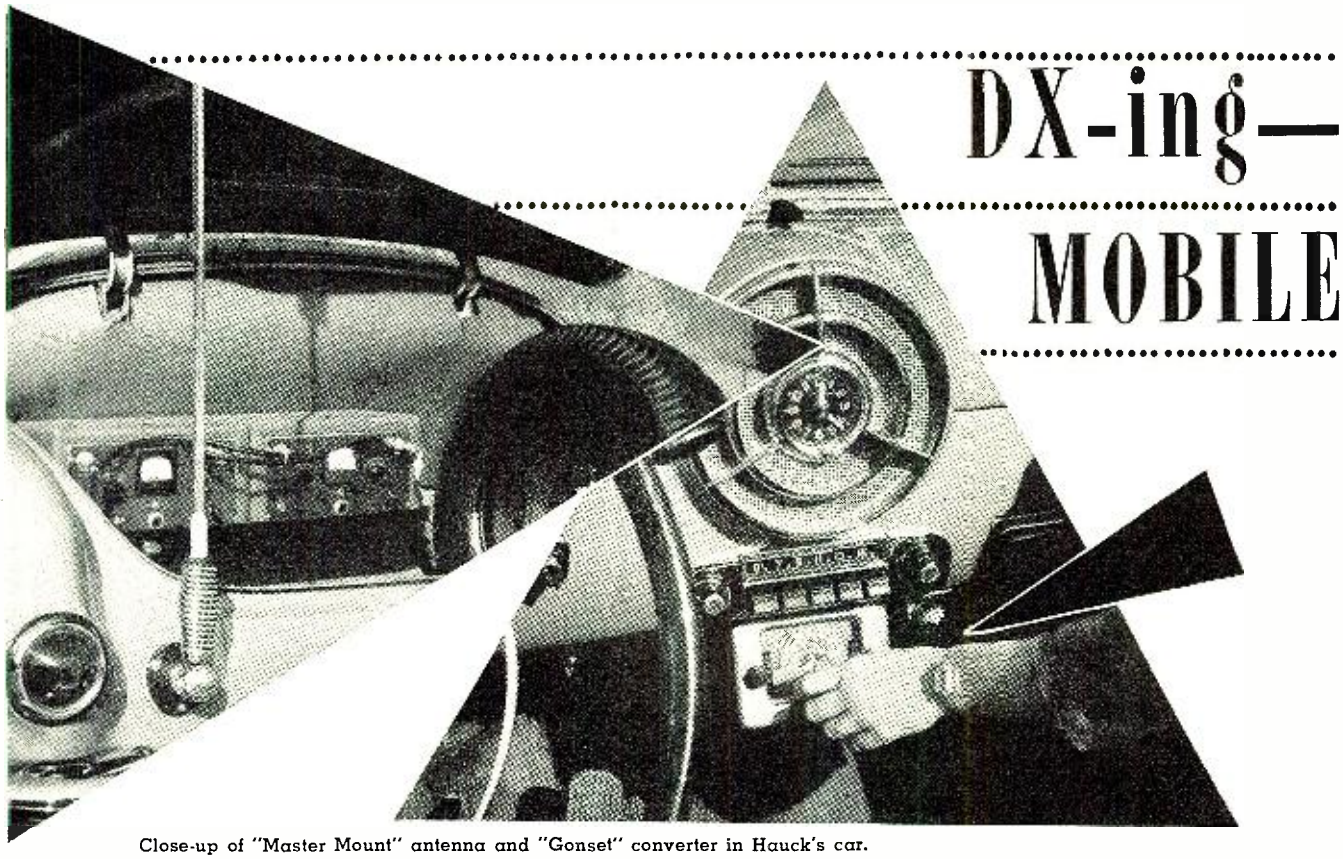
The room of bed-ridden rheumatic fever victim Sylvia C. Grischott, Patterson, Calif. has been converted into a completely-equipped Listening Post where Sylvia keeps in constant contact with all corners of the world through the modern "miracle" of short-wave radio. During January and February alone she logged 140 stations, 41 countries.



(Note: Unless otherwise indicated, all time is expressed in American EST: add 5 hours for GCT. "News" refers to newscasts in the English language. In order to avoid confusion, the 24 hour clock has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.)

The symbol "V" following a listed frequency indicates "varying." The station may operate either above or below the frequency given. "A" means frequency is approximate

DX-ing—MOBILE



Close-up of "Master Mount" antenna and "Gonset" converter in Hauck's car.

Details on Dale and Elouise Hauck's mobile ham "shack," shown in color on this month's cover.

THE two carefree-looking people on this month's cover are Dr. and Mrs. Dale Hauck of Los Angeles, California.

Dale Hauck is W6YFT ("*Y*ellowstone *F*irestone *T*ombstone") while his wife, Elouise, holds the call W6YFF ("*Y*oung *F*rustrated *F*emale").

The Haucks are particularly proud of their mobile installation—as well they might be—for not only does it look well but it turns in a fine performance. That it is a good looking rig is readily attested by the photographs of the equipment while its performance record, represented by a goodly array of QSL cards, speaks for itself.

This same equipment, installed in the convertible's predecessor, was the mobile unit involved in a thrilling snow rescue some of our readers may recall. It was in November 1946 when two hundred hapless motorists found themselves snowbound on Highway 66, some fifty miles west of Albuquerque, New Mexico. The Haucks (then W8VAX) were among those trapped by the storm. After a seemingly endless night, dawn came and with it came activity on the 10 meter band. A contact with W8UIL in Canton, Ohio was the *modus operandi* which set the rescue wheels in motion. W8UIL contacted an Albuquerque ham and the local authorities were soon appraised of the motorists' plight. The rescue was then carried out without a hitch.

The current "shack" is a 1950 *Pontiac* convertible. The twin transmitters are *Hoyt* mobile kits using instant heating tubes with HY69's in the final. One transmitter is on 10 meters while the other operates on either 20 or 75 meters with bandswitching being accomplished from the front panel.

The power pack is a PE-103 mounted in the tail of the right rear fender. Frequency shifting is performed from the dash, using a multiple, individually-tuned crystal in each transmitter. The microphone is a F-1 carbon unit.

The antenna is a *Master Mount* which is used on all three bands, with the necessary coil change. The antenna is very stable and little sway is experienced even at high speeds, according to the Haucks. They report excellent results, especially on 75 and 20 meters. Since this particular antenna fits most "back up light" holes on present-day cars, this eliminates the necessity for drilling holes in the body—a feature that makes most car dealers happy when it comes trade-in time on the old model.

No extra batteries or high output generator are required in this installation. The standard *Pontiac* electrical system has been retained and because of the instant heating tubes in the transmitter the Haucks have had no battery problems—a fault that was frequently encountered with the heater type tubes.

The Haucks attribute their success as mobile operators to a good antenna system and the facility with which they can change frequency while underway. They also stress the elimination of filament battery drain during listening periods as a factor in smooth operation.

The receiver is a 3-30 *Gonset* converter installed ahead of the car receiver. The noise limiter is built into the receiver and utilizes circuits similar to those found in the *Gonset* clipper. Even though the car motor is "California hopped", *i.e.,* uses a very hot ignition system, the noise level is low enough to preclude complaints from even the most particular XYL.

The original *Hoyt* installation was made by Al Freeman of San Pedro, California while the present transmitter was installed by Charles Messman, W6EH, of Hollywood.

Dr. Hauck, who is a practicing eye surgeon in Los Angeles, has a rather limited amount of time to devote to his radio hobby. Mobile operation allows him to keep active on the ham bands without taking time from his flourishing practice. Their home station is equipped with a BC-610E transmitter, a "Super Pro" receiver, and a three-element beam, but the Haucks still find their greatest enjoyment in climbing into the *Pontiac* and heading for the "wide open spaces" where they can DX to their hearts' content with as sweet a portable rig as any ham could wish for.

With the advent of summer and with thousands of persons taking to the highways, mobile radio is in for another seasonal boom. DX-ing mobile can be fun—once you try it you will be a fan—just ask the Haucks! —30—

THE DEGENERATIVE TONE CONTROL

By
CHARLES P. BOEGLI
Cincinnati Research Co.

Both bass and treble boost and attenuation are obtained in this type of tone control. Using just a single tube automatically reduces amplifier stages to a minimum.

THE degenerative type of tone control has enjoyed rather widespread use in audio amplifiers. It has the particular advantage that only a single tube is required to accomplish both bass and treble boost and cut; this results in reduction of total amplifier stages to a minimum and simplifies the power-supply requirements when compared to other more complex controls.

On the other hand, as usually designed, the tone control makes use of an iron-core choke which is considered undesirable by many designers. Furthermore, when utilized in certain ways a parallel-resonant arrangement is introduced into the circuit and this, in the opinion of a large number of engineers, is to be avoided at almost any cost. One purpose of this article is to study the extent to which the degenerative tone control introduces undesirable characteristics.

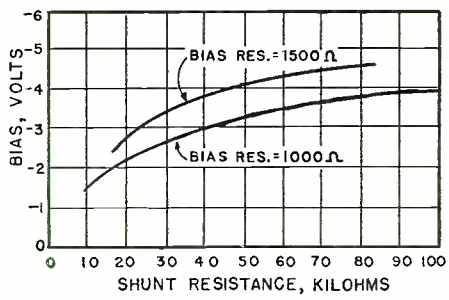
The usual objection to the use of an iron core choke coil for tone control is the possibility of hum pickup.

With modern, well-shielded chokes available for this purpose, this is not a valid objection, and the hum introduced by the choke is negligible.

The second purpose of this report is to elucidate a process by which such tone control stages may be designed. As has been previously intimated, this is not an involved procedure but at least one of the commonly-used circuits seems to utilize unnecessarily complicated controls. Furthermore, individuals have varying tastes in frequency-response curves and it is desirable for the designer to be able to vary the circuit to accommodate these differences.

The basis of the degenerative tone control is the simple plate-and-cathode loaded phase inverter, incorporated in the circuit of Fig. 4. As is generally known, if R_1 and R_2 are equal the signal voltages at points A and B will also be equal but of opposite sign. The output is taken from point A and, in principle, a bass cut is attained by shunting this output with a suitable choke while a bass boost results if the cathode resistor is shunted. By substituting a condenser for the choke, the treble is similarly controlled. The maximum amount of cut in either case is 6 db. per octave but the maximum boost depends upon the amplification factor of the tube. With a low-mu triode like the 6J5, which is customarily used, a boost of about 5 db. per octave is the most that can be realized.

Fig. 1. Variation of bias with shunt resistance for phase inverter of Fig. 4.



The first step in the design of the stage is thus simply the choice of component values for a suitable phase inverter. By way of example, a 6J5 will be assumed with a plate-supply voltage of 400, under which circumstances R_1 and R_2 may be 27,000 ohms each and the bias resistor may be 1000 ohms. The bypass is omitted from the cathode bias resistor with little effect.

The bass turnover frequency (the frequency at which bass boost or cut begins to become effective) and the treble turnover frequency may be independently specified. In the case of bass and treble cuts, the choke and condenser are shunted across the output resistance of the stage, which is substantially equal to R_1. Bass cut becomes effective when the reactance of the choke equals R_1; hence, if a 500 c.p.s. turnover is chosen with $R_1 =$ 27,000 ohms, an 8.5 henry choke will be required. In a similar manner if treble cut is to begin at 2000 c.p.s., an .003 μfd. condenser will be needed. Boosts become effective at approximately the same frequencies because the cathode resistor is the same size as the plate resistor. The condenser and choke together in the above case resonate at 1000 c.p.s., so that when maximum bass and treble cut are both employed, a 1000 c.p.s. parallel-resonant circuit is shunting the output.

In order to introduce each of these shunts independently to either the plate or cathode portion of the circuit, two controls must be used. There is more than one way to connect each control into the circuit, but the simplest method seems to be to attach one end directly to point A and the other to point B (Fig. 4). Since two controls are used, the tube then operates with a d.c. shunt equal to the parallel resistance of the two controls. This shunt naturally affects the bias voltage and some adjustment in the size of the bias resistor is necessary to permit the shunted tube to handle the same signal voltage as an unshunted one. It

would, of course, be possible to use a control of very high resistance, say, five megohms, in which case the effect on the d.c. voltages would be negligible. As the resistance of the control is increased, however, the region in which the control action takes effect becomes confined more and more to the ends of the rotation of the knob; with a five megohm control the entire boost or cut action occurs within a few degrees of the ends of this rotation, which effect is decidedly undesirable. It has for this reason been found preferable to choose a value equal to about five times the plate resistor of the inverter—in this case, around 100,000 or 150,000 ohms.

The d.c. voltages in a shunted-triode plate-and-cathode loaded phase inverter can easily be calculated, and the simplest method for finding the required bias resistor seems to be to assume a series of values of "B" supply currents, from which the voltage drop through the load resistors and hence the effective plate-cathode voltage across the tube can be found. With this voltage and a bias line drawn for a given bias resistor on the tube characteristics chart, the tube plate current and effective bias can be located. By subtracting this plate current from the assumed "B" supply current, the current flowing through the shunt is immediately found, and the tube plate-cathode voltage divided by this current equals the size of the shunt required to bring about the assumed operating conditions. Fig. 4 illustrates the method of calculation just described.

This procedure must be repeated for several assumed values of bias resistor, and the results plotted as shown in Fig. 1, which applies to the circuit used as an example in this article. From this chart, it is evident that with 150,000 ohm controls, which impose a 75,000 ohm shunt across the tube, a bias resistor of 1500 ohms results in a grid bias approximately the same as that for an unshunted tube with a 1000 ohm bias resistor.

Since the signal voltages occurring at each end of the controls are equal in magnitude but opposite in sign, the center point of each control is effectively at ground a.c. potential even though no grounded center tap is provided. If the center point of the knob rotation is to correspond to flat response, equal resistance must be provided each side of this center, which usually indicates the use of linear-taper potentiometers. Fader types have been tried but found to be unsatisfactory for this circuit. To obtain the control action the slider of the bass control is grounded through the choke whose size was previously calculated, and the other slider is connected to ground by means of the condenser.

In a single-ended stage (Fig. 3) the d.c. must be prevented from flowing through the choke to ground. This requires a very large blocking condenser because the series resonance of the choke and blocking condenser must occur below the lowest frequency to be amplified. Electrolytic condensers are usually used in consideration of space requirements. A push-pull stage (Fig. 2) has the advantage of eliminating this blocking condenser and in addition, as usual, leads to reduced distortion in the amplifier output and permits some simplification in the power supply.

The last step in the design is to assign values to the tube grid resistor and the input coupling condenser. This is complicated by the fact that the input resistance at low frequencies decreases when bass boost is employed, and this decreasing input resistance acts in combination with the coupling condenser to reduce the bass response. For example, if a grid resistor of 100,000 ohms is used with a .01 μfd. coupling condenser the bass response will be down 3 db. at 16 c.p.s. with the bass control set for flat response, but at maximum boost the 3 db. point will be at 160 c.p.s. This undesirable effect can be eliminated only by making the bass response extend to the proper frequency at maximum boost; in other words, the combination of grid resistor and coupling condenser should be chosen for the desired bass response under the assumption that the stage input resistance is equal in magnitude to the grid resistor. Since at flat response the gain of the stage is slightly less than unity motorboating will not occur, but at an intermediate bass-boost setting low-frequency oscillation does sometimes take place. It can be avoided by careful decoupling and control of the bass response of the preceding and succeeding amplifier stages. No such difficulty with oscillation is experienced with the push-pull circuit.

The cathode of the tone-control tube is at a high d.c. potential above ground. This makes a separate heater supply essential in some cases, but this arrangement is at any rate always desirable because hum is considerably reduced.

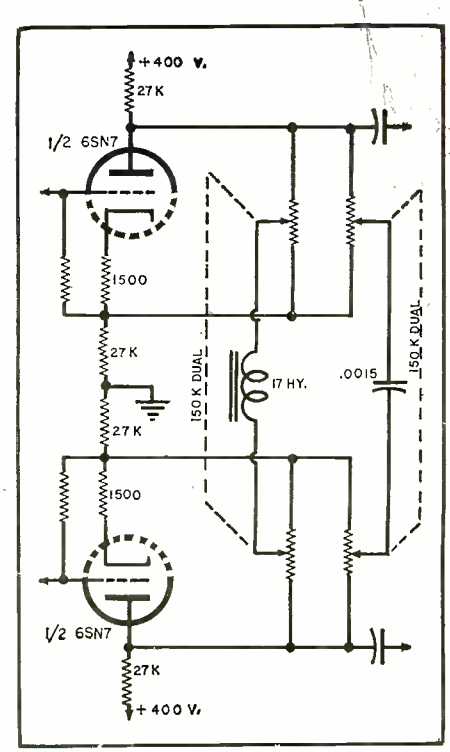


Fig. 2. Push-pull tone control circuit.

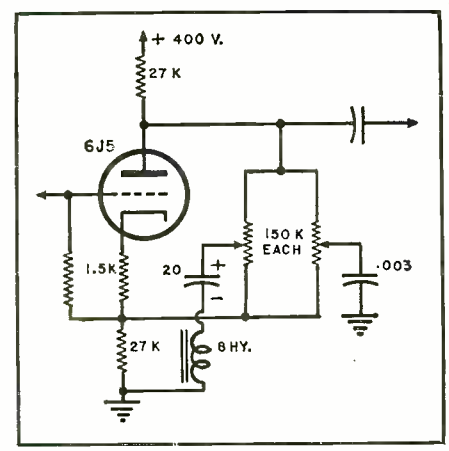


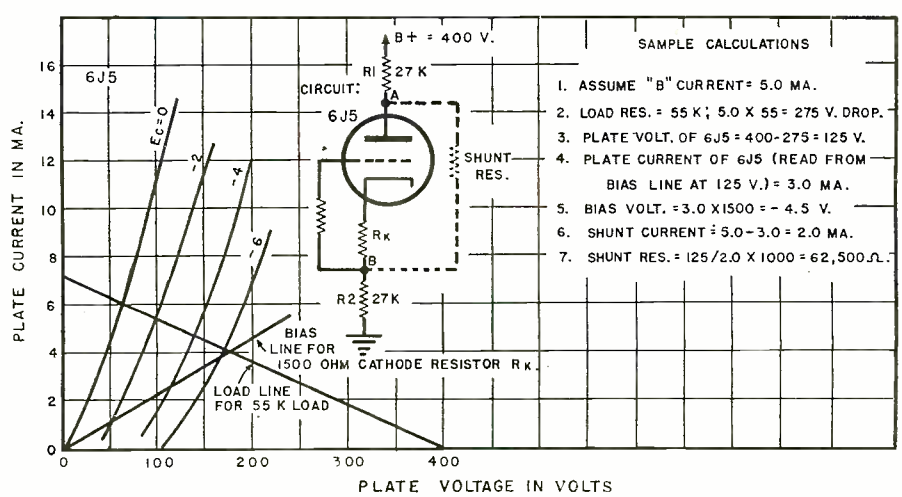
Fig. 3. Single-ended tone control unit.

Experimental Work

Because the push-pull arrangement is least likely to introduce distortion and since it also eliminates the problem of the large condenser required to prevent current flow through the

(*Continued on page* 96)

Fig. 4. Calculations that were used in the design of the shunted phase inverter.



An ELECTRONIC ADVERTISING DISPLAY

A novel eye-stopper. The different colored lamps light progressively as they pass through oscillator field.

By

WALTER FINKE, W9ABK

Instructor, DeForest's Training, Inc.

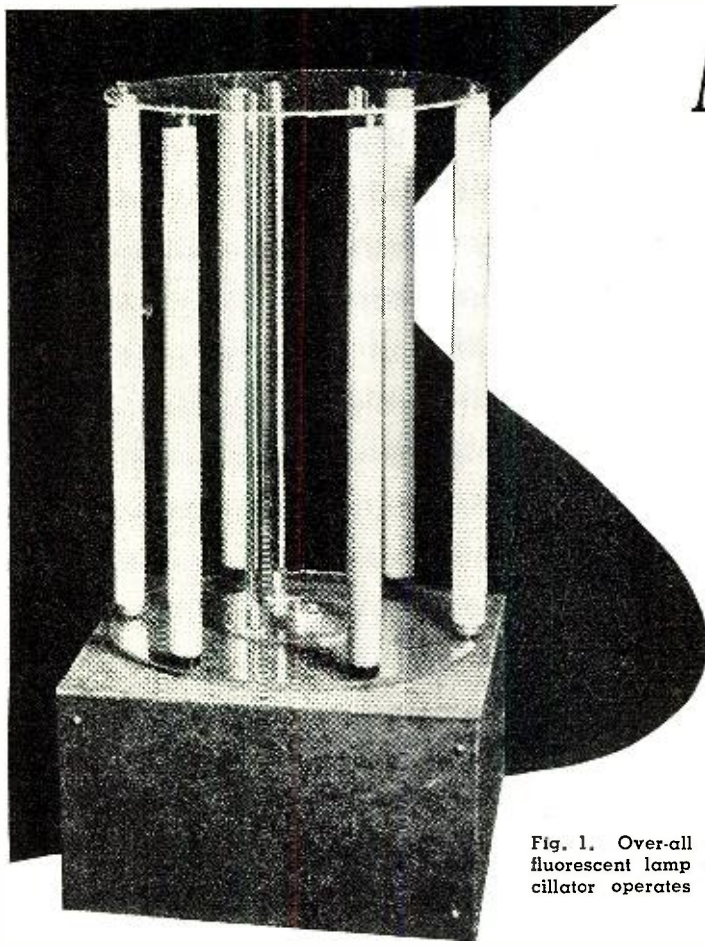


Fig. 1. Over-all view of electronic fluorescent lamp display. The oscillator operates in 27 mc. band.

THIS article describes the construction and use of a novel advertising display that combines movement and changing colors to attract the eye of prospective customers. To the more inquisitive it poses the question. What makes it work?

By studying Figs. 1 and 4, the general idea can be seen to be the illumination of a fluorescent lamp by passing it through the field of an oscillator. The lamps are standard 15 watt units, 18 inches long. For best results, each lamp should be of a different color. Six lamps are used in the model shown.

The entire structure for holding the lamps in position is made of clear plastic. The three center rods are ⅝ of an inch in diameter and the circular end pieces are one foot in diameter by ⅛ inch thick. This thickness permits enough flexibility for removing or replacing the lamps. The lamps are held in place by drilling 3/32 inch holes in the plastic end pieces to receive the pins in the ends of the lamps The ⅝ inch plastic rods are held to the end pieces by drilling and tapping a hole in each rod to receive a 6-32 screw.

While other materials could be used for supporting the lamps, it has been found that the clear plastic enhances the appearance of the display and leaves no doubt in the mind of the onlooker that there is no electrical connection to the lamps. Articles to be displayed may be placed on top of the structure or, if small enough, they be placed on the lower plastic disc between the lamps. If the articles to be displayed are very heavy, then it would be best to make the disc out of ¼ inch plastic.

The oscillator and motor for revolving the lamps are located in a cabinet which serves as a base for the unit. See Fig. 4. In the model shown, an aluminum cabinet was made first and then all sides except the bottom were covered with masonite. An opening must be left in the aluminum cabinet at the point where the lamp is to pass over the oscillator coil. The size of this opening will determine the length of time that each lamp is lighted. An opening 8 by 6 inches was found satisfactory. With proper placement of the oscillator coil below the opening and the correct plate voltage on the 6BG6, it is possible to have one lamp go out as the next lamp comes on.

The schematic of the oscillator and the power supply is shown in Fig. 2. Since the main requirement of the oscillator is to furnish an electrostatic field sufficiently strong to ionize the gas in the fluorescent lamps when the end of the lamp is at least an inch from the end of the coil, it becomes necessary to use a fairly high plate voltage on the oscillator tube. A minimum of 800 volts is recommended; lower plate voltage will either result in failure to ionize the lamp or failure to light the lamp over its full length. Several types of single-ended oscillator circuits were tried and the Hartley circuit shown gave the best results for a given "B+" supply voltage. As can be seen in Fig. 2, the method used to obtain the required "B+" voltage from readily available and inexpensive type power transformers is to use half-wave rectification of the entire voltage from the high voltage secondary. As noted, this voltage should have a minimum value of 750 volts in order to be sure of obtaining a "B+" voltage in excess of 800 volts. Many power transformers used in a.c. radios will meet these requirements as well as supplying filament voltages to the rectifier and oscillator tubes. Since the inverse voltage on the rectifier tube will be in excess of the rated value for most common rectifiers used in radio sets, it is necessary to use a rectifier with an inverse voltage rating of 2000 volts or more. The 816 meets these requirements and the use of a 1 μfd. input filter condenser raises the output voltage without any adverse effect being noticed in the operation of the gas rectifier. The plate current of the 6BG6 will not exceed 20 ma. if only one lamp is lighted at a time. The working voltage of all condensers should be 1000 volts or more.

The oscillator coil L_3 consists of a total of thirteen turns of #10 enameled copper wire, 1¾ inches in diameter and four inches in length. In the model shown in Fig. 4, this coil is made self supporting by placing it over a 1¾ by 5 inch remnant of clear plastic and letting the extra inch of plastic extend below the bottom of the coil; two small "L" type brackets were then attached to this end of the plastic and bolted to the top of the chassis to hold the coil in position. Referring to Fig. 2, the section of the coil from *d* to *c* consists of 1½ turns, from *c* to *b* is 5 turns, and from *b* to *a* is 6½ turns. This last part of the coil (*b* to *a*) provides an auto-transformer action which will give a

stronger electrostatic field next to the end of the fluorescent lamps. The end of the coil labeled "*a*" should be placed as close as possible, without touching, to the underside of the cabinet. A short piece of #10 wire may be attached to point "*a*" and extended in the line of travel of the lamps to maintain them at full brilliance for a longer time if desired.

After completing the wiring of the unit, it should be tested to see if it is operating properly. This can be done by measuring the bias across the 50,000 ohm grid leak resistor. An r.f. choke should be attached in series with the negative probe of the meter to prevent r.f. from entering the meter. The bias should be between 80 and 120 volts. No bias voltage indicates that the circuit is not oscillating; and the power should be turned off and the circuit rechecked if this occurs. If the proper bias is obtained, a fluorescent lamp should light when it is held within an inch of the hot end of the coil.

It is probably desirable to make the preliminary tests at reduced plate voltage to reduce the possibility of damage to the tubes in view of the present shortage. By moving the plate lead of the rectifier to the center tap of the transformer, instead of using the full secondary winding, the plate voltage may be cut in half. This will still allow the oscillator to be checked for proper operation without endangering the tubes. When satisfactory operation has been obtained, the plate lead of the rectifier can be returned to its previous position to use the full secondary.

Aside from a defective component, there is little that can prevent the oscillator from operating properly. If proper operation is not obtained as indicated by grid current, the various components in the oscillator circuit should be checked.

Before any sustained operation of the oscillator is attempted, it must be set on a frequency to comply with Federal Communications Commission regulations. At present, there are three bands of frequencies set aside for operation of diathermy machines and industrial oscillators. The limits of these bands as set forth in FCC Rules and Regulations, Part 18, are: 13,553.22 kc. to 13,566.78 kc.; 26,960.00 kc. to 27,280.00 kc.; 40,660.00 kc. to 40,700.00 kc.

A license is not required to operate in these bands. The values of L_3 and C_3 are chosen to provide operation in the 27 megacycle band. Since the band is 320 kc. wide, any well calibrated communications receiver, grid dip oscillator, or wavemeter can be used to set the frequency of the oscillator to the middle of the band.

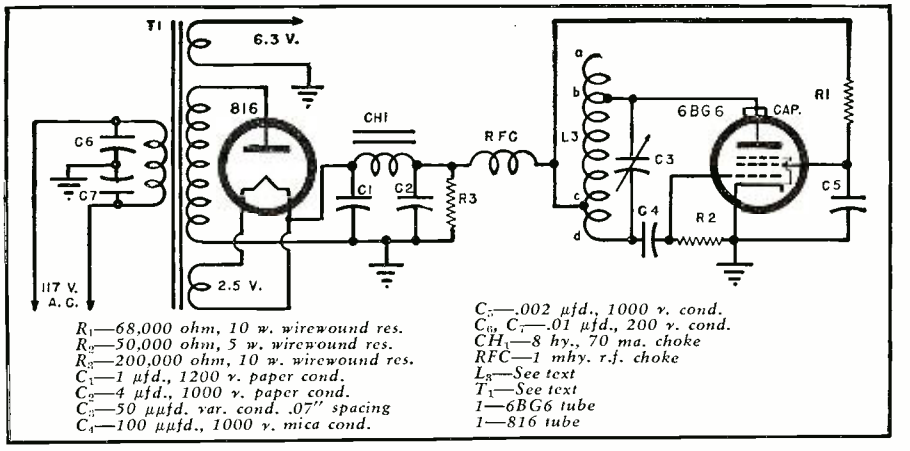
The frequency should be rechecked with the fluorescent tubes in place and rotating. The frequency will vary somewhat but should stay within the limits of the band. A slight adjustment of C_3 will probably be needed.

By no means the least complicated part of the unit is the motor and reduction drive for rotating the lamps. The parts required can usually be obtained from local radio and hardware stores. In the model shown in Fig. 4, a driving motor from an old code machine with an additional 5 to 1 reduction gear was used. This gave a final speed of rotation of the lamps of 10 rpm which results in a new lamp being lighted every second. Much faster speeds can be used if no advertised items are to be placed on the rotating assembly and the primary objective is to draw attention to the store window. Other usable motors that are readily available are those from phonograph turntables, electric fans, erector sets, and numerous gear reduction motors on the surplus market.

The shaft that supports the lamp assembly is made from a piece of 5/16 inch drill rod supported in two small bearings. The method of attaching the lamp assembly to the top end of this shaft is shown in Figs. 1 and 3. The metal disc and collar assemblies were made from salvaged receiver dials.

Many novel innovations in operating this display may be used. As an example, a photoelectric system or capacity operated relay may be used to start or stop the motor that rotates the lamps when someone passes by the display window. By keeping the ambient light level low and replacing one of the lamps with an ultraviolet lamp in conjunction with fluorescent paints and decals, some novel effects may be obtained.

—30—



R_1—68,000 ohm, 10 w. wirewound res.
R_2—50,000 ohm, 5 w. wirewound res.
R_3—200,000 ohm, 10 w. wirewound res.
C_1—1 μfd., 1200 v. paper cond.
C_2—4 μfd., 1000 v. paper cond.
C_3—50 μμfd. var. cond. .07" spacing
C_4—100 μμfd., 1000 v. mica cond.
C_5—.002 μfd., 1000 v. cond.
C_6, C_7—.01 μfd., 200 v. cond.
CH_1—8 hy., 70 ma. choke
RFC—1 mhy. r.f. choke
L_3—See text
T_1—See text
1—6BG6 tube
1—816 tube

Fig. 2. Schematic diagram of the oscillator and power supply assembly.

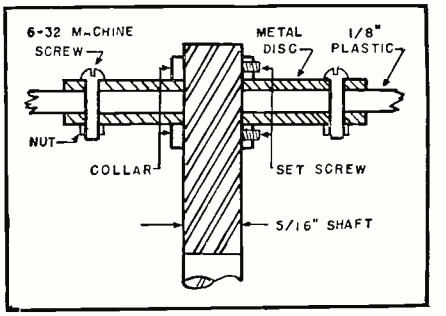
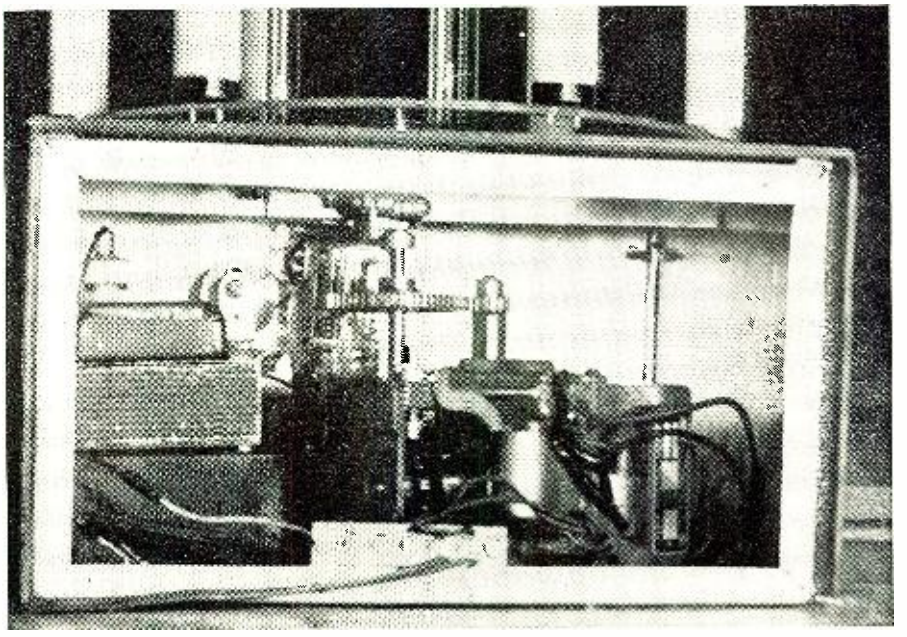


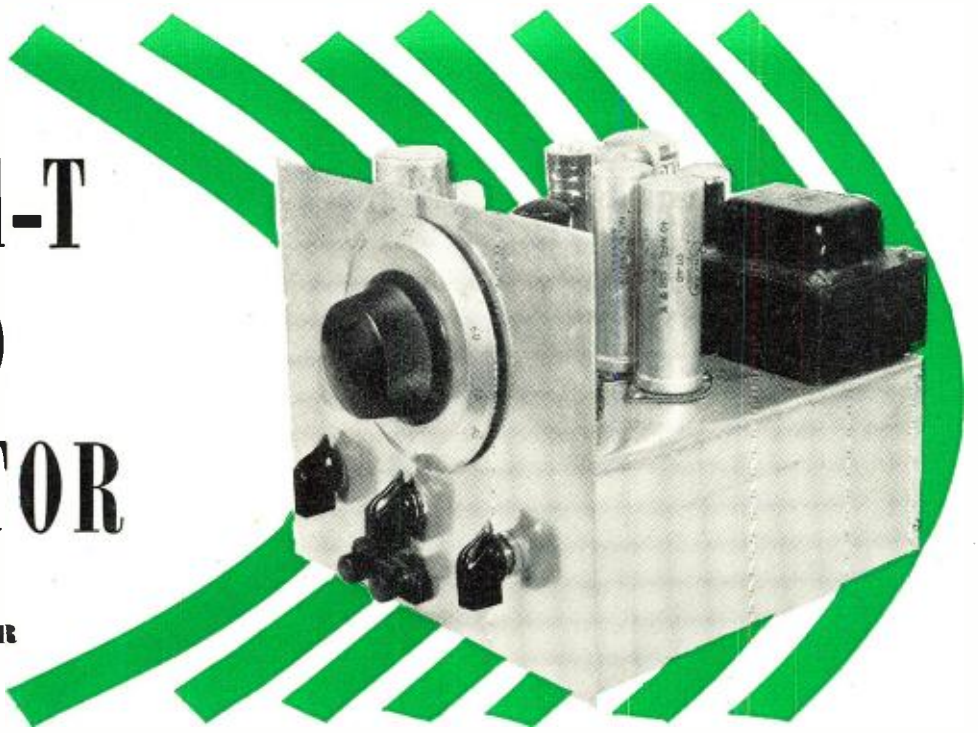
Fig. 3. Method for connecting the drive shaft to the lamp assembly.

Fig. 4. Rear view showing the motor on the right, gear reduction and shaft for supporting the lamps in the center, and the oscillator chassis on the left. The oscillator coil, L_3, is directly behind the 6BG6 tube in the center of the photograph.



A Bridged-T AUDIO OSCILLATOR

By
JACK D. GALLAGHER
W5HZB



Although not of laboratory caliber, this easily-built unit is an excellent all-purpose test instrument.

Fig. 1. Over-all view of audio oscillator. The controls are (left to right, bottom row) potentiometer R_3, selector switch S_1, and attenuator R_{18}. The frequency adjusting control (R_7-R_{10}) is at top center. Binding posts at bottom are the output terminals.

THE wide-range *RC* oscillator developed by Peter G. Sulzer of the National Bureau of Standards and described in the September, 1950 issue of RADIO & TELEVISION NEWS, is a unique test instrument. However, if the instrument is to be used for general audio frequency tests, such as determining resonant peaks in speaker systems, frequency characteristics of amplifiers over the audio range, and other audible frequency tests in service work where great accuracy is not required, a slight modification of Mr. Sulzer's circuit results in an excellent general purpose audio oscillator.

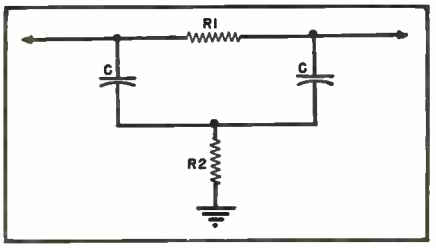
Some of the desirable features which should be incorporated into an audio oscillator are: a low grid input impedance to minimize power hum pick-up and other grid circuit disturbances, elimination of the variable condenser to reduce mounting and shielding problems, the power supply should be mounted on the same chassis for compactness, there should be a wide angle dial rotation for easy calibration, the unit should be constructed at a reasonable cost, and the oscillator should have a high degree of frequency stability and resetability.

A major portion of the features previously mentioned can be incorporated into an audio oscillator by using the bridged-T network shown in Fig. 2. In this particular network a true null is not produced, however if the ratio of R_1/R_2 increases beyond four a fairly sharp attenuation curve results.

The schematic diagram of the completed unit shown in the photographs is given in Fig. 3. The reader will note that a dual potentiometer is used in conjunction with condensers for frequency variation. This potentiometer is a *Centralab* "Blue Shaft" Type F-50M-C3, R-500M-C3, Code No. BA017-000. It is a reversed log taper dual control. Although the reset accuracy of a dual variable resistance is not as great as that of a variable condenser, the writer has noted that there has been no change in the dial calibration after several weeks of use.

After the unit was constructed, a calibrated oscillator was used to determine if the use of ordinary stock condensers caused an appreciable change in the multiplier switch (S_1). It was found that the two lower ranges were very close to a ratio of 10 to 1. The higher range did not calibrate too closely. Other condensers for this range were selected until the proper ratio was obtained. If greater accuracy is desired in the multiplier switch, matched condensers of the values shown in the diagram should be used.

Fig. 2. Wiring diagram of bridged-T network incorporated in audio oscillator. Actually a true null is not obtained, however if the ratio of R_1 to R_2 is at least four, a fairly sharp attenuation is obtained.



The only adjustment necessary after the unit has been allowed to warm up is the adjustment of R_3 in the cathode of V_1. This adjustment consists of setting the selector switch, S_1, to the lowest frequency range and the frequency dial to the low frequency end of the scale. With the aid of test receivers, adjust R_3 until oscillation begins. With an a.c. voltmeter or v.t.v.m.. slowly advance R_3 further in the direction of oscillation until the output is stable on the meter. Greater output may be obtained by advancing R_3, however the harmonic content will increase under this condition.

The power supply shown in the diagram is quite conventional, and any well filtered supply delivering 250 volts at 50 ma. will be adequate. The complete unit is mounted on a home-constructed chassis measuring 8" x 7" x 3½". The distance between the oscillator and the power supply is less than six inches; and with a v.t.v.m. there were no perceptible beats between the power supply and the oscillator frequencies, and none could be heard when using a sensitive test receiver.

Figs. 4 and 5 give a general idea on how the parts could be laid out on the chassis. No particular construction details were followed, with the exception of the location of the a.c. line switch. This switch was mounted on the rear of the chassis to keep the a.c. line cord away from the oscillator. Referring to Fig. 5, the top view of the completed oscillator, and starting at the top left hand corner, from left to right, are: 6AG7, dual control (R_7-R_{10}). C_9; second row: C_{11}, C_1, 6AG7, PL_1; third

row: VR-105, VR-105; and bottom row: T_1, 5Y3, and C_{12}-C_{13}-C_{11}.

The controls on the front panel, as shown in the front view, are: R_3 at the extreme left; S_1, center; and the output control, R_{15} at the right; the output terminals are below and to the left of S_1. The dial was made from an old bakelite knob. The numbered portion of the dial was sanded and given a coat of aluminum paint. A sharp pencil marked the calibration points, while pen and ink completed the job. The position of the knobs as shown in the front view of the unit were not set that way for photographic purposes, but represent the positions of R_7, R_{10}, R_3, S_1, and R_{15} for a frequency of 1200 cycles.

If a clipping circuit is added following the output, the instrument may also be used for square wave testing.

Most square wave clipping circuits require a rather high voltage input to allow the tops of the sine waves to be clipped well down on the sides, and this will probably require an additional stage preceding the clipper.

Several articles on the use of clippers have appeared in previous issues of this magazine.

The fact that the dual potentiometer provided over 270 degrees of dial rotation made calibration points from 20 to 200 cycles occupy approximately 230 degrees of the dial. All of the features previously mentioned are incorporated in the unit shown in the diagram and its construction is well worth the time and effort involved.

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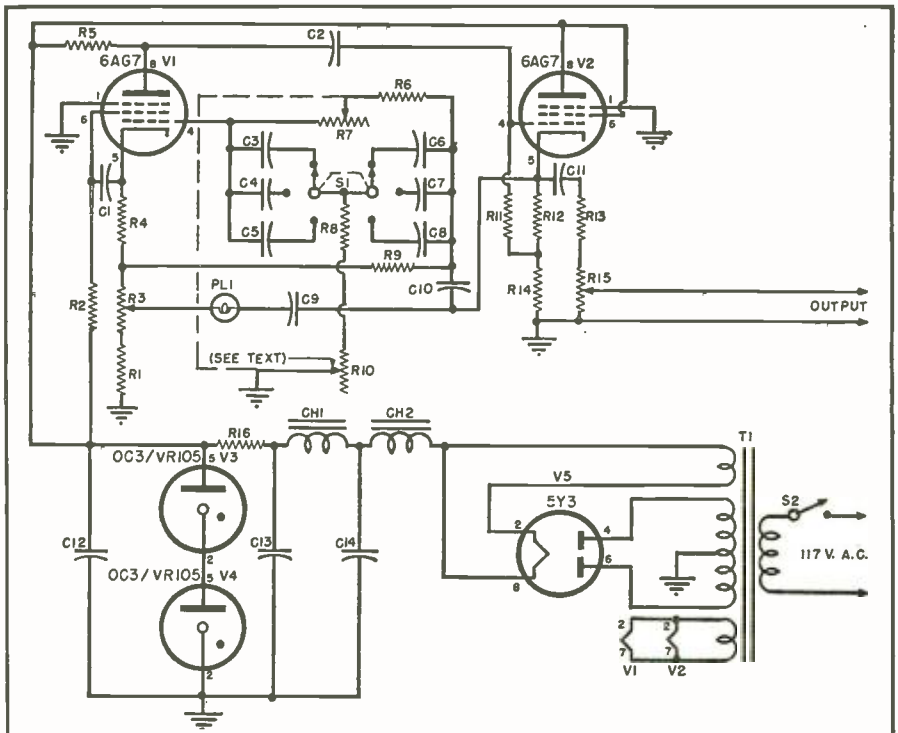


R_1—*1000 ohm, 1 w. res.*
R_2—*27,000 ohm, 2 w. res.*
R_3—*2000 ohm, 2 w. pot*
R_4, R_{12}—*68 ohm, 1 w. res.*
R_5, R_{11}—*5000 ohm, 10 w. wirewound res.*
R_6—*50,000 ohm, ½ w. res.*
R_7, R_{10}—*Reversed log taper dual control (Centralab "Blue Shaft" Type F-50M-C3 (R_7) and R-500M-C3 (R_{10}) Code No. BA017-000)*
R_8—*5000 ohm, 1 w. res.*
R_9, R_{11}—*1 megohm, ½ w. res.*
R_{13}—*150 ohm, 1 w. res.*
R_{15}—*10,000 ohm, 1 w. pot*
R_{16}—*1000 ohm, 10 w. wirewound res.*
C_1, C_{11}—*40 µfd., 450 v. elec. cond.*
C_2—*.25 µfd., 600 v. cond.*
C_3, C_6—*.05 µfd., 400 v. cond. (preferably matched)*
C_4, C_7—*.005 µfd., 400 v. cond. (preferably matched)*
C_5, C_8—*500 µµfd. mica cond. (preferably matched)*
C_9—*120 µfd., 25 v. elec. cond.*
C_{10}—*.1 µfd., 600 v. cond.*
C_{12}-C_{13}-C_{14}—*20/20/20/20 µfd., 450 v. elec. cond. (Mallory Type FP-444. C_{12} is 40 µfd., two sections in parallel)*
S_1—*2-gang, 3-pos. rotary sw.*
S_2—*S.p.s.t. toggle sw.*
PL_1—*3 w., 115 v. lamp*
T_1—*Power trans., 350-0-350 v. @ 90 ma.; 5 v. @ 3 amps.; 6.3 v. @ 3.5 amps. (Stancor P-6012)*
CH_1, CH_2—*50 ma. filter choke*
V_1, V_2—*6AG7 tube*
V_3, V_4—*VR-105 tube*
V_5—*5Y3 tube*

Fig. 3. Schematic diagram of the audio oscillator. The instrument covers a frequency range of from 20 to 20,000 cycles. The main tuning control, R_7-R_{10}, is calibrated from 20 to 200 cycles while switch S_1 is used to increase the range in steps of 10X.

Fig. 4. Under chassis view of the home-built audio oscillator unit. Careful parts placement gives neat, uncluttered look.

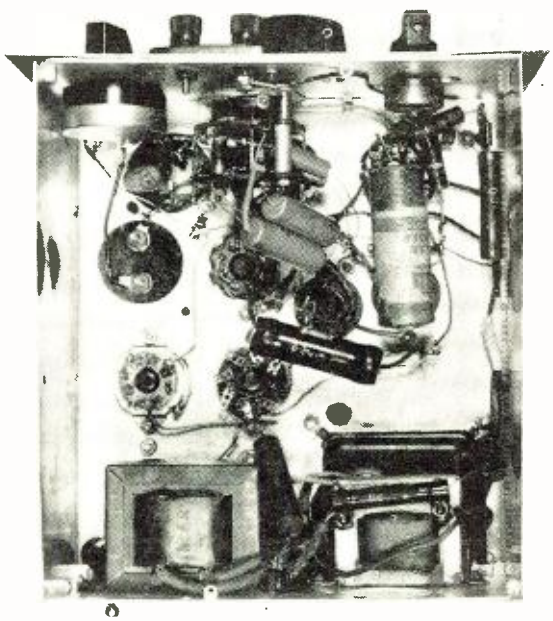
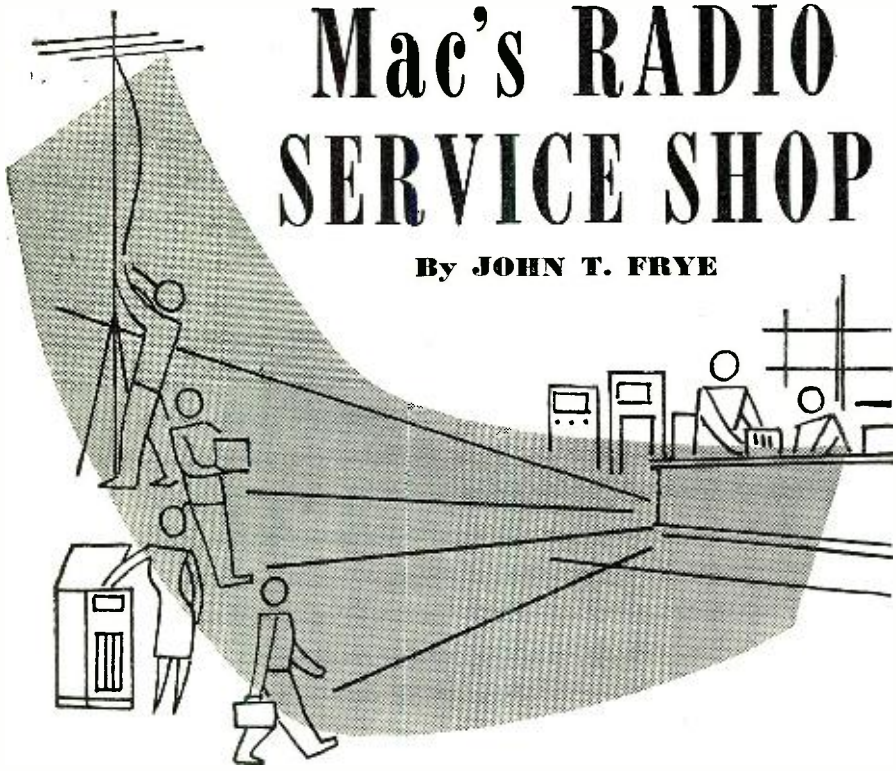


Fig. 5. Top chassis view of unit. The line "on-off" switch, S_2, is mounted on rear flange of chassis, lower right in photo.

Mac's RADIO SERVICE SHOP

By JOHN T. FRYE



SKEETER G'S AND TEST PATTERNS

AS Mac jokingly expressed it, it was "two l-o-o-n-g years" now that the unpredictable Barney had been working for him; so when the former came into the radio shop that fine June morning and found his red-headed assistant prodding a small cylinder of screen wire resting on the service bench and savagely muttering, "Come on, cuss you; fly! I double-dog-dare you to get off the bottom of that cage," Mac did not turn a hair. Instead he merely leaned against the door jamb and casually remarked:

"Excuse me for mentioning it, Buster, but aren't you slipping your clutch again? Talking to yourself makes you live bait for the boys with the butterfly nets, you know."

"I'm *not* talking to myself," Barney protested. "I'm talking to that blood-sucking mosquito in the wire cage."

"Well, then; that's different!" Mac said with exaggerated relief. "All of us like to have a little chat with a mosquito now and then. Will the two of you excuse me for interrupting?"

"You quit trying to make it sound like I was losing my marbles," Barney shouted. "Outside of being crazy enough to work on radios, I'm as hep as the next guy and maybe a little hepper.

"The whole thing started last night after I walked Margie home from the show," he went on. "It was the first really warm night we have had; the moon was as big and bright as a twenty-inch tube; and her old man had just put up the porch swing that afternoon. In short, things were perfect for a little front porch woo-pitching—or 'sparking' I believe they called it in your day."

"Thankee kindly fur the translation, young feller," Mac piped in the cracked, falsetto voice of age.

"Well, we had no more than snuggled down in the porch swing than a squadron of mosquitoes started dive-bombing us. You probably are too old to remember, but smooching takes a certain amount of concentration. You can't get very far whispering sweet nothings into one shell-like ear while a mosquito is making like a miniature fire siren in the other. After I had intercepted a couple of wild swats Margie was making at the pests—at least I think that is what she was doing—I gave up and went home and to bed; but I didn't go right to sleep. Instead, I lay awake and thought up a fiendishly clever way of clobbering mosquitoes.

"And there it is!" he said waving dramatically at the service bench. "A captured mosquito is in that little screen cage. Directly in front of the cage and pointed at it is a tweeter speaker that is being driven by the output of that hi-fi amplifier. Our audio frequency generator is going into the amplifier."

"I get it!" Mac interrupted. "You're going to drive the insects mad by outsinging them."

"Worse than that," Barney said darkly. "I intend to tune the oscillator to the natural vibration frequency of either the mosquito's body or his wings—it makes no difference which—and then I'll simply shake one loose from the other with the compression and rarefaction waves from the speaker. Because of the small masses involved, I figure the frequency will be too high to be heard. This arrangement will be set up on my porch with the speaker pointed toward Margie's. Boy! I can hardly wait until tonight to see those de-winged mosquito fuselages ploughing into the porch paint around that swing!"

"Hm-m-m-m," Mac said a little dazedly. "And how is your experiment panning out?"

"Aw, Old Buzzo there won't cooperate," Barney said disgustedly. "I've got to catch him on the wing to try out the gadget, but all he does is sit there with his toenails dug into the bottom of the cage."

"We-l-l-l, let's not fret our little pointed head about it now," Mac said soothingly. "After awhile I'll hunt up a graph that *Sylvania* put out a few years back for estimating forces due to vibrational motion, and then you can really 'engineer' this project by figuring just how many 'G's' a mosquito's wings will stand. Right now, though, I want to talk to you about something else."

He opened a cupboard and took out two small album-shaped books bound in imitation red leather and another black book with a spiral wire binder.

"Here," he said, holding out the red books, "are Volumes 1 and 2 of *RCA's* 'Pict-O-Guides.' I want you to take them home and study the diagrams, the text, and, above all, the pictures until they are literally sticking out of your big freckled ears."

"Why?"

"So you can learn TV servicing easier and better than I learned radio servicing. In the beginning my radio knowledge, like that of most of us who grew up with the business, consisted entirely of scraps of unrelated information picked up haphazardly from experience, from reading, and from what other technicians told me. I wasted ten years before realizing that some way had to be found to tie all of this knowledge together into a compact whole if I was to keep it and get the most out of it.

"That is when I hit on the idea of servicing radios as much as possible 'by ear.' Circuits were analyzed in terms of what they contributed to the receiver in the way of sensitivity, selectivity, noise-suppression, and fidelity. Component failures and misadjustments were studied for the effects they had on these qualities in the receiver's output. In other words, all of the information I had collected was rearranged and revised in terms of how it made a set *sound*."

"A system that really works!" Barney exclaimed. "It still seems uncanny to me how you can always tell what's wrong with a set by just listening to it."

"Not always," Mac disclaimed; "but by concentrating on this approach both of us keep our batting average pretty good. The funny thing is, though, that I forgot all about this when I started studying television and began to make the same mistake all over again. I studied r.f. tuners, sweep circuits, i.f. systems, flyback power supplies, and so on, as individual units; and I was having one heck of a time trying to keep

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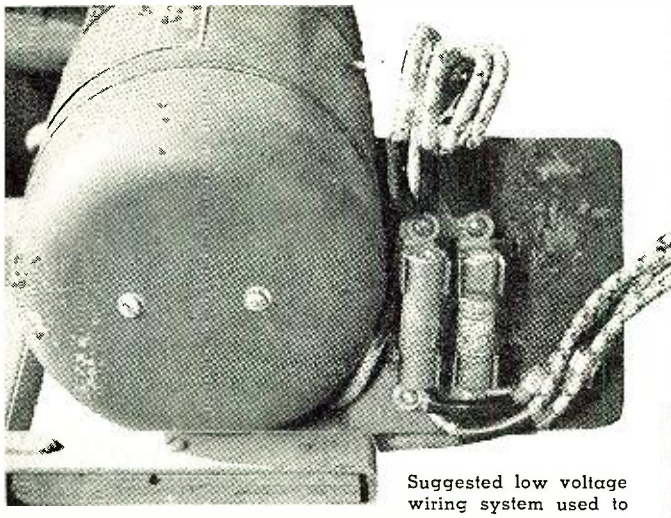
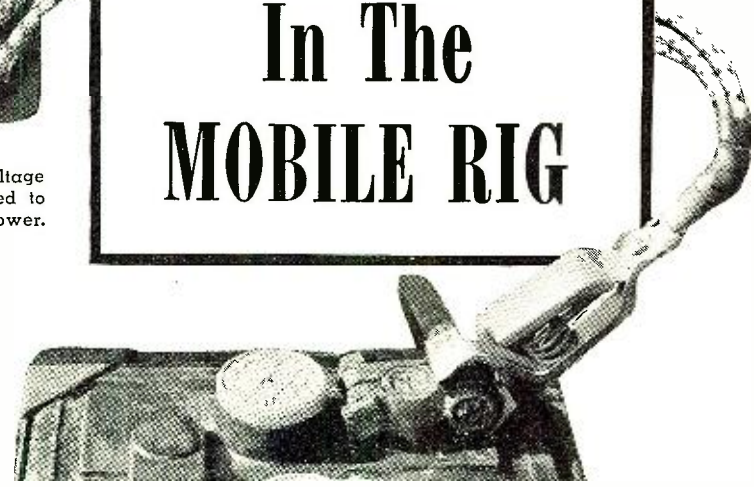
PLUGGING POWER LEAKS In The MOBILE RIG



Suggested low voltage wiring system used to obtain greater power.



By

WALTER B. FORD, W6YT

Increase power output of your transmitter by a few changes in the low voltage circuit.

UNLESS he is willing to go to the expense and trouble of installing an oversize generator or additional batteries in his car, the operator of a mobile transmitter usually has to limit his maximum power to 25 or 30 watts. Although he generally knows that power losses will occur between the car battery and transmitter, he is usually not aware of the magnitude of those losses, or what effect they could have on the operation of the transmitter as a whole.

The author operates a mobile transmitter which consumes about 24 watts in the final stage. A surplus thermocouple r.f. ammeter with a 0 to 1.5 ampere range is connected in the antenna circuit to serve as a tuning check. From time to time it was noted that there was a falling off in antenna current after the transmitter had been operating but a short time, but what was more perplexing was the fact that the decrease in antenna current was greater after the car had been driven some distance, even though the transmitter had not been in operation. The normal drop in output could have been due to a number of causes ranging from flat tubes to a defective storage battery, but the causes of the lowered output after a long drive did not lend themselves to a similar line of reasoning.

A thorough check of all tubes, condensers, resistors, and the storage battery failed to disclose a defective part. Beginning with a cold motor, a voltage check on the dynamotor and storage battery was made, which revealed a voltage drop of one volt between the two units when the dynamotor was fully loaded. The significance of the term, "cold motor" will be shown shortly. The low voltage circuit consisted of a heavy duty battery clip which was secured to the positive post of the battery, No. 8 stranded leads, fuse and fuse holder, relay, and a single-pole switch.

In order to break down and trace the individual voltage drops across the various parts, a low reading voltmeter was secured and with its use some very interesting things began to come to light. No noticeable drop appeared across the battery clip, but between the clip and the fuse holder a drop of 125 millivolts showed on the meter. The next check across the fuse holder indicated a drop of 100 millivolts. The main switch terminals showed a drop of 250 millivolts. The relay contacts provided the greatest surprise. Although they consisted of two ¼ inch contacts in parallel, the drop across them totaled 350 millivolts. The negative lead to the car frame accounted for a loss of 100 millivolts, and the leads connecting the relay, switch, and fuse holder provided an additional loss of 75 millivolts, bringing the total to 1000 millivolts, or one volt.

The power supply for the author's transmitter is a surplus PE-103 dynamotor, the input of which is 21 amperes at six volts. The full load output is .16 ampere at 500 volts. It was noted that the leads and other parts of the low voltage circuit began to heat up after the transmitter had been in operation a short time, even though their cross sectional areas were more than ample to carry the full load current of 21 amperes. An ammeter placed in the circuit indicated the somewhat startling figure of 160 amperes when the dynamotor was started. While such a large starting current was of extremely short duration, occurring several times a minute as it is apt to do in phone operation it was sufficient to raise the temperature of all parts of the low voltage circuit, thereby increasing the resistance and causing a still greater voltage drop to bring the total to about 1.25 volts, which, incidentally, accounted for the drop in antenna current after the transmitter had been in operation but a short time. While a drop of 1.25 volts between the battery and dynamotor might not seem to be too serious, it might be interesting to note at this point what it meant in terms of power losses in watts. The full load power consumption of the dynamotor was around 126 watts. With a voltage drop of 1.25 volts the power loss was approximately 26 watts, or expressing it another way, about 20 per-cent was being dissipated as heat and that figure does not include the possible further losses in the transmitter due to lowered filament voltages.

After the above losses had been accounted for, there still remained the problem of further decrease in radiation after the car motor had been run for some time. After an hour's drive the voltmeter check was repeated and it was found that the car motor had increased the temperature of the battery circuit to such an extent that the voltage drop had jumped to nearly 1½ volts. Of necessity the author's dynamotor is installed under the hood where it is subjected to the heat of the car motor. Located elsewhere it undoubtedly would have been free from additional heat losses.

After having located the sources of the various losses, the author set out to eliminate them, or rather reduce

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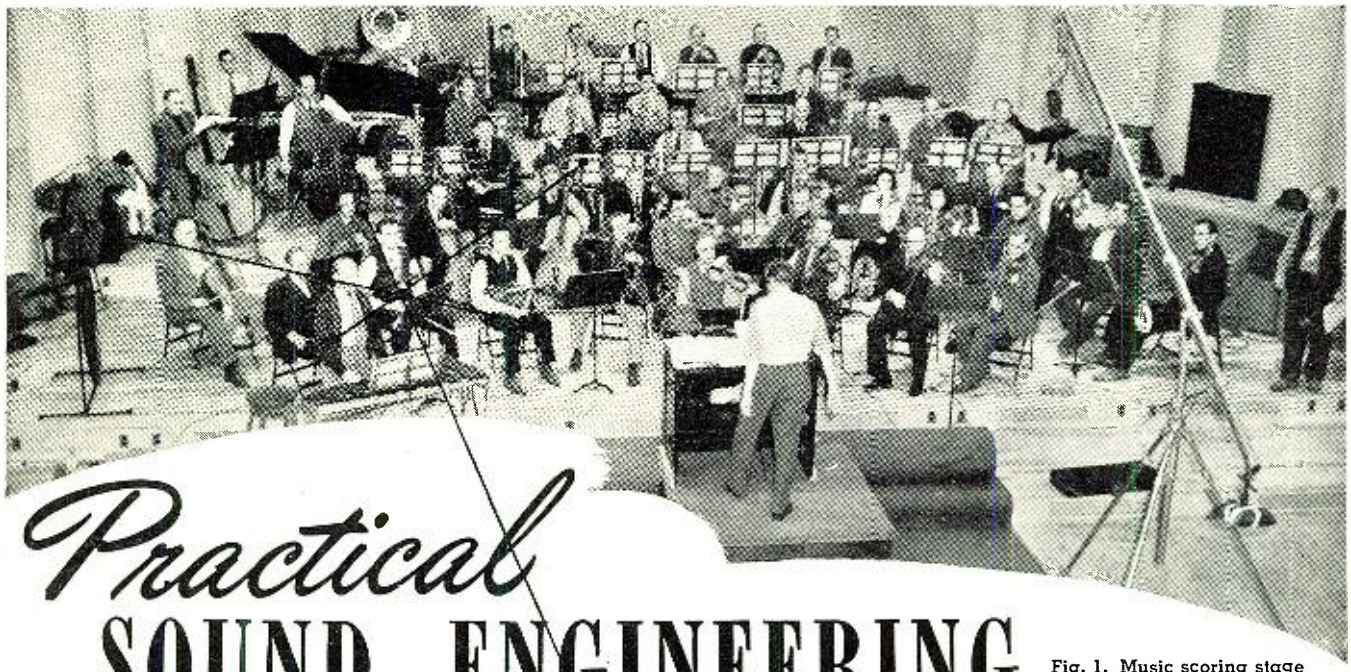


Practical SOUND ENGINEERING

Fig. 1. Music scoring stage on Walt Disney's motion picture lot. Note sound diffusers in the background.

By H. M. TREMAINE, D.Sc.
College of Audio Engineering
University of Hollywood

Part 4. Methods for determining reverberation time of sound studios, and how to compensate to obtain the most desirable acoustical characteristics.

REVERBERATION is the reflection and re-reflection of sound waves. The decay time of a given enclosure is the time required for a sound wave to decrease its intensity 60 db or to one-millionth of its original intensity. This decrease in intensity may be calculated by the use of the equation:

$$db = 10 \log_{10} \frac{P_1}{P_2} \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

where P_1 equals the original intensity and P_2 the diminished intensity.

Interference occurs when two or more sound waves collide, resulting in confusion and unintelligibility. Since reverberation constitutes perhaps the most important single factor in determining the acoustical properties of a room, it will be briefly reviewed.

Reverberation is sometimes defined as the persistence of sound, caused by repeated reflections. When the reverberation time of any room is too long, intelligibility of speech is reduced and a "blurring effect" is apparent. On the other hand, if the reverberation time is too short, sounds will be "flat" and "dead," and it will be extremely difficult, if not impossible, for a speaker to make himself understood, particularly if the room is large.

Before taking up the subject of reverberation characteristics, it may be well to again consider the three fundamental laws of sound. These are:

1. Sound tends to travel in straight lines.
2. When two sound waves intersect, their subsequent paths are the same as though each wave existed independently.
3. The angle of incidence of a reflected sound wave is exactly equal to the angle of reflection, if the dimensions of the reflecting surface are greater than those of the sound wave. If they are smaller, the wave will be bent, or diffracted.

In the recording or broadcast studio, the position of the microphone has a definite bearing on the character of sound reproduction. Various locations may enhance or lessen intelligibility or result in the sound being more or less reverberant, despite the fact that the reverberation time of the studio is practically the same for any given point in the room.

Correction in reverberation time and characteristics of an enclosure are obtained by the use of acoustic or sound-absorbing materials. The customary procedure is to place panels of acoustical materials around the walls of the room in such a manner that no two panels of the same material are directly opposite each other, remembering that the absorbability of any given material varies with the angle of incidence.

The various manufacturers of acoustical materials have run exhaustive tests on the absorption coefficients of their particular products and have prepared the results in tabular form. These tables are obtainable from the manufacturer or may be found in numerous text books (see Table 1). Generally the over-all absorption is taken at a frequency of 512 cycles.

Reverberation time is defined as the time required for a sound to die away to one-millionth of its original intensity. This time will vary with the room characteristics, and may be computed by means of the following formula:

$$T = 0.05 \frac{V}{A} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

where V is the room volume in cubic feet, and A the total absorption of the acoustical materials in the room. The value of A is computed by multiplying

Table 1. Absorption coefficients of the most commonly-used acoustical materials.

MATERIAL	512 CPS
Hard plaster on wood lath and wood studs	0.032 per sq. ft.
Poured concrete painted and varnished	0.014 per sq. ft.
Carpet, pile on ⅛" felt base	0.370 per sq. ft.
Glass surfaces	0.030 per sq. ft.
Each person, seated	3.800 per sq. ft.
Draperies, velour, 18-oz. per sq. yd. in contact with wall	0.350 per sq. ft.
Cushiontone—A1—½", perforated 484 holes per sq. ft.	0.580 per sq. ft.
Theater and auditorium chairs heavily upholstered in plush or mohair	2.800 per sq. ft.

the area in square feet of each surface by its absorption coefficient and taking the sum of these products plus the absorption of such objects as seats, furnishings, draperies, persons, etc.

As a matter of discussion, assume we have a studio which is 20 feet long, 10 feet wide, and 9 feet high. The walls are of hard plaster supported on wood lath and wooden studs. The floor is of concrete which has been painted and the ceiling is completely covered with A-1 type "Cushiontone" ½ inch thick. On the floor is a deep pile 9′ x 12′ rug laid on a ⅛″ felt base. There is also a control room window 2 feet by 4 feet in size, and 10 upholstered theater type seats. What would be the reverberation time of this room for a frequency of 512 cps?

First, we must determine the value of *A*. To do this, the absorption coefficient of each factor of the room is added, starting with the floor, then the walls, and finally the ceiling.

The floor is 10′ x 20′ giving us 200 square feet with a 9′ x 12′ rug located thereon. Since the floor is of concrete which has been painted, we will use the coefficient, given in Table 1, of 0.032 per sq. ft., which when multiplied by the area in square feet results in the coefficient of absorption of the floor, $200 \times 0.014 = 2.8$. However, this would be for the entire floor. As a portion of the floor is covered by the rug with a different coefficient, we consider the rug first.

The rug is 9′ x 12′ on a ⅛″ felt base, which from Table 1 has an absorption coefficient of 0.37 per sq. ft. 0.37 x 108 = 39.96 for the rug. Thus we have a space 1′ x 12′ and a space of 8′ x 10′ of the concrete floor which is exposed. This makes a total of 92 sq. ft. of concrete with a coefficient of 0.014 or 92 x 0.014 = 1.288 as the coefficient of the concrete.

Now consider the walls: two are 9′ x 20′ or 180 sq. ft. in size, and one end wall which is 9′ x 10′ or 90 sq. ft. The other end wall contains the monitor room window, which is 2′ x 4′ or 8 sq. ft. in area which leaves the remainder of the wall as 82 sq. ft. The coefficient of the glass window is 0.030 x 8 or 0.24. The remaining wall space totals 532 sq. ft. and has a coefficient of 0.032 per sq. ft. $532 \times 0.032 = 17.024$ as the coefficient for the entire wall space.

The ceiling is 200 sq. ft. with an absorption coefficient of 0.580 since it is covered entirely by Cushiontone. 200 x 0.580 equals 116.0, as the absorption of the ceiling. These products are now added together to obtain *A*. *Adding* up the totals 39.96 plus 1.288 plus 0.24 plus 17.024 plus 116.00 equals 174.512. In addition are seats with a coefficient of 2.8 each, making their total 28.0 which is added to 174.512, resulting in a total value for *A* of 202.512.

The volume of the room *V* is equal to 10 x 20 x 9 or 1800 cubic feet. Substituting in the equation, we find that:

$$T = 0.05 \times \left(\frac{1800}{202.5}\right) = 0.444 \text{ second}$$

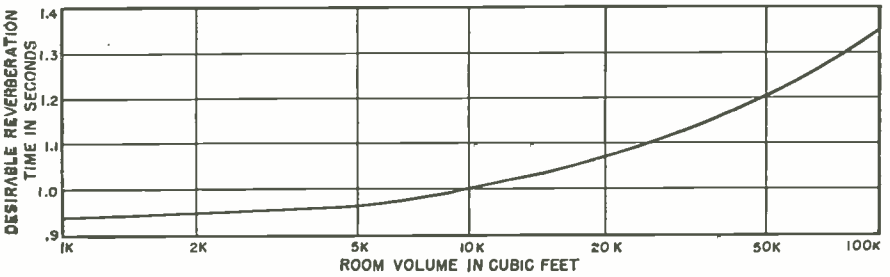


Fig. 2. Optimum reverberation times of various sized sound studios.

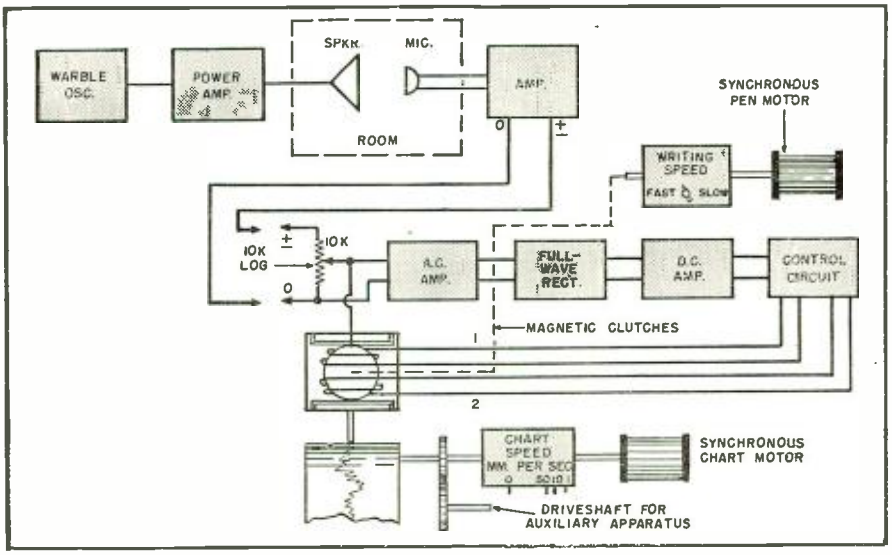


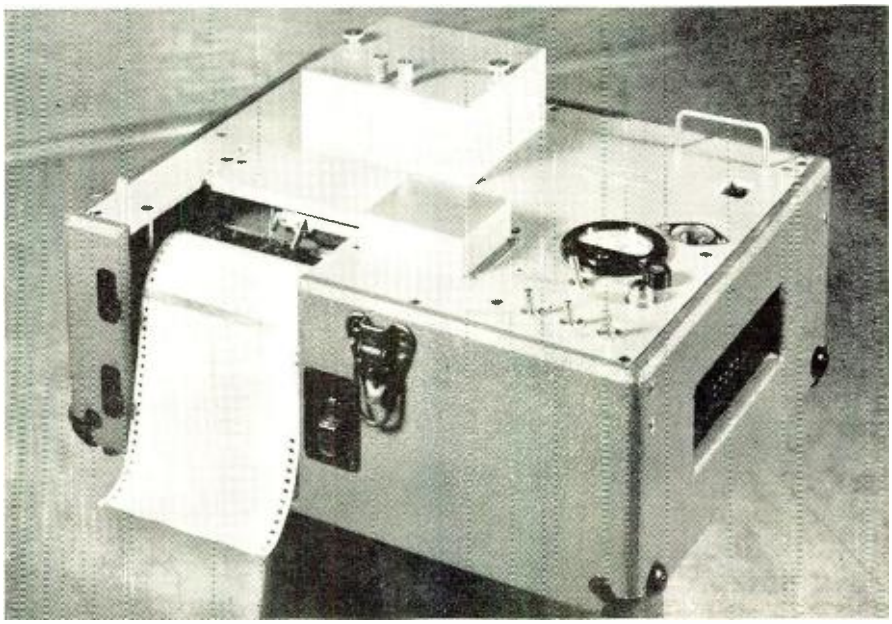
Fig. 3. Simplified diagram of the recorder shown in photograph below. Acoustical measurements of the studio under test are recorded on tape for later analysis.

Referring to the graph of Fig. 2, it will be noted that the optimum reverberation period for a room of 1800 cubic feet in size is 0.95 second. Since the problem room only has a reverberation period of 0.444 second, it will be too "dead" and it will be necessary to add sufficient treatment to "liven" it up or increase its reverberation time to as near 0.95 second as possible.

This increase of the reverberation time may be achieved by placing additional alternate panels of material that will reflect the high frequencies. Under no circumstances should any of the present material be removed, but material which will reflect the higher frequencies should be added and the reverberation time recalculated after each treatment until the desired reverberation period is achieved.

When these changes have been made

Fig. 4. High-speed graphic recorder developed by Sound Apparatus Co., Sterling, N. J.



and it is felt that the reverberation time is satisfactory, acoustical measurements should be made of the complete studio. This may be done in either of two ways. Test recordings may be made in the room and listened to critically, or actual acoustical measurements made by means of a special automatic high-speed graphic recorder, shown in Fig. 4.

A simplified diagram of this recorder is shown in Fig. 3. The recorder consists of three principal parts. They are: an input potentiometer with a stylus mounted on its movable arm which bears on a motor-driven wax-coated paper tape; an amplifier-rectifier system; and a servomechanism for controlling the action of the stylus. External to the recorder is a loudspeaker, power amplifier, warble oscillator, and microphone for picking up the signal from the loudspeaker.

At the left of the diagram is an input potentiometer, which has mounted on the contact arm a stylus which bears on the paper tape. Connected to the output of the potentiometer is the input of a wide-range audio amplifier, followed by a rectifier and a d.c. amplifier, feeding a control circuit which connects to the coils 1 and 2. These coils are mounted on a magnetic disc, which operates in conjunction with a carriage connected to the movable arm of the input potentiometer and stylus.

With no signal across the input potentiometer, the control circuit is unbalanced, causing a heavy current flow through coil 2 while the current through coil 1 is very small. This condition attracts the stylus carriage to the magnetic disc on the side carrying coil 2, increasing the friction between the carriage and the disc. The friction causes the carriage to move with the disc carrying the stylus and potentiometer arm to the left end of the potentiometer, where the attenuation is at a minimum. This puts the instrument in a condition of maximum sensitivity.

Now if a signal is applied to the input potentiometer, it will be amplified, rectified, and the rectified current flowing through coil 2 will be decreased. As the input signal amplitude increases, the current through coil 2 will continue to decrease to a very small amount while the current through coil 1 will increase.

This action causes the carriage and potentiometer arm to move to the right, reducing the input voltage to the amplifier, thus restoring the current balance through coils 1 and 2. The distance the potentiometer arm moves in restoring the balance is inscribed on the moving tape; thus a record is obtained of the changes in signal level at the microphone input.

Several typical recordings of different type signals are shown in Fig. 5. The reverberation time is determined by the average slope of the decay curve. Noise measurements of a room may be made by shutting off the oscillator and running only the recorder, the microphone picking up the room noises.

It is the practice when measuring auditoriums and theaters to make a field plot of the sound distribution. This is done by placing the microphone in different parts of the room and recording the response. If a measurement is to be made of a motion picture projection system, a special warble film is used on the projector and the the sound picked up by the microphone from the stage speakers. If the house has a balcony, a measurement should be made under the balcony at several different locations.

Means is provided with the recorder to plot the response in decibels, phons, or as a linear voltage, as the situation requires. Generally, it is plotted in decibels.

The mechanical design of the servomechanism is such that "hunting" and "overshooting" of the stylus are prevented. A range of 75 db is possible with tape speeds of 50 mm. per second.

It must also be remembered that each person who enters a room will act as an additional absorption coefficient of 3.8 (at 512 cycles), and in climates where heavier clothing is worn in winter than in summer, the heavier clothing will increase the absorption coefficients. Consequently, the absorption coefficient for a given room under these circumstances will be higher in winter than in summer.

Not only is the absorption coefficient influenced but the change in the volume of the room caused by the number of people in it has a direct bearing on its acoustic response. For example, when a theater is one-quarter to one-half full, the volume control in the projection booth is placed at one setting. But when the theater is more than one-half filled, it is necessary to increase the setting of this control from 3 to 6 db in order that the proper level of sound may be maintained, to offset the absorption of the audience.

It is also important that the humidity and temperature be kept fairly constant in the theater, not only for the comfort of the patrons, but because the acoustical characteristics are affected by temperature and humidity.

The baffling of the air conditioning vents is important, too, not only because of the vast amounts of air which must be moved, but also to prevent the entrance of external noises, which must be kept at a minimum, to prevent distraction of the audience.

Another factor in the determination of reverberation in any enclosure is the shape of the room. Generally speaking, parallel walls are more objectionable than non-parallel walls, since they are productive of echoes, unless highly absorbent. Concave walls are objectionable because they focus the sound within given areas, irrespective of the intensity or distance from the source of the sound. However, they are frequently used behind the source of sound to act as reinforcing systems.

In general, the most satisfactory method of obtaining a desirable acoustical response in rooms which are relatively free from excess reverberation and noise, is by the use of numerous bold projections from walls and ceiling. The irregular wall contours effectively smooth the growth and decay curves of the sound, and, since nearly, if not all the meaningful sounds emitted in the room are essentially transient, the resulting sound has a pleasant smoothness. This feature is particularly important in the design or treatment of studios, to obviate the critical positioning of the microphones for optimum pickup.

In the construction of motion picture theaters, it is desirable to keep the ceiling as low as possible for a number of reasons. Among them is the fact that this reduces the volume of the auditorium and hence construc-

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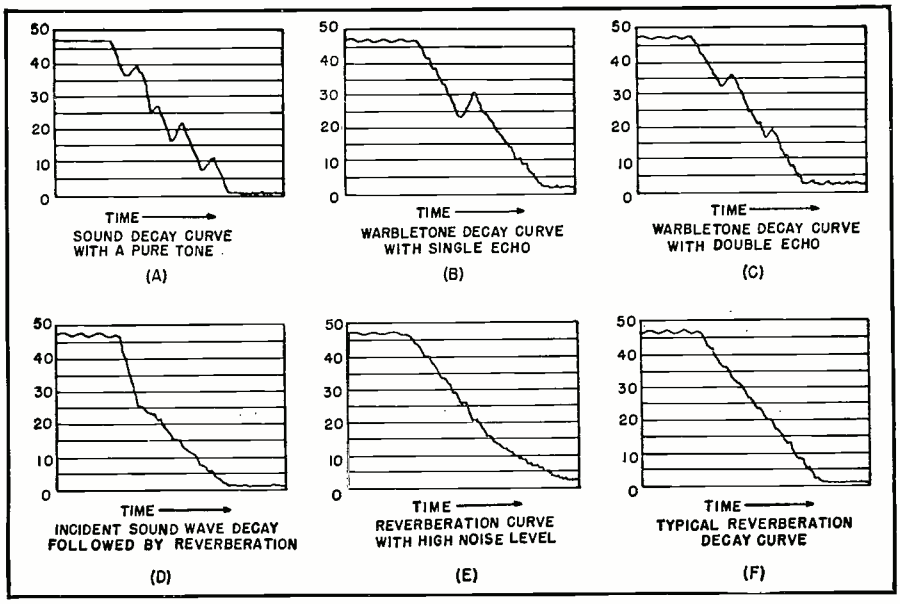
Fig. 5. Actual recordings of several different signals. The reverberation time of the studio being tested can then be determined directly from these curves.



"TO CUT COSTS, WE HAD TO CUT CALL-BACKS!"

"Call-backs tied up our repairmen —wasted valuable working time. *Quality* tubes solved the problem for us . . . *G-E* tubes!"

Says **EVERETT CAUDILL**, *Manager*
Tel-Rad Center
829 Madison Ave., Covington, Ky.

"We were building up a big log of repair time that we couldn't invoice—and profits were narrowing in consequence. Too many of our Cincinnati and Covington customers kept phoning in that their sets wouldn't work, anywhere from a day to a week after our repairmen had been there. The trouble was mostly tube failures. We had to stop that in its tracks—and we did, by going over 100-percent to quality tubes. . . . When we say 'quality tubes' here at Tel-Rad Center, we mean, first of all, General Electric tubes. Our whole staff agrees on that!"

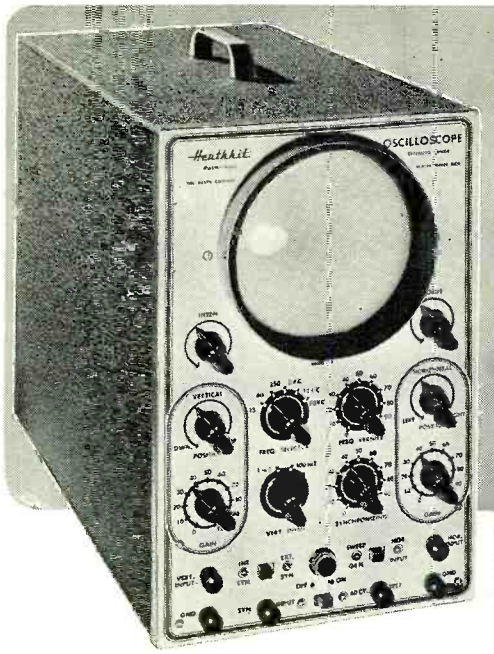
Receiver owners, Tel-Rad finds, ask to be shown the G-E label on tube cartons. They've learned that when quality tubes—G-E tubes—are installed as replacements, their TV sets will perform better; will give many more hours of trouble-free enjoyment.

How well-made can tubes be? Study G-E tubes to find out! Below, a polariscope is used to check G-E receiving-tube stems for glass strains that might result in warping or fracture. Only one of many scientific G-E factory tests for top tube quality!

FOR QUALITY TUBES TO CUT DOWN YOUR CALL-BACKS, SEE YOUR G-E TUBE DISTRIBUTOR!

GENERAL ELECTRIC

181-KA6



Heathkit MODEL 0-6 . . . PUSH-PULL . . . 5" OSCILLOSCOPE KIT

The new Heathkit 5" Push-Pull Oscilloscope Kit is again the best buy. No other kit offers half the features — check them.

Measute either AC or DC on this new scope — the first oscilloscope under $100.00 with a DC amplifier.

The vertical amplifier has frequency compensated step attenuator input into a cathode follower stage. The gain control is of the non frequency discriminating type—accurate response at any setting. A push-pull pentode stage feeds the CR tube. New type positioning control has wide range for observing any portion of the trace.

The horizontal amplifiers are direct coupled to the CR tube and may be used as either AC or DC amplifiers. Separate binding posts are provided for AC or DC.

The multivibrator type sweep generator has new frequency compensation for the wide range it covers: 15 cycles to over 100,000 cycles.

The new model 0-6 scope uses 10 tubes in all, including 5" CR tube. Has improved amplifiers for better response useful to 2 megacycles. Tremendous sensitivity .04V RMS per inch horizontal — .09V RMS per inch vertical. Only Heathkit Scopes have all the features.

New husky heavy duty power transformer has 50% more laminations. It runs cool and has the lowest possible magnetic field. A complete electrostatic shield covers primary and other necessary windings and has lead brought out for proper grounding.

The new filter condenser has separate sections for the vertical and horizontal screen grids and prevents interaction between them. An improved intensity circuit provides almost double previous brilliance and better intensity modulation.

A new synchronization circuit allows the trace to be synchronized with either the positive or negative pulse, an important feature in observing the complex pulses encountered in television servicing.

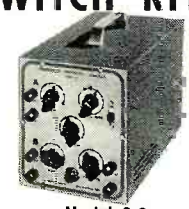
The magnetic alloy shield supplied for the CR tube is of new design and uses a special metal developed by Allegheny Ludlum for such applications.

The kit is complete, all tubes, cabinet, transformer, controls, grid screen, tube shield, etc. The instruction manual has complete step-by-step assembly and pictorials of every section. Compare it with all others and you will buy a Heathkit.

Model 0-6..... Shipping Wt. 24 lbs.

$39.50

NEW INEXPENSIVE Heathkit ELECTRONIC SWITCH KIT



The companion piece to a scope — Feed two different signals into the switch, connect its output to a scope, and you can observe both signals — each as an individual trace. Gain of each input is easily set (gain A and gain B controls), the switching frequency is simple to adjust (coarse and fine frequency controls) and the traces can be superimposed for comparison or separated for individual study (position control).

Use the switch to see distortion, phase shift, clipping due to improper bias, both the input and output traces of an amplifier, — as a square wave generator over limited range.

The kit is complete; all tubes, switches, cabinet, power transformer and all other parts, plus a clear detailed construction manual.

Model S-2
Shipping Wt. 11 lbs.

$19.50

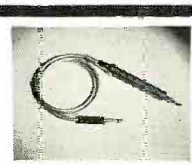
$5.50

Heathkit 30,000V DC PROBE KIT

A new 30,000 V DC Probe Kit to handle high voltages with safety. For TV service work and all other high voltage applications. Sleek looking — Two color molded plastic — Red body and guard — jet black handle. Comes with connector, cable, and PL55 type plug. Plugs into Heathkit VTVM so that 300V scale is conveniently multiplied by 100. Can be used with any standard 11 megohm VTVM.

No. 336 High Voltage Probe Kit.....Shipping Wt. 2 lbs.

Heathkit RF PROBE KIT

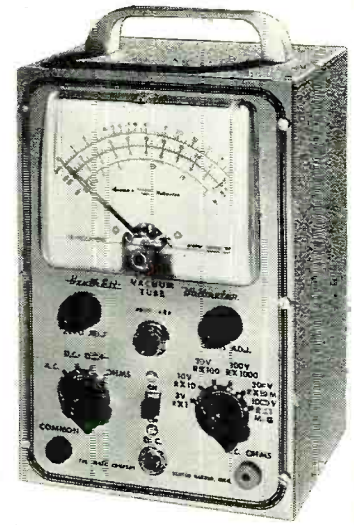


This RF Probe Kit comes complete with probe housing, crystal diode detector, connector, lead and plug and all other parts plus clear assembly instructions. Extends range of Heathkit VTVM to 250 Mc. ± 10%. Works on any 11 megohm input VTVM. Specify No. 309 RF Probe Kit.

Shipping Wt. 1 lb.

$5.50

New MODEL V-4A Heathkit VTVM KIT



The new Heathkit Model V-4A VTVM Kit measures up to 30,000 Volts DC and 250 megacycles when used with accessory probes — think of it, all in one electronic instrument more useful than ever before. The AC Voltmeter is so flat and extended in its response (± 1 db from 20 cycles to 2 megacycles) that it eliminates the need for separate expensive AC VTVM's.

The new 200 microampere, 4½" streamline meter with quality Simpson movement (five times as sensitive as the commonly used 1 MA meter) has a shatter proof plastic meter face for maximum protection. Meter has all the desirable scales and indicates AC volts, DC volts, ohms, db (direct reading), and even has a special zero center marking for quick FM alignment.

There are six complete ranges for each function. Four functions give total of 24 ranges. The 3 volt range allows 33⅓% of the scale for reading 1 volt, as against only 20% of the scale on the 5 volt types.

New ½% ceramic precision resistors are the most accurate commercial type available — you find the same make and quality in the finest laboratory equipment selling for thousands of dollars. The entire voltage divider decade uses these ½% resistors.

Model V-4A .....Shipping Wt. 8 lbs.

Note New Low Price

$23.50

Both AC and DC voltmeter measurements use a push-pull electronic voltmeter circuit, and the meter circuit makes the meter burn-out proof. Electronic ohmmeter circuit measures resistance over the amazing range of 1/10 ohm to one billion ohms, all with internal 3 volt battery. Ohmmeter batteries mount on the chassis in snap-in mounting for easy replacement.

Voltage ranges are full scale — 3 Volts, 10 Volts, 30 Volts, 100 Volts, 300 Volts, 1000 Volts. Complete decading coverage without gaps.

The DC probe is isolated for dynamic measurements. Negligible circuit loading. Gets the accurate reading without disturbing the operation of the equipment under test. Kit comes complete: cabinet, transformer, Simpson meter, test leads, complete assembly and instruction manual.

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The HEATH COMPANY

. . . BENTON HARBOR 15, MICHIGAN

NEW

Heathkit TV ALIGNMENT GENERATOR KIT

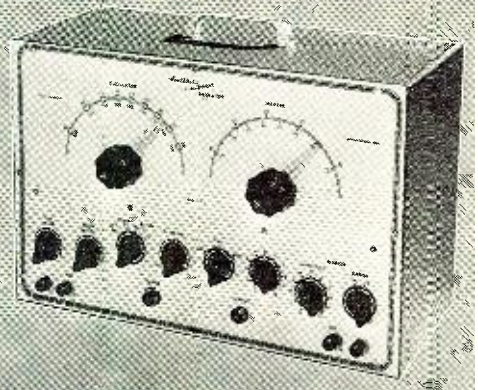
Here is an excellent TV Alignment Generator designed to aid TV service work quickly, easily, and properly. The model TS-2 when used in conjunction with an oscilloscope provides a means of correctly aligning television receivers.

The instrument provides a frequency modulated signal covering, in two bands, the range of 10 to 90 Mc. and 150 to 230 Mc. — thus, ALL ALLOCATED TV CHANNELS AS WELL AS IF FREQUENCIES ARE COVERED.

An absorption type frequency marker covers from 20 to 75 Mc. in two ranges — therefore, you have a simple, convenient means of frequency checking of IF's, independent of oscillator calibration.

Sweep width is controlled from the front panel and covers a sweep deviation of 0-12 Mc. — all the sweep you could possibly need or want.

And still other excellent features are: Horizontal sweep output available at the front panel (and controlled with a phasing control) — both step and continuously variable attenuation for setting the output signal to the desired level — a convenient instrument stand-by position — vernier drive of both oscillator and marker tuning condensers — and clamping for establishing a single trace with base reference level. Make your work easier, save time, and repair with confidence — order your Heathkit TV Alignment Generator now!



$39.50

Model TS-2
Shipping Wt..... 20 lbs.

Heathkit SIGNAL GENERATOR KIT

Model SG-6
Shipping Wt. 7 lbs.

$19.50

The new Heathkit Signal Generator Kit has dozens of improvements. Covers the extended range of 160 Kc to 50 megacycles on fundamentals and up to 150 megacycles on useful calibrated harmonics; makes this Heathkit ideal as a marker oscillator for TV. Output level can be conveniently set by means of both step attenuator and continuously variable output controls. Instrument has new miniature HF tubes to easily handle the high frequencies covered.

Uses 6C4 master oscillator and 6C4 sine wave audio oscillator. The kit is transformer operated and a husky selenium rectifier is used in the power supply. All coils are precision wound and checked for calibration making only one adjustment necessary for all bands.

New sine wave audio oscillator provides internal modulation and is also available for external audio testing. Switch provided allows the oscillator to be modulated by an external audio oscillator for fidelity testing of receivers. Comes complete, all tubes, cabinet, test leads, every part. The instruction manual has step-by-step instructions and pictorials. It's easy and fun to build a Heathkit Model SG-6 Signal Generator.

Heathkit SIGNAL TRACER

and UNIVERSAL TEST SPEAKER KIT

The popular Heathkit Signal Tracer has now been combined with a universal test speaker at no increase in price. The same high quality tracer follows signal from antenna to speaker — locates intermittents — finds defective parts quicker — saves valuable service time — gives greater income per service hour. Works equally well on broadcast, FM, or TV receivers. The test speaker has an assortment of switching ranges to match either push-pull or single output impedances. Also tests microphones, pickups and PA systems. Comes complete: cabinet, 110V 60 cycle power transformer, tubes, test probe, all necessary parts, and detailed instructions for assembly and use

Model T-2
Shipping Wt.. . 7 lbs.

$19.50

Heathkit TUBE CHECKER KIT

Test your tubes the modern way — dynamically — the simplest, yet fastest and surest method— your Heathkit has a switch for each tube element and measures that element — no chance for open or shorted elements slipping by; all the advantages of the mutual conductance type without the slow cumbersome time consuming setups. Checks for opens, shorts, each element individually, filament and filament tap continuity, and emission.

This Tube Checker has all the features — beautiful 3 color BAD-?-GOOD meter — complete selection of voltages — roller chart listing hundreds of tubes including the new 9 pin miniatures — finest quality Centralab lever switches — high grade birch, counter-type cabinet — continuously variable line adjust control — every feature you need to sell tubes properly. The most modern type tube checker with complete protection against obsolescence. Uses only the best of parts — rugged oversize 110V 60 cycle power transformer, finest of Mallory and Centralab switches and controls, complete set of sockets for all type tubes with blank spare for future types. Fast action, gear driven roller chart quickly locates the setting for any type tube. Simplified switching cuts necessary testing time to a minimum and saves valuable service time. Simple method allows instant setup of new tube types without waiting for factory data. No matter what the arrangement of tube elements is, the Heathkit flexible switching method easily handles it. Order your Heathkit Tube Checker Kit today and see for yourself that Heath again saves you two-thirds and yet retains all the quality. Complete with instructions, all parts, and cabinet.

Model TC-1
Shipping Wt. 12 lbs.

$29.50

Heathkit CONDENSER CHECKER KIT

$19.50

Checks all types of condensers — paper, mica, ceramic, electrolytic. All condenser scales are direct reading and require no charts or multipliers. Covers range of .00001 MFD to 1000 MFD. A Condenser Checker that anyone can read. A leakage test and polarizing voltage for 20 to 500 V provided. Measures power factor of electrolytics between 0% and 50% and reads resistance from 100 ohms to 5 megohms. The magic eye indicator makes testing easy.

The kit is 110V 60 cycle transformer operated and comes complete with rectifier tube, magic eye tube, cabinet, calibrated panel and all other parts. Has clear detailed instructions for assembly and use.

Model C-2 ..... Shipping Wt. 6 lbs.

NEW Heathkit

HANDITESTER KIT

$13.50

A precision portable volt-ohm-milliammeter. Uses only high quality parts — All precision ½% resistors, three deck switch for trouble-free mounting of parts, specially designed battery mounting bracket, smooth acting ohm adjust control, beautiful molded bakelite case, 400 microamp meter movement, etc.

DC and AC voltage ranges 10-30-300-1000-5000V. Ohms range 0-3000 and 0-300,000 Range Milliamperes 0-10 Ma, 0-100 Ma. Easily assembled from complete instructions and pictorial diagrams.

Model M-1 ..... Shipping Wt. 3 lbs.

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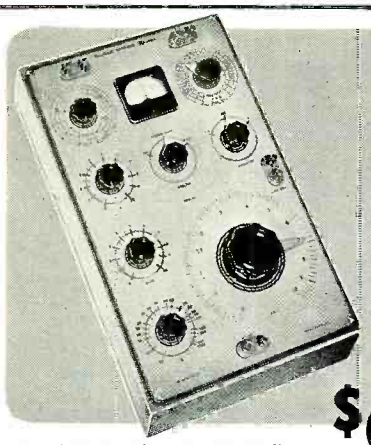


Model IB-1B....Shipping Wt. 15 lbs.

NEW *Heathkit*

IMPEDANCE BRIDGE KIT

This Impedance Bridge Kit is really a favorite with schools, industrial laboratories, and serious experimenters. An invaluable instrument for those doing electrical measurements work. Reads resistance from .01 Ohms to 10 megohms, capacitance from .00001 MFD to 100 MFD, inductance from 10 microhenries to 100 henries, dissipation factor from .002 to 1, and storage factor from 1 to 1000. And you don't have to worry about selecting the proper bridge circuit for the various measurements — the instrument automatically makes the correct circuit when you set up for taking the measurement you want. Bridge utilizes Wheatsone, Hay, Maxwell, and capacitance comparison circuits for the wide range and types of measurements possible. And it's self powered — has internal battery and General Radio 1000 cycle hummer. No external generator required — has provisions for external generator if measurements at other than 1000 cycles are desired.

Kit utilizes only highest quality parts, General Radio main calibrated control, General Radio hummer, Mallory ceramic switches, excellent 200 microamp zero center galvanometer, laboratory type binding posts with standard ¾ inch centers, ½% precision ceramic-body type multiplier resistors, beautiful birch cabinet, and ready calibrated panel. (Headphones not included.)

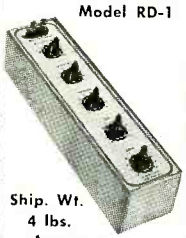
Take the guesswork out of electrical measurements — order your Heathkit Impedance Bridge Kit today — you'll like it.

$69.50

Heathkit LABORATORY

RESISTANCE DECADE KIT

Model RD-1



Ship. Wt. 4 lbs.

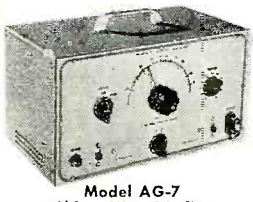
$19.50

An indispensable piece of laboratory equipment — the Heathkit Resistance Decade Kit gives you resistance settings from 1 to 99,999 ohms IN ONE OHM STEPS. For greatest accuracy, ½% precision ceramic-body type resistors and highest quality ceramic wafer switches are used.

Designed to match the impedance bridge above, the Resistance Decade Kit has a beautiful birch cabinet and attractive panel. It's easy to build, and comes complete with all parts and construction manual.

NEW *Heathkit* SINE and SQUARE WAVE

AUDIO GENERATOR KIT



Model AG-7
Ship. Wt. 15 lbs.

$34.50

We proudly present the NEW MODEL Sine and Square Wave Audio Generator Kit. Designed with versatility, usefulness, and dependability in mind, the AG-7 gives you the two most needed waveshapes right at your fingertips — the sine wave and the square wave.

The range switch and plainly calibrated frequency scale give rapid and easy frequency selection, and the output control permits setting the output to any desired level.

A high-low impedance switch sets the instrument for either high or low impedance output — on high to connect to high impedance load, and on low to work into a low impedance transformer with negligible DC resistance.

Coverage is from 20 to 20,000 cycles, and distortion is at a minimum — you can readily trust the output waveshape.

6 tubes, quality 4 gang tuning condenser, power transformer, metal cased filter condenser, ½% precision resistors in the frequency determining circuit, and all other parts come with the kit — plus, a complete construction manual. A tremendous kit, and the price is truly low.

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	Heathkit Oscilloscope Kit — Model O-6			Heathkit R.F. Probe Kit — No. 309	
	Heathkit VTVM Kit — Model V-4A			Heathkit H.V. Probe Kit — No. 336	
	Heathkit FM Tuner Kit — FM-2			Heathkit R.F. Signal Gen. Kit — Model SG-6	
	Heathkit Broadcast Receiver Kit — Model BR-1			Heathkit Condenser Checker Kit — Model C-2	
	Heathkit Three Band Receiver Kit - Model AR-1			Heathkit Handitester Kit — Model M-1	
	Heathkit Amplifier Kit — Model A-4			Heathkit Power Supply Kit — Model PS-1	
	Heathkit Amplifier Kit — Model A-6 (or A-6A)			Heathkit Resistance Decade Kit — Model RD-1	
	Heathkit Tube Checker Kit — Model TC-1			Heathkit Impedance Bridge Kit — Model IB-1B	
	Heathkit Audio Generator Kit — Model AG-7				
	Heathkit Battery Eliminator Kit — Model BE-2				
	Heathkit Electronic Switch Kit — Model S-2				
	Heathkit T.V. Alignment Gen. Kit — TS-2				
	Heathkit Signal Tracer Kit — Model T-2				

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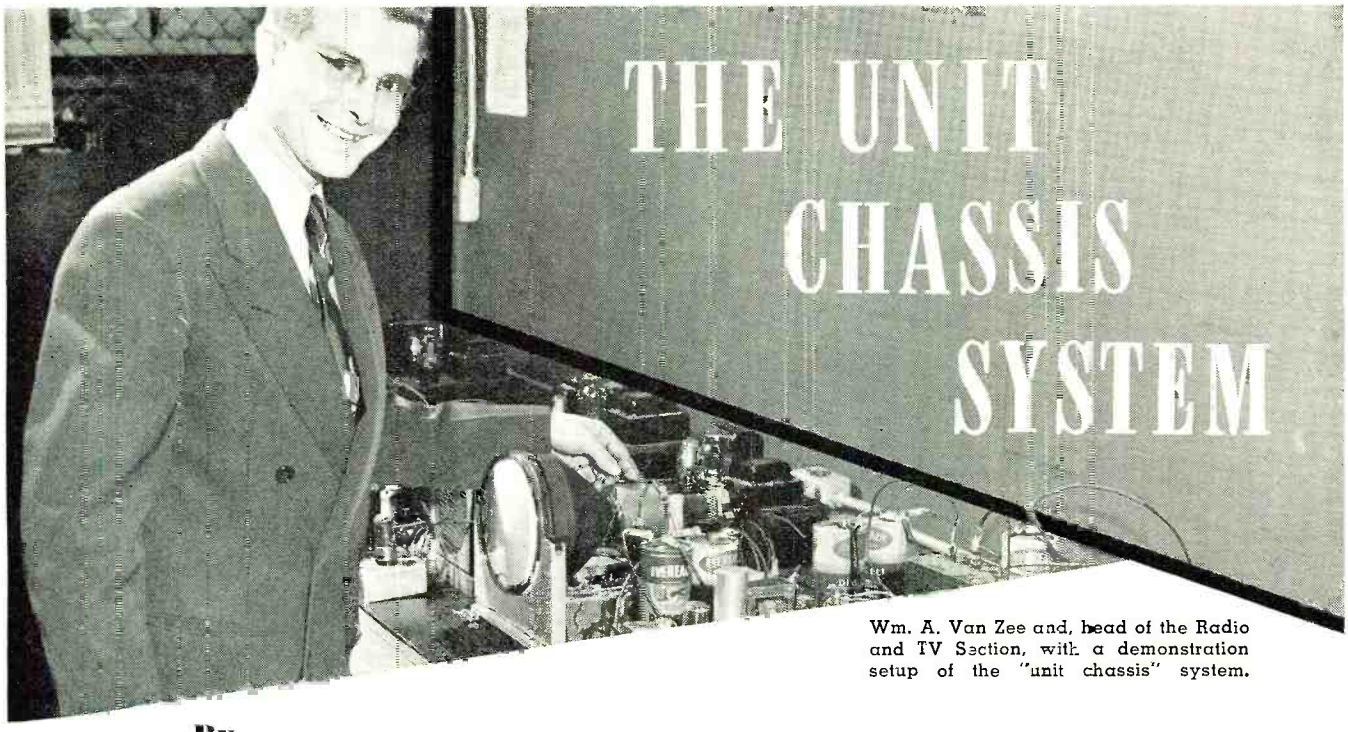
THE UNIT CHASSIS SYSTEM



Wm. A. Van Zee and, head of the Radio and TV Section, with a demonstration setup of the "unit chassis" system.

A unique technique being used by one school to facilitate television engineering instruction.

By
BLAYNE E. ARNESON
and
WM. A. VAN ZEELAND
Milwaukee School of Engineering

IN A good radio theory course, students are taught that radio receivers are a combination of basic electronic circuits—not a single complex unit, and that each circuit consists of basic electronic components—vacuum tubes, condensers, resistors, etc. As the course progresses each new unit is tied in with those studied earlier. Thus at the end of the course, the student has a complete, functional knowledge of each individual unit, plus a sound picture of how these units work together. Then by using this knowledge, a student can quickly localize defects to a single stage—and finally to a single component—with a minimum number of measurements and in the shortest possible time. This method of teaching also helps develop confidence—an important asset for a good technician.

One of the newest techniques in teaching television is the "unit chassis" system which is based on the theory that all TV receivers, regardless of make or model, can be broken down into 14 basic units, each of which can be associated with one or more of the remaining sections.

Laboratory and lecture classes under this system are organized so that the introduction to television is accomplished by the presentation of a typical block diagram. The name and function of each block are considered individually.

While a block diagram cannot be used exclusively to determine the faulty component in a television receiver, it can be used as a starting point in an analysis of the symptoms displayed by a faulty receiver.

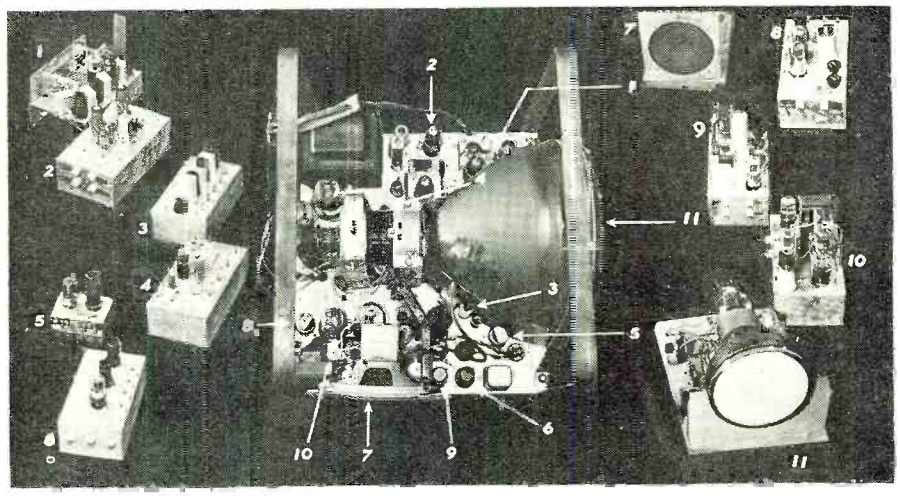
As a prelude to studies in the "unit chassis" system, students undergo a period of "familiarization" during which they learn the operation of any knobs or controls on the front or rear panel of the set. While the observation and analysis of the performance of any individual block is not practical during the familiarization period, the net result of any misadjustment of the controls can be observed on the picture tube or in the sound.

With that phase behind him, the student then moves into the first block of the "unit chassis" system. This study consists of a brief review of the circuit's function and its part in the over-all performance of the receiver. Simplified typical circuits are discussed next, including the operation, adjustment, advantages and disadvantages of each type. This is followed by a similar analysis of the actual circuits used by various manufacturers. Included is information relating to typical difficulties encountered, the effect on the composite picture and sound, and recommended solutions.

The laboratory program in this system of instruction is so timed that each block can be investigated immediately after completion of its analysis in the classroom. The block under discussion is built into an individual "unit chassis" to allow a concentrated analysis of this particular unit.

In this way, the student is not confused by a large, complex chassis of 25 to 40 tubes when he is concerned with only one or two tubes at this stage.

Complete TV receiver with its component "unit chassis" blocks used for instruction.



A laboratory manual provides a schematic and an outline of various tests to be performed. Units requiring alignment are properly adjusted by each student. The circuits are designed to demonstrate the operation of typical blocks under investigation.

For some sections of a receiver, one or two different units may suffice, but for others, several may be necessary.

As each block study is completed, an experiment is performed which is designed to tie it in with the complete receiver and to familiarize the student with this block when it becomes part of a large receiver chassis. Commercial receivers are used in this experiment. —30—

N. Y. ANTENNA LAW

GOV. Thomas E. Dewey recently signed a bill which makes it unlawful to attach "radio, television antennas or other wires" to any fire escape or to any soil or vent line extended above the roof of any building in the state of New York.

The bill, sponsored by Sen. George H. Pierce, was designed to decrease roof accidents and damage to the sanitary systems of multiple dwellings. According to the bill's sponsor, the prevalent practice of attaching radio and television antennas to fire escapes has proven extremely dangerous, particularly in the New York City area and that their attachment to soil and vent lines loosens the waterproofing around the pipes, causing bad leaks in the roof.

—30—

ACHIEVEMENT AWARD

THE Dunsmuir Amateur Radio Club, W6KII, located in Dunsmuir, California has recently established a "Certificate of Achievement" Award for members of the ham fraternity.

The Award was drafted and designed by Jay M. Smith, W6HPL, and Cloyd L. Haney, W6CFU, sponsored by the Dunsmuir Rotary Club in the interest of amateur radio and civilian defense. The DARC award was designed to promote interest in amateur radio and stimulate contacts with amateurs throughout the country.

The rules governing the award are: (1) The Club will issue an award certificate to any licensed amateur presenting proof of two-way contact with five different amateur stations licensed within the immediate area of Dunsmuir. Endorsements will be made for multiples of five confirmed contacts. (2) Any Dunsmuir area amateur station may be worked. Written proof of the contact from any amateur station licensed and operating within a five mile radius of Dunsmuir proper will be acceptable. (3) Contacts may be made on any amateur band. (4) Written confirmation in the form of QSL cards or letters showing the date, time, band, and station contacted should be forwarded, together with return postage, to Dunsmuir Amateur Radio Club, W6KII, Dunsmuir, California. (5) Any amateur station that has worked five stations in the past is eligible for the award under the provisions of condition 4.

At the present time there are 11 active stations operating in the Dunsmuir area, 160 to 10 meters.

—30—

HOME STUDY COURSE in TELEVISION SERVICING

. . . based on the experience of the RCA Service Company

Now available to the Industry

Here's *your* golden opportunity to take the time-tested RCA Service Company course on television receiver servicing . . . to earn a valuable RCA Institutes' certificate that can lead straight to a better job at higher pay.

Now, for the first time, *you* can take the same basic course that has already been given to the thousands of RCA's own servicemen . . . an easy-to-understand home-study course based on the actual experience of the RCA Service Company in servicing thousands of home television receivers.

Cost is *low* . . . only $9 a unit for 10 units or $90 total, on an easy pay-as-you-learn plan. And value is *high* . . . the certificate of completion issued by RCA Institutes is known and honored throughout the radio-electronics industry.

Never before available to anyone outside RCA. Now offered to *you* through RCA Institutes, one of America's oldest and most respected technical training schools. Course covers most major makes and types of TV receivers. Designed specially for men already in electronics; therefore no kits or paraphernalia are required. Handled entirely by correspondence. Available *exclusively* to men in the radio-television-electronics field. Not offered to the general public, or under the G.I. Bill.

• • •

ENROLL NOW! Mail the coupon *today.* Don't miss your great opportunity to take this proven course. If you're just getting started in TV, it will make you a *good* serviceman. If you're already *good,* it can't help but make you *better!* Send the coupon . . . get on the reservation list . . . **NOW!**

LOWER RATES FOR GROUPS!

If any employer in the radio-electronic industry desires to enroll six or more of his employees for this course, lower rates will apply. A special group application form is available for employers desiring to take advantage of this offer.

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Without obligation on my part, please reserve a place for me in your *home study course on television servicing* and send me full details. No salesman will call. I understand I must be employed in the radio-TV-electronics field to qualify for the course.

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350 WEST FOURTH STREET, NEW YORK 14, N.Y.

McGEE'S "SUPER STORE" OPERATION SAVES YOU MONEY!

5 OZ4 TUBE & 5 VIB. DEAL No. RN-V5 ..... $9.50

Here's a red hot deal for you fellows that do a lot of auto radio service. 5 standard brand metal OZ4 tubes and 5 of our famous 4-prong serrated can vibrators. This vibrator is of the latest design, for long life. Standard diameter can, short enough to fit all Chrysler auto sets, also fits Motorola, etc. Our 20th Anniversary, big deal No. RN-V5. You can get 5 OZ4 metal tubes and 5 4-prong vibrators, all for $9.50. Shipping weight 3 lbs.

MN-8.	8 mfd 450 volt	39c
MN-16.	16 mfd 450 volt	49c
MN-30.	30 mfd 450 volt	59c
MN-20.	20 mfd 150 volt	39c
MN-40.	40 mfd 150 volt	49c
MN-220.	20-20 mfd 150v	49c
MN-53.	50-30 mfd 150v	59c
MN-442.	40-40-20 mfd 150v	69c

All cond. guaranteed one year.

RED HOT SPEAKER VALUES

McGee has a tremendous stock of 100,000 speakers to fill your needs. Every speaker is fully guaranteed. Order your speakers now.

4 inch, square	1 oz. magnet	$1.69
5 inch, pincushion	1 oz. magnet	1.79
6 inch, pincushion	1.47 oz. magnet	2.79
4 x 6 inch	1 oz. magnet	2.29
5 x 7 inch, oval	1.47 oz. magnet	2.49
7 inch, pincushion	2.15 oz. magnet	3.49
8 inch, pincushion	2.15 oz. magnet	3.49
6 x 9 inch, oval	2.15 oz. magnet	3.49

100 Molded Plastic Bypasses $9.95

100 molded plastic tubular by-pass condensers. All 600 volt. And all by the same nationally known mfgr. Regular dealers' net is over two and one-half times our 20th Anniversary sale price. You'll chuckle when you look these over. Here's what you get: 10—.001, 10—.002, 20—.005, 20—.01, 20—.02, 10—.05 and 10—.1. Our big deal No. RN-202. 100 plastic tubulars. Shipping weight 2 lbs. Net price, $9.95.

100 600 VOLT TUBULARS $6.95

100 top quality 600 volt tubular by-pass condensers. Made this year by a famous condenser factory. Don't confuse these with grab-bag surplus. McGee's deals are guaranteed to please you. Here's what you get: 10—.001, 10—.002, 20—.005, 20—.01, 10—.02, 20—.05 and 10—.1 600 volt condensers. Our big deal No. RN-203. Shipping weight 2 lbs. Net price, $6.95.

20 50 x 30 150 V. ELECTROLYTICS $10.95

Here's a red hot value. 20 of our XX quality replacement electrolytics. The most popular condensers in use today. Takes care of 90% of your AC-DC radio filter needs. Compact construction 1950 production. 1-year guarantee. 50-30 mfd. 150 volt, housed in a cardboard tube with common negative. has long flexible leads. 20th Anniversary, big deal No. RN-204. Sale price, $10.95.

SELENIUM RECTIFIERS

65 mil Selenium Rectifier, net ..... 59c each

100 mil Selenium Rectifier, net ..... 69c each

150 mil Selenium Rectifier, net ..... 79c each

200 mil Selenium Rectifier, net ..... $1.09 each

250 mil Selenium Rectifier, net ..... 1.19 each

350 mil Selenium Rectifier, net. 1.59 each

450 mil Selenium Rectifier, net. 1.79 each

McGee offers you the finest in Selenium rectifiers. All standard 130 volt.

1 or 4 VOLT CRYSTAL CARTRIDGES $1.99

McGee offers you a famous make crystal cartridge. Standard size and shape, but very light weight. Will track on ¾ oz. or more pressure. Stock A-6, one volt output, replaces Astatic L-70 etc., Net $1.99. Stock No. A-10, 4 volt output, replaces Astatic L-72 and L-82, etc., Net $1.99. Buy 10 assorted for $19.00.

5-STATION INTERCOM MASTERS $16.95

SUB-STATIONS $3.95

Model 2700 5-station intercom master, in an attractive walnut cabinet 10x5½x6". Push-button for each sub and talk-listen switch and volume control. AC-DC amplifier with lots of power and full size Alnico V PM speaker. 1950 production of a famous factory. Only 300 left, weight 7 lbs. Model 2700, net. $16.95.

Model MC-100 molded walnut plastic substation with call-back switch and heavy PM speaker, 5½x8½x3½", for wall or desk. Weight 2 lbs. Net, $3.95 each: 5 for $18.95.

3 wire intercom cable, plastic, $1.95 per 100 ft.; 500 ft., $9.50.

6-TUBE AUTO RADIO

SALE PRICE $27.95

with separate 5" PM speaker 6x9 or 7" PM, $2.00 Extra

A Red Hot close-out value. 6-tube superhet auto radio for universal underdash mounting. Size 13" deep, 6" wide and 4" high. Uses 2—6SK7, 6SA7, 6SQ7, 6V6 and 6X5 tubes. Stock No. AM-6, auto radio, complete with heavy duty 5" PM speaker, to mount in dash. Ideal for all cars and trucks. May be purchased with 6x9" or 7" PM speaker for extra $2.00. Shipping weight 16 lbs. Net price with 5" PM, $27.95.

66" 3 section side cowl antenna, shipping weight 2 lbs. Net, $1.95.

56" 3 section top cowl antenna, shipping weight 3 lbs., Net, $3.27.

19 TUBULAR ELECTROLYTICS DEAL RN-PL19 $7.50

19 tubular electrolytics, guaranteed for one year. All fresh stock in aluminum tubes with cardboard insulating sleeves. You must be satisfied or money back. You get, 10 8 mfd. 450 volt, 4 16 mfd. 450 volt, 3 20 mfd. 150 volt and 2 40 mfd. 150 volt condensers. Shipping weight 2 lbs. Deal #RN-PL19. Net $7.50.

10 FP ELECTROLYTICS DEAL RN-10DS $3.49

10 assorted F.P. aluminum can electrolytics. Popular twist tap mounting. Mostly multiple section banks. 150, 350 and 450 volts. A red hot deal. Shipping weight 2 lbs. Deal #RN-10DS, Net $3.49.

10 BOXES OF PILOT LIGHTS $5.49

Pilot lamps, boxed 10 to a handy carton. American made. 7 boxes #47, 1 box #40, 1 box #44 and 1 box #46. A total of 100 lamps. Deal #CM-51. Net $5.49.

100 #47 imported panel lamps. Guaranteed. 100 to the carton. Deal #RN-J47. Net $4.49.

25-WATT TRUMPET AND DRIVER $16.95

Full 12-month guarantee on this 25 Watt, all-weather re-entrant type trumpet and driver combination. 15 Ohm impedance. 9" Bell diameter. 9¾" length. Made by a famous speaker manufacturer. New 1951 production, offered to you at a tremendous saving. Ideal for a deluxe paging speaker as well as general P.A. use. Complete with adjustable mounting bracket. Shipping weight 6 lbs.

Model RE-17X, 25 Watt Trumpet and Driver. Net price $16.95

30-WATT TRUMPET and DRIVER $28.95

Model XX100-RM35. The finest trumpet driver combination value that we know. You get a full 30 Watt, 15 Ohm, PM Driver, guaranteed for 12 months and a 3½ ft. span aluminum trumpet. (Bell diameter 18", air column 3½ ft., 16" overall length.) Both driver and trumpet have standard threads. (1¾-18) Driver is completely weather and waterproof. This is not surplus, but the latest 1951 production, by a famous speaker manufacturer. Trumpet furnished complete with adjustable mounting bracket. RM-35, 30 Watt Driver unit only, shipping weight 6 lbs.

Net price $15.95

XX-100, 31½ ft. Trumpet only, shipping weight 15 lbs.

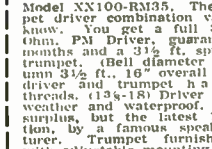
Net price $13.95

XX100-RM35, combination trumpet and driver complete. Net price.. $28.95

SUPER HEAVY DUTY 10" PM $6.95

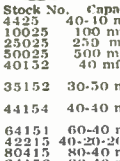
We made a special purchase on several hundred 20 watt, 10", 32 oz. Alnico 3 magnet PM speakers. Deep throat and easy moving cone. Ideal for all high fidelity sound systems and radio replacement. The magnet on this speaker is usually used on a 15" size. Very efficient, good high and bass response. You'll appreciate it when you get your hands on this speaker. Attractive copper finish. 8 ohm voice coil. Stock No. 1025PS. Weight 7 lbs. Net price $6.95 each.

Order three of these and use them in a cluster of three. They will take 60 watts of audio and have more cone area than any 15" speaker. For high power, top quality P.A. work. Think this over. 3 No. 1025PS speakers for only $19.95.



12" 32 OZ. PM SPEAKER $7.95

12", 32 oz. magnet, 20 watt PM speaker, with 8 ohm voice coil. A regular $17.00 list Consolidated speaker. Weight 8 lbs. No. CN-1232. $7.95 each. 4 for $29.95.



BIG SALE ALUMINUM CAN ELECTROLYTICS

McGee offers you Nationally known brands of FP type electrolytic condensers at a tremendous saving. After these are gone, we don't know where we can buy any more to sell at these prices. Order a good supply now. Unconditionally guaranteed.

Stock No.	Capacity	Voltage	Dia.	Net
4425	40-10 mfd.	25 volt	1"	29c
10025	100 mfd.	25 volt	1"	49c
25025	250 mfd.	25 volt	1"	49c
50025	500 mfd.	25 volt	1"	59c
40132	40 mfd.	150v, 200-10v	1"	39c
35152	30-30 mfd.	150v,20-50v, 10-10v		59c
44154	40-40 mfd.	150v,40-40 25v	1½"	59c
64151	60-40 mfd.	150v,10-25v1"		59c
42215	40-20-20 mfd.	150v,20-25v1½"		69c
80415	80-40 mfd.	150 volt	1"	59c
84152	80-40 mfd.	150v,25-25v1"		69c
15115	15-15 mfd.	150v,1200-1½v	1"	59c
77715	75-75-75 mfd.	150v,30-25v1½"		89c
3025	30 mfd.	250 volt	1"	29c
40252	40 mfd.	250v,20-25v1½"		39c
15125	15-15 mfd.	250 volt	1"	44c
40352	40 mfd.	300v, 50-25v,20-200v	1½"	69c
13342	130 mfd.	300v,40-20 150v,10-50v		79c
21322	10 mfd.	350v,20-25v1"		69c
1547	15-10 mfd.	473 volt	1"	59c
33332	30-30 mfd.	350v,20-25v1½"		74c
15415	15 mfd.	400v,10-5 350v	1"	64c
20422	20 mfd.	400v,20-25v1"		54c
15422	15 mfd.	400v,20-300v, 20-25v	1"	69c
8450	8 mfd.	450 volt	1"	39c
1045	10 mfd.	450 volt	1"	44c
1645	16 mfd.	450 volt	1"	47c
2045	20 mfd.	450 volt	1"	49c
3235	32 mfd.	450 volt	1"	54c
30422	30 mfd.	450v,20-20 25v	1"	64c
30433	30 mfd.	450v,30-350v, 40-25v	1"	69c
10145	10-10 mfd.	450 volt	1"	69c
21145	20-10-10 mfd.	450 volt	1½"	89c
1650	16 mfd.	500v, sep-arate use	1"	59c
2115	20-10 mfd.	150v,10-25v1"		49c
1545	15 mfd.	450 volt	1"	45c
3045	30 mfd.	450 volt	1"	49c
2145	20-10 mfd.	450 volt	1"	69c
5012	50 mfd.	12 volt	1"	19c
11451	15-15 mfd.	450v, 10-350v	1"	59c
21145	20-10-10 mfd.	450 volt	1½"	59c
4410	40-40 mfd.	150 volt	1"	59c
4410	100 mfd.	10 volt	1"	59c

V.M. 3 SPEED Record Changers $22.95

VM Model 406 deluxe 3 speed automatic record changer—plays them all—intermixes records of the same speed—equipped with a flip over crystal pickup with twin needles—a very sleek designed record changer—base size 12¼x13. Ship. weight 12 lbs. VM-406. Net, $22.95.

Buy the VM-950 changer with or without base. Choice of G.E. VR or crystal cartridge. We think the VM-950 record changer is the finest in America. It automatically plays all records all speeds and all sizes; 12 10-in., 33⅓ or 78 rpm. 10 12-in., 33⅓ or 78 rpm and 12 and 10-in. records of the same speed intermixed. 7 12-in. 33⅓ or 12 7-in. 45 rpm. Automatically shuts off after the last record. Size 13 13/16x11⅞x7¼ in. high. Offered with crystal cartridge, G.E. VR cartridge, or either with a base. VM-950. 3 speed changer with standard output crystal cartridge and needles for 1 and 3 mil. (78 rpm, 33⅓, 45 rpm.) Net $29.62.

VM-950GE. 3 speed changer with the new RPX-050 magic button, all-in-one variable reluctance cartridge with stylus. Net $32.80.

VM-955, 3 speed changer with crystal cartridge on a base. Net $32.01.

VM-955GE. 3 speed changer with RPX-050 VR cartridge and stylus; with base. Net $35.19.

Special Sale Buy PM Speakers and Baffles for Less at McGee

Combination offer, buy a speaker and baffle at the same time and save money. Baffles are all plywood construction with Brown Leatherette covering and are the slanting, wall mounting type.

	Stock No.	
6 inch baffle and 6" PM	6-CR	$4.79
8 inch baffle and 8" PM	8-CR	5.49
10 inch baffle and 10" Heavy duty 32 oz. Alnico 3 PM	10-CR	8.95
12 inch baffle and 12" Heavy duty 32 oz. Alnico 3 PM	12-CR	9.95

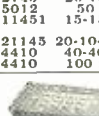
5% discount on above speaker baffle combinations on orders of 3 or more.

UNIVERSAL OUTPUTS

Universal replacement output transformers for push-pull or single plate. 2500 to 13,000 ohms, from 2 to 16 ohm voice coil. Standard size strap mounting with long leads and lugs for voice coil connections. U-5, 5 watt universal.

Net		$.99
U-8.	8 watt universal	1.19
U-15.	15 watt universal	1.39
U-20.	20 watt universal	1.79

5 watt, single universal output transformer. Any tube to 3.2 ohm voice coil. It pays to have some of these around the shop. They come in handy. No. JJ-4, ea. 79c; 10 for $7.50; 25 for $17.50.



McGee's Super High Fidelity *Best Value In U.S.A.* OUTPUT TRANS. 20-20,000 CPS. $7.95

Model A-403 High fidelity output transformer. Why pay $20 or $30 for an output, when our A-403 is available at $7.95? Impedance, 6600 ohms plate to plate. (for PP 6L6 or 6V6). 10% feedback winding, 4-8-15-250 and 500 ohm secondary. Housed in a potted case. Net weight 6 lbs. Recommended for all amplifiers up to 34 watts.

4-PRONG VIBRATORS $1.29 IN ALUMINUM SERRATED CANS

10 FOR $11.90

4 MILLION AUTO RADIOS BUILT IN 1950 AND HERE IS THE PERFECT REPLACEMENT VIBRATOR FOR MOST OF THEM.

Latest 1951 production by a top quality manufacturer. Fully guaranteed six months. Quiet running. A result of modern vibrator engineering and research. Replaces Motorola, Chrysler and any standard 4 Prong non-sync Vibrator. McGee contracts for a tremendous quantity to take care of your 1951 needs. Stock —V-53 Standard 4 Prong Vibrator $1.29 each. 10 for $11.90: 50 for $55.00

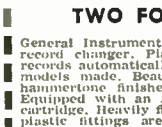
Buick Replacement same as Delco 5050500. Fits all Buicks. 1937 thru '47, etc. $1.95 each. 10 for $17.90.

Mallory 534C 7 Prong Reversible Sync., $1.95 each, 10 for $17.90.

Offset 4 Prong for Delco, etc..$1.39 each

PHONO MOTOR $3.50

9" Turntable heavy duty 78 RPM 110 Volt 60 Cycle, phono motor with heavy 1½ lb. turntable 4 pole motor. Don't confuse this with ordinary motor. Shipping weight 5½ lbs. Stock #GS-87, Net, $3.50; 3 for $10.00.



GENERAL INSTRUMENT 78 R.P.M. Record Changer SCOOP PRICE $11.95

TWO FOR $21.95

General Instrument 78 RPM automatic record changer. Plays 10- or 12-inch records automatically. One of the latest models made. Beautiful golden brown hammertone finished base. 12x12⅞". Equipped with an Astatic L-70 crystal cartridge. Heavily flocked turntable and plastic fittings are deep maroon colored. This may be our last chance to offer a 78 RPM changer at this price. Comes packed two to a master carton, just like they would be shipped to a set manufacturer. Order 2 changers for an additional saving. Shipping weight for 2 changers, 20 lbs. Stock No. 17-8G1. Net price, $11.95 each: two for only $21.95.

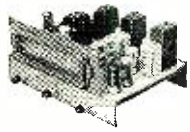
McGEE RADIO COMPANY

Prices F.O.B. K.C. Send 25% Deposit with Order, Balance Sent C.O.D. With Parcel Post Orders, Include Postage

TELEPHONE VICTOR 9045. WRITE FOR FLYER
1422 GRAND AVE., KANSAS CITY, MISSOURI

McGEE HAS COMPLETE KITS FOR SCHOOLS AND CUSTOM BUILDERS

7-TUBE FM-AM TUNER



★ AC SELF POWERED ★ 3 GANG TUNING ★ A COMPLETE KIT

$29.95

McGee has ready for delivery, this self powered AC, 7 tube FM and AM superhet tuner kit. Build yourself a professional looking tuner that may be connected to any audio amplifier. Receives broadcast 550 to 1650 kc and FM 88 to 108 mc. A 3 gang tuning condenser is used on both FM and AM. This extra stage of TRF makes a smoother working tuner. 2 IF stages on FM and one IF stage on AM (I.F. frequency 456 and 10.7 mc). Lighted slide rule dial with metal escutcheon plate. Our own lab designed and wired an original tuner using these parts. Chassis is ready punched and painted. Everything furnished including tubes and diagrams. Shipping weight 12 lbs. Stock No. RAL-8, net price $29.95.

MODEL ME6-2 $19.95

NEW MODEL 6-TUBE, 2-BAND RADIO KIT

A FULL 2-GANG SUPERHET KIT

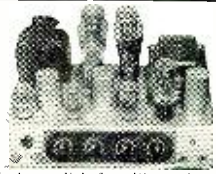
RECEIVES 550-1600 KC PLUS 6-18 M.C.

McGee's new 1951, 6 tube; AC-DC 2 band radio kit. Receives broadcast, 550 to 1600 kc and short wave, 6 to 18 mc. A straight forward superhet circuit with 2 gang tuning condenser, 456 kc I.F. transformers, etc. 5" PM speaker illuminated slide rule dial. Everything furnished, including tubes, diagram and a photo showing view of underside of completely wired chassis. The chassis pan and dial parts are factory production. With this kit, you can build a commercial looking and factory quality 2 band radio, housed in a streamlined plastic cabinet. Size: 13 x 6¾ x 6¼". Stock No. ME6-2, shipping weight 10 lbs. Net $19.95.

SELF POWERED AC Broadcast Tuner Kit. 3-Gang Tuning. Complete Kit, $12.95

A self-powered, 3-gang superhet tuner kit with R.F. stage. When wired according to our diagram will make a top quality broadcast tuner (550 to 1650 kc), for use with any amplifier. Don't class this with ordinary tuners; this has its own power transformer. This complete kit is furnished with a diagram, photos and tubes: 6SH7 R.F., 2—7E5 converter-mixer-oscillator, 6SF7 I.F. detector and 7Y4 rectifier. Connect to any audio amplifier. Ideal for use with our S-2020, TM-16 or 7X5 amplifier kits. Chassis size, 9½x8x4 4½" high. Shipping weight, 7 lbs. Broadcast tuner kit Model BT-38X. Net price, $12.95.

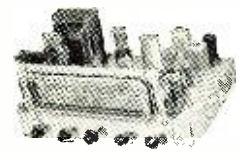
8-TUBE 22 WATT Wide Range Amp. Model 7x5 Kit Only $37.95



A complete kit, including tubes (3-7E5, 2-7F7, 2-6A3, plus rectifier), diagram and photos. All triode circuit makes for minimum harmonic distortion. Inputs for radio tuner any kind of phono pickup (crystal or G.E. variable reluctance) and either crystal or dynamic mike. Output transformer matches 8 ohm voice coil. Twin electronic tone controls, bass and treble with range selector switch for either juke box quality with heavy bass response or brilliant symphonic range. The best quality amplifier kit we know how to make. Has a very wide range output and heavy power transformer. Response 18 to 20,000 CPS. 8 tube all triode amplifier kit, complete with tubes. Weight 25 lbs. Net $37.95.

10-TUBE RADIO KIT $29.95

3-GANG TUNING
MIKE INPUT
12 WATT
HI-FI AUDIO
BASE-TREBLE
BOOST



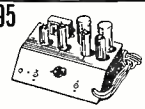
A NEW 1951 ALL-PURPOSE RADIO KIT

10-Tube Broadcast (550 to 1700 kc) Radio Kit for custom builders. Features 3-gang superhet circuit with A.V.C., high gain IF circuit, 8" slide rule dial. Chassis size 12½" long, 10" front to back, 6½" high. Audio inputs for a crystal or dynamic mike, and record changer or player. Tone compensation for standard crystal pick-up or General Electric variable reluctance. Push-pull 6V6 output tubes, shielded high fidelity output transformer matches 8 ohm PM speaker, husky power transformer, 2 tone controls for separate base and treble boost. A complete kit, including tubes (3—7E5, 6SH7, 6SF7, 2—7F7, 2—6V6, plus rectifier), diagram and instructions. Shipping weight 18 lbs. Stock No. BK-R10. Net price $29.95. 10" PM speaker, $6.95 extra. Crystal mike and desk stand, $4.95 extra. VM-406 3-speed automatic record changer, $22.95 extra.

5-TUBE BROADCAST SUPERHET RADIO KIT $12.95

Model NS-5X 5 tube AC-DC superheterodyne radio kit. Has loop antenna and 2 gang condenser, with lighted slide rule dial and attractive plastic cabinet. Receives broadcast, 550 to 1650 kc. Full size dynamic speaker, matched 456 I.F.'s, automatic volume control. This is a complete radio kit. Everything furnished, including diagram, photos and tubes: 14B6, 14Q7, 14A7, 50l5 and rectifier. Shipping weight 7 lbs. Stock No NS-5X. Net price $12.95.

Build Your Own Phono-Mike Broadcaster $7.95



Kit Model DE-6R. With this simple kit, you can build a 3-tube phono oscillator that also has a mike input. Will broadcast over any radio, within your home, (about 75 feet) from 800 to 1500 kc. Inputs for crystal mike or crystal phono pickup. Fader control fades from mike to record. Ideal for a home P.A. system, baby listener and home entertainment. A complete kit of parts including tubes. Kit Model DE-6R. Net price, $7.95. DE-6XWT, wired and tested. Net price, $9.95. Crystal mike and desk stand, $4.95 extra. Concealed microphone unit, only 1" in diameter and ¼" thick. Specify hidden mike when ordering. Stock No. T-001. Net, $3.95 extra.

3-SPEED RECORD PLAYER KIT $13.95

Complete record player kit to build a 3 speed player. Heavy 3 speed phono motor, universal crystal pickup, all parts and tubes to build a 70L7 type amplifier in an attractive walnut case with grill for speaker cut on top. Kit model D-3378, net price $13.95.

BUY YOUR WIDE RANGE COAXIAL SPEAKER AT McGEE

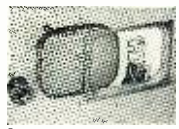
12" COAXIAL PM $12.95

A $32.50 retail value, 20 watt 12" coaxial PM speaker of quality used on radios of the $300 to $500 bracket. Hook up like any PM speaker. High pass filter is built on speaker. Matches 8 ohm output of radio or amplifier. Wide range response, 20 to 17,500 CPS. Model No. CU-14X. Ship. wt. 9 lbs. Special sale price, $12.95.

15" COAXIAL PM $17.95

Only $19.95 buys a full 15", 20 watt coaxial PM speaker, with built-in high pass filter. Hook to any 8 ohm output on radio or amplifier. Response below 20 to above 17,500 CPS. Good bass response. A lucky purchase makes this price possible. Full 32 oz. magnet in the woofer. 5" tweeter. Model P15-9. Ship. wt. 11 lbs. Sale price, $17.95.

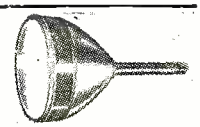
GUARANTEED T.V. PICTURE TUBES—PARTS



CONVERSION KIT FOR 16" $34.95 with Flyback and Conversion Data

Big deal of the month! A 16" rectangular, blacktface picture tube, plus a heavy plastic combination mask and safety glass, with gold colored trim; plus a 70 degree deflection yoke all for $34.95. This kit enables you to make conversions worth $75.00 or more. Shipping weight 25 lbs. Shipped via express or freight only.

"EVERY TUBE GUARANTEED"



Look over these picture tube prices and you will see, that for set replacement and conversion use, McGee offers you more for your money. Every picture tube guaranteed full replacement for 90 days. Every tube is a tremendous value. These tubes are not seconds, but 1st quality.

Type	Description	Net Price
10MP4	10" (replaces 10BP4)	$16.95
12LP4	12" round glass, neutral face	17.95
12QP4	12" round glass, neutral face	17.95
14BP4A	14" rectangular, black face	19.95
15DP4	15" round glass, neutral face	29.95
16AP4	16" round metal, neutral face	29.95
16AP4A	16" round metal, black face	29.95
16GP4A*	16" round metal, black face	24.95
16JP4	16" round glass, neutral face	22.95
16LP4	16" round glass, neutral face	29.95
16RP4A	16" rectangular, black face	24.95
17HP4A	17" rectangular, black face	24.95
19DP4A	19" round glass, black face	39.95
20CP4A	20" rectangular, black face	39.95

* 16GP4A is short neck tube (6⅞").

TUBES

Guaranteed quality tubes for radio sets and TV. Tubes have been difficult for us to keep in stock. If you need tubes and will accept them, either individually cartoned or unboxed, we will do our best to supply your needs.

Note: (B) Uncartoned, (C) Cartoned, (R) Raytheon, (KR) Ken-Rad, (S) Sylvania, (TS) Tung Sol, (NU) Nat'l. Union, (J) Jewel, etc.

0Z4		B	$0.69	6AL5			$1.00	7A5		R	C	$1.10	14N7		R	C	$1.32
1B3	KR	B	1.32	6AQ5	J	B	1.00	7A7		R	C	.90	14R7		C	C	1.32
1C6	KR	C	1.60	6AT6			.75	7A6		R	C	.90	14W7	KR	C	C	1.32
1H5			.90	6AU6			1.00	7B4		S	B	.90	14Y7	KR	C	C	1.20
1L4	S	B	1.00	6B8g		B	1.60	7B6		S	B	.90	14X7	KR	C	C	1.32
1LA4	R	C	1.32	6BA7			1.20	7C4		R	C	1.60	19BG6		R	C	3.00
1LA6			1.32	6BG6	R	C	2.40	7E6		P	B	1.10	24A	MW	C		1.10
1LC5	S	B	1.32	6BH6			1.60	7E7			B	1.32	25L6				1.60
1LC6	S	B	1.32	6C5	R	C	.83	7F7		S	B	1.10	25W4gt	R	C		1.00
1LD5	S	B	1.32	6C6	R	C	1.10	7H7	NU	C		1.00	25Z6gt	KR	B		.83
1LG5	S	B	1.32	6F5	R	C	.83	7L7	KR	B		1.32	26	KR	C		1.00
1LH4	S	B	1.32	6F7	R	C	1.60	7N7		J	B	1.10	27	S	C		.90
1LN5	R	C	1.32	6K5gy	H	B	1.20	7Y7		S	B	1.32	35/51	GE	C		1.10
1N5	KR	B	1.00	6K6gt	R	C	.83	7Y4		S	B	.90	35B5				1.00
1O5		B	1.32	6K7	R	C	1.00	7Z4		S	B	.90	35C5				1.00
1S5	R	C	1.00	6K8g	W	C	1.60	10Y			C	1.95	35Y4				.90
1T4	R	C	1.00	6L7g	B	C	1.60	12A8gt	R	C		1.10	35Z5		R	B	.75
1T5	B	B	1.32	6Q7gt	R	C	.90	12AL5				1.00	39/44		R	C	1.32
1U4			1.00	6S4	J	B	1.00	12BA7				1.20	41		R	C	1.00
1V2	R	C	.75	6S8			1.32	12BD6				1.00	42		KR	C	1.00
1X2A	R	C	1.32	6SA7			1.00	12J5gt	S	C		.75	43		R	C	1.00
2A5	R	C	1.10	6SD7	TS	C	1.45	12J7	NU	B		1.10	47		C		1.45
2A7	R	C	1.32	6SF5	TS	B	.83	12K8	KR	B		1.32	50A5	S	C		1.10
3A4	TS	C	1.00	6SF7		B	1.00	12Q7		C		.90	50C5				1.00
3LF4	R	C	1.32	6SG7	R	C	1.00	12SA7				1.00	50L6				.90
3Q4	R	C	1.10	6SH7	KR	B	1.10	12SF7		B		.90	50Y6		R	C	.90
3S4	R	C	1.00	6SJ7	R	C	.90	12SH7	KR	B		1.10	55		MW	C	.90
5T4	R	C	2.40	6SK7	R	C	.90	12SK7				.90	57		MW	C	1.00
5U4G		B	.83	6SQ7			.75	12SL7	R	C		1.20	58		GE	C	1.00
5W4	R	C	.83	6SS7	R	B	1.00	12SQ7		B		.89	76		Z	C	.83
5X4			1.30	6ST7	KR	C	1.32	12SR7	KR	B		1.10	77		R	C	1.00
5Y3gt	R	B	.63	6SV7	KR	C	1.45	14A4		R	C	1.32	78		R	C	1.00
5Y4	R	C	.75	6T8			1.60	14AF7		J	B	1.20	85			C	1.10
5Z4	R	C	1.32	6V6	KR	B	1.00	14B8		S	B	1.10	89		GE	C	1.10
6AG5			1.32	6W4	KR	B	.90	14C5	KR	C		1.32	117L7	KR	B		1.95
6AG7	R	C	1.60	6X4			.75	14E6		C	C	1.10	117N7	R	C		1.95
6AH6			1.95	6X5g	S	B	.75	14E7		R	C	1.32	11776	CR	B		1.20
6AK5			1.95	6Y7g	R	C	1.60	14H7		R	C	1.20	9003	JAN	C		1.00

T.V. BOOSTER REGENCY $19.10

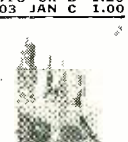
Regency DB-410 television booster. A real engineered unit, small and compact. Stug tuned, using 1—6J6 tube as neutralized push-pull amplifier. Dollar for dollar, your best booster buy. 5¾x 4¾". For 110 volt AC operation. Weight 6 lbs. Net price $19.10.

Astatic AT-1, "Channel-Chief" booster. Two tuned circuits and two broad circuits on all channels. Dual controls tune sound and picture independently. 8½x6½x7¼". Weight 6 lbs. Net price, $32.70.

Astatic BT-1 television booster. For either 72 or 300 ohm input and output. Woodgrain metal cabinet. Weight 4 lbs. Net $19.10.

BRAND NEW R. C. A. TELEVISION FRONT END-TUNERS

Sale Price **$14.95**



A fortunate purchase from a T.V. set manufacturer makes this value possible. RCA 13 channel completely tested and aligned T.V. tuner. A 13 channel selector switch with outer sleeve fine frequency control. Converter output transformer is attached for direct coupling to video and sound I.F. stages. Shaft length, 3⅜". Original dealer's cost on this item was over $30.00. McGee offers them to you brand new (they have never been soldered to or in sets) for only $14.95, less tubes. (3 6J6 tubes required). Shipping weight 2 lbs. Stock No. RCA-13P, less 3 6J6 tubes. Net $14.95, two for $27.95.

SARKES-TARZAIN 13-CHANNEL T.V. FRONT END WITH TUBES AND DIAGRAM $7.95

This popular Sarkes-Tarzain television front end is widely used today. The 13 channel rotary switch type with individually tuned coils. Price includes a schematic diagram and 3 tubes, 6C4 osc, 6BH6 RF and 6AG5 mixer. Regular factory cost is twice our price. Each tuner and its own tube sockets are wired ready to hook up to a video and sound IF strip. May be used with either intercarrier or separate sound IF circuits. Built-in fine frequency control. Ship. weight 3 lbs. Sarkes-Tarzain Type 2 TV tuner with tubes net..... $7.95

Combination deal, Sarkes-Tarzain TV tuner and 205-XX video coil kit, both for... $14.95

Sarkes-Tarzain Type 3—Same as Type 2 only has input IF coil built-on. Tapped for sound IF channel. Net..... $9.95

Sarkes-Tarzain Type 3 tuner and 205-XX coil kit both for..... $16.95

Video Coil Kit $7.95

20 matched TV video and sound I.F. coils. Intended for use with the RCA circuit. You get 6 peaking coils, 4—25.75 mc picture I.F.'s, 2—21.25 mc sound I.F.'s, discriminator and converter coil and 5 filament chokes. Stock No. 205-XX, weight 3 lbs. Net price. $7.95, $6.95 if purchased with a Sarkes-Tarzian TV tuner; all coils identified.

New 2-Tube Sarkes Tuner $7.95 Less Tubes

Sarkes Tarzain new two-tube model, type TT-3A, 12-channel television tuner. This is the new two-tube model requiring a 6J6 plus 6AK5 or 6AG5, or 6CB6, or 6AU6 RF tubes. Pre-factory aligned by trained factory personnel. Input feeds 21 M.C. broad band. Fine tuning control is over the channel selector shaft. Power requirements 120 to 140 Volts D.C. at 17 Mills plus 6.3 Volt filament. This tuner is offered at a terrific saving to you. Stock No. TT-3A. Net price, $7.95; two for $15.00, less tubes. Specify shaft length desired — 2 lengths available. 7½" as used on many late sets or 2⅞".

Mac's Service Shop

(*Continued from page* 64)

all of this mass of new information in my head. Then suddenly I wised up: what I needed to do was to apply the same technique to TV sets that I had been using in radio servicing. Each circuit was studied for just what contribution it made to the picture on the screen or the sound from the speaker. Every possible component failure was projected as a defect in the picture or the sound.

"That system made all the difference in the world. Once I got it through my thick head exactly how a picture on the screen was put together, precisely what contribution each circuit and component made to the composition of that picture, the whole thing suddenly came into sharp and clear focus. What is better, just as soon as I understood how a good picture was made, I was able to work backward from the picture to the cause of any defects in that picture.

"What burns me, though, is that this 'discovery' of mine was old stuff to many people. John Meagher of *RCA* had been harping on this method of attack for months, and he had been photographing distorted test patterns and explaining what circuit defects caused these patterns. Other companies, too, were and are using test pattern pictures liberally in their service information to illustrate various forms of trouble and misadjustment.

"But these two books represent the largest number of clear pictures arranged in a logical order that I have been able to find. I don't want you just to look at them or even to memorize them. I want you to *study* them. Beneath each picture is an explanation of likely causes of the picture distortion in terms of a particular part failure in a typical circuit; but I want you to go beyond that: I want you to give me, in each case, a clear and logical explanation of just *why* the failure of that component resulted in precisely the pattern-disruption shown.

"For example, a pattern with reduced height and poor vertical linearity is attributed to the change in capacity of a condenser in the plate circuit of the vertical discharge tube. I want you to explain *how* an increase in that capacity changes the waveform presented to the grid of the vertical output tube (being able to draw the correct and distorted waveforms) and then go ahead and actually show *how* this incorrect waveform causes the picture to be stretched 'here' and crowded 'there.' You grab me?"

"Yeah, I grab you," Barney said dubiously, "but I'll have to do a heck of a lot of brushing up on my TV theory. You want me to use that group of test pattern pictures as a kind of framework on which to hang all the knowledge of TV theory I have or can get hold of. It would be a lot simpler just to use them as a kind of 'rogue's gal-

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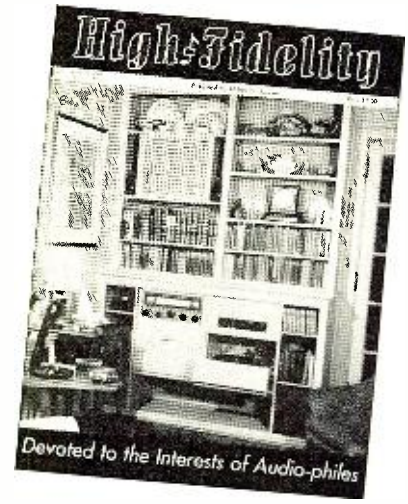

Here Is a Partial List of the Contents in the Current Issue

Custom Radio-Phonograph installations
A 7-page section, with 14 beautiful photographs, illustrates the newest methods of getting high-quality performance and million-dollar appearance at very reasonable cost. Philip Kelsey offers a wealth of ideas for your own use, and to sell others, if you are doing custom work.

Information about Orchestras and Recordings
C. E. Burke, one of the leading experts on recorded music, explains why much of the finest work of the classical and modern composers is excluded from public performances, and what the recording companies are doing now to make "lost" compositions available now.

Getting Top Performance from a Klipschorn
The performance of a given type of speaker depends, to a large extent, on the associated equipment used to drive it. So we asked Paul Klipsch to give our readers the benefit of his experience in selecting equipment to drive a Klipschorn. His reply makes very interesting reading.

The Growing Popularity of Fine Music on FM
Most of the 665 FM stations now on the air are doing an excellent job of providing fine entertainment to fast-growing audiences. This article tells about some of the stations that are building big audiences with programs planned for people who want the best in music.

A Review of Preamplifier Designs
This article, by Allen Macy, reviews the purpose, design, and performance of all the various standard makes of preamplifiers. From it, you can decide which particular model is best suited to your needs, or which might be better than what you are using now.

The FAS Audio System
There is no doubt but what the series of articles in RADIO COMMUNICATION on the Fowler-Allison-Sleeper system has inspired more people to build new audio systems, has done more to improve bass response, and has started more controversies than anything published before. For those who missed the original series, the complete data on building an FAS system is published in HIGH-FIDELITY.

Facts about Audio Amplifiers
Represented among the many different types of amplifiers are certain features of basic importance, others that are important only in specific kinds of installations, and a few that are merely point-of-sale features. Robert E. Newcomb brings out these points, good and bad, in his discussion of amplifier designs.

All about Important Record Releases
People from all over the world consult Jack Indcox about selecting records. His record reviews in HIGH-FIDELITY are invaluable to collectors because they include notes on the music, composers, conductors, and comparisons with other recordings of the same selections.

Other Features You Mustn't Miss
These are only a few of the features appearing in the current issue of HIGH-FIDELITY. It's a big magazine, with four or five times as many articles on audio and related subjects as in any monthly publication. And you will find it refreshingly different in style and appearance from anything you have ever seen before.

Don't Wait Till It's Too Late
A year's subscription (4 big quarterly issues) will give you a full 12 months' supply of information and new ideas you won't find anywhere else. And a 3-year subscription will save you exactly $6.00 over the single-copy price. The coupon below will bring you your first copy at once.

High-Fidelity

Published by Milton B. Sleeper

Radio Building, Great Barrington, Massachusetts

HIGH-FIDELITY MAGAZINE
Radio Building, Great Barrington, Mass.

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lery' for identifying an electronic 'criminal' when I meet up with one, but you aren't satisfied with just catching the crook and clapping him into jail. You want me to psychoanalyze him yet!"

Mac chuckled at this complaint and then went on: "After you think you are pretty hot as a pattern-puzzler, I'll use this book of pictures put out by *Sylvania* as a sort of final examination. There are nearly fifty pictures in here that will be strange to you. When you can just glance at them and tell me the probable cause of trouble in nine out of ten cases, I'll give you your diploma!"

"It could be worse," Barney said philosophically. "I was afraid you might try taking pictures of tough cases yourself for me to analyze."

"We are going to do that, too," Mac promptly countered. "I wrote *RCA* for how-to-do information on this subject, and John Meagher, with the kind of cooperation those fellows over in Harrison, New Jersey, always show technicians, promptly sent this information:

Film Speed	Shutter Speed	Lens Opening
Weston-Tungsten 40	½ sec.	f/4.5
Weston-Tungsten 80	⅕ sec.	f/4.5

"Those figures are for a perfectly stationary, fairly-bright pattern. If some part of the pattern is moving, shutter speeds of 1/50 or 1/25 must be used. I'm going to use a close-up lens on my camera and make it a practice to take a picture of every puzzling form of distortion I meet in servicing and which I cannot find duplicated in either the *RCA* or *Sylvania* books. These prints will be mounted on 4" x 6" file cards, together with data on the discovered cause of trouble, and then filed in a box or punched and inserted in the "Pict-O-Graph' books."

Barney heaved a big sigh. "There goes another of my simple pleasures," he mourned. "Up until now I have always associated a camera with pictures of beautiful babes, but from now on every time I see a *Kodak* I'll think of a test pattern!"

—30—

"Hey, fellows, I just got my ham license!"

PARTS and TUBES

ORDER from "PREMIER"
Your reliable source since 1926

INDIVIDUALLY BOXED—ALL BRANDS—STANDARD FACTORY GUARANTEE

0Z4	$0.83
0Z4G	.83
1A5GT	.90
1A6	1.60
1A7GT	1.00
1B3GT	1.32
1C5GT	1.10
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1D7G	1.60
1D8GT	1.95
1F4	1.32
1F5G	1.32
1G4GT	1.32
1G6GT	1.32
1H5GT	.83
1H6G	1.60
1J5G	1.32
1J6G	1.60
1J6GT	1.60
1L6	1.32
1LA4	1.32
1LA6	1.32
1LB4	1.32
1LC5	1.32
1LC6	1.32
1LD5	1.32
1LE3	1.32
1LG5	1.32
1LH4	1.32
1LN5	1.32
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1Q5GT	1.32
1R5	1.00
1S5	.90
1T4	1.00
1T5GT	1.32

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Twin V Antenna with 8-ft. mast $6.95
In-line Antenna $8.95
All band YAGI with 8-ft. mast can be used in-line or hi-low **$10.74**
WORLD'S BEST DELUXE CONICAL **$10.74**
with 8-ft. mast and heavy cast fittings.

TWIN LEAD
55 web virgin polyethylene, 300 ohm twin lead in either clear or brown ..... 1000 ft. $19.95
100 ft. 2.25

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450 Working Volts

8—450 V. ..... ea. 29c
10—450 V. ..... ea. 35c
20—450 V. ..... ea. 47c
30—450 V. ..... ea. 59c
30—450 V w/ 20-20—25 V. ..... ea. 35c
8-8—450 V ..... ea. 48c
10-10—450 V. ..... ea. 52c
20-10—450 V. ..... ea. 55c
20-20—450 V. ..... ea. 59c
30-30—450 V. ..... ea. 65c
40-40—450 V. ..... ea. 74c
20-20-20—450 V. ..... ea. 73c
10-10-10-20—450V-150-25 V. ea. 59c
30-30—400 V-350 V ..... ea. 47c
30-30-25—400 V-25 V ..... ea. 47c

150 Working Volts

8—150 V. ..... ea. 23c
8-8—150 V. ..... ea. 23c
10—150 V. ..... ea. 23c
10-10—150 V. ..... ea. 29c
10-10-10—150 V. ea. 35c
15—150 V. ..... ea. 25c
20—150 V. ..... ea. 30c
30—150 V. ..... ea. 35c
40—150 V. ..... ea. 35c
15-15—150 V. ..... ea. 35c
20-10—150 V. ..... ea. 35c
20-20—150 V. ..... ea. 35c
30-20—150 V. ..... ea. 47c
30-30—150 V. ..... ea. 47c
35-35—150 V. ..... ea. 47c
40-20—150 V. ..... ea. 47c
40-40—150 V. ..... ea. 47c
50-50—150 V. ..... ea. 47c
60-60—150 V. ..... ea. 47c
40-40—150 V 20-25 V ..... ea. 47c
50-30—150 V. ..... ea. 47c
20-20-20—150 V. ea. 47c
40-40-20—150 V. ea. 47c
40-40—150 V— 20-50 V ..... ea. 47c
20-16-16—350 V Sprague type ea. 47c
25-25—150 V- 200-10 V ..... ea. 47c

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10-25 V
20-20—25 V
20-20-20—25 V
10-50 V
25-50 V
30-50 V
50-50 V
100—25 V ..... 29c ea.
15-15-40-20— 150 V-25 V. ..... ea. 35c
20-20—150 V- 25 V. ..... ea. 47c
30-30-200—150 V-10 V. ..... ea. 47c
20-16-16—150 V. ea. 47c

19c ea.

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100 Condensers assorted in package **$7.14**

.001	6c	.0005		
.002	6c	.00025		
.005	6c	.0005		
.01	8c	500 mmf		7c
.02	8c	250 mmf		
.05	10c	100 mmf		
.1	11c	50 mmf		

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In lots of 25 or more ..... ea. 11c
.25 mfd. 600 V. Less than 25 ..... ea. 14c

400-VOLT BY-PASS CONDENSERS
.05 mfd ..... ea. 7c
.2 mfd. ..... ea. 7c
.25 mfd. ..... ea. 12c
.5 mfd. ..... ea. 18c

BUFFER CONDENSERS
.005 mfd. 1600 WV
.008 mfd. 1600 WV
.01 mfd. 1600 WV
..... ea. **18c**

VARIABLE CONDENSERS
Two-gang for superhet or TRF. .ea. **53c**

TUBES—Radio and TV

Additional 10% discount in lots of 100 or more tubes, assorted.

1U4	$1.00	6B4G	$1.60	6S8GT	$1.32	7F7	$1.10	12SQ7	$0.75	35Z6G	$1.32
1U5	.90	6B5	1.60	6SA7	1.00	7F8	1.32	12SQ7GT	.83	36	1.32
1V	1.10	6B6G	1.10	6SA7GT	1.00	7G7	1.32	12SR7	1.10	37	.90
1X2A	1.32	6B7	1.60	6S87Y	1.20	7H7	1.00	12SR7GT	1.10	39/44	1.32
2A3	1.60	6B8GT	1.60	6SC7	1.00	7J7	1.32	12Z3	1.32	41	.83
2A5	1.10	6BA6	.90	6SD7GT	1.45	7K7	1.32	14A4	1.32	42	.83
2A6	1.32	6BA7	1.20	6SF5	.83	7L7	1.32	14A5	1.95	43	.83
2A7	1.32	6BC5	1.00	6SF5GT	.90	7N7	1.10	14A7	1.10	45	.83
2E5	1.90	6BC7	1.10	6SF7	1.00	7Q7	.90	14AF7	1.20	45Z5GT	.90
2A5GT	2.40	6BD5GT	1.60	6SG7	1.00	7R7	1.10	14B6	1.10	46	1.32
3B7 1291	1.32	6BE6	.90	6SH7	1.10	7S7	1.32	14B8	1.10	47	1.20
3C8	1.60	6BF5	1.10	6SH7GT	1.10	7V7	1.32	14C5	1.32	50	1.95
3E6	1.32	6BF6	.83	6SJ7	.90	7W7	1.32	14C7	1.20	50A5	1.10
3LF4	1.32	6BG6G	2.40	6SJ7GT	.90	7X6	1.10	14E6	1.10	50B5	1.00
3Q4	1.10	6BH6	1.00	6SK7GT	1.00	7X7	1.32	14E7	1.32	50C5	1.00
3Q5GT	1.20	6BJ6	1.00	6SL7GT	1.20	7Y4	.90	14F7	1.10	50C6G	1.45
3S4	1.00	6BN6	1.60	6SN7GT	1.10	7Z4	.90	14F8	1.10	50L6GT	.83
3V4	1.00	6BQ7	1.60	6SQ7	.75	10	1.95	14H7	1.20	50X6	1.10
5T4	1.95	6C4	.83	6SQ7GT	.83	12A	.68	14J7	1.32	50Y6GT	.90
5U4G	.83	6C5GT	.83	6SR7GT	.90	12A6	.79	14N7	1.32	50Y7GT	1.00
5V4G	1.20	6C6	1.00	6SS7	.90	12A7	1.60	14Q7	1.10	55	1.10
5W4	.83	6C8G	1.60	6T7G	1.10	12A8GT	1.00	14R7	1.32	56	.90
5W4GT	.83	6C8G	1.00	6T8	1.60	12AH7GT	1.32	14X7	1.32	57	1.00
5X4G	.90	6CD6G	3.00	6U4GT	1.32	12AT6	.75	14Y4	1.20	58	1.00
5Y3GT	.64	6D6	1.00	6U5	1.00	12AT7	1.45	19BG6G	3.00	59	1.76
5Y4G	.75	6D8G	1.60	6U6GT	1.00	12AU6	1.00	19J6	1.60	70L7GT	1.95
5Z3	.90	6E5	1.10	6U7G	.90	12AU7	1.20	19T8	1.45	71A	1.00
6A4	1.32	6F5GT	.83	6V6GT	1.00	12AV6	.75	20	1.95	75	.83
6A3	1.60	6F6GT	.83	6V7G	.90	12AV7	1.60	22	1.60	76	.83
6A4	1.60	6F8G	1.60	6W4GT	.90	12AW6	1.32	24A	1.10	77	.83
6A5G	1.95	6G6G	1.32	6W6GT	.90	12AX7	1.20	25A6	1.32	78	.83
6A7	1.00	6H4GT	1.32	6X4	.75	12BA6	.90	25A7GT	3.00	79	1.32
6A8GT	1.00	6H6	.83	6X5GT	.75	12BA7	1.20	25AC5GT	1.45	80	.68
6AB4	.90	6H6GT	.83	6Y6G	1.20	12BE6	.90	25BQ6GT	1.60	81	1.95
6AB5/6N5	1.32	6J5GT	.75	6Y7G	1.60	12BF6	1.32	25C6G	1.45	82	1.32
6AB7	1.60	6J6	2.42	6Z5G	1.10	12BH7	1.20	25D8	1.95	83	1.32
6AC5GT	1.45	6J7G	1.00	7A4	1.00	12C8	1.60	25L6GT	.90	84	.90
6AC7	1.45	6J8G	1.60	7A5	1.00	12F5GT	.90	25W4GT	1.00	85	1.10
6AD7G	1.60	6K7GT	1.20	7A6	.90	12H6	.90	25Y5	1.45	89Y	1.10
6AF6G	1.32	6K8GT	.83	7A7	.90	12J5GT	.75	25Z5	1.32	117L7	1.95
6AG5	1.32	6K7G	.83	7A8	.90	12K7GT	.83	25Z6GT	.75	117N7GT	1.95
6AG7	1.60	6K7GT	.83	7AD7	1.60	12Q7GT	.90	26	.90	117P7GT	1.95
6AH6	1.95	6K8	1.20	7AF7	.90	12S8GT	1.32	27	.75	117Z3	.75
6AK5	1.95	6K8GT	1.20	7AG7	1.10	12SA7	1.00	30	1.00	117Z6GT	1.20
6AK6	1.20	6L5G	1.32	7AH7	1.10	12SA7GT	1.00	31	1.32	VR150	1.50
6AL5	1.00	6L6	1.76	7B4	.90	12SC7	1.10	32L7GT	1.60	482B	1.20
6AL7GT	1.32	6L6G	1.76	7B5	.90	12SF5GT	1.00	33	1.60	483	1.20
6AQ5	1.00	6L6GA	1.76	7B6	.90	12SF7	1.00	35/51	1.00	199V	1.20
6AQ6	1.60	6L7	1.20	7B7	.90	12SG7	1.00	35A5	.90	807	1.75
6AQ7GT	1.20	6N6G	1.45	7B8	.90	12SH7	1.10	35B5	1.00	813	9.95
6AR5	.83	6N7GT	1.20	7C4	1.60	12SH7GT	1.10	35C5	1.00	1619	.25
6AS5	1.00	6P5GT	1.20	7C5	.90	12SJ7	.90	35L6GT	.90	1622	1.75
6AT6	.75	6Q7	1.00	7C6	.90	12SJ7GT	.90	35W4	.64	2050	1.75
6AU5GT	1.32	6Q7GT	.90	7C7	.90	12SK7	.90	35Y4	.90	2051	1.25
6AU6	1.00	6R7GT	1.32	7E5	1.32	12SK7GT	1.20	35Z3	.90	7193	1.20
6AV6	.75	6S4	.90	7E6	1.10	12SL7GT	1.20	35Z4GT	.75	VT51	.30
6AX5GT	.68	6S7GT	1.60	7E7	1.32	12SN7GT	1.10	35Z5GT	.75	VT52	.30

TV PICTURE TUBES

10BP4 ..... $11.95
12LP4 ..... $19.95
14BP4 ..... $22.95
7JP4 ..... $17.95
16RP4 ..... $29.95
16TP4 ..... $29.95
17BP4A $31.95
19AP4A $44.95

VIBRATORS

Standard small size, 2¾" in height (the popular small size), bright and shiny
Stock up while they last, all 4-prong Universal Vibrators.
$1.59 each

OUTPUT TRANSFORMERS

STANDARD REPLACEMENT

For 50L6, 35L6, 50A5, 35A5, 117L7 ..... **74c ea.**
For 6V6, 6F6, 3Q5, 3Q4, 3S4, 3V4, 41, 42, 6K6, 2A3, 45, 6L6 **79c ea.**

UNIVERSAL OUTPUT TRANSFORMERS SPECIAL
Up to 12 watts to any speaker (while they last) ..... ea. **$1.18**

VOLUME CONTROLS

VERY BEST BRANDS	10 or more Each	Price Each
½ meg. or 1 meg. or 1/10 meg. with switch—long shaft	52c	59c
2 meg. for battery sets—switch, long shaft	52c	59c
½ meg., 1 meg., 1/10 meg. or 2 meg., long shaft, less switch	34c	38c
1000 ohm	19c	23c
5000 ohm	19c	23c
½ meg. with 6" shaft	59c	71c

10% deposit with order, balance C.O.D. $1.00 handling charge for orders less than $5.00. All shipments F.O.B. Chicago. Our parts and tubes are warranted to be 100% replacements for the prototypes in the listings above. Prices are subject to revision without notice. Satisfaction Guaranteed. Illinois residents add 2% sales tax. ORDER TODAY!

SPEAKERS

12" Coaxial PM Speakers ..... **$12.95 ea.**

A high fidelity compact package with high pass filter attached to frame. 20 watt capacity; 20-17500 cps. response; 8 ohm VC. A REAL BUY!

Very Best Quality—NATIONAL BRANDS—Individually Packed

	10 or more each	Price Each	
3"	$1.14	$1.26	5 x 7 ..... $2.25 ea.
4"	1.55	1.65	6 x 9 ..... $3.25 ea.
5"	1.69	1.79	5" PM with 50L6 o.
8"	2.94	3.23	p. Xformer $1.99
10"	4.74	5.10	
12"	5.94	6.54	

SPECIAL—6" PM Speakers, big Alnico 5 magnet
In lots of 10 ..... each $1.55
Individual 1.67

PILOT LIGHT SPECIAL

No. 47—100 for ONLY . . . $3.95
Box of 10 Bulbs . . 45c
#44 and #51 100 PILOT LIGHTS . $4.74
Box of 10 ..... 59c
#40 #41 #46 100 Bulbs $5.88
Box of 10 Bulbs 65c

TV Screen Filters with suction cups—best quality INDIVIDUALLY BOXED for highest re-sale value. 10" ..... $1.40 12" 2.34

IF TRANSFORMERS

Standard Replacement Regular size 455 Kc. ..... ea. **35c**
Midget 455 Kc. ..... ea. 47c
Midget 10.7 AM-FM 59c

6-FT. LINE CORDS

Good Rubber with plug.
10 for **$2.13**
Underwriters' Approved.
10 for **$2.79**

HOOK-UP WIRE 100 ft. **69c**

OSCILLATOR COILS

for any 5-tube AC-DC **23c**

OCTAL SOCKETS 10 for **59c**
7-PIN MINIATURE SOCKETS ..... 10 for 59c
Loctal Sockets ..... 10 for 59c

Order Today!

Premier RADIO TUBE CO.
551 West Randolph St.
Chicago 6, Illinois
Phone ANdover 3-1590

OLSON AKRAD

Olson Radio Warehouse, Inc.

73 E. Mill St. • Akron 8, Ohio

Weather-proof Trumpet

30-WATT TRUMPET AND DRIVER

A high quality trumpet and driver having excellent frequency characteristics. Completely weatherproof and designed for sound trucks, churches, auditoriums, ball parks and gatherings of all kinds where high volume with good fidelity is required. Made by a nationally famous manufacturer. Brand new factory-sealed cartons. Trumpet bell diameter 18", overall depth 16½". Equipped with adjustable mounting brackets. Driver unit will operate continuously at 30 watts and is fully guaranteed. Voice coil impedance 15 ohms. Both driver unit and trumpet have standard threads. Shpg. weight 17 lbs. Weatherproof Trumpet.

$13.95 S-152-A

S-152-A, ea. $13.95

30-watt Driver unit. Shpg. weight 8 lbs.

S-151-A, ea. **$15.95**

25-WATT TRUMPET & DRIVER

S-161

$16.95

Never before such a value. Think of it! A complete Trumpet and Driver unit guaranteed to operate at 25 watts continuously. Can be used effectively with any amplifier, either indoors or out. Bell diameter 9", length 9¾". MADE BY A NATIONALLY FAMOUS MANUFACTURER. Brand new in factory-sealed cartons. Complete with adjustable mounting bracket. Voice coil impedance 15 ohms. Shpg. wt. 8 lbs.

SPECIAL COMBINATION DEAL. Both S-152-A and S-151-A Driver unit, both for only **$28.95**

3-VOLT CARTRIDGE

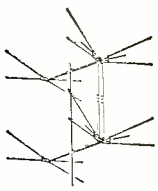
OLSON'S SPECIAL

ORDER TODAY:

Standard 3-volt cartridge. Mtg. centers ½". Excellent response, 50-6000 cps. Complete with pin plug tips.

XC-50 Single, Ea. $1.99.
Lots of 10, Ea. **$1.79**

TV INSTALLATION MEN



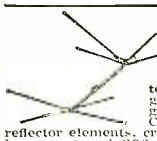
If you install TV Antennas, Olson wants you to take advantage of this terrific Antenna Value. High gain Stacked Conical Array with high frequency stubs. Ideal for "Fringe" Area Reception. Sturdily constructed, elements are aluminum. Easily assembled.

This Is a Terrific Value! Each Antenna consists of two conical bays plus a pair of matching Q bars. Less mast. Packed—3 Antennas to a carton. This gives you six bays and 3 pairs of Q bars.

Sold Only in Boxes of 3 Antennas

AV-66. In lots of 3, each..... **$8.66** Carton of 3..... $25.98 Weight 25 lbs.

TV ANTENNAS



Here is a real bargain for TV installation men. Genuine Conical TV Antennas scientifically designed to give optimum reception. Highest grade aluminum tubing is used. Complete with antenna members, reflector elements, cross arm and cross arm brackets. Less mast and 300 ohm twin-lead line. Take any size masts up to 1⅜" O.D. Packed in factory sealed cartons of 6 Antennas to a box.

SOLD ONLY IN BOXES OF 6 ANTENNAS

AU-62. In lots of 6, each ..... **$3.83** Carton of 6, wt. 25 lbs.. **$22.98**

POPULAR TV COMPONENTS

These TV parts are made by famous name manufacturers. A lucky purchase makes possible these bargain prices. Stock up now. Each part shown here uses Alnico 5 magnet material which is practically impossible to obtain. Get your share of these scarce components at far less than wholesale.

EM-PM FOCUS COIL

T-90 Special, While they last, each.... $2.98

Latest style combination EM-PM type requiring less power than the straight EM coils. Uses a very heavy Alnico 5 magnet thereby maintaining a more constant focus. This focus coil is used in scores of TV sets including General Electric, Stromberg-Carlsen, Air King and many more. Can be used on all 16"-70° and 19"-66° Kinescopes. Here's a real value. Buy now and save. **Because of the shortage of Cobalt these will not be available after our present stock is gone.**

ION TRAP

T-91 Special. While they last, each.... 98¢

Well made ion trap with two powerful Alnico 5 magnets. Exceptionally well made. Bronze spring keeps trap firmly against kinescope neck. **Because of the shortage of Cobalt these will not be available after our present stock is gone.**

FOCALIZERS

T-89 Special. While they last, each.... $1.98

Genuine focalizers, also known as focus magnets. Provides sharp focus relatively independent of regulation in the low voltage power supply. No connections necessary. Widely used in many 1950 models. Utilizes heavy duty Alnico 5 magnet.

UNIVERSAL VIDEO PEAKING COILS

L-39 package of 6 coils with instructions, per pkg. ... 98¢

Adjustable from 31 to 820 micro-henrys. No need to carry a big stock of peaking coils if you have a supply of these. Nylon insulated wire. Here's a real Olson value.

DEFLECTION YOKE

Deflection Yoke for use with 10BP4, 12LP4, 16AP4 and all similar kinescopes, same RCA 205D1 WT. 2 #. **T-84, Olson's Price, only....$2.79**

Deflection Yoke for use with kinescopes requiring 70 degree magnetic deflection such as Rectangular 14BP4, 14CP4, 16BP4, 16TP4, 16KP4 and round 16GP4. WT. 2 #. **T-86, Olson's Price, only.....$4.49**

$2.99 Hi-Voltage Flyback output transformer for 10" & 12" kinescopes. Provides 9KV. Same as RCA 211T1. WT. 4 #. **T-82, Olson's Price, only $2.99**

300-Ohm Lead-in

$4.00 High grade, low loss. For all TV installations. Ship. wt. 3 lbs. **W-68.** 100 ft. coil.

FREE—SEND FOR OUR LATEST RADIO AND TELEVISION BARGAIN CATALOG

BUY ALL YOUR RECORDING NEEDS FROM OLSON

STEEL RECORDING WIRE

For all standard wire recorders. Frequency response is excellent. Stainless steel wire.

X-165 ½ hr. spool..... $1.98
X-166 1 hr. spool..... $2.98

TAPE

Fine magnetic recording tape. Frequency response, 50 to 8,000 cycles at 7½" per second. Uniformly coated with red oxide. Available in paper base and plastic base which is stronger. Order your recording tape from Olson. Get the best for less.

PAPER BASE

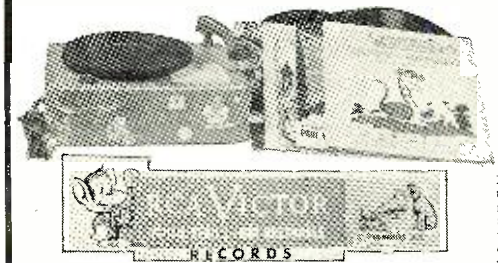
Stock No.	Size	Olson's Price, ea.
X-203	¼"x 600 ft.	$1.35
X-205	¼"x1200 ft.	2.10

PLASTIC BASE

X-204	¼"x 600 ft.	$2.10
X-206	¼"x1200 ft.	3.30

AMAZING RECORD PLAYER DEAL

*AT LESS THAN THE COST OF THE PARTS



$19.97 RA-60 Your Special Price At Olson's

Here is a once-a-year special. In this deal you get a nationally famous 78 RPM Record Player and $10.00 worth of genuine RCA Victor non-breakable children's records. You couldn't buy the parts alone at this price.

And best of all—this is not a kit. The phonograph comes to you completely assembled and factory tested. No troublesome wiring. No mistakes. Just plug in—put on the RCA non-breakable records which you get with the outfit and you have dependable entertainment. The amplifier employs 2 tubes, a 50L6 and a 35Z5. Motor is Alliance, the finest. The crystal tone arm is made by Astatic. Shure and Electro-Voice. In addition you get a complete set of RCA Victor non-breakable Children's Records which include such favorites as "Happy the Rumburg," "The 500 Hats of Batholomew Cubbins," "Rapunzel," "Aladdin and His Lamp," etc. Discs are enclosed in beautifully colored albums giving each story so that the child can follow the recording.

The cabinet is decorated with gay circus figures and the volume can be easily regulated by the full range volume control. Operates on 115 volts AC. Shpg. wt. 15 lbs.

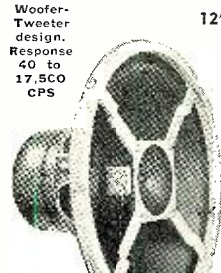
Don't delay, order several now. The price is low enough so it pays to order even for the parts contained.

NO MORE WHEN THESE ARE GONE

*Look what the parts would cost if bought separately even at our SPECIAL SALE PRICE.

78 RPM Motor	$ 3.79
Phono arm and cartridge	2.99
Amplifier	3.98
Set of tubes for amplifier	1.89
PM Speaker	1.99
Output Transformer	.99
AC Cord	.29
Decorated Case	4.99
Set of RCA Victor Non-Breakable Records	10.00
	$30.31

Woofer-Tweeter design. Response 40 to 17,5CO CPS



ORDER NOW!

12" CO-AXIAL SPEAKER

$13.95 S-160

Months of research went into the design of these high efficiency speakers. The 12" woofer section is driven by a heavy Alnico 5 6.8 oz. magnet and this part delivers the bass notes.

The 3" tweeter which is built into the center of the speaker is driven by a 2.15 oz. Alnico 5 magnet and delivers the treble notes. The high pass filter is built into the speaker and the entire combination gives you tone you never dreamed possible. There are only two wires to connect to any radio or amplifier and the speaker is ready to play for you. Voice coil impedance is 8 ohms. This high quality speaker should not be confused with inferior makeshift units. Olson sells these speakers on an ironclad money-back guarantee if you are not 100% satisfied. Order today. Shpg. wt. 8 lbs.

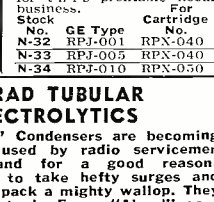
Genuine Alnico 5 PM Speakers

Because of the shortage of Cobalt (used in Alnico 5 powerful magnets) these speakers will not be available after our stock is gone. Protect yourself—Order now—Order enough. These speakers are made by a nationally famous manufacturer and are guaranteed to give 100% satisfaction. Frequency response is excellent. All speakers have 3.2 ohm voice coils except 12" which are 6-8 ohm.

Stock No.	Size	Watts	Shpg. wt. lbs.	Each
S-4	4"	3	2	$1.69
S-5	5"	3	2	1.79
S-8S	5"	5	2½	2.19
S-7	6"	5	2½	2.29
S-102	6"	6½	3	2.69
S-114	6x9"	9	4	3.39
S-96	7"	6	3	3.39
S-86	8"	7	4	3.49
S-111	12"	10	5	5.95
S-112	12"	13	6	6.95

Exact Replacement GE Needles

USED IN ALL GE VARIABLE RELUCTANCE CARTRIDGES



No service shop, large or small, should be without a stock of these popular replacement needles. The three types listed below will take care of all General Electric Variable Reluctance Phono Cartridges. Equipped with GENUINE Sapphire tips. 100% guaranteed. Beautifully packaged. Order some of each—be ready for this profitable needle replacement business.

Stock No.	For GE Type	Cartridge No.	Tip	Your Cost
N-32	RPJ-001	RPX-040	3 MIL	$2.06
N-33	RPJ-005	RPX-040	1 MIL	2.06
N-34	RPJ-010	RPX-050	DUAL	3.50

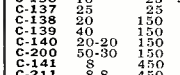
OLSON'S NEW AKRAD KIT —WITH 4-DRAWER STEEL CABINET FREE

$6.95

Reg. List Price $18.38. AS-36

We have a limited quantity of Olson Akrad "Super Sealed" by-pass condensers available in 4 drawer steel cabinets, size 6¼x5¾x8⅛. Drawers have compartments. Condensers are designed to give long dependable service even in the tropics. **Kit Contains 42 Condensers.** You get the 4 drawer steel cabinet and the following 42 Olson Akrad "Super Sealed" by-pass condensers.

Qty.	Cap.	Volts	Qty.	Cap.	Volts
2	.001	600	10	.05	600
2	.002	600	10	.1	600
2	.005	600	2	.005	1600
5	.01	600	2	.008	1600
5	.02	600	2	.01	1600



Packed 10 of a size to a box. Order 10 of a size.

No.	Cap.	W.V.	Each
C-136	10	25	$0.25
C-137	25	25	.30
C-138	20	150	.39
C-139	40	150	.45
C-140	20-20	150	.59
C-200	50-30	150	.69
C-141	8	450	.39
C-211	8-8	450	.69
C-142	16	450	.57
C-197	20	450	.69
C-198	30	450	.79
C-199	40	450	.89

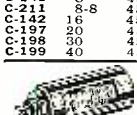
AKRAD TUBULAR ELECTROLYTICS

Olson "Akrad" Condensers are becoming more widely used by radio servicemen everywhere—and for a good reason! They're made to take hefty surges and overloads and pack a mighty wallop. They cost so little, too! Every "Akrad" condenser is backed by Olson's famous Satisfaction or Your Money Back Guarantee! Always get "Akrad." Compact size with superior characteristics. Easily mounted. Sealed aluminum inner tubes insure maximum life. Tinned copper leads. Give long, trouble-free service.

RPX-040 XC-45 $3.49 EACH

Variable Reluctance Cartridge with Removable Stylus

Regular price is $9.95 on this Phono Cartridge with removable 3 mil Stylus for 78 RPM discs. Stylus pressure 3/4 oz.



CLOSE-OUT ENTIRE STOCK!

CONDENSERS

Save big money during Olson's big close-out sale. Over 35,000 brand new shiny electrolytic condensers will be purchased by Olson's customers. Be sure of getting your share. Order early.

Stock No.	Fig.	Capacity	Volts	Close-out Price
C-530	A	8	450	$0.59
C-510	B	15	300	.29
C-501	B	10-10-20	450-450-25	.39
C-617	B	20-10-10-10	450-450-450-450	.99
C-502	C	32	350	.39

Paper Filter Block

Hard to get, but Olson has these 4 MFD 400 volt tough condensers. Not Electrolytic. Dry construction throughout. Size 3¼"x2"x1". Reg. list price $2.95.

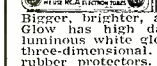
C-523 Olson's Price, each..... 49c

FAIRCHILD GRINDER

TL-3 each **$9.98**

Every service shop needs one of these handy tools made by Fairchild, famous manufacturer of precision electric grinders. Regular nationally advertised price is $19.75. The set consists of 1—115 volt high speed, air cooled grinder, 6 assorted grinding wheels, 1 circular saw blade, 1 hardened steel reamer, 1 buffing brush, 1 abrasion stone and a natural finish wood stands on 10"x5"x 3" to house the grinder. Shipped in original factory sealed cartons.

RCA "FIRE GLOW" FLUORESCENT SIGN



2F-985 **$8.95** SPECIAL PRICE

Bigger, brighter, and whiter. The new RCA Fire Glow has high daytime visibility and brilliant luminous white glow at night. The plastic face is three-dimensional, cased in steel. Sign stands on rubber protectors, or can be hung from ceiling with chain supplied. 110 Volt, 60-cycle AC operation. Complete with fluorescent lamp. Shpg wt. 15 lbs. 26¾" long, 8¾" high.

PHILCO 1951 AUTO RADIO

THE ONLY UNIVERSAL ONE-PIECE AUTO RADIO FOR ALL CARS

FITS ANY CAR OLD OR NEW

OLSON'S GREAT VALUE!

A brand new Philco 6-tube super-het auto set with 30% more undistorted sound output for rich, clear-voiced volume and greater range. New 3-gang permeability tuner. Built-in interference filtering.

New streamlined design, with slide-rule dial encased in gleaming chrome finish to harmonize with modern cars. Rugged, compact steel case finished in dark blue hammertype lacquer, has sloping front—neat, attractive, space-saving—out of passengers' way. Installed in a few minutes beneath the instrument panel of the car. Controls are easy to reach and tune . . . yet set is out of the way and virtually out of sight like a built-in part of the car. Complete with tubes, mounting bracket, generator condenser and distributor suppressor. Size 5¾"x 8⅜"x7¼". Shpg. wt. 20 lbs.

Model CR-501

$34.37

OLSON AKRAD

THE HOUSE OF RADIO AND TELEVISION BARGAINS

3-SPEED RECORD PLAYER

*AT LESS THAN THE COST OF THE PARTS

$19.97 YOUR SPECIAL PRICE FROM OLSON'S

Model RA-56

While they last Olson offers these high quality 3-speed record players at less than the cost of building one. The players were made for a nationally famous store and Olson was able to get one thousand to move at this fantastically low price.

Remember, this is not a kit, but a completely assembled 3-speed record player with built-in 2-tube amplifier and speaker, housed in a beautiful carrying case. Plays all 33⅓, 45 and 78 RPM records up to 12" diameter. Motors are made by Alliance and the finely balanced low pressure tone arms are supplied by Astatic, Shure and Electro-Voice. Every phonograph is 100% guaranteed. Original factory-sealed carton. Operates on 115 volts AC. Shpg. wt. 15 lbs. Don't delay, order several now. The price is low enough so it pays to order even for the parts contained.

*Look what the parts would cost if bought separately even at our SPECIAL SALE PRICE.

3 Speed Motor	$ 5.99
3 Speed Phono Arm	4.95
Osmium Tipped Needle	.69
Amplifier	3.98
Set of Tubes for Amplifier	2.19
PM Speaker	1.69
Output Transformer	.69
Set of Knobs	.24
AC Cord	.29
Portable Case with Cover	5.49
Total	$26.11

NO MORE WHEN THESE ARE GONE

AUTO RADIO ANTENNAS

RUSTPROOF BRASS TUBING! INSTANTLY ADJUSTED! DURABLE SIDE COWL MOUNT

3 section; extends to 66". Includes low loss lead-in cable.

AU-1 **$1.99**

TRIPLE CHROME PLATED HIGHEST QUALITY INSULATORS! TOP COWL MOUNT

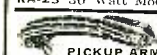
3 section; extends to 54". Includes low loss lead-in cable.

AU-8 **$2.99**

AMPLIFIERS

Latest models. Incorporates dual tone controls for Bass and Treble. Input for crystal, ribbon or dynamic mike and phono. Output Impedances, 4, 8, 15 and 500 ohms. Less tubes.

RA-28 15 Watt Model $21.95
RA-23 30 Watt Model $34.95



PICKUP ARM

With crystal cartridge. Plays all 78 RPM records. Olson's price is less than you'd pay for the cartridge alone.

M-58 Each $2.99

3 SPEED PICKUP ARM

Cartridge flips by means of a lever. Equipped with dual cartridge, one side plays 33⅓ and 45 and other 78 RPM. Double needle included.

M-64 Each $4.95

Build a Receiver Set of Basic Components

Kit of 5 parts . . . AS-38

You get this kit of 5 basic parts to build an AC-DC set or portable: **$1.89**

Parts	Reg. List Price
Loop	$0.95
R. F. Coil	1.10
I.F. Transformer (456 KC) Input	1.60
Output	1.60
Oscillator Coil	.75
List Price of Set	6.00

Use any 365 mfd variable for tuning. Covers 535-1625 KC.

RIM DRIVE PHONO MOTORS

Real bargains. Self-starting; complete with turntable. All parts included. Shpg. wt. 4 lbs.

M-52, 78 rpm for 115 volts AC $3.79

M-63, 3-speed, 33⅓, 45 and 78 rpm $5.99

PHONO AMPLIFIER RA-19

$3.98

Connect to phono or speaker or just the thing for a portable. Uses: 12SQ7, 50L6, 35Z5 tubes. 2 controls: on/off volume and tone. 7"x3¼"x2". Shpg. wt. 2 lbs.

TUBES FOR ABOVE SET. AS-22 . . . . . $2.64

IT'S EASY TO ORDER FROM OLSON'S

How to order: Order directly from this ad. For convenience use this order blank. Fill in columns below with quantity desired, stock number, description and price. You may send remittance with order (include enough for postage or parcel post shipment), or if you prefer SEND NO MONEY. Olson will ship C.O.D. and you may pay mail or expressman for merchandise and postage.

MONEY BACK GUARANTEE: *Everything you order from Olson is guaranteed as advertised. If you are not more than satisfied, you may return merchandise for cash refund.*

Please Minimum Order $3.00

QUANTITY	STOCK NUMBER	DESCRIPTION	PRICE EACH	TOTAL

NAME _____ TOTAL

ADDRESS _____ ADD POSTAGE

CITY _____ ZONE ____ STATE ____ TOTAL AMOUNT

RN651

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OUTPUT TRANSF.

T-21

69¢

Most popular transformer in use today. Matches 50L6, 35L6, 25L6, etc. Primary 2000 ohms. Secondary matches any 3.2 ohm voice coil speaker. Regular list price is $1.75. Size 1⅝"x 1¼". Shpg. wt. 1 lb.

T-21 . . . . . 69c

BATTERY ELIMINATOR

MODEL S

$10.95 Each

Converts portable battery sets to all-electric AC. Will give years of dependable, trouble-free service. Supplies 1.4 volts "A" and 90 volts "B" power for 4 to 6 tube sets.

PANEL LAMPS

Westinghouse, GE. and Tung-Sol bayonet panel lamps. 100 of a type to the box.

Stock No.	Type No.	Price per 100
X-161	47	$5.59
X-174	44	
PL-25	S1	$4.29

8 MFD 450 VOLT CONDENSERS

Kit of 50 Stock No. AS-A1 **$16.95**

The finest money can buy. One year guarantee. Aluminum tubular type with cardboard insulating sleeve. Over 1,000,000 sold. Used by radio men all over the world.

MICROPHONE

High output crystal mike for PA systems and recorders. Equipped with handle base and 7' shielded cable. Shpg. wt.—5 lbs.

M-67, each, **$5.95**

M-66, same but with on-off switch built into handle **$6.95**

AS-24, each

FP CONDENSER KIT

$3.98

Assortment of 15 popular FP condensers, double and triple sections. Capacities from 10 mfd to 50 mfd; from 25 to 450 volts. Shpg. wt. 3 lbs.

10-WATT RESISTOR KIT

RK-2 **$4.95**

All wire wound resistors, 10 watt, fully insulated. Long leads. You get 20 resistors ranging from 25 ohms to 25,000 ohms.

4-DRAWER STEEL CHEST

$2.19 X-199

For small parts, etc. Knob on each drawer; various size compartments. Each drawer 1¼" deep. Size: 6¼" H., 5¾" W., 8⅛" D. Shipping weight 5 lbs.

Olson's Special **$4.29** M-71

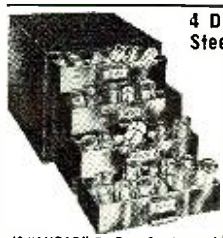
NEW CRYSTAL MIKE

Nationally famous make. Smart New Design, easy to hold. Used in many tape, wire and disc recorders. Can be used on P. A. systems, amplifiers, etc.

$4.95 AS-19 500 FT.

HOOK-UP WIRE KIT

How can we give you so much high grade wire for so little? Olson bought all the wire in sight and is passing the bargain on to you. Kit contains 5 rolls, each 100 ft.—total 500 ft. Various colors, push back, plastic and rubber insulation; solid and stranded copper. Shpg. wt. 3 lbs.



4 Drawer Steel Cabinet FREE with OLSON'S *Gigantic* AKRAD CONDENSER KIT

Olson's Price AS-20 **$16.95**

You get $45.20 (list) worth of "Akrad" condensers plus cabinet, 8½"x7½"x10½".

42 "AKRAD" By-Pass Condensers!

Qty.	Cap.	Volts	List ea.	Total
2	.001	600	$.25	$.50
2	.002	600	.25	.50
2	.005	600	.25	.50
5	.01	600	.30	1.50
5	.02	600	.30	1.50
10	.05	600	.40	4.00
10	.1	600	.45	4.50
2	.005	1600	.55	1.10
2	.008	1600	.55	1.10
2	.01	1600	.60	1.20

27 "AKRAD" Electrolytic Condensers

Qty.	Cap.	Volts	List ea.	Total
2	10	25	$ .75	$1.50
2	25	25	.85	1.70
5	20	150	.95	4.75
5	40	150	1.10	5.50
4	20-20	150	1.30	5.20
5	8	450	.95	4.75
4	16	450	1.35	5.40

69 Total List Value $45.20

Profit from Portables

(*Continued from page 38*)

ingly large crowds and one messenger was seen walking down the street followed by some 40 people during one particularly exciting inning!

When a department store conducted a sales drive on portables two years ago, they featured this merchandise in their luggage departments and the sales went up a surprising 13 per-cent over the previous year's record sales volume.

One New York radio retailer set up an entire window display of portables. Each receiver carried a price tag and were arranged in an ascending price scale. Despite the fact that there was no promotional material in the window other than the sets themselves, in three days he had sold 57 units at an average of $47.50.

In 1951, designers and manufacturers have surpassed their efforts of previous years in developing portable merchandise that is lightweight, strikingly attractive, and reasonably priced.

The opportunity was never greater nor the incentive stronger than now to go to work repairing and selling these units. —30—

Sound Engineering

(*Continued from page 68*)

tion costs. But, perhaps most important is the fact that it prevents what are known as delayed reflections. In addition, since parallel walls give rise to the production of echoes, it is desirable to have the walls fan out in the direction of the rear of the house and to provide fluted or other decorative projections on the sidewalls to smooth out the growth and decay times, as previously mentioned, thus giving rise to the illusion of more normal sound characteristics.

The ceiling should be broken up into slanting sections at the proper inclinations, to aid in the proper distribution of the sound. Naturally, where a theater is to be equipped with a balcony the ceiling height will be increased, and undesirable effects may also be noted because of the second ceiling under the balcony. However, if the same general reasoning is used in the treatment of the underside of the balcony, no special problems should arise.

One of the problems encountered under a balcony is the reverberation caused by kickbacks from the rear walls hitting the overhead and creating multiple paths of sound to the listener. If the delay is just right, a high rate of confusion results and intelligibility diminishes very rapidly.

The characteristics of sound recording studios may be controlled by the use of convex splays or diffusers as discussed earlier in this series. The use of such splays is illustrated in Fig. 1, which is a picture of the music scor-

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The *selling power* of the RCA Trademark makes it *easy* for you to move RCA Batteries . . . and gain a satisfied customer every time.

Remember, too, that RCA Batteries are *radio-engineered* for *extra* listening hours . . . provide a type for practically every renewal requirement.

So—starting now—push RCA Batteries. Build a profitable repeat business with virtually no competition from non-radio outlets.

See your RCA Battery Distributor for fast, reliable service.

2. Radio Trade Distribution

3. Completely Rounded Line

4. Radio-Engineered Quality

5. Super Selling Aids

The Batteries for the Radio Trade!

RADIO CORPORATION of AMERICA

RADIO BATTERIES **HARRISON, N. J.**

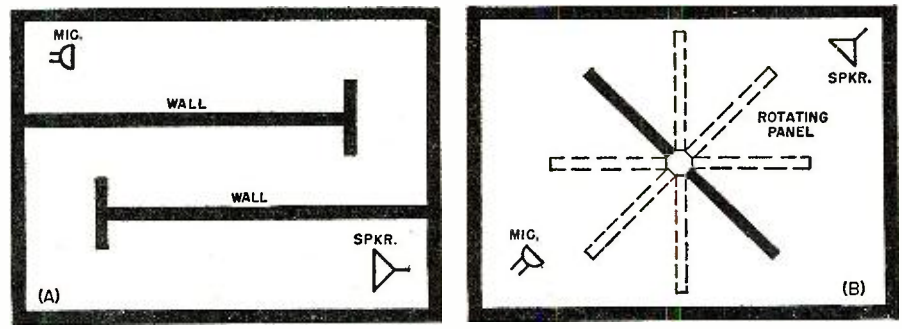


Fig. 6. (A) Echo chamber using two fixed baffle walls. (B) Echo chamber employing a rotating panel. Delay time can be varied by changing position of panel.

ing stage on the *Walt Disney* motion picture lot at Burbank, California.

Thus far we have only discussed the control of reverberation for the physical construction of stages and studios to prevent the introduction of objectionable qualities in the sound pickup or reproduction. At times it may be desirable to deliberately induce controlled reverberation into the program material to enhance the quality of the recording, and subsequent reproduction. Controlled reverberation is used to obtain an "echo" effect by the use of an "echo chamber" and the illusion of a large concert hall, a cavern, public address system, or it may be used to brighten up certain recordings. However, synthetic reverberation must be carefully controlled as to the amount and its frequency characteristic or the quality of the original program material may be seriously affected.

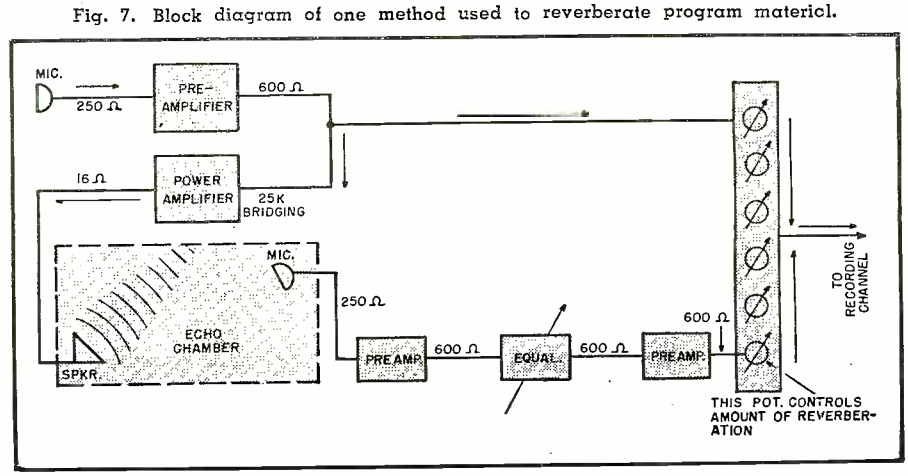
The conventional echo chamber consists of a room of approximately 1600 to 2000 cubic feet in volume, with parallel walls constructed of hard plaster, and with a cement floor painted with a highly reflective paint. A loudspeaker and microphone are placed at opposite ends of the room. The program material to be reverberated is fed to the speaker and picked up by the microphone and returned to the mixing panel, where it is mixed with the original program material. The loudspeaker and microphone should not be placed directly in line, but at positions that will result in the longest delay time. Fig. 6A is the floor plan of an echo chamber with two baffle walls, while Fig. 6B is an echo chamber which employs a rotating panel at its center. This panel is remotely controlled by a motor system and can be set at various angles to increase the delay time.

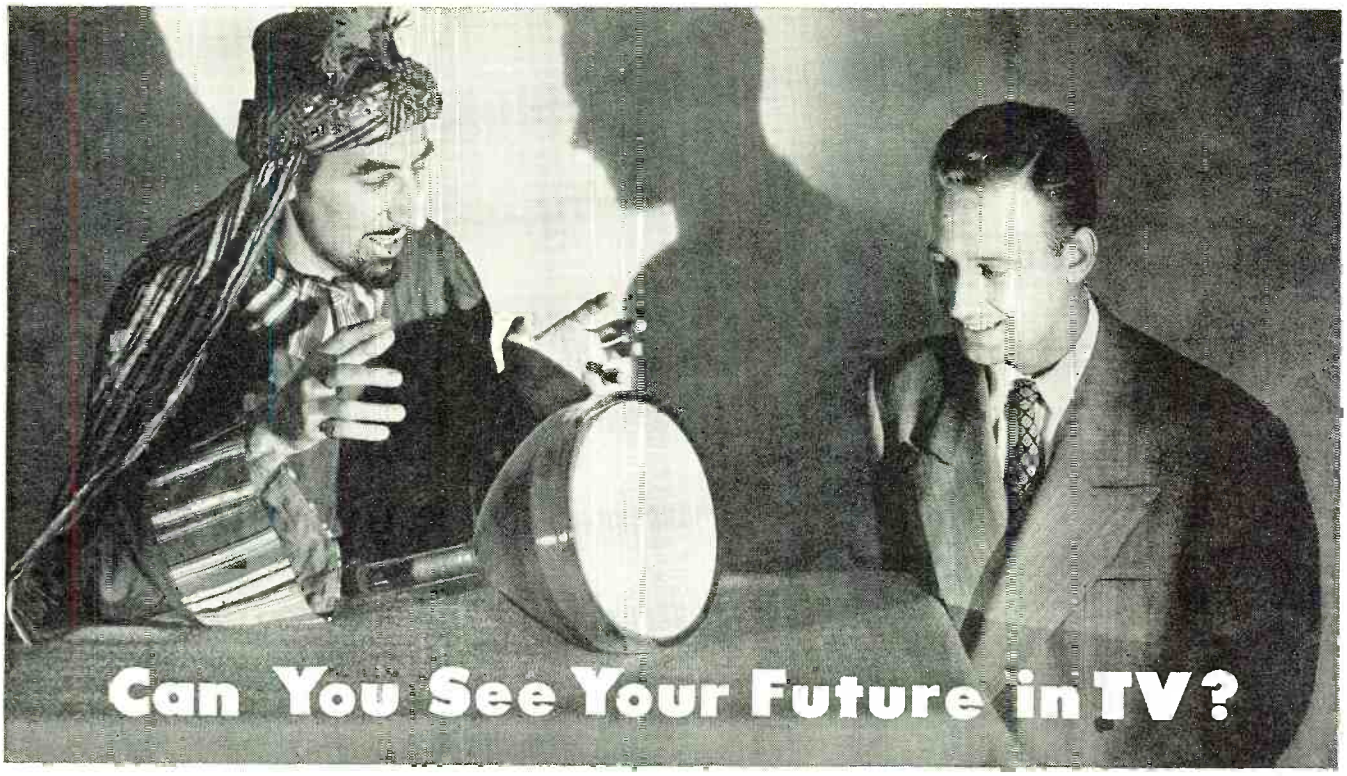
Other types of delays may be created by the use of long metal pipes, 50 to 150 feet in length, with a speaker at one end and a microphone at the other. The length of the pipe will depend on the delay time required. In the *Hammond* electric organ, echo effects are created by sending the sound through a series of steel springs, then picking it up again on a microphone. Although these methods will give fairly good results, the echo chamber is still the most favored method.

Fig. 7 is a block diagram of one method used to reverberate program material. At the output of the preamplifier serving the original pickup microphone, is bridged a power amplifier which drives the loudspeaker in the echo chamber. The output of the echo chamber microphone preamplifier is fed into one of the mixer inputs and mixed with the incoming program material. It will be noted the power amplifier driving the echo speaker is bridged ahead of the mixer; therefore, the mixer pot controlling the levels of the program material has no effect on the signal sent to the echo chamber. The gain of the echo speaker amplifier is set to give the proper level in the chamber, and will vary with different types of program material. Variable equalization is inserted in either the speaker or microphone circuits of the echo chamber.

(To be continued)

Fig. 7. Block diagram of one method used to reverberate program materiel.





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2C34/RK34 .89	5D21 ....55.00	446B 4.95	884 ..... 1.85	1LA4 .... 1.15	6BF6 ..... 1.05	7C5 ..... 1.10	35Z3 .... 1.25
2C39 ....24.50	5D21 ....24.50	450TH ...47.50	885 ..... 1.49	1LA6 .... 1.35	6BG6G 2.45	7C6 ..... 1.25	35L6GT ... 1.10
2C40 .... 8.95	5FP7 .... 1.95	450TL ...47.50	902 ....11.95	1LB4 .... 1.30	6BH6 ..... 1.20	7C7 ..... 1.20	35W4 .... 1.25
2C43 ....14.95	5GP1 .... 4.95	527 ..... 12.75	905 ..... 3.59	1LC5 .... 1.10	6BJ6 ..... 1.48	7E5 ..... .89	35Y4 .... 1.05
2C44 .... 1.49	5JP1 ....24.45	559 ..... 1.39	908 ....12.95	1LC6 .... 1.18	6BQ6 ..... 2.50	7E6 ..... .89	35Z3 .... 1.05
2C46 .... 7.95	5JP2 ....24.45	562 ....97.50	918 ..... 1.69	1LD5 .... 1.30	6C4 ..... 1.40	7E7 ..... 1.05	35Z4 .... 1.05
2C51 .... 6.95	5JP4 ....24.45	575A 13.95	919 ..... 2.79	1LE3 .... 1.18	6C5 ..... .85	7F7 ..... 1.10	35Z5 .... 1.05
2D21 .... 1.79	5J23 .... 12.95	701A 5.95	922 ..... .98	1LG5 .... 1.15	6C6 ..... 1.10	7H7 ..... 1.10	36 ..... 1.05
2E22 .... 1.95	5J29 .... 12.95	702A 3.95	923 ..... 1.05	1LH4 .... 1.75	6C8G 1.10	7K7 ..... 1.49	37 ..... .89
2E24 .... 4.89	5J30 ....49.50	703A 7.95	927 ..... 1.59	1LN5 .... 1.30	6CB6 ..... 1.45	7L7 ..... 1.10	38 ..... .98
2E26 .... 3.69	5JP2 .... 9.50	704A 1.05	930 ..... 1.20	1N5GT 1.05	6D6 ..... 1.10	7N7 ..... 1.65	39/44 .... .68
2E30 .... 2.29	5LP1 ....15.95	705A 2.95	931A 4.95	1P5GT 1.05	6D8 ..... 1.15	7Q7 ..... 1.10	41 ..... .98
2J21A 9.95	5NP1 .... 5.95	706BY ...39.50	954 ..... .39	1Q5GT 1.18	6F5 ..... 1.15	7R7 ..... 1.15	42 ..... .98
2J22 .... 8.45	6AS6 .... 3.69	706CY ...39.50	955 ..... .49	1R4 ..... 1.05	6F6 ..... 1.25	7S7 ..... 1.35	43 ..... .98
2J26 ....29.50	6C21 ....24.50	706DY ...42.50	956 ..... .45	1R5 ..... 1.39	6F7 ..... 1.05	7V7 ..... 1.35	45 ..... 1.10
2J27 .... 9.95	6F4 .... 5.95	706GY ...42.50	957 ..... .45	1S4 ..... 1.50	6F8G 1.35	7W7 ..... 1.45	45Z3 .... 1.05
2J30 ....99.50	6J4 .... 6.95	707B 17.95	958 ..... .45	1S5 ..... 1.50	6G6G 1.35	7X7 ..... 1.69	45Z5 .... 1.05
2J31 ....39.50	7BP7 .... 8.95	708A 4.95	959 ..... .45	1T4 ..... 1.50	6H6 ..... 1.25	7Y4 ..... .98	46 ..... 1.10
2J32 ....39.50	9GP7 ....14.95	709A 3.95	991/NE16. .39	1T5GT 1.18	6H6GT 1.15	7Z4 ..... .98	47 ..... 1.10
2J33 ....39.50	9JP1 .... 14.95	710A/8011 1.75	1603 .... 5.25	1U4 ..... 1.30	6J5 ..... .89	12A ..... .79	48 ..... 2.10
2J34 ....39.50	9LP1 .... 19.95	713 ..... 1.45	1613 .... 1.25	1V ..... .89	6J5GT .... .79	12A6 .... .75	49 ..... 1.10
2J36 ....97.50	9LP7 .... 14.95	714AY 6.95	1614 .... 2.25	1X2 ..... 1.60	6J6 ..... 1.75	12A7 .... 1.25	50A5 .... 1.10
2J37 .... 12.75	10BP4 ....22.50	715A 7.95	1616 .... .88	2A3 ..... 1.65	6J7 ..... 1.40	12ASGT ... 1.05	50B5 .... 1.25
2J38 .... 12.75	7DP4 ....17.95	715B 9.75	1619 .... .35	2A4G 1.40	6K5GT 1.35	12AH7GT . 1.85	50C5 .... 1.25
2J39 .... 39.50	10 ..... .49	715C 29.95	1622 .... 3.25	2A5 ..... 1.05	6K6GT 1.30	12AL5 ... 1.35	50L6GT ... 1.15
2J40 ....39.50	12DP7 ....16.95	717A 1.69	1624 .... 1.98	2A6 ..... .98	6K7 ..... .98	12AT6 .... 1.05	50Y6 .... 1.25
2J46 ....39.50	12GP7 ....16.95	721A 2.59	1625 .... .45	2A7 ..... .98	6K8 ..... 1.35	12AT7 .... 2.25	53 ..... 1.35
2J48 ....29.50	12HP7 ....16.95	722A 2.95	1629 .... .45	2B7 ..... 1.20	6L5G 1.25	12AU6 .... 1.35	56 ..... .98
2J49 ....39.50	12LP4 ....22.50	723A/B ... 9.95	1629 .... .35	2W2G .... .98	6L6 ..... 3.00	12AU7 .... 1.45	57 ..... 1.05
2J50 .... 22.50	15P 1.59	723A/B ...14.95	1630 .... .98	2X2 ..... .65	6L6G 2.65	12AV6 .... 1.10	58 ..... 1.25
2J54B 39.50	15R ..... .89	724B 3.89	1631 .... 1.29	2X2A 1.95	6L6GA ... 2.65	12BA6 .... 1.25	59 ..... 1.25
2J55 .... 97.50	16AP4 ....42.50	725A 7.95	1633 .... .79	3A4 ..... .69	6L7 ..... 1.25	12BE6 .... 1.25	70L7 .... 1.30
2J61 ....49.50	16CP4 ....42.50	726A 6.95	1634 .... .75	3A5 ..... 1.95	6L7G 1.25	12C8 ..... 1.05	71A 1.25
2J62 ....49.50	16P8 .... 2.90	729B 29.50	1636 .... 3.25	3B7/1291 . .85	6N7 ..... 1.45	12F5GT .... .98	75 ..... 1.25
2K25/	23D4 .... .45	726C 49.50	1638 .... .65	3D6/1299. .69	6Q7 ..... 1.45	12H6 ..... .98	76 ..... .89
723AB..29.50	28D7 .... .98	730A 12.95	1639 .... .98	3LF4 .... 1.10	6R7 ..... 1.20	12J5GT .... .79	77 ..... .89
2K28 ....36.25	30 Special. .59	730TL ...79.50	1644 .... .98	3Q4 ..... .95	6S7G 1.59	12J7GT 1.05	78 ..... 1.10
2K29 ....24.50	35TG 4.95	800 ..... 1.95	1654 .... 2.39	3Q5GT 1.25	6S8GT 1.35	12K7GT 1.05	80 ..... 1.20
2AP1 .... 3.50	45 Special. .49	801A .... .49	1665 .... 1.45	3S4 ..... 1.10	6SA7 ..... 1.15	12K8GT 1.05	82 ..... 1.20
3B22/Elic 2.95	53A 5.95	802 ..... 4.49	1851 .... 1.89	3V4 ..... 1.25	6SC7 ..... 1.75	12K8 ..... 1.05	83 ..... 1.35
3B23/RK22 4.85	75TL 6.95	803 ..... 4.49	1960 .... .79	5R4GY 3.75	6SD7GT 1.50	12Q7 ..... .98	83V 1.35
3B24 .... 5.95	100R .... .89	804 ..... 9.95	1961 .... 4.99	5T4 ..... 1.95	6SF5 ..... 1.10	12SA7GT ... 1.15	84/6Z4 .... 1.10
3B24W ... 7.95	100TH 9.95	805 ..... 4.49	2050 .... 1.25	5U4G .... .98	6SF5GT 1.20	12SC7 .... 1.45	85 ..... 1.10
3B25 .... 4.65	121A 2.08	806 .....29.95	2051 .... 1.45	5V4G 2.40	6SF7 ..... 1.25	12SF5 .... 1.20	89Y ..... .89
3B26 .... 3.95	203A 8.95	807 ..... 1.98	8005 .... 5.95	5W4 ..... 1.10	6SG7 ..... 1.50	12SF7 .... 1.05	117L7/M7. 1.75
3B27 .... 3.95	204A 69.50	808 ..... 7.25	8011 .... 1.75	5X4G 1.28	6SH7 ..... 1.10	12SG7 .... 1.05	117N7 .... 1.75
3B28 .... 8.95	211 ..... .69	809 ..... 2.45	8012 .... 3.95	5Y3GT .... .89	6SJ7 ..... 1.30	12SH7 .... 1.05	117P7 .... 1.75
3BP1 .... 8.95	212E 49.50	810 ..... 9.95	8013 .... 2.95	5Y4G .... .98	6SK7 ..... 1.50	12SJ7 .... 1.15	117Z3 .... 1.05
3C22 ....64.50	215A .... .19	811 ..... 3.25	8013 .... 2.95	6AL5 .... 1.05	6SL7GT 1.50	12SK7 .... 1.50	117Z6 .... 1.25
3C23 .... 9.95	217C 8.95	812 ..... 2.95	WL681 ...22.50	6AL7GT 1.50			

FULL-WAVE SELENIUM RECTIFIER STACKS

Max. A.C. Input Volts RMS	Max. D.C. Volts Output	Cell Size in Inches	Max. D.C. Amps. Output Continuous	Order by This Number	Price
SINGLE PHASE BRIDGE					
0-18	0-14.5	1¾″ x1¾″	1.3	18B4D1S1	$ 3.95
″	″	2-3/16″x2-3/16″	2.4	18B4E1S1	4.95
″	″	3⅜″ x3⅜″	6.6	18B4F1S1	7.95
″	″	4½″ x5″	13.0	18B4J1S1	12.95
″	″	5″ x6″	17.5	18B4J1S1	15.45
″	″	4½″ x5″	26.0	18B4K1S2	22.50
″	″	4½″ x5″	39.0	18B4K1S3	37.50
″	″	4½″ x5″	52.0	18B4J1S3	47.50
″	″	4½″ x5″	70.0	18B4J1S4	54.50
0-40	0-34	1¾″ x1¾″	0.60	40B3D1S1	4.95
″	″	2-3/16″x2-3/16″	1.2	40B4EW1S1	6.95
″	″	3⅜″ x3⅜″	3.2	40B4FW1S1	9.75
″	″	4½″ x5″	6.0	40B4K1S1	14.95
″	″	5″ x6″	9.0	40B4JW1S1	17.50
″	″	4½″ x5″	12.0	40B4K1S2	28.75
″	″	5″ x6″	18.0	40B4JW1S2	34.50
″	″	4½″ x5″	25.0	40B4J1S3	42.50
″	″	4½″ x5″	34.0	40B4J1S4	54.25
″	″	5″ x6″	36.0	40B4JW1S4	62.25
0-120	0-100	1¾″ x1¾″	0.60	40B4D1S1	12.45
″	″	2-3/16″x2-3/16″	1.2	40B4EW1S1	14.95
″	″	3⅜″ x3⅜″	3.2	40B4FW1S1	24.50
″	″	4½″ x5″	6.0	40B4K1S1	32.50
″	″	5″ x6″	9.0	40B4JW1S1	42.50
CENTER-TAP					
10-0-10	0-8	1¾″ x1¾″	1.2	20C2D1S1	2.35
″	″	2-3/16″x2-3/16″	2.4	20C2EW1S1	3.10
″	″	3⅜″ x3⅜″	6.4	20C2FW1S1	4.25
″	″	4½″ x5″	12.0	20C2J1S1	6.95
″	″	5″ x6″	16.0	20C2J1S1	8.95
″	″	4½″ x5″	24.0	20C2K1S2	14.75
″	″	4½″ x5″	36.0	20C2K1S3	19.65
″	″	4½″ x5″	48.0	20C2J1S3	27.50
″	″	4½″ x5″	64.0	20C2J1S4	34.50
″	″	4½″ x5″	80.0	20C2J1S5	42.50
″	″	4½″ x5″	84.0	20C2KW1S7	49.50
″	″	5″ x6″	96.0	20C2J1S6	55.50
″	″	4½″ x5″	128.0	20C2J1S8	67.50
3 PHASE BRIDGE					
0-120	0-150	1¾″ x1¾″	0.90	40B6D3S1	24.50
″	″	2-3/16″x2-3/16″	1.8	40B6FW3S1	29.50
″	″	3⅜″ x3⅜″	4.75	40B6FW3S1	42.50
″	″	4½″ x5″	9.0	40P6K3S1	79.50
″	″	5″ x6″	12.5	40B6J3S1	86.75

SPECIAL RECTIFIERS ON REQUEST

TRANSFORMERS—115V 60 CY HI-VOLTAGE INSULATION

2700v @ 2 MA; 6.3v @ .6A; 2.5v @ 1.75A..$ 4.45
2300v @ 15 MA..... 3.49
1540v @ 5 MA; 340-0-340 @ 300 MA..... 4.35
925v @ 10 MA; 525-0-525v @ 60 MA; 2x5v @ 3A; 6.3v @ 3.5A; 6.3v @ 2A; 6.3v @ 1A 4.85
425-0-425v @ 5 MA; 6.3v @ 1.5A; 5v @ 3A 5.65
415-0-415v @ 60 MA; 5v CT @ 2A; 115/230 Dual Pri..... 4.25
400-315-0-100-315v @ 200 MA; 2x6.3v @ 9A; 5v @ 3A; 2.5v @ 2A..... 5.35
500-385-0-385v @ 200 MA; 3x6.3v @ 6A; 5v @ 3A; 2.5v @ 2A..... 4.75
375-0-375 @ 175 MA, 5v @ 3A, 6.3v @ 5A, 7.5 v @ 1A..... 3.79
325-0-325v @ 12 MA; 255-0-255v @ 240 MA.. 4.25
300-0-300v @ 65 MA; 6.3v @ 2.5A; 6.3v @ 1A; 2x5v @ 2A..... 3.25
0-17.4/21.6/25.8v @ 400 MA; 6.4v @ .5A; 2.6v CT @ 2.5A Pri 115/230..... 3.65
12.6v CT @ 10A; 11v CT @ 6.5A..... 6.35
6.5v @ 12A; 6.3v @ 2A; 115v @ .1A..... 3.50
6.5v @ 8A; 6.5v @ 6A; 2.5v @ 1.75A..... 4.17
6.3v @ 1A; 2.5v @ 2A..52.29 4-0-4v @ 1A 5v CT @ 20A; 10 KV INS..... .87
.6v @ 15A RMS..... 8.55
1.47

TRANSFORMERS—220v 60 Cyc

512.5-0-512.5 @ 427 MA.....$ 5.35
2x5v @ 6A; 4v @ 23A..... 2.95
2x6.3v CT @ 3A; 6.3v CT @ 1.6A..... 2.95
10v CT @ 6.5A; 6.3v CT @ 2.5A; 6.3v CT @ 1.8A @ 440 Pri..... 3.95
Step Up/Down 110/220, 500 watt..... 10.95

FILTER CHOKES HI V INS

.025 HY @ 1.36A ....$ 1.98	10 HY@250 MA.$3.15
2 HY @ 175 MA 1.49	10/20 HY @ 85 MA 1.49
3 HY @ 50 MA. .39	13 HY @ 130 MA 1.55
5 HY @ 70 MA/.2 HY350 MA DUAL... 2.39	15 HY @ 25 MA. .59
10 HY @ 700 MA 11.95	200 HY @ 10 MA 2.95
10 HY @ 55 MA .89	325 HY @ 2 MA. 2.95
10 HY @ 100 MA 1.49	600 HY @ 1 MA. 2.95
	9/60 HY @ 50/-400 MA 9.95

OIL CONDENSERS—DC RATINGS

3X.1 MFD	600v $ .59	.1	MFD 2500v	$1.15
.25 " "	.35	.25	" "	1.25
.5 " "	.45	.5	" "	1.35
1 " "	.69	2	" "	3.45
2X2 " "	1.15	.05	" "	1.30
4 " "	1.20	.1	" "	1.35
6 " "	.98	.25	" "	2.75
8 " "	1.85	.5	" "	2.85
10 " "	2.25	1	" "	2.95
3X.1 " 1000v	.85	2	" "	4.25
.5 " "	.89	4	" "	6.95
1 " "	.67	12	" "	9.95
2 " "	1.75	1	" 3600v	3.98
4 " "	1.85	.25	" 4000v	3.49
8 " "	2.45	.5	" "	3.75
10 " "	3.19	1	" "	3.95
20 " "	4.25	2	" "	5.75
.5 " 1500v	1.02	3	" "	5.89
1 " "	1.19	.1	" 5000v	2.75
2 " "	1.69	.25	" "	2.95
4 " "	2.69	1	" "	3.10
.1 " 2000v	1.75	.1	" 7000v	3.75
.25 " "	1.92	.01	" 7500v	2.25
.5 " "	1.95	.02	" "	2.25
1 " "	2.09	.03	" "	2.35
2 " "	2.85	.05	" "	2.35
4 " "	4.45	.1	" "	4.95
8 " "	4.95	2X.1	" "	7.95
15 " "	6.95	.02	" 12000v	12.95

HIGH CAPACITY CONDENSERS

2X3500 MFD 25v $3.47	200	MFD 35v $ .57
2500 " 3v .35	100	" 50v .45
3000 " 25v 2.45	4000	" 30v 3.25
650 " 80v 1.29	2350	" 24v 2.25
2000 " 15v 1.69	10000	" 25v 4.57

WANTED! WANTED!

ATTENTION colleges, schools, hams, industrials!! Highest prices paid for surplus equipment, parts, and tubes. We are especially looking for test equipment TS-12, 13, 35, 14/AP, 15/AP, 146/UP, 173, 174, 175, 239, 259, 263. Any types with TS prefix. Write, wire or call.

R-H-S
SPECIALS OF THE MONTH

WANTED! WANTED!

APR-4, 5, 7 and tuning units. ARC-1, 3. ART-13, ATC, APS-10, microwave equipment in S, K, X-band. APS-15, APQ-13, APS-13, SCR-300, 284, 694, etc. BC-221, 342, 348. BC-1016 tape recorders. Write, wire or call.

RADAR—COMMUNICATIONS AND TEST EQUIPMENT

TS-35/AP X-band Signal Generator. Pulsed and C.W. freq. range. 8100-9600 mcs. This unit will measure power and frequency. 115v 60-2600 cyc.

TS-3/AP S-band Frequency and Power Meter. Portable. Battery operated. Complete with all cables.

TS-33/AP X-band Frequency Meter. 8500-9600 mcs. Contains crystal detector and indicating meter. Output to scope will indicate pulse wave shape.

TS-62/AP X-band Echo Box. 8400-9600 mcs. tuned and untuned input. Will indicate resonance on meter. Complete with pick up antenna and cable.

TS-268/UP Crystal Diode Test Set. Used to check 1N21, 1N22, 1N23, etc. Battery operated. Portable. Complete with spares.

TS-89/AP Voltage Divider. 1:10 and 1:100 ratios. Wide band for true pulse shape. Output to scope.

TS-10/APN Altimeter Test Set. Good condition. Complete with cables and dummy antenna **$35.00**

TS-12/AP V.S.W.R. Test Set for X-band. Complete with amplifier, slotted line, termination, adaptors, etc. In 2 carrying cases. Excellent.

TS-23/APN Test Set to check freq. and power output of SCR-718 transmitter. Complete with all cables.

TS-36/AP X-band Power Meter. Consists of power measuring circuit. Horn antenna, co-ax to wave guide adaptor, connecting cable and probe. Will measure either absolute or relative power. Nominal band of usefulness is approx. 8.5-9.7 KMC. Excellent condition.

TS-118/AP R.F. Wattmeter for the range of 20-750 mcs. Will measure power up to 500 watts. Complete.

TS-174/U Freq. Meter. Freq. range is 50-250 mcs. High freq. version of BC-221. Excellent Condition.

1-185 Signal Generator. L-band search, S-band track. Used with SCR-545 and similar sets. Complete with cables. Good condition.

TS-61/AP S-band Echo Box. Using meter provided it is possible to maximize the XMTR adjustment and determine relative power output. Complete with probe and cable. Very good condition.

TS-131/AP Field Strength Meter. Consists of pickup unit, control box C-111/AP, cord CX-119/AP, adaptor M-359 and case. Unit will check output in range 200-1000 mcs. Excellent condition.

TS-226/AP used to measure peak power output of any xmitter in the range of 200-1000 mcs. Has provision for oscilloscopic signal observation and built in calibration. Part of AN/APM-29. Excellent.

TS-108/AP X-band Dummy Load. Consists of a length of X-band guide filled with sand. One end closed other terminates in a coupling choke. Excellent.

TS-14/AP consists of S-band signal generator, freq. meter, wattmeter and cables. Power input is 115v 50-2600 cyc. Used to check various S-band radars and beacons.

TS-170/ARN-5 XTAL controlled test osc. with the following freq. ranges: 332.6, 333.8, 335.0 depending on XTAL in use. This set is used to align glide path receivers. Batteries and antenna are self contained. Excellent condition.

AN/APS-3 Airbourne X-band Search and Homing radar. Complete. Contains RF head, modulator, synchronizer, control boxes, plugs, antenna, etc. 115v 400 cyc. Excellent condition. . . . **$875.00**

ASB-5 L-band Search and Homing radar. Complete. Contains xmitter, receiver, power unit, control box, plugs, etc. 115v 400 cyc. Excellent condition **$125.00**

SCR-518 Radar Altimeter. 500 mcs. equipment. Complete with xmitter, receiver, control box, power unit, junction box with all cables, racks, etc. Unit will indicate altitude up to 50,000 ft. Power input is 28v. New condition. . . . **$125.00**

AN/APS-15 R.F. Head and Modulator. X-band. Complete with all tubes. Good condition. . . . **$125.00**

AN/APA-23 Automatic Signal Strength and Time Recorder. Unit will scan a receiver thru its range and record all signals on electrosensitive paper. Input is 115v 60-2600 cyc. and 28v DC. Excellent condition **$175.00**

DYNAMOTORS AND POWER UNITS

Type	Input Volts	Output Volts	Output Amps	Price
DM-19	12	500	.200	$ 6.95
DM-25	12	250	.050	4.95
DM-32	28	250	.060	1.75
DM-33	28	570	.160	2.95
DM-34	12	220	.080	8.95
DY-12	12	275	.110	
		500	.50	
PE-73	28	1000	.350	10.00
PE-94	28	300	.260	
		150	.010	
		14.5	.5	2.25
PE-97	Vibrator Power Supply			8.95
PE-98	12v	300v		35.00
PE-101	28	400		
		800		5.75
PE-103	6 & 12	500	.160	35.00
PP-18-AR	Vibrapack			15.95
RA-42	(for BC-639 Receiver)			29.95
ATR	Inverter 12v	110v AC 125 watts		14.95

PHONE DIGBY 9-0347

WRITE FOR QUANTITY PRICES

Prices subject to change without notice. F.O.B., NYC minimum order $10.00. 20% deposit required. All merchandise guaranteed.

AN/CRT-3 Victory Girl. Dual frequency emergency lifeboat xmitter. Complete with xmitter, kite hydrogen generator, etc. New in knapsack. C.A.A. approved **$129.50**

AN/APR-5 Radar Search Receiver. Freq. range 1000-3100 mcs. Will detect signals up to 10,000 mcs. with reduced sensitivity. Contains oscillator and mixer cavity, IF strip, power supply. Input 60-2600 cyc. 115v. Excellent condition. . **$375.00**

T-50 Radiotelegraph Transmitter complete with power supply and all accessories with spares. Portable. New in cases. **$375.00**

AN/APT-5 300-1500 mcs. xmitter cavity oscillator using 3C22 lighthouse tube. Power output 30 watts. Noise modulated. Excellent condition. Complete with all tubes. **$149.50**

SK-1M Radar Receiver Indicators. Freq. 195 mcs. 2 R.F. stages, 3 IF stages. 1 video, etc. New condition **$125.00**

SCR-183 Airbourne Command Equipment. Freq. range 201-398KC and 2500-7700KCS. Complete. Contains receiver, xmitter, dynamotor, antenna switch, control box, coils, etc. Power input 24-28v. Brand new in original cases. Manufactured by Western Electric. **$125.00**

NAVY RU Command Equipment. Similar to SCR-183 . . . . . **$125.00**

DU-1 Direction Finding Equipment for SCR-183 and RU Series Equipment. Can be used with any receiver for direction finding in freq. range 200-1600KC. New. Complete. **$45.00**

SCR-515 (BC-645) contains xmitter, receiver, dynamotor PE-101, control box, manual, etc. New **$18.95**

AN/PPN-1 EUREKA! Ground portable, beacon responder. Unit will work into the AN/APN-2 transponder for purposes of homing. C.W. communication can also be carried on between plane and ground. Unit comes complete with xmitter, receiver, power pack, phones, etc. Brand new in knapsack. AN/APN-2 EQUIPMENT CAN BE SUPPLIED ON ORDER.

SCR-269/G Automatic Radio Compass. Freq. range 200-1750KC. Complete with BC-433-G receiver, BC-434, LP-21, 1-81, 1-82, BK22, etc. Very good condition **$129.95**

SCR-300 Frequency Modulated Transceiver. Freq. range 40-48 mcs. complete with 18 tubes, handset and antenna. Powered from self contained battery pack. Excellent condition. Weight approx. 35 lbs. with battery, each **$450.00**
Pair **$800.00**

TCS Marine Radio Telephone and Telegraph Xmitting and Receiving Equipment. Freq. range 1500-12000KC. Consists of xmitter, receiver, antenna loading coil, remote control box, power unit, cables, etc. Power input is 12 or 32v DC. We can supply an 110v AC power supply for stationary use at additional cost. Excellent condition.

SCR-536 Xmitter-Receiver (handy talkie). Freq. range 3885-5500KC. Complete with coils, tubes, crystals. Very good condition. **$89.95**

AN/APA-10 Panoramic Adaptor for use with any receiver with following IF's: 455KC, 5 mcs, 30 mcs. Unit will give panoramic presentation (1 mc wide for 455KC input) (100KC for 5MC input) (2MC for 30 mcs input). Power input 115v 400 cyc. but can be changed with the addition of a proper power transformer. Excellent condition **$175.00**

AN/ARN-5 Glide Path Receiver. Freq. range 332.6, 333.8, 335.0 mcs. selected by changing crystals. Complete with receiver, mounting MT-28, AS-27 antenna, BC-732 control box, and indicator 1-101-C. Power input is 28v 1.7 amp. Excellent condition **$49.95**
With B model receiver. **$99.95**

SCR-510 Freq. Modulated Portable Transceiver. Covering range of 20.0-27.9 mcs in 80 channels 100KC apart. Complete equipment consisting of BC-620 transceiver, power supply PE-97A, T-17 mike, handset, AN-45 antenna, battery operated or 6 or 12v input. Excellent condition. . **$69.95**

SCR-610 similar to SCR-510 except for freq. range which is 27.0-38.9 mcs. Excellent condition **$79.95**

AN/APA-11 Pulse Analyzer to work with Search Receiver for analysis of received pulsed signals. PPS, pulse width, wave shape, can be displayed on an CR tube. Unit can also be used as a standard oscilloscope for general servicing work. Input is 115v-400-2600 cyc. but can be changed with the addition of a 60 cyc. transformer. Very good condition.

SCR-694 Field Radio. Light weight version of SCR-284. Freq. range is 3.8-6.5 mcs. Power output is A1-20, A3-5; comes with transceiver BC-1306, GN-45 or 58 hand generator, antenna system, microphone, headset, etc. In excellent condition.
PE-237 AC Power Supply for stationary use can be supplied at additional cost.

SCR-522 VHF Airbourne Command Equipment. Freq. range 100-156 mcs. in 4 channels receiver and transmitter. Crystal controlled. Complete equipment. Consists of trans/rec. control box BC-602, dynamotor PE-94, AN104A antenna, plugs, etc. Power input with PE-94 is 28v. Excellent condition. We can supply PE-98 dynamotor for 12v input at additional cost.

COMMAND EQUIPMENT

ARC-5 274N OTHERS

RECEIVERS

ARA 500-1500KC. New.	$24.95
453B 200-550KC. New.	14.95
455B 6-9 mcs. New.	16.50
433 200-1750KC. Good.	29.95
ARR-2 234-258 mcs. New.	19.95

TRANSMITTERS

459-A 7-9.1 mcs. New.	$12.85
696-A 3-4 mcs. New.	29.95
TYPE O 5.3-7 mcs. New.	9.95
AVT-23 3000-13,000KC complete w/control box, manual, etc. C.W. or phone. 14 or 28v input. Brand new. Original cases. . .	79.50
BC-950A 100-156 mcs. New.	59.95

ACCESSORIES

BC-456 Modulator. Good.	$2.25
BC-450 Control Box (3 rec). Used.	1.25
BC-451 Control Box (xmitter). Used.	.98
BC-442 Relay Unit (ANT.). Used.	1.95

Flexible Shafting Available

MISCELLANEOUS SPECIALS!

Sound Powered Chest and Headsets MI-2154-B type O, mfg. RCA. Brand new in original boxes. Pair.	$ 29.95
Trailing Wire Antenna Feed Tube. New. . .	5.95
Goniometer for SCR-277 Direction Finder. Excellent	39.95
RL-7 Interphone Control Box. New.	1.95
FT-154 BC-348 Shock Mounts.	2.98
AN/CRW Receiver for Remote Control. . . .	5.95
BC-1206 Beacon Receiver 200-400KC, 28v in. Excellent	4.95
MN/26-Y Compass Receiver. Very good. . .	24.95
BC-433G Compass Receiver, 200-1750KC in 3 bands. Excellent	39.95
BC-778 Gibson Girl 500KC. Good condition	3.95
BC-1016 Tape Recorder. Complete. New. .	459.50
CFI Unit with 200KC Xtal. New.	14.95
T-17 Carbon Mike. Used. Good.	1.59
BC-329 Transmitter. Excellent.	89.95
QBG-1 Sonar complete with Hydrophone. Excellent	125.00
BC-1091 RF Head. Very good condition. . .	69.95
AN/104A Antenna for SCR-522, ax handle. New	3.95
LP-21 Direction Finding Antenna. Good. . .	12.95
ASB 500 mcs YAGI Antenna Dual 6 Element Single 5 Element.	14.95 8.95
AN/APA-17 Radar Direction Finding Antenna, back to back parabola, freq. range 300-1000 mcs. Horizontally and vertically polarized. Excellent.	59.00
CG-(172/173) CPN-8 10CM Coax Patch Cable, New	4.95
CX-518/CRD-3 Cable. New.	1.25
CX-546/CRD-3 Cable. New.	1.25
CD-508A with SW 14-U and 2 Cord Attachments with JK-48 Jack and PL-68 Plug. New	.75
CD-307A with PL-55 and JK. New.	1.29

Spares for ARC-5 and 274N, APX-1, ASG-10. We have a large stock of TS-31A/AP Spares.

COAXIAL CABLE CONNECTORS

83-1AP	$ .30	83-1SP	$ .45	83-16S	$ .15
83-1F	1.30	83-1SPN	.50	83-18S	.15
83-1H	.09	83-1T	1.30	UG-27/U	.68
83-1J	.80	83-22AP	1.10	UG-58/U	.63
83-1R	.40	83-22R	.48	UG-83/U	.88

Others in stock. Write for prices.

CORDS AND PLUGS

CD 508A Cord Assembly with SW 14-U Switch and 2 cord attachments with JK 18 Jack and PL 68 Plug. Value—$5.00. Our Special Low Price. Brand New	59c
CD307A with PL 55 and JK. New.	$1.29
JK 26 Jack only—Brand New.	20c
PL 55 Plug—New.	35c
PL 68 Plug—NEW.	25c
Jones plug 8 contact male and female.	25c
PL-Q-59	49c
PL-P-60	49c
PL-Q-61	49c
PL-Q-62	49c
PL-Q-77	69c
PL-Q-171	89c
PL-153-A	69c
PL-172	89c

BC-221 FREQUENCY METER

This is a Terrific Value! QUANTITY IS LIMITED—so first come, first served. They are just like new, with original calibration charts. Range 125-20,000 KC with crystal check points in all ranges. Complete with crystal and tubes. **ONLY $99.50**

RADIO HAM SHACK Inc.
189 GREENWICH STREET . NEW YORK, N. Y.

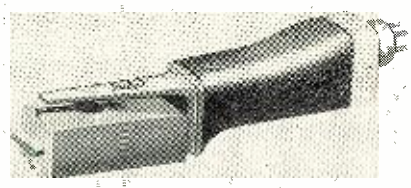
What's New in Radio

For additional information on any of the items described herein, readers are asked to write direct to the manufacturer. By mentioning RADIO & TELEVISION NEWS, the page, and the issue number, delay will be avoided.

POLYPHASE REPRODUCER

A new polyphase reproducer, the L-6-G, is the latest item of equipment to come from the laboratories of the *Audak Company* of 500 Fifth Avenue, New York 18, New York.

This single magnetic unit will play



any and all lateral recordings at speeds of 33⅓, 45, or 78 r.p.m. A special connector is available which permits the unit to be plugged into the *Garrard* changer arm and once the unit has been plugged in, it becomes a permanent part of the arm, thus eliminating repeated adjustments.

The point pressure is 8 grams for all discs. The output is approximately 20 mv. Response is from 20 to over 10,000 c.p.s. The sapphire or diamond stylus is replaceable.

Full details on the L-6-G are available from the company.

MINIATURE MOTORS

A new line of miniature permanent magnet field-type d.c. motors is now in production at the *Servo-Tek Products Co.* plant in Paterson, New Jersey.

The units measure 1⅛" in diameter by 1½" long and weigh approximately 2½ ounces. Motor voltage ratings from 6 to 28 volts are available for varied service applications ranging from fan or blower uses to telemeter-

ing sequence switch drives. Front flange or base mounting types are available.

A cylindrical, or ring type, Alnico V field magnet is used in conjunction with a 14 commutator segment armature. All units employ precision ball bearings and are available with high altitude brushes for aircraft and allied services.

Full information and application engineering data are available from the manufacturer.

MOBILE ANTENNA

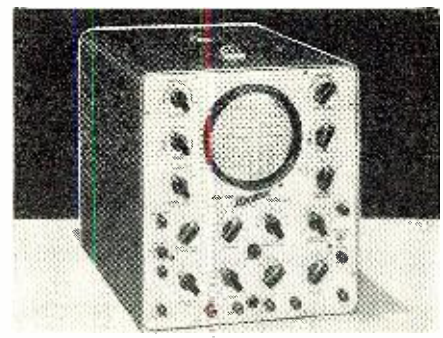
The Workshop Associates, Incorporated of 135 Crescent Road, Needham Heights, Massachusetts is currently in production on a new high gain antenna for service in the 450-470 mc. band.

The new Model 6HW consists of six half-wave dipoles with an over-all gain of nearly 8 db. The vertical radiation pattern is narrowed to concentrate energy on the horizon, enabling greater distance coverage while the horizontal radiation is nondirectional. Impedance is 50 ohms with a v.s.w.r. of less than 2 to 1.

A specification sheet on the Model 6HW is available on request.

5-INCH SCOPE

Hickok Electrical Instrument Co., 10677 Dupont Avenue, Cleveland 8, Ohio has announced a new 5 inch oscil-



loscope which has been designed for general purpose industrial and electronic laboratory use.

The new Model 640 features a wideband amplifier frequency response of from 0 to 4.5 mc. with the "Low-High" switch in the high position. With the switch in the low position a reduced bandwidth of 0-1 mc. is obtained. The input impedance is 2 megohms, 50 $\mu\mu$fd. and recurrent and driven sweep from 2 to 30,000 cycles is obtainable.

The entire unit is shielded and shock mounted. Calibrating voltages are built into the unit. Full information and performance data are available from the company on request.

MOBILE ANTENNA

The *Ward Products Corp.* of 1523 East 45th Street, Cleveland 3, Ohio has just announced the availability of a new antenna for mobile service.

The new Model SPP-143 10-meter transmitting antenna requires just a single mounting hole 15/16" in di-

TUBES

ALL NEW FAMOUS BRANDS BOXED AND GUARANTEED

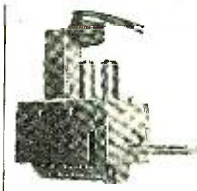
- TRANSMITTING
- RECEIVING
- INDUSTRIAL
- SPEC. PURPOSE

From **NIAGARA**

ONE OF AMERICA'S GREAT ELECTRONICS STORES

CUT **50% to 90%** OFF

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
00A	$1.60	3S4	$1.00	6K8GT	.75	7X6	$1.10	25B6G	$1.33
0A2	1.60	3V4	1.00	6L5	1.33	7X7	1.33	25B8GT	2.48
0A3/VR75	1.33	5AZ4	.73	6L6G	1.78	7Y4	.90	25BQ6GT	1.60
0A4G	1.33	5T4	2.40	6L6GA	1.78	7Z4	.90	25C6G	1.60
0B2	1.78	5U4G	.90	6L7	1.20	10	1.95	25D8	1.95
0B3/VR90	1.33	5W4GT	.83	6N5	1.33	10Y	1.95	25L6	1.60
0C3/VR105	1.33	5X4G	.90	6N6	1.95	12A	.68	25L6GT	.90
0D3/VR150	1.33	5X4GT	.68	6N7GT	1.20	12A5	1.60	25N6G	1.95
0Y4	2.40	5Y3GT	.75	6P5GT	1.20	12A6	1.20	25S	1.60
0Z4G	.83	5Z3	.90	6P7G	1.60	12A6GT	1.45	25W4GT	1.00
01A	.75	5Z4	1.33	6Q6G	1.60	12A7	1.60	25Y5	1.45
1A3	.75	6A3	1.60	6Q7GT	1.00	12A8GT	1.10	25Z5	.83
1A4P	1.95	6A4/LA	1.60	6R7GT	.90	12AH7GT	1.33	25Z6	1.10
1A5GT	.90	6A5G	1.95	6R8	1.60	12AL5	1.00	25Z6GT	.75
1A6	1.60	6A6	1.33	6S4	.90	12AT6	.75	26	1.00
1A7GT	1.10	6A7	1.10	6S7	1.33	12AT7	1.45	26BK6	.83
1AB5	1.60	6A8GT	1.10	6S8GT	1.33	12AU6	1.00	27	.30
1AC5	1.10	6AB4	1.00	6SA7GT	1.00	12AU7	1.20	30	.25
1AD5	1.10	6AB5/6N5	1.33	6SB7Y	1.20	12AV6	.75	31	1.10
1B3GT	1.33	6AB7/1853	1.60	6SC7	1.00	12AV7	1.45	32	1.78
1B4P	1.95	6AC5GT	1.45	6SD7GT	1.45	12AW6	1.33	32L7GT	1.60
1B5/25S	1.60	6AC7/1852	1.45	6SF5GT	.90	12AX7	1.20	33	1.60
1B7GT	1.60	6AD7G	1.60	6SF7	1.00	12AY7	3.00	34	1.78
1C5GT	1.10	6AE6G	.90	6SG7	1.00	12B7	1.10	35/5I	1.10
1C6	.75	6AF6G	1.33	6SH7GT	.75	12B8GT	1.95	35A5	.90
1C7G	.75	6AG5	1.33	6SJ7GT	.90	12BA6	.90	35B5	1.00
1C8	.75	6AG7	1.60	6SK7GT	1.00	12BA7	1.20	35C5	1.00
1D5GP	.75	6AH6	1.95	6SL7GT	1.20	12BD6	1.00	35L6GT	.90
1D7G	.75	6AJ5	1.75	6SN7GT	1.10	12BE6	.90	35W4	.63
1D8GT	.75	6AK5	1.95	6SQ7GT	.83	12BF6	.83	35Y5	.90
1E5GP	.75	6AK6	1.20	6SR7GT	.90	12BH7	1.20	35Z3	.90
1E5GT	.75	6AL5	1.00	6SS7GT	1.00	12BJ6	.75	35Z4GT	.75
1E7GT	.75	6AL7GT	1.33	6ST7	1.33	12BK6	.75	35Z5GT	.75
1F4	.75	6AQ5	1.00	6SV7	1.45	12BN6	1.45	35Z6G	1.33
1F5G	.75	6AQ6	.90	6SZ7	1.10	12BT6	.75	36	1.33
1F6	.75	6AQ7GT	1.20	6T7G	1.60	12BU6	.75	37	.90
1F7G	.75	6AR5	.83	6T8	1.45	12C8	.90	38	1.10
1G4GT	.75	6AS5	1.00	6U4	1.20	12F5GT	.90	39/44	.25
1G5G	.75	6AT6	.75	6U5	1.00	12H6	.90	40	1.10
1G6GT	.75	6AU5GT	1.33	6U6GT	1.00	12J5GT	.60	41	1.00
1H4G	1.10	6AU6	1.00	6U7G	.75	12J7GT	1.10	42	1.00
1H5GT	.90	6AV5GT	1.33	6V5GT	1.33	12H7G	1.00	43	1.00
1H6GT	1.60	6AV6	.75	6V6	1.60	12K7GT	1.10	45	1.00
1J5G	.75	6AV6GT	1.00	6V6GT	1.00	12K8GT	1.33	45Z3	.90
1J6GT	1.60	6AW6	1.33	6V7G	.90	12Q7GT	.90	45Z5GT	.90
1L4	.75	6AX5GT	.83	6W4GT	.90	12S8GT	1.33	46	1.45
1L6	1.33	6B4G	1.60	6W5G	1.33	12SA7GT	1.00	47	1.45
1LA4	1.33	6B5	1.60	6W6GT	1.00	12SC7	1.10	48	2.40
1LB4	1.33	6B6G	1.10	6W7G	1.33	12SF5GT	1.00	49	1.33
1LC5	1.33	6B7	1.60	6X4	.75	12SF7GT	1.00	50	3.00
1LC6	1.33	6B8G	1.60	6X5	1.33	12SG7	.75	50A5	1.10
1LD5	1.33	6BA6	.90	6X5GT	.75	12SH7GT	.75	50B5	1.00
1LE3	1.33	6BA7	1.20	6Y3G	1.95	12SJ7GT	.83	50C5	1.00
1LG5	1.33	6BC5	1.00	6Y6G	1.20	12SK7GT	1.00	50C6G	1.45
1LH4	1.33	6BC7	1.33	6Y7G	1.60	12SL7GT	1.20	50L6GT	.90
1LN5	1.33	6BD5	1.60	6Z4	.90	12SN7GT	1.10	50X6	1.10
1N5GT	1.00	6BD6	1.00	6Z7G	1.95	12SQ7GT	.83	50Y6GT	.90
1P5GT	1.33	6BE6	.90	6ZY5G	2.20	12SR7GT	1.10	50Y7GT	1.00
1Q5GT	.75	6BF6	.83	7A4	1.00	12Z3	1.33	50Z7G	.90
1Q6	1.10	6BG6G	2.40	7A5	1.10	14A4	1.33	52	1.95
1R4	.75	6BH6	1.00	7A6	.90	14A5	1.95	53	1.33
1R5	1.00	6BJ6	1.00	7A7	.90	14A7	1.10	55	1.10
1S4	.75	6BK6	.75	7A8	.90	14AF7	1.20	56	.90
1S5	.90	6BL7	1.45	7AD7	1.60	14B6	1.10	57	1.00
1S6	1.10	6BN6	1.60	7AF7	.90	14B8	1.10	58	1.00
1T4	1.00	6BQ6GT	1.60	7AG7	1.10	14C5	1.33	59	1.78
1T5GT	.75	6BT6	.75	7AH7	1.10	14C7	1.20	70A7GT	1.95
1T6	1.20	6BU6	.83	7AJ7	.90	14E6	1.10	70L7GT	1.95
1U4	1.00	6BY5	1.33	7AU7	1.10	14E7	1.33	71A	1.20
1U5	.90	6C4	.83	7B4	.90	14F7	1.10	75	1.00
1V	1.10	6C5GT	.83	7B5	.90	14F8	1.33	76	.45
1V2	.75	6C6	1.10	7B6	.90	14H7	1.20	77	1.00
1V5	1.10	6C8G	1.60	7B7	.90	14J7	1.33	78	1.00
1W4	1.33	6CB6	1.00	7B8	.90	14N7	1.33	79	1.33
1W5	1.10	6CD6	3.00	7C4	1.60	14Q7	1.10	80	.68
1X2	1.33	6D6	1.10	7C5	.90	14R7	1.33	81	2.40
1X2A	1.33	6D8	1.60	7C6	.90	14S7	1.33	82	1.33
2A3	.75	6E5	1.10	7C7	.90	14W7	1.33	83	1.60
2A4G	.85	6E6	1.33	7C8	1.33	14X7	1.33	83V	1.60
2A5	.45	6E7	1.95	7E5	1.33	14Y4	1.20	84	.90
2A6	.45	6F5GT	.83	7E6	1.10	15	.35	85	1.10
2A7	.45	6F6	1.00	7E7	1.33	18	.35	89	.25
2B7	.40	6F6GT	.83	7F7	1.10	19	.35	99	1.60
2E5	.45	6F7	1.60	7F8	1.33	19BG6G	3.00	99V	1.60
2X2	.70	6F8	1.60	7G7	1.33	19C8	1.60	99X	1.60
2X2A	2.18	6G6	1.33	7H7	1.00	19J6	1.60	117L7GT	1.95
2Z2	1.95	6H4GT	1.33	7J7	1.33	19T8	1.45	117N7GT	1.95
3A8GT	2.40	6H6GT	.83	7K7	1.33	20	.35	117P7GT	1.95
3B7	.45	6J5GT	.75	7L7	1.33	22	.35	117Z3	.75
3C6/XXB	1.60	6J6	1.45	7N7	1.10	24A	1.10	117Z4GT	1.45
3D6	.45	6J7GT	.85	7Q7	.90	25A6GT	1.60	117Z6GT	1.20
3E6	1.33	6J8	1.60	7R7	1.10	25A7GT	3.70	FM-1000	1.60
3LF4	1.33	6K5GT	1.20	7S7	1.33	25AC5GT	1.43	XXD	1.20
3Q4	1.10	6K6GT	.83	7V7	1.33	25B5	1.95	XXFM	1.33
3Q5GT	1.20	6K7GT	.75	7W7	1.33				



A STANDARD TYPE TV TUNER

Exceptional value in a 12 channel turret tuner or front end. This high gain, low noise tuner is designed for receivers with 21.25 or 21.9 MC I.F. Drum type turret has replaceable channel coil and contact strips. Fine tuning is provided with stop at each extreme. Guaranteed to last for years and years. Will replace any tuner. DOUBLE YOUR MONEY BACK if replacement detent is ever required.

Tuner uses 1-6AK5 RF and 1-6J6 Mixer-OSC

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With Tubes $14.95

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REMOTE CONTROL for *THE THING!*

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The answer to the "Remote Control" Experimenter's dream! A completely wired, 3-tube Remote Control Unit, originally used as ELECTRONIC BRAIN for remote thermostatic control of electric blankets. Can be used, with slight modification, to control model trains, planes, trucks, remote on-off for radios, open and close garage doors from your car, or to remotely control any device in accordance with your own ingenuity. AND THAT'S NOT ALL! With each unit we will give you, **ABSOLUTELY FREE**, one copy of Gernsback Library's popular new book "Model Control by Radio." 112 pages containing more than 125 illustrations, diagrams, tables, formulas, crammed full of theory and practical uses for electronic remote control. Remote control unit, including fil. xfmr, 3000 ohm plate circuit "trigger" relay, completely wired with circuit diagram, and above described book, less tubes. Shpg. wt. 3 lbs. All for only..... **$5.50**

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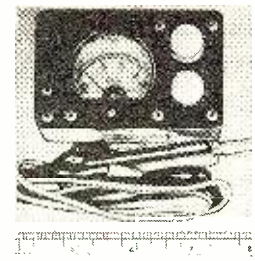
TINIEST V. O. M. IN THE WORLD

TERRIFIC! IMPROVED AND SMALLER!



- 0-100,000 ohms
- 0-15 V. AC or DC
- 0-150 V. AC or DC
- 0-750 V. AC or DC
- 0-150 DC Milliamperes

The Now Famous "UNIVERSAL BABY TESTER" has been further improved and, impossible as it sounds, reduced in size. The new meter measures 3½"x2¼"x1⅜".

Measurement ranges from a basic 240 microampere movement (2400 ohms per volt).

Made of heavy molded bakelite, set into a chrome on brass case, it includes batteries, AC voltage rectifier, and one pair of insulated test leads. FULLY GUARANTEED.

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All Items must meet with full approval or money refunded.

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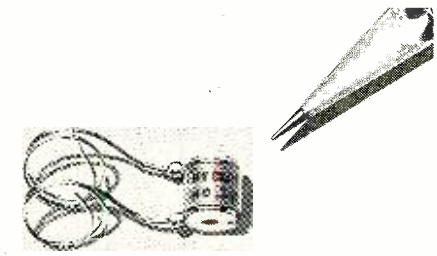
ameter. The unit can be mounted on the cowl, fender, or flat rear deck of any passenger car. When the transmitter is removed from the car the same hole can be used for mounting a standard broadcast antenna.

The Model SPP-143 is 55½" in length and is made of solid tapered stainless rod. The rod assembly is replaceable in the case of non-repairable damage. The ball and socket universal mount will fit any surface curving from between 35 degrees below horizontal and horizontal. The female lead connection will accept commercial fittings for RG-8/U or RG-58/U coax.

A data sheet on this new antenna is available on request.

PRECISION RESISTORS

The Hycor Company of 11423 Vanowen Street, North Hollywood, California, is in production on a new line



of fixed, non-inductive, wirewound precision resistors, the Series "E."

These new units have a standard temperature coefficient of .000025 per degree C, are varnish impregnated for moisture protection, and feature non-inductive windings on ceramic bobbins. Standard tolerance with this series is 1 per-cent with tolerances up to .05 per-cent available at additional charge.

Bulletin R giving complete information on the new Series "E" resistors is available on request.

GIFT PACKAGE

In honor of the company's 12th anniversary, the *Walter L. Schott Co.* of Los Angeles is distributing a gift package, valued at $2.00, with every $2.00 purchase of the company's hardware, chemicals, dial cords, or accessories, or $10.00 purchase of *Walsco* antennas.

The gift package contains five of the company's most popular service items: an electronic contact cleaning fluid; a

solution for application to noisy TV tuners; a lubricator for reaching cramped and hidden spots on TV, radio, and changer chassis; an injector unit for applying contact chemicals to vol-

Superior's New Model 670

SUPER-METER

A COMBINATION VOLT-OHM MILLIAMMETER PLUS CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS

SPECIFICATIONS:

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5 Amperes
RESISTANCE: 0 to 500/100,000 Ohms 0 to 10 Megohms
CAPACITY: .001 to .2 Mfd. .1 to 4 Mfd. (Quality test for electrolytics)
REACTANCE: 700 to 27,000 Ohms 13,000 Ohms to 3 Megohms
INDUCTANCE: 1.75 to 70 Henries 35 to 8,000 Henries
DECIBELS: — 10 to + 18 + 10 to + 38 + 30 to + 58

ADDED FEATURE:

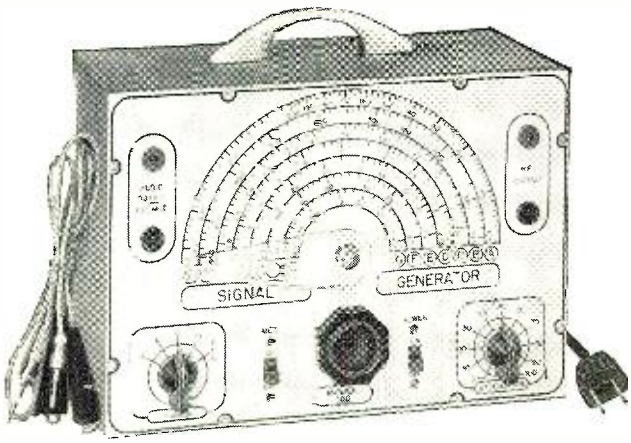
The Model 670 includes a special GOOD-BAD scale for checking the quality of electrolytic condensers at a test potential of 150 Volts.

The Model 670 comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 5½" x 7½" x 3".

$28.40 NET

The New Model 200

AM and FM SIGNAL GENERATOR



SPECIFICATIONS

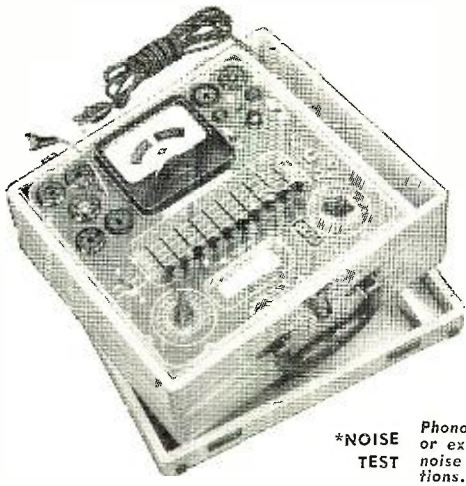
★ **R.F. FREQUENCY RANGES:** 100 Kilocycles to 150 Megacycles.
★ **MODULATING FREQUENCY:** 400 Cycles. May be used for modulating the R.F. signal. Also available separately.
★ **ATTENUATION:** The constant impedance attenuator is isolated from the oscillating circuit by the buffer tube. Output impedance of this model is only 100 ohms. This low impedance reduces losses in the output cable.
★ **OSCILLATORY CIRCUIT:** Hartley oscillator with cathode follower buffer tube. Frequency stability is assured by modulating the buffer tube.
★ **ACCURACY:** Use of high-Q permeability tuned coils adjusted against 1/10th of 1% standards assures an accuracy of 1% *on all ranges from 100 Kilocycles to 10 Megacycles* and an accuracy of 2% on the higher frequencies.
★ **TUBES USED:** 12AU7—One section is used as oscillator and the second is modulated cathode follower. T-2 is used as modulator. 6C4 is used as rectifier.

The Model 200 operates on 110 Volts A.C. Comes complete with output cable and operating instructions.

$21.85 NET

Superior's New Model TV-11

TUBE TESTER



- 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.
- Tests for "shorts" and "leakages" up to 5 Megohms.
- 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.
- The Model TV-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.
- Newly designed Line Voltage Control compensates for variation of any line voltage between 105 Volts and 130 Volts.

EXTRA SERVICE

The Model TV-11 may be used as an extremely sensitive Condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakage even when the frequency is one per minute.

***NOISE TEST** *Phono Jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose external connections.*

The Model TV-11 operates on 105-130 Volt 60 Cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover.

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	200 Signal Generator	
	TV-11 Tube Tester	
	TOTAL	

Name_____

Address_____

City_____ Zone_____ State_____

$..... (Payment in Full Enclosed)

$..... (Deposit Enclosed—Ship Balance C.O.D.)

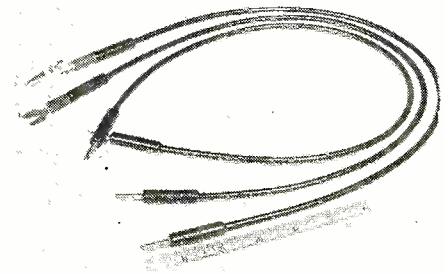
ume controls and switches; and a tube of radio cement.

Distribution of these gift packages will be handled through parts jobbers during the months of June and July.

"ADDAPLUG" LEAD

The *Associated Engineering Corporation of Boston,* 38 Euston Road, Brighton 35, Massachusetts, has recently introduced a new accessory, the "Addaplug" connecting lead.

Completely molded of vinyl plastic, the lead consists of an insulated low



resistance wire, terminated in "Addaplug" connectors. These connectors feature a durable plug with a spring-loaded knife edge for firm low resistance connection. They have plug holes for multiple connections and fit into alligator clips, spade lugs, and terminals of standard equipment.

The lead will withstand 5000 volts and has a current capacity of 15 amperes. They are available in various lengths and in red or black.

BUDGET POWER TOOL

Kapner Hardware, Inc., 2248 Second Avenue, New York 29, New York, is distributing a new power tool combination which is priced for budget-conscious buyers.

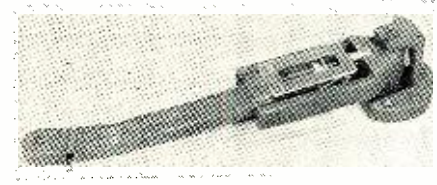
The ¼" electric drill for 115 volt a.c. operation comes complete with a 4" portable electric saw attachment, a 4" saw blade, lamb's wool bonnet, 6 sanding discs, 7 assorted drills, steel arbor and attachments, cloth buffing wheel, grinding wheel, wire wheel brush, steel paint mixer, steel bench stand, and portable steel carrying case.

This power tool is suitable for the home workshop, the ham shack, and the radio service shop.

PROFESSIONAL TONE ARM

The Receiver Division of the *General Electric Company,* Syracuse, New York has recently introduced a new professional tone arm, the FA-21-A.

The new arm is designed to mount the company's variable reluctance



cartridge, RPX-050. This transcription arm is made for lateral transcriptions and recordings. The mass of the transcription arm has been reduced through functional design and the use of mag-

nesium alloy for the moving parts. Both the lateral and vertical planes have very low bearing friction due to the precision, hand-adjusted cone-type bearings.

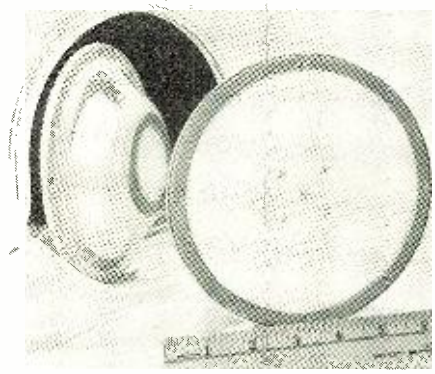
Principal features of the new unit include ease of installation on popular turntables; the absence of arm resonances in the audio range; easy groove location, low mass, low friction arm, and a highly damped and compliant cartridge producing a combination relatively immune to groove jumping.

Additional details on the FA-21-A are available from the company.

LOW COST SPEAKERS

The *Audiotron Corporation* of 1640 18th Street, Santa Monica, California, is introducing a new speaker, the "Audiotron Jr."

This lightweight speaker of small dimensions (6"x2.5") has a frequency response to above 15,000 cps and a power rating of 10 watts (above 1200



cps). The compliant cone membrane is loosely suspended and because it is made of cloth, long life is assured. The large magnet and voice coil are situated within the cone, serving to give greater stability and improved transient response with high sensitivity. The voice coil assembly and magnet are totally dust sealed.

Full details on this new speaker will be furnished by the company on request.

SILVER "MICROPAINT"

Micro-Circuits Company of New Buffalo, Michigan, has developed a new Silver "Micropaint," the SCT series.

This series comprises a closely related group of new electrically conductive coating materials having a high degree of durability and heat resistance combined with low electrical resistance.

The manufacturer suggests that this new paint may be substituted for copper, brass, and aluminum in many current-carrying and shielding applications. It may be applied to any shape and nearly any type of base material by brushing, spraying, dipping, silk screen stencilling, brush or spray stencilling, etc. The material is baked at from 225 to 400 degrees F. depending on the application.

Full application data and additional details on the new SCT series are available from the company. —30—

Tone Control

(*Continued from page* 59)

choke, it was selected for the tests. The choke was a *UTC* VIC-17 reactor, which could be adjusted to the desired inductance, and when this was done the frequency response was substantially as expected, Fig. 5. The use of 150,000 ohm controls resulted in a smooth control action over most of the rotation of the knob.

When connected to an oscilloscope, the output appeared to be distortionless as long as the input was maintained at less than that permitted by the bias voltage of the control tubes. When the controls are in flat position the circuit will handle at least ten times this permissible input without distortion, because of degenerative action. Distortion due to overloading is, therefore, most apt to occur at low or high frequencies when bass and treble boost are on full.

The apparent fact that the resonant circuit introduces no transient distortion at mid-frequencies (1000 c.p.s.) may perhaps be explained by noting that at these frequencies its impedance is higher than the plate or cathode resistance of the tube and the resonant circuit is consequently of little effect there. With the controls in "flat" position, of course, the resonant combination is effectively removed from the circuit and has no effect whatsoever.

The measured gain of the stage is .88. The hum level of the output is very low, less than that of the power supply used for the experimental work. It is nevertheless desirable to keep the signal voltages in such stages at reasonably high levels to override the various sources of noise. With an input of two or three volts peak to the stage designed in this article the noise is negligible.

Conclusions

The degenerative tone control serves the quadruple purpose of boosting or cutting bass or treble frequencies with a simplicity unmatched by any other arrangement. In the past the most serious objection raised against its use has been the possibility of introduction of distortion by the iron-core choke and the resonant circuit. This distortion, however, appears to be extremely small and since most other tone-control arrangements use two cascaded stages it seems that at best there is little difference from the distortion standpoint. On the other hand there are two more valid objections to the degenerative tone control; the first is that the high cathode voltage necessitates a separate heater winding and the second is the possibility of noise in the output.

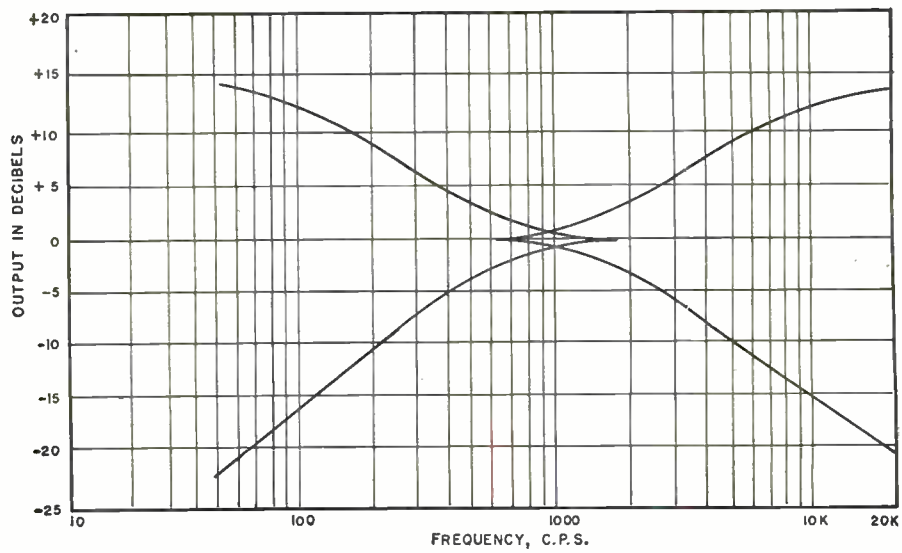
The first objection is hardly a basis for rejection of the circuit since a separate heater transformer is readily supplied. With regard to the second, however, it appears that the tone control shares the same shortcomings as the plate-and-cathode loaded phase inverter, namely, the noise level is higher than that of an ordinary triode stage. For this reason it is desirable that the circuit be incorporated into an amplifier where the peak signal voltages are moderately high—on the order of two or three volts.

The gain of the stage is so near to unity that the tone control is easily incorporated into existing amplifiers without extensive changes in other parts of the circuit. Thorough decoupling of the "B" supply is about the only stringent requirement.

Finally, not the least of the advantages of this circuit is the ease with which it may be designed for any required bass and treble turnover points and the fact that the controls themselves are commercially available from a number of sources. It appears, therefore, that this circuit is an excellent choice for incorporation into new or existing equipment, including that intended for high-fidelity use.

—30—

Fig. 5. Frequency response curves for the degenerative tone control discussed in text.



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SIDE COWL: 3 section staff, 63″ extension. Complete with tenite insulators. Static ball and tip shielded. Low loss lead.

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Standard 4 prong..... **$1.45** each.
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A real bargain for these first-rate tubes.

16″—16RP4.....**$23.50** each
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PHONO CARTRIDGES—Brand New —Will replace 95% of all cartridges.
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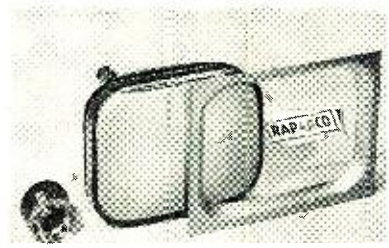

14″ Kit—14BP4 CR tube, 70° Deflection yoke. Attractive Lucite mask. **$32.95**

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1B3GT..	$1.20	6K6GT..	$ .69
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THE PERFECT SPEAKER FOR REPLACEMENT OR SOUND WORK

10″ PM 3.15 oz. Alnico V Magnet. Rated at 15 watts.....**$3.95** each.
6 for **$3.75** each.

GT TUBE CARTONS

Sturdy—Many Uses

Box bulk tubes, spare parts, nuts and bolts. **79c** per 100. **$4.95** per 1000.

CUSTOM BUILT AUTO RADIOS

Easily installed. Fine, top quality. Ready to place in your car. Designed for each specific car.

All sets—6 tube. 3 gang; super heterodyne. Extra sensitive circuit. Low battery drain. Beautiful finish and dial. These models now available:

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This handy, useful 6-piece set with unbreakable, shockproof, nonflammable amber handles, with flange aluminum screw chuck. Blades hardened, tempered and fully polished. In attractive leatherette pouch. NOW ONLY **$1.11** each.
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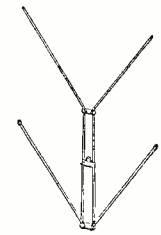
FLYING ARROW TV ANTENNA DOUBLE V ARRAY



Hi-gain for fringe areas. Completely pre-assembled. Packed two arrays per carton. Can be stacked for extra signal strength. Price per carton of two **$7.10**
Lots of 6 cartons.....**$40.50**
10 ft. 1¼" heavy gauge steel mast, rustproof.....**$2.29** ea.
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CHIMNEY MOUNTS—2 piece heavy-duty, rust-proof brackets. No drilling or guy wire needed. Includes strapping. **$1.30** each 12 for **$1.20** each

Radio Parts Company, 614 RANDOLPH ST., CHICAGO 6, ILL.

TV Alignment

(*Continued from page* 55)

imum output as indicated on the scope, adjust the primary in the same way. The generator output lead is worked back, stage-by-stage, to the converter. During the alignment process, the output of the sweep generator should be adjusted to the lowest value which will give a clear indication on the scope. When working back from the detector to the mixer, the generator output must be reduced as each stage is passed to avoid overloading with resultant distortion of the alignment curve. After the converter primary has been peaked, all stages should be trimmed or touched up if necessary to improve the over-all response. (In aligning the first i.f. stage, a scope detector network, Fig. 5, may be required to give the proper scope reading.)

Alignment of Stagger-Tuned I.F. Transformers

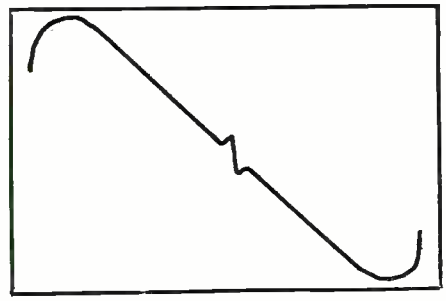
Stagger-tuned transformers are aligned in exactly the same way as single-tuned transformers, except that the i.f. frequency is shifted slightly for each successive stage. The marker oscillator is set at the correct frequency for each stage as specified by the manufacturer, and the corresponding transformer peaked for *maximum* output.

Sound I.F. Adjustment

These stages follow the alignment pattern for regular FM receivers and need not be treated in detail. The only precautions are to avoid overloading, to make sure the bandwidth is 50 to 100 kc. (as specified for the particular receiver), and to adjust the proper sound traps to the exact *center* of the sound i.f. carrier. It is extremely important, especially in intercarrier receivers, that the center i.f. sound frequency is aligned exactly 4.5 mc. from the center i.f. video frequency.

Discriminator Adjustment. Video receivers usually employ either the Foster-Seeley discriminator or some form of ratio detector. In many cases it will be found that an "X"-type discriminator curve (see Fig. 8) will make adjustments easier than the more familiar "S" curve in Fig. 7. The X-type pattern can be obtained by leaving the

Fig. 7. The familiar "S" curve obtained at the FM discriminator. The "X" type discriminator curve shown in Fig. 8 will, in many cases, simplify the alignment procedure.



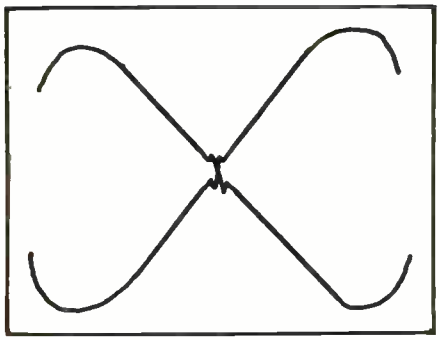


Fig. 8. The "X" type discriminator curve.

scope and signal generator set up as shown in Fig. 6 and setting the scope controls as follows: Horizontal Amplifier on *Internal Saw-tooth Sweep*, Sweep Frequency on *120 cycles*, and Sync Selector Switch on *External*. (The external 120 cycle sync voltage can be obtained by connecting the scope sync leads directly to the input filter condenser of the receiver's low-voltage power supply, if the power supply uses a full-wave rectifier.)

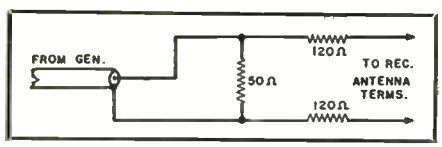
R.F., Converter, Oscillator Adjustments

Make these adjustments with the scope connected as before (Fig. 6). Connect the signal generator to one terminal of the antenna, and connect the marker generator to the other antenna terminal. (In some receivers, better results will be obtained by connecting the signal generator *only* to the antenna terminals and coupling the marker generator to the antenna by placing it close to the sweep generator output leads.) Connect a 300 ohm carbon resistor as a dummy load across the antenna terminals.

Oscillator Alignment. Adjust each oscillator trimmer for maximum output on the scope, following the frequency settings and adjustment steps recommended by the manufacturer. For all adjustments, leave the fine-tuning control at its center position, except in receivers where this control must be set otherwise in order to expose the oscillator tuning slugs. In this case, do not disturb the fine tuning setting until all adjustments have been completed.

Again, note that the manufacturer's instructions as to the *order* of alignment *must* be followed. Some types of receivers employing transmission-line inductance tuning, for example, require that Channel 13 be aligned first, and the rest in succession from Channel 12 through Channel 2. Other receivers may specify that Channel 2 be aligned first, while in still others the order of alignment will not matter.

Fig. 9. Matching network to be inserted between generator and receiver when generator is 50 ohms and receiver input is 300 ohms.



R.F. and Converter Alignment. These stages are aligned for maximum output on each channel, with the sweep generator and scope connected the same as for oscillator adjustments (Fig. 6). The correct center frequency for each channel should be indicated with the marker generator.

In some receivers which employ a stage of r.f. preselection, it may be necessary to connect the marker generator to some convenient point in one of the i.f. stages instead of to the r.f. stage. The 20-30 mc. marker frequencies might otherwise have trouble in passing through the r.f. stages, which are tuned from 54 mc. and higher and probably would not accept the marker signals. (Remember, the purpose of a marker in r.f. alignment is the same as for i.f. alignment—to fix the exact center frequency and to make sure the bandpass characteristics conform to the manufacturer's specifications.

Sweep-Checking Faulty Components

The presence of a defective part or tube can be detected by giving the entire video portion of the receiver a rapid "sweep check." This is done by feeding an appropriate sweep signal into the receiver and noting the resultant waveform on the scope as the suspected part is tapped or probed. (The scope can be connected across the output of the last video amplifier or to the grid of the picture tube). A noisy, intermittent, or otherwise defective part or tube will cause the waveform to change its shape or amplitude as the defective part is moved. The sound channel can be checked in much the same way by connecting the scope across the output of the audio output stage or speaker. —30—

HAMFESTS SCHEDULED

THE Starved Rock Radio Club, Inc. has scheduled its hamfest for June 3 at the Boy Scout Camp Ki-Shau-Wau, near Starved Rock State Park, Illinois.

Admission at the gate is $1.50. The usual complete program is planned with special emphasis on entertainment for the ladies and children. George E. Keith, W9QLZ, is the secretary of the organization. He may be addressed at Box 22-A, Utica, Illinois.

* * *

On June 16th the Radio Association of Erie will hold its 25th anniversary hamfest at Lake Le Boeuf Park, Waterford, Pa.

Registration opens at 11 and dinner will be served at 4:30 p.m. An elaborate program has been planned.

Tickets are available from Dr. W. R. Cook, 929 State St., Erie, Pa.

* * *

The Third Annual Missouri Emergency Net picnic and hamfest has been scheduled for June 17th at Tweedies Resort in Eldon, Missouri, on the Lake of the Ozarks.

All hams, XYL's, and YL's are invited. The committee advises that there will be a well-stocked snack bar and plenty of prizes. Admission will be 50 cents. For reservations and further information contact Paul M. Cooper, WØTGG, Eldon, Missouri. —30—

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FT241-A. Holder ½" Pin spacing, for ham and general use. Xtal controlled. Signal Generators, marked in army Mc harmonic frequencies—Directions for deriving fundamental frequencies enclosed. Listed below by fundamental frequency, fractions omitted.

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372	397	422	458	488	515	448
374	398	423	459	490	516	450
375	400	424	461	491	518	451
376	401	425	462	492	519	453
377	402	427	468	493	520	454
379	403	429	469	494	522	455
380	404	430	470	495	523	456
381	405	431	472	496	525	457
383	406	433	473	497	526	463
384	407	434	474	502	527	465
385	408	435	475	503	529	498
386	409	436	476	504	530	500
387	411	437	477	505	531	501
388	412	438	479	506	533	538
390	413	440	480	507	534	540
391	414	441	481	508	536	
392	415	442	483	509	537	each
393	416	443	484	511	each	
394	418	444	485	512	**69c**	**$1.49**
395	419	445	486	513		

BATHTUB CAPACITORS

MFD	VOLT.	TYPE	PRICE EACH	PRICE 10 FOR
.5	400	2BT	$0.23	$2.20
.5	600	2TT	.25	2.40
3X.1	600	3TT	.45	4.35
3X.1	600	3ST	.45	4.35
2X.1	400	3ST	.26	2.50
2X.1	600	3ST	.28	2.65
2X.1	600	3BT	.28	2.65
2X.1	400	2TT	.26	2.50
2X.1	200	2ST	.23	2.20
2X.1	600	2BT	.26	2.50
2X.1	600	3TT	.26	2.50
.1-.1-.025	400	3ST	.28	2.65
.1	600	2BT	.22	2.10
.1	600	1ST	.22	2.10
.1	600	2TT	.22	2.10
.1	600	2ST	.22	2.10
.13	600	2ST	.25	2.40
2X.25	600	3ST	.30	2.85
.05	600	2TT	.21	2.00
1	100	2TT	.23	2.20
20	50	2ST	.26	2.50

TEST EQUIPMENT

Frequency Modulated Generator, Type 155A Frequency 38 MC—50 MC. Range 1 MC—10 MC. Boonton Radio.

Solar Examcter Capacitor Analyzer.

Tube Tester Model 7050, Philco 110/120 AC 60 Cy.

3" scope No. 155A C. R. Oscillograph R.C.A.

Test Set I-180A. Hickok Model 540 Test Equipment Tube checker.

Sweep Signal Generator Model 909.

McMurdo (Silver). Range 2-226 MC. Output 0-.5 V Max. 105/125V 50/60 Cy. 35W.

Frequency Meter BC221N 125-20000 KC.

Precision Series E-400. Sweep Generator FM-TV-AM.

Signal Generator Model 702. Radio City Products.

Standard Signal Generator Model 78B. Boonton (Measurements Corp.)

Television Calibrator WR-39A. R.C.A.

Microvolter Model 20-B Ferris Instrument Boonton.

Signal Generator I-216 15-26 MC CKE 115V/60 Cy. 180-235 MC.

Model LU-1. Radar Test Equipment. Frequency meter & Test Oscillator.

Industrial Instrument Bridge. LB2-DRL. 10 Watt 115V 60 Cy.

Industrial Instrument Bridge RN-1.

Hunter charging control analyzer Model 372K2.

Hickock Thermo Ammeter Model 14T #1-4270.

Weston DC Milliammeter Model #155.

Leeds & North Type S Test Set #5300 #5410.

RCA Voltmeter Ohmyst.

Leeds North Galvanometer #2420A.

GR Output Meter #783A.

Boonton Q Meter Type 160A & 170A, Industrial Bridge LB1D.

Write or Phone for Prices

TOP TRANSFORMER BUYS

These XFRMRS are Army Spec. All Underrated.

Comb. Transformers—115V/50-60 cps input

Item	H.V.	Amp.	Filaments	Price
CT-861	2100VCT	.175	7.5VCT/4A, 2.5V/10A	$10.95
CT-142	645VCT	.060	5V/2A,6.3V/1.2A	4.25
CT-825	360VCT	.340	6.3VCT/3.6, 6.3VCT/3A	3.95
CT-076	600V	.100	2 x 12.6V/1	1.95
CT-626	1500V	.160	2.5/12, 30/.100	9.95
CT-15A	350VCT	.070	6.3/.6, 6.3/1.8 3 lbs	2.95
CT-071	110V	.200	33/.200, 5V/10, 2.5/10	4.95
CT-378	2300V	4 MA	2.5/2	6.95
CT-367	580VCT	.050	5VCT/3A	2.25
CT-721	550VCT	.100	6.3/1, 2.5VCT/2	2.95
CT-99A	2x110VCT	.010	6.3/1A, 2.5 VCT/7A	3.25
CT-91A	726V	.100	5V/3A, 6.3/3.5	3.25
CT-441	50V	.200	5V/2.4, 5V/1.2	2.29
CT-408	350VCT	.026 MA	5V/3A	2.75
CT-931	585VCT	.086	5V/3A, 6.3V/6A	4.25
CT-610	1250	.002 MA	2.5V/2.1A, 2.5V/1.75A	4.95
CT-137	350VCT	.026 MA	5V/3A	2.75
CT-102	1080VCT	.055	25V/3A,6.3V/1.8A,6.3V/1.2A	5.95
CT-866	330V	.065	6.3V/1.2, 6.3V/600 MA	1.75
CT-319	330VCT	.085	5V/2, 6.3/7.5, 6.3/3	3.25

Filament Transformers—115V/50-60 cps input

Item	Rating	Each
FT-029	13.5V/1.11A	$ .79
FT-346	5VCT/13/5, 5VCT/6.75, 5VCT/6.75	5.95
FT-781	866 Trans. 2 x 2.5/5A	2.25
FTG-31	2.5V/2.5, 7V/7A (Tape @ 2.5V/2.5A), 16 lbs	9.95
FT-674	8.1V/1.5A	1.10
FT-157	4V/16A, 2.5V/1.75A	2.95
FT-391	6.4V/3A	1.10
FT-736	2 x 6.3VCT/3.2-1.2A	1.49
FT-899	2 x 5 V/5.5A 29000 Rms	22.95
FT-418	6.3VCT/1A, 6.3VCT/7A	1.95
FT-735	6.3VCT/5A, 6.3VCT/1A	1.79
FT-101	6V/.25A	.79
FT-738	6.3VCT/1A, 5V/2A	1.69

Plate Transformers—115V/50-60 cps input

Item	Rating	Each
PT-976	Auto: 120VCT/10 MA	$ 0.69
PT-31A	2 x 300V/5 MA	.79
PT-46A	4080VCT N.L. 3⅜ to 1 8" H x 6" W x 7" L 20 lbs	29.95
PT-033	4150V/400 MA 11½ x 9¼ W x 9" D 70 lbs	49.95
PT-75-2	3780/3446/3112VCT/77 MA	10.95
PT-28-1	4600VCT/.077	12.95
PT-403	Auto: 70V/1A	2.29
PT-160	1120VCT/770 MA, 590VCT/82 MA, 25 lbs	24.95
PT-170	Auto: 156/146/137/128—.71A	3.29
PT-139	42V/46V/50V/55V/15.2A 7⅛x7" W x 6¼" H	10.95
PT-31A	2 x 300V/5 MA	.79
PT-976	120VCT/10 MA	.79
PT-67-1	62V/3.5A	2.95
PT-12A	280VCT/1.2A	2.95

SELSYN TESTER

Magnesyn Instrument Field Tester AAF 43G23330 Spec. 40772. To test individual mag. Ind. & Xmitters, for isolating Faults in magnesyn systems. Brand new $99.00

VARIABLE TRIMMER CONDENSERS

C890 15 MMF
C881 20 MMF
C993 50 MMF
C677 60 MMF
} 32c ea.

HEADSETS & MIKES

HS23 Used Good 8000 Imp. $2.49
HS33 Used Good 600 Imp. $2.49
HS30B Replace Elements .....60c ea.
Rubber Earplugs for HS30.....10 for 25c
Matching XFRMR C410 Less Cords..59c
T45 Lip Mikes...98c
T30 Throat Mike..39c
CD505T30 Ext. Cords w/ Switch Sw141. Complete $1.25
Gas Mask Mike Elements 49c
Cords 3' Cond. Color coded approx. 42". 15c ea.
Hdband HBJ 25c
Hdband HB30 .....25c

LEARN OR TEACH CODE

Uses 6-10-24-115V DC, 115-230 VAC. Can use hookup of over 20 students. Contains speaker, blinker, freq. control, etc., in fiber trunk 17"x13"x10½".

New $24.95

MOBILES! C.A.P. C.D.!

6 V. DYNAMOTOR SUPPLY

RATINGS OUTPUT	INPUT
Volts ....450 VDC	6 VDC
Amps .... 350 MA	45A
OR	
Volts ....450 VDC	6 VDC
Amps .... 200 MA	22A

Originally designed for 14V, but mobiles over U.S.A. report ex. results on 6V.
Brand New, w/Filter Box, Starting Relay, Mounting Plate... **$12.95**
Plugs, Set of 2.....$1.00
(With Dynamotor only)

Tuning Units for BC-375 & 191 Diag. for Conver to VHF Freq. Meter in Oct. 1950.
TU7 4500— 6200KC
TU8 6200— 7700KC
TU9 7700—10000KC
TU20 200— 500KC
Price $2.49 ea.

AUDIO TRANSFORMERS

ITEM		
AT666	Input 6 ohms: 250K ohms	$0.79
AT SUB	Multimatch Subouncer 200 ohms 15K ohms C. T.: 100K ohms/20K ohms	.69
AT070	Input to Grid 250 ohms: 60K ohms HI FI	1.19
AT566	Input to Grid, 500/200 ohms: 50K ohms	.95
AT227	Output to line, 7500K 500 ohms CT 200—5key	1.45
AT353	Output PP 6L6 to 300/20/12/16 ohms 25 Watt	2.95
ATS71	UNIV. Output. HI FI. Pri 20K ohms nec. 15/7.5/5/3.75/1.25/500 ohms	2.79
AT554	Interstage, 10K ohms: 250K ohms 15db Level	1.95
AT765	Input 600 ohms to 50K ohms	.79
AT707	Interstage ouncer 10K ohms: 125/125K ohms	.79
AT449	Driver 5K ohm to 4K ohm PP6L6 to PP805 Class B	3.89
AT21	Dual XFRMR 300 ohms: 300 ohms and 600 ohms: 250K ohms	1.35
AT383	Output 8500 ohms: 19 ohms 25W	1.79
AT415	Output 18K ohms CT to Line 125 ohms 175W	2.95
AT649	Input Line 500 ohms T Grid. 75K ohms	.79

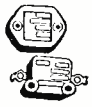
MANY OTHERS

INSULATORS

Feeder Support IN81-IN82 Porc. Standoff 1½ H x 1 3/16 D. 10c ea.; 10 for 75c
Feed Thru IN84-NS1. Complete w/ Hdwre.....15c ea.; 10 for $1.25
Feed Thru Lapp Bowl Sim to NS3 for 2¾" hole. 6¾ L x 3" dia..$1.25 ea.
ANT Insulators. IN86 3⅝ L x 1 x 1. 18c ea.; 10 for $1.50
Feeder Spreaders 2 11/16 x 7/16". 2" C to C Holes.....Price 10c
Feeder Spreaders 2⅛" L x ⅜" Sq. 1⅝ C to C Holes.....Price 8c ea.
Locke Suspension Ins Cat # CAL 61249. 18" L x 2" D....Price $19.95
Telephone Knob Insulator Whiteall Tatum #4. Heavy Glass..Price $2.29
Many Others—Write

ANTENNA MAST

Are you in a dead spot. If you can't get a good T. V. Picture. Here is a Sig. Corps Ant. mast 30' high of rugged plywood construction to solve your problem. It telescopes into 3 ten ft. sect. for easy stowage. Easy to Mnt. Comp. with stakes & rods..Ea. $19.95



MICA CAPACITORS
SOLAR XMB
TAPPED POLES

Mfd.	Price
2500 V Test	
.00001	$0.35
.00025	.35
.00003	.35
.00005	.35
.0000075	.35
.0001	.35
.00015	.35
.00025	.35
.0003	.35
.0004	.35
.0005	.40
.00075	.40
.00085	.40
.001	.50
.0015	.50
.0016	.50
.0017	.55
.002	.65
.0023	.65
.003	.75
.004	.95
.005	.95
.006	.98
.0063	.98
.0069	.98
.007	.98
.0075	.98
.0076	.98
.008	1.05
.01	1.25
.015	1.25
.02	1.30
.025	1.30
.027	1.35
.03	1.45
5000 V Test	
.0015	1.75
.002	2.00
Solar XQ Solder Lugs 2500 V Test	
.01	1.25
.015	1.30
.02	1.50
.04	1.75
.001	.60
.0015	.60
.002	.75
.0022	.75
.0023	.75
.0024	.75
.0025	.75
.0027	.80
.003	.80
.004	.85
.005	.90
.0056	.95
.006	.95
.0063	.95
.0075	1.00
.0076	1.00
.008	1.05
.0085	1.20
.0005	.60
.00085	.70
.00015	.60

OIL CONDENSERS

Mfd.	Volt.	Price
5	50	$0.45
650	80	1.95
5	150 AC	1.45
15	220 AC	2.20
1	500	.40
7	600	1.25
20	600	2.10
0.5	750 AC	1.59
0.5	1000	.69
2x0.5	1000	.70
1	1000	.75
1.5	1000	.85
2	1000	.90
4	1000	1.75
3x.01	1200	1.35
0.0016	1500	1.25
1	1500	1.30
1.5	1500	1.40
2	1500	1.45
2x0.1	2000	1.10
1	2000	1.45
2	2000	2.25
3	2200	2.45
0.5	2500	1.35
1.5	2500	1.35
0.15	4000	1.20
2x0.1	4800	1.20
0.1	6000	1.20
2x0.1	7000	1.25
0.1	7500	1.25
2x0.15	8000	4.75

MANY OTHERS

932 PHOTO TUBE

Gas Phototube having S1 response, particularly sensitive to Red and Near Infrared Radiation. Can be used with incandescent light source. Send for Data. Price..... **75c**

ARC 5 MODULATOR

MD7/ARC5 Plate Modulator w/ dynamotor complete w/Tubes 1—1275, 2—1625, 1—VR50. Good cond. Price.....$6.95
BC456 Screen Mod. $2.25

EE89A TELEPHONE REPEATER

Used to extend range of field telephones, teleg. & 20 cyc. ringing possible over lines complete w/305 tube & phone. Fine weight. Price $9.95

Heineman Ckt Bkrs for AC-DC operation.
AM 1510M 7 Amp
1614 80 Amp
1614 50 Amp
Price each $1.10

Aircraft Rec. # 429 for Mobile or Aircraft Covers from 201 Kc up by interchange plug in tuning units includes one Dual Tuning Unit: 200 KC. 400 KC. & 2.5 Mc-4.7 Mc. Less tubes. Rec. Only a few left. .....$3.95 ea.

DYNAMOTORS

Type	Input Volts	Input Amps.	Output Volts	Output Amps.	Radio Set
PE86	28	1.25	250	.060	RC 36
DM416	14	6.2	330	.170	RU 19
DY-2/ARR-2	28	1.1	250	.060	ARC-5
DM36	28	1.4	220	.080	SCR 508
DM25	12	2.3	250	.050	BC 367
	28	1.25	275	.070	BC 348
DM31A	28	7	540	.250	BC 456
DM42	14	46	515	.110	SCR 506
			1030	.050	
			2/8		
PE101C	13/26	12.6	400	.135	SCR 515
		6.3	800	.020	
BD AR 93	28	3.25	375	.150	
23350	27	1.75	285	.075	APN-1
35CO458	28	1.2	250	.060	
ZA-085	12/24	4/2	500	.050	
ZA-056	12/24	8/4	12/275	3/110	
B-19 pack	12	9.4	275	.110	Mark II
			500	.050	
D-104	12		225	.100	
			440	.200	
DA-3A	28	10	300	.060	SCR 522
			150	.010	
			14.5	.5	
5053	28	1.4	250	.060	APN-1
PE73CM	28	19	1000	.350	BC 375
DM21	14	3.3	235	.090	BC 312
CW21AAX	13	12.6	400	.135	
	26	6.3	800	.020	
			9	1.12	
BD 77KM	14	40	1000	.350	MC 191
PE94	28	10	300	.200	SCR
			150	.010	522
			14.5	.5	

PE 86 DM 32A DY 22 ARC 3 DAG 33A

Screen Mod. XFRMR for pair of 807's PP — PP or Barll Sidetone Wndg. 95c

T. U. for BCAR230 or 430 3.2—4MC 5—6.2MC 1.2—1.5MC 1—1.2MC
Price 95c ea. 4—5MC w/ 1495KC
XTAL $1.69 ea.

NEW—BC—906 FREQ. METER—NEW

Range 15-22.5 MC—Bat. operation with Precision vernier dial, tuning charts, 0-500 D.C. microammeter, diode - Triode and plug-in antenna. Contained in black aluminum carrying case 12½ x 8¾ x 6½. Price $15.95.

1% PRECISION RESISTORS

.6	128	10,000
1.01	250	12,000
5	300	12,500
5.05	430	17,000
10.1	463	17,300
18	800	20,000
43.5	920	25,000
50	1100	30,000
75	4300	33,000
82	5000	40,000
120	7500	55,000
125	8500	57,000
128	10,000	75,000
150	10,000	84,000

30c ea. 10 for $2.50

100,000	150,000
120,000	220K
120,000	250K

40c ea. 10 for $3.50
1 Meg. 75c ea.

MODULATION XFMRS.

#9466 P-P 807's to P-P or Par. 807's R.F. 300 Ohm Sidetone Wdg. $1.65
#T104 P-P 6L6's to 832 RF, 20W $1.49
#5651 Screen Mod: 807 to P-P or Par. 807's: Sidetone Wdg. 95c

AMPS—RF

0-4 Amp RF GE Type DW52. 2% Accuracy. Expanded Scale. 2.19" dia. Int. Thermocouple. List Price $19.75. Our Price $2.95

Fish Pole Sectional Antennas

MS49-S0, 6¼ ft. 49c
MS49-52, 12½ ft. $1.69
MS49-53, 16 ft. 2.49
MS49-56, 25 ft. 5.98
BASES; MP22 ..... 3.95

CAPACITORS CERAMICON

MMF.	MMF	MMF.
3	35	82
3.1	47	125
4	50	200
11	51	240
13	60	250
14	62	345
15	65	350
20	70	500
220		1000
25		

$7 PER 100

SILVER MICA BUTTONS

MMF.	MMF	MMF.
40	175	500
50	180	2000
100	185	

$7.50 PER 100

All merch. guar. Mail orders promptly filled. All prices F.O.B. N. Y. C. Send MO or Chk. Only shipping chgs. sent C.O.D. Rated Concerns send P.O.

COMMUNICATIONS EQUIPMENT CO.

MIN. ORDER $3.00

131 Liberty St., New York, N. Y. Dept. N-6 Chas. Rosen Phone: Digby 9-4124

Audio Modulation Tests

(*Continued from page 53*)

erence to compare with a signal of the same initial phase and frequency. The modulated carrier and the low frequency tone are mixed and applied to the system under test. Phase shift will cause a displacement of the low frequency, in relation to the modulation envelope, which may be easily observed on an oscilloscope. This technique would seem to conveniently lend itself to the analysis of elements such as telephone lines where it might be difficult to provide an accurate reference voltage by conventional means. However, transient distortion in the system may alter the characteristics of the modulation envelope and it may be desirable to use a carrier of variable frequency in order to average the results obtained. Oscilloscope photos of phase shift measurements by this method are shown. It is interesting to note that if an in-phase signal is mixed with a modulated carrier, the scope pattern will at first glance appear to show rectification although actually the waveform of the high frequency carrier is unaltered. Nevertheless, the resultant complex wave may have assymetrical characteristics distressing in certain types of equipment.

The modulator used in the foregoing experiments is shown in the accompanying photograph and includes a number of characteristics considered desirable for this type of work although being relatively simple in design. Modulation percentages variable from zero to well over 100% may be easily obtained with good suppression of the modulating frequency. Wide range transformers are employed in order to permit observations at the extremes of the audio spectrum and provision is made either for internal 60 cycle modulation or external modulation of variable frequency. In order to permit high percentages of modulation with a minimum of distortion of the modulated frequency, a large amount of degeneration is used in the cathode of the modulated stage. This, in turn, considerably lowers the output obtainable from the device, but improves the waveform of the modulation envelope as well.

An interesting, though unprecise, experiment is to apply speech or music to the input of the modulator and aurally observe the results through a reproducing system at various percentages of modulation by a constant nonharmonic frequency, such as 60 cycles. A test of this nature may give some indication of the tolerance of a particular reproducing system or listener for this type of intermodulation distortion, and is probably more reliable than comparisons between audio amplifiers in which variations in circuitry and components may produce other results than differences in intermodulation percentages. Limited listening experiments indicated that the objection-

ableness of intermodulation distortion was greater when the modulation was accompanied by high order harmonic distortion of the modulated tone, much higher percentages being tolerable when the carrier was undeformed other than in amplitude.

In conclusion, the modulated wave technique appears to have useful applications in nearly every phase of audio testing from precise laboratory analysis to tests of subjective quality. The relative lack of complexity of the equipment required, as well as the versatility of the tests that may be performed, should well recommend this technique to the worker in the audio field.

-30-

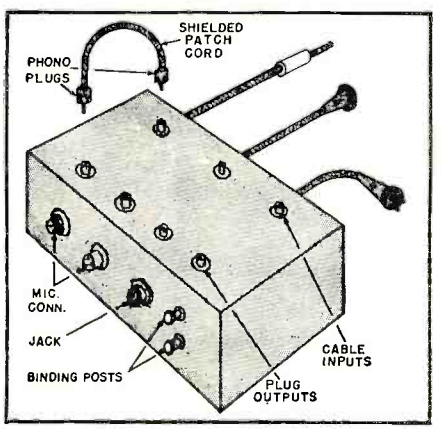
PATCH PANEL SPEEDS AMPLIFIER TESTING

By HUGH LINEBACK

BY borrowing an idea from broadcast stations, a handy accessory for amplifier testing can easily be made for the service shop. One of the routine annoyances in testing different kinds of amplifiers is matching the plugs used for input connections. Some spare connectors of the types frequently encountered are mounted in the sides of a small metal box, as shown in Fig. 1. The input connectors are terminated in phono jacks mounted on the top of the box. Output cables from the other side are fed by similar jacks, so that the desired coupling can be made quickly by means of a "patch cord." This cord is a short length of shielded wire, with a phono plug on each end. While this arrangement handles only one "hot" wire, the shield being grounded, it will be found that most three-terminal plugs have two of the terminals connected together and grounded at one point in the amplifier, so that this type of system could be accommodated.

In some cases it might be desirable to include connectors which would enable plugs of the PL-54 and PL-55 types to be interchanged. The binding posts, one of which is grounded to the box, make it easy to simply take the wires from a microphone or pickup and attach the desired termination. Binding posts could also be provided for the output if needed. Of course, since this versatile arrangement has the small phono jacks and plugs already available, equipment having such fittings can easily be handled. -30-

Fig. 1.



MARS Station of the Month

MARS BEAMS WEEKLY BROADCASTS

MARS—Army Headquarters station, WAR, located at the Pentagon Building, Washington, D. C., broadcasts a weekly message each Tuesday at 0100Z and at 0400Z. (This is Monday at 8 p.m. and 11 p.m., Eastern Standard Time; Monday at 7 p.m. and 10 p.m., Central Standard Time; Monday at 6 p.m. and 9 p.m., Mountain Standard Time; and Monday at 5 p.m. and 8 p.m., Pacific Standard Time.)

Simultaneous broadcasts are made on frequencies 3497.5 kc., 6997.5 kc., 14,405 kc., and 20,995 kc. Each message is sent three times, once at 10 words per minute, once at 15 words per minute, and once at a higher rate of speed—usually 20 words per minute

Designed especially to transmit quasi-official traffic and training information to MARS members, the broadcast offers an excellent opportunity for all amateurs to build up their code proficiency.

A1SS-W1SS has been designated MARS Station of the Month by Captain Lester A. Peterson, Chief of MARS (Army), as a tribute to one of the "deans" of amateur radio who still maintains an active interest and participates in military and amateur radio communication.

The call letters are assigned to Art Stockellburg of Lincoln, Massachusetts, who is known as Boston's first amateur and commercial wireless operator. He was the first operator hired when *United Wireless* put in the first Boston station, more years ago than Art cares to recall.

Art's first telegraph training came from Morse operators in the railroad towers. They taught him Morse code; he ran errands for the railroaders. In 1901 Art built his first wireless transmitter using a Rhumkof coil, blue vitriol batteries, and 300 feet of iron wire for an aerial.

"The nickel filing coherer and tapper never did work good," Art relates. "I always had trouble with it."

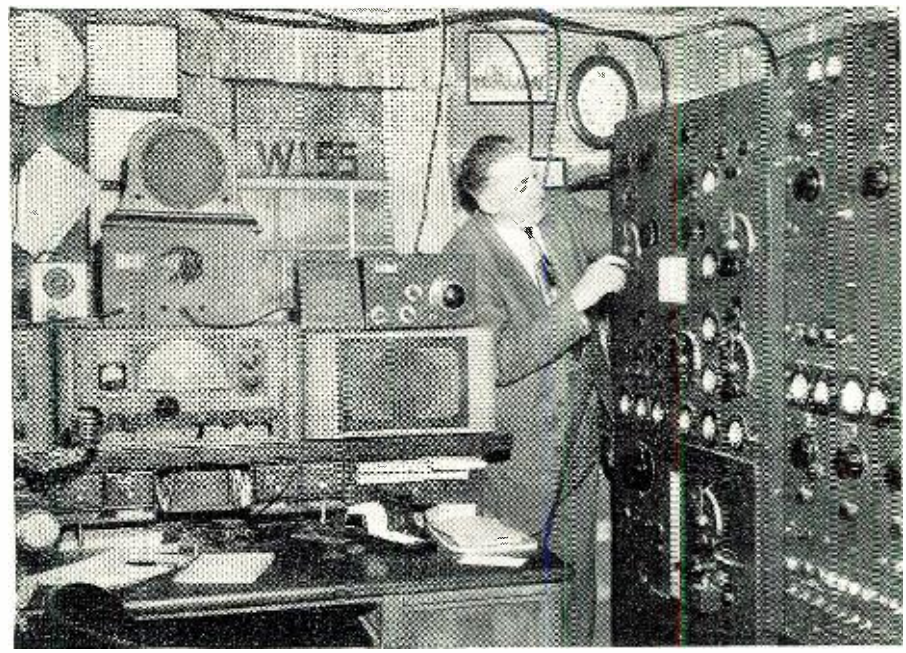
After completing grade school Art started work as an office boy with the *Holtzer Cabot* company, but the call of telegraphy was too strong. He went to work for *Postal Telegraph* company as a relief operator, later moved to *Western Union*. Later he joined *United Wireless*. He recalls also that he was wireless operator aboard the first wireless-equipped ship out of Boston port.

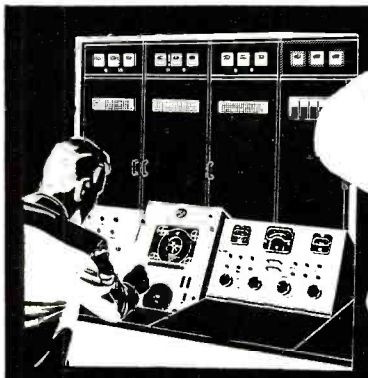
Art is now president of a radio school in Boston, but continues to remain active as an amateur. He holds six Public Service citations from the ARRL for his work in emergency communications.

A founder of the New England Emergency net and the Transcontinental phone net, Stockellburg also is a life member of the Veteran Wireless Operator Association, president of the Eastern Massachusetts Amateur Radio Association, secretary of the M. A. K. Radio Association, and a member of the Old, Old Timers Club.

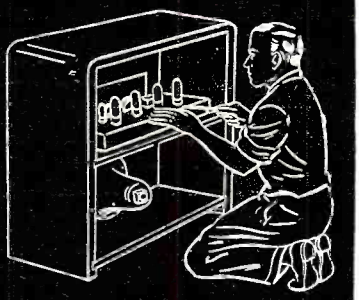
-30-

The home "shack" of Art Stockellburg, A1SS-W1SS, of Lincoln, Massachusetts.





Where Will You be in ELECTRONICS 6 Months from Today?



ADD TECHNICAL TRAINING TO YOUR PRACTICAL EXPERIENCE

GET YOUR FCC LICENSE IN A HURRY!

THEN—Use Our Amazingly Effective JOB-FINDING Service

Get this Valuable Booklet FREE

Money-Making FCC Commercial Radio Operator LICENSE Information

TELLS HOW—

WE GUARANTEE

TO TRAIN AND COACH YOU AT HOME IN SPARE TIME UNTIL YOU GET

YOUR FCC LICENSE

If you have had any practical experience — Amateur, Army, Navy, Radio repair, or experimenting.

TELLS HOW— Employers make

JOB OFFERS Like These to Our Graduates Every Month

Telegram, August 9, 1950, from Chief Engineer, Broadcast Station, Pennsylvania, "Have job opening for one transmitter operator to start immediately, contact me at once."

Letter, August 12, 1950, from Dir. Radio Div. State Highway Patrol, "We have two vacancies in our radio Communication divison. Starting pay $200; $250 after six months' satisfactory service. Will you recommend graduates of your school."

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

HERE'S PROOF FCC LICENSES ARE OFTEN SECURED IN A FEW HOURS OF STUDY With OUR Coaching AT HOME in Spare Time.

Name and Address	License	Lessons
Lee Worthy, 2210½ Wilshire St., Bakersfield, Calif.	2nd Phone	16
Clifford E. Vogt, Box 1016, Dania, Fla.	1st Phone	20
Francis X. Foerch, 38 Beucler Pl., Bergenfield, N. J.	1st Phone	38
S/Sgt. Ben H. Davis, 317 North Roosevelt, Lebanon, Ill.	1st Phone	28
Albert Schoell, 110 West 11th St., Escondido, Calif.	2nd Phone	23

CLEVELAND INSTITUTE OF RADIO ELECTRONICS
Desk RN-30, 4900 Euclid Bldg., Cleveland 3, Ohio
Approved for Veteran Training Under G.I. Bill

TELLS HOW—

Our Amazingly Effective JOB-FINDING SERVICE Helps CIRE Students Get Better Jobs

Here are a few recent examples of Job-Finding results:

GETS JOB WITH CAA

"I have had a half dozen or so offers since I mailed some fifty of the two hundred employment applications your school forwarded me. I accepted a position with the Civil Aeronautics Administration as a Maintenance Technician. Thank you very much for the fine cooperation and help your organization has given me in finding a job in the radio field."

Dale E. Young, 122 Robbins St., Owosso, Mich.

GETS FIVE JOB-OFFERS FROM BROADCAST STATIONS

"Your 'Chief Engineer's Bulletin' is a grand way of obtaining employment for your graduates who have obtained their 1st class license. Since my name has been on the list I have received calls or letters from five stations in the southern states, and am now employed as Transmitter Engineer at WAMT."

Elmer Powell, Box 274, Sparta, Tenn.

GETS CIVIL SERVICE JOB

"I have obtained a position at Wright-Patterson Air Force Base, Dayton, Ohio, as Junior Electronic Equipment Repairman. The Employment Application you prepared for me had a lot to do with me landing this desirable position."

Charles E. Loomis, 4516 Genesee Ave., Dayton, Ohio.

OURS IS THE ONLY HOME STUDY COURSE WHICH SUPPLIES FCC-TYPE EXAMINATIONS WITH ALL LESSONS AND FINAL TESTS.

Your FCC Ticket is always recognized in all radio fields as proof of your technical ability.

Get All 3 FREE

MAIL COUPON NOW

CLEVELAND INSTITUTE OF RADIO ELECTRONICS
Desk RN-30—4900 Euclid Bldg., Cleveland 3, Ohio
(Address to Desk No. to avoid delay)

Approved For Veteran Training Under G. I. Bill

I want to know how I can get my FCC ticket in a minimum of time. Send me your FREE booklet, "How to Pass FCC License Examination" (does not cover exams for Amateur License), as well as a sample FCC-type exam and the valuable new booklet, "Money-Making FCC License Information."

NAME.....

ADDRESS.....

CITY.....ZONE.....STATE.....

Paste on penny post card or send air mail.

Within the Industry

(*Continued from page 30*)

electron tube staff and chairman of the Joint Army and Navy Electron Tube Committee.

* * *

LOUIS C. KUNZ has been named product manager for cathode-ray tubes in the *General Electric Company's* Tube Divisions. He will direct a broad program of product planning on cathode-ray tubes.

Mr. Kunz has been with the company since August of 1940. Following an assignment on the engineering test program, he was named design engineer on cathode-ray picture tubes in 1941. In 1949 he was appointed section engineer on cathode-ray tubes at Syracuse, a position he held until his present appointment.

He will maintain headquarters at Schenectady.

* * *

W. A. WEISS has been named manager of the new *Sylvania Electric Products Inc.* radio receiving tube plant in Burlington, Iowa . . . **MAURICE L. LEVY** is the newly-appointed director of engineering for the *Tele-Tone Radio Corporation* . . . **FRANK GUTHRIE** has been named field assistant to the president of *Air King Products Co., Inc.* . . . **JOHN S. BOYERS,** formerly chief engineer and assistant treasurer of *Magnecord, Incorporated,* has been elected president of the company . . . **ALBERT C. ALLEN** has been promoted to the post of central states regional sales manager for the receiver sales division of *Allen B. Du Mont Laboratories, Inc.* . . . **WILLIAM LIGHTFOOT** has been named general manager of *Russell Electric Company,* Chicago manufacturer of fractional horsepower motors . . . **CHARLES L. CADE** has been made director of distributor sales for *Sarkes Tarzian, Inc.* . . . **JOHN KUNEAU,** director of public relations and a member of the Management Operations Committee of *Philco Corporation,* has been advanced to vice-president, Executive Staff . . . **R. V. BONTECOU** has been named to fill the newly-created post of product manager for the *General Electric Company's* Tube Divisions . . . *Radio Corporation of America* has elected **ROBERT L. WERNER** general attorney of the company . . . **PATRICK J. BRADY** formerly chief industrial engineer of *Sylvania's* Radio and TV Division in its Buffalo plant, has been named manager of the company's Williamsport plant . . . **HERBERT J. ALLEMAND,** a widely-known management consultant, has been appointed vice-president, Executive Staff of *Philco Corporation.* He will head the forward planning program for the company . . . **LEWIS CHAPS** is the new sales manager of *Television Materials Corp.* of New York . . . **LEON A. WORTMAN** is the new director of advertis-

ing and sales promotion for the *Audio & Video Products Corporation . . . Jewel Radio Corporation* has announced the appointment of **BERT C. TIEVY** to the post of executive assistant to the company's president . . . **ROBERT S. PEARE,** vice-president of the *General Electric Company* in charge of public relations and advertising policy, died recently in Schenectady, New York. He had been associated with the company since his graduation from the University of Michigan in 1922 . . . **H. E. FARRER** has been added to the electric department staff of the *American Standards Association.* He was formerly assistant to the secretary of the A.I.E.E. . . . **HAROLD E. FELLOWS,** director of New England operations for *CBS* and general manager of station WEEI in Boston, was recently elected president of the National Association of Radio and Television Broadcasters . . . **JAMES L. EMAUS** has been appointed sales application engineer of the sales department of the Electronic Parts Division, *Allen B. Du Mont Laboratories, Inc.* . . . **LOUIS H. NIEMANN** of *Sylvania Electric Products Inc.* has been chosen to serve as chief of the Electron Tube Section of the Electronics Division, National Production Administration. He is on leave of absence from his company post as manager of sales engineering for the sales department of the Radio Tube and Television Picture Tube Division.

* * *

EMIL J. MAGINOT is the new manager of advertising for *Cornell-Dubilier Electric Corporation* of South Plainfield, New Jersey.

Mr. Maginot is widely known throughout the electronics industry, having been associated with the servicing, retailing, wholesaling, and manufacturing phases of the business for over twenty-five years.

Before taking his new post, Mr. Maginot was with *National Union Radio Corporation* for more than nine years, serving successively as director of sales engineering, manager of advertising and sales promotion, and sales manager of the distributor division.

* * *

THE RADIO CRAFTSMEN, INC. has recently moved to new and larger quarters at 4401 North Ravenswood Ave. in Chicago . . . **JERROLD ELECTRONICS CORPORATION** has taken possession of the newly-completed addition to its plant at 26th and Dickinson Street in Philadelphia. Production, laboratory, and office facilities have been provided in the new quarters . . . Excavation work has been started on a new manufacturing and assembly plant for **ZENITH RADIO CORPORATION.** When completed, the new factory at 1500 N. Kostner Avenue in Chicago, will provide an additional 453,000 square feet of production space for the manufac-

ture of components and the testing of electronic equipment for the military services. The plant will be converted for the manufacture of radio and television receivers when the military emergency is over . . . **GLOBE-UNION INC.** has purchased a new building at 3410-3450 W. Hopkins Street in Milwaukee for use by the company's **CENTRALAB** electronics division in the manufacture of a defense item in the "classified" category . . . **LONG ISLAND RADIO COMPANY** has moved from 164-21 Northern Blvd., Flushing, New York to new quarters in Montrose, Pa. The company's new address will be P.O. Box 474, Montrose . . . **SOUTHWEST RESEARCH INSTITUTE** has acquired new and larger quarters for its Mechanical Laboratory in San Antonio, Texas . . . **CANNON ELECTRIC CO.** has a new plant in the East Haven district of New Haven, Conn. The new plant which is located at 191 Kimberly Street, brings to a total of four the plants now in operation . . . **McCORMICK SELPH ASSOCIATES,** manufacturers of glass-to-metal seals for guided missiles and other specialized applications, has acquired a new plant in Palo Alto, California. The new location is immediately adjacent to the Palo Alto Airport on Embarcadero Road . . . **CORNING GLASS WORKS** is building a new glass plant in Danville, Kentucky to provide additional facilities for the manufacture of glass bulbs and tubing . . . **CREST TELEVISION LABORATORIES, INC.** has acquired new quarters in the Whitehall Building, Far Rockaway, New York. The plant and general offices will occupy two floors . . . **KEYSTONE CARBON COMPANY** of St. Mary's, Pa. has recently completed a 20,000 square foot addition to its plant which will provide the necessary floor space for the manufacture of powdered metal parts and negative temperature coefficient resistors . . . **PHILCO CORPORATION** has purchased three new manufacturing plants in Bedford, Indiana. The new acquisitions add about 175,000 square feet of space to the company's manufacturing facilities . . . **WESTINGHOUSE ELECTRIC CORPORATION** will construct an electronic tube manufacturing plant on a 70 acre site in Bath, New York. The new factory will produce electronic tubes for the Armed Services and for essential industries . . . **RAYTHEON MANUFACTURING COMPANY** is building a new plant for its Receiving Tube Division in Quincy, Massachusetts . . . **NATIONAL UNION RADIO CORPORATION** has just purchased 50 acres of land in northeast Philadelphia as a site for its new electronics center. Present plans call for the manufacture of miniature tubes at the new factory . . . **FEDERATED PURCHASER INC.** has recently expanded its distribution to provide coast-to-coast service with the acquisition of space at 911 S. Grand Avenue in Los Angeles. The company's headquarters are at 66 Dey Street in New York, with branches in Newark, Allentown and Easton, Pa. —30—

ARROW "The Home of Values!"

CW 49505

High impedance headset complete with leather headband and rubber cushions. Used. **98c**

AD-1 MOTOR

24 VDC 1/12 HP 6000 RPM Intermittent Duty **98c**

PE 97 or PE117

Vibrator Power Supply for BC 620 and BC 659. Used—Less Tubes, Vibrator and Condenser **$2.95**

PE 120

Vibrator Power Supply for BC 620 and BC 659 with Tubes, etc.—Complete for 6 or 12 Volt operation. ..... Used **$6.95**

SCR 625 Famous Army Mine-Detector

For Prospectors, Miners, Oil Companies, Plumbers, Etc.

This unit is being offered now at a considerable reduction in price. Recently advertised at $79.50 it is now available in the same brand new wrappings in suitcase style carrying case (less batteries) at

$59.50

WHILE THEY LAST!

SCR 508 EQUIPMENT

BC 603 Receiver	$24.95	Exc. Used
BC 604 Transmitter	12.95	Exc. Used
BC 605 Amplifier	4.95	New
BC 606 Control Box	.95	Exc. Used
FT 237 Mounting	9.95	Exc. Used
MP 48 Mast Base	2.95	Exc. Used
MS Mast Sections	.49	Exc. Used
TM 11-600 Tech Manual	1.95	
Crystals, Set of 80	19.95	

PE 206 INVERTER

24 VDC to **80 VAC** at 800 CPS/ **500 VA** ..... Used **$3.95**

SCOTT HI-FI OUTPUT TRANSFORMER

Made for Scott Navy Receiver. Fully Potted. Primary 5000 ohms. Secondary: 600 ohms center tapped and 60 ohms center tapped with inverse feedback. ..... New **$1.49**

TUBES!

39¢

01A	1G1	30 spec.	1625
01B	1G6GT	33	1626
01C	1H4G	34	
1A6	1H6G	38	
1B4P	2C26A	39/44	
1B5/255	3B7	49	
1C6	3D6/1299	CRP 72	
1E7GT	10Y	843	
1F4	15R	954	
1F5G	19	1619	

49¢

2V3G			
6J7G			
6T7G			
6Z7G			
12A6			
12F5			
12H6			
12J5GT			
77			
211	957		

69¢

0Z4A	CK1005		
1A5GT			
2X2			
6J5GT			
6L7G			
6R7GT			
6ST7			
6W7G			
12Z3			
705 A			

89¢

1B26	6CY	9002	
1B32	6H6	9003	
1LD5	6K6GT		
1LN5	6K8G		
1S4	6SH7		
2A4G	6V6GT		
3S4	VR90		
5W4	VR150		
6AC7	717A		
6AL5	1613		

$1.59

6AG5
6AK6
1624

TUBES!

2E22	$1.09	805	$3.29
100TH	9.95	807	1.89
304TH	10.95	813	9.95
304TL	10.95	866A	1.69
307A	4.95	872A	2.29
803	2.89	830B	2.95

CATHODE RAY TUBES

3FP7	$1.95	5FP7	$1.95
4AP10	1.95	5GP1	3.95
5BP4	3.95		

MISCELLANEOUS SPECIALS!

	Used	New
RA 10 DA Receiver	$17.50	$24.95
BC 347 Interphone Amplifier		2.95
BC 442 Less Condenser	1.49	1.95
APS 13 UHF Antenna, Pair		.98
FL 8 Filter		2.95
I-97 Bias Meter	3.95	4.95
RL 42 Antenna Gearbox Motor and Reel	4.95	7.50
AN ARC-5 VHF Transmitter (T-23/ARC5)		29.95
One Tube Interphone Amplifier—Small compact alminum case fully enclosed 2¼"x3¾u"x5¾". Less Tube		.79
40 Amps Circuit Breaker		.59
220 M.A. Circuit Breaker		.59
Collins VFO Dial—5 calibrated ham bands form 3.2 Mc to 32 Mc; complete with pointer, gears, logging dial and flywheel. Scale 6" on 8" plate, each		.95
C-18 Antenna coil assembly slug tuned used in BC 603 receiver. Frequency range **20-27.9** Mc—fully shielded, New for 10		1.95
I 82 F Five Inch 360 degree compass indicator and Selsyn receiver		4.95
A-81-2 Transmitters Selsyn for I82 indicator (both I82F & Trans. Selsyn for $7.00)		2.45

COMMAND (SCR 274 N) EQUIPMENT

	Used	New
BC-455	$ 7.95	$14.95
BC-457	4.95	
BC-458	4.95	
BC-450 3 Receiver Remote Control.	.89	1.95
BC-442		2.95
3 Receiver Rack	1.95	
2 Transmitter Rack	1.50	

MN 26Y COMPASS RECEIVER

Twelve stage superhet covering frequencies of 150 to 325 KC; 325 to 695 KC; and 3400 to 7000 KC in three bands. These units are brand new but with Dynamotor, Band Switch motor and tubes removed. Schematic Furnished. While they last, ea. **$4.95**

T-32

Desk Stand microphone. Good used cond. **$2.95**
Throat Mike—T 30—New **98c**
Lip Mike—Navy Type—New **98c**
Extension Cord and switch Assembly for these Mikes—New **98c**

OIL FILLED CONDENSERS

2 mfd	1000 VDC	59c	2 for $1.00
4 mfd	500 VDC	39c	3 for 1.00
1-1-1 mfd	1200 VDC	59c	2 for 1.00
.1-.1 mfd	2000 VDC	39c	3 for 1.00
.5 mfd	750 VAC	39c	3 for 1.00
.5 mfd	1500 VDC	39c	3 for 1.00
.25 mfd	600 VDC B/T	24c	5 for 1.00
40 mfd	25 VDC	24c	5 for 1.00

MONTHLY SPECIAL!

10 Assorted Condensers. A real value at ..... **98¢**

CHOKES

10 Henry 20 MADC ..... **29c** 4 for **$1.00**
10 Henry 50 MADC ..... **39c** 3 for **1.00**

AM 61

Indicator amplifier—New with blower and all parts except tubes. **$7.95**

VIBRATORS

2 Volt—7 Prong Synchronous.... **69c** 10 for **$6.00**
6 Volt—4 Prong Non synchronous **98c** 10 for **9.00**

BC 709

Battery operated lightweight interphone amplifier. Complete with tube and shock mount, but less battery. New ..... **$3.95** ea.

FLAP PITCH MOTOR

24 VDC will operate on AC 3300 or 11,000 R.P.M. Complete with gear box and limit switches, ea. **$2.95**

AS-138/ARN

10 inch streamline loop as used with direction finding receivers. Fixed position, it is ideal for planes, boats, automobiles. New **$1.95**

TS/10

Sound powered phones. Brand New, each **$10.00**
Used **$6.50** 2 for **$17.95**

TEST EQUIPMENT

No. M-652 Jackson Audio Oscillator.... used **$29.50**
No. 155 A RCA Oscilloscope ..... used **75.00**
No. M-840 Triumph Oscilloscope..... used **39.95**

WANTED!

304 TL Tubes. I 152 Indicators. BC 788-C Transceivers. APS 13 Transceivers. ARC 3 Equipment. R 89 Glide path Receivers. APN-9; ARC-1; APR-4. Or—Send in a list of what you have in good clean surplus equipment.
State Lowest Price in first correspondence.

CABINET CH-118

Olive drab in color, this cabinet has a full length interlock access door on the rear. The front takes the standard 19" panels with 60 inches of height and 20 inches deep. It is shock mounted on a heavy steel platform and has a two-inch protrusion fully covering one side to accommodate wave trap and wiring. Louvered vents allow air circulation top and bottom. Each F. O. B. Chicago **$34.50**

RA 52-RECTIFIER

A transtat controlled rectifier to produce high voltage DC from 110 VAC 60 cycle source. Up to 11,500 volts DC at 50 watts. Metered high voltage (0-15KV) and current (0-20 MA). New **$74.50**

BC 768

Radio Receiver Chassis. Complete except for 13 tubes. This chassis with standard 19" panel front contains the receiver for 493.5 MC complete with power supply and an additional low voltage power supply that originally supplied the keyer BC 770 as described below.

110 VAC 60 cycles is the primary voltage.
Five 10 mfd—600 VDC oil filled GE condensers are used as filters. Five stages of 49 MC IF's.
Two of 10.4 MC, 6.3 VAC Transformer and of course power transformers—chokes and miscellaneous parts.
All units are in good condition as removed from new equipment. Even the salvage value is a great deal more than the low price of **$9.95**

BC 770 Keyer P/O RC 100 Radar Equipment

This unit was used to pulse the transmitter BC 769 as described below. It is in a standard 19" panel chassis and contains many valuable parts such as a 10 Amp. 110 VAC 60 cycle circuit breaker, a 10 mfd 600 VDC oil condenser, a 6.3 Filament transformer, switches, pots, resistors and numerous others. Less tubes **$4.95**

BC 769 TRANSMITTER

Originally designed to transmit RF pulses at 470 MC with the use of two 15E tubes. Power was supplied by RA 52 rectifier. Parts consist of 0-150 VAC 60 cycle meter, 6.3 VAC filament transformer, associated circuits for VHF transmission, standard 19" panel chassis, and a .15 Mfd—12000 VDC oil cond. Less Tubes.. **$6.95**

Shipments FOB warehouse. 20% Deposit on orders. Minimum order $5.00. Illinois residents, add regular sales tax to remittance. Prices subject to change without notice.

ARROW SALES, Inc. Dept. N, 1712-14 S. Michigan Ave., Chicago 16, Ill. PHONE: HArrison 7-9374

Spot Radio News

(*Continued from page* 18)

ture area once in each of the primary colors. In the line-interlaced scanning pattern, a color frame will consist of two color fields. In color transmissions, the number of scanning lines per frame will be 405, as per *CBS* requirements, interlaced two-to-one in successive fields of the same color. The frame frequency will be 72, the field frequency 144, the color frame frequency 24, color field frequency 48 and the line frequency 29,160 per second. One term, to be used in the color dictionary, will have broad applications and that is the term, *color transmission,* which has been defined as the transmission of color television signals which can be reproduced with different values of hue, saturation, and luminance.

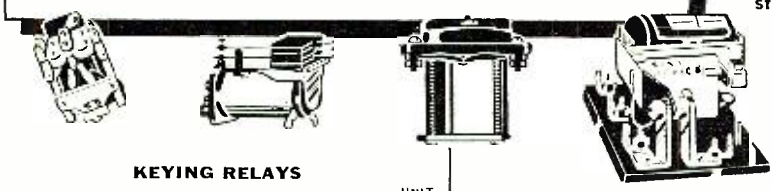
THE COMMUNICATIONS ACT of 1934, may soon be replete with amendments, involving salary controls, restrictions on employment during and after Commission service, stricter rules for applicants and fines for rule violators. The additions, contained in a bill known officially as S. 658, were not received with too much enthusiasm by members of the Commission. Describing these objections before the House Committee on Interstate and Foreign Commerce, FCC Spokesman Wayne Coy declared that the Commissioners did not see eye to eye with the proponents of the bill on such items as employment restrictions. They did not believe, for instance, he said, that the suggested limitation on the employment of the top staff officers subsequent to their leaving the Commission, (one year after tenure) or a restriction on employment of Commissioners leaving before the completion of their appointed term of office, was either wise or practical. It was recognized, the ether patrolmen said, that these provisions have as their worthy objective, the aim of preventing improper influence, but the proposal would prove to be more harmful than helpful. According to Coy, the ruling would make it . . ." even harder than it is now to secure competent trained personnel to take the important top Commission jobs. In addition to working at government salary rates, which I think we can agree are substantially less than first rate men could be expected to receive in private life, they would know that if for any reason it became necessary for them to leave government service, they would be seriously limited for at least a year's period in putting their specialized knowledge and competence to work in earning a livelihood. I sincerely believe that the proposal is, in reality, a prescription for bureaucratic mediocrity."

Serious objections were also cited to another section of the new bill, which would in effect set the Commission up as a . . . "kind of administrative court

RELAYS

FOR EVERY PURPOSE

Over a Million in Stock!



Whether you require large quantities of relays for production runs or single units for laboratory or amateur work, Wells can make immediate delivery and save you a substantial part of the cost.

Our capable engineering staff is prepared to offer assistance in the selection of correct types to suit your exact requirements.

Each relay is brand new, standard make, inspected, individually boxed and fully guaranteed.

The following list represents only a tiny portion of our relay stock. Write or wire us for information on types not shown.

KEYING RELAYS

STK. NO.	VOLTAGE	OHMAGE	CONTACTS	UNIT PRICE
R-714	9/14 VDC.	65	2C/5 AMPS.	$1.55
R-653	12 VDC.	14	2C.	1.55
R-721	18/21 VDC.	290	2C/5 AMPS.	1.55
R-773	24 VDC.	280	3C/10 AMPS.	1.60
R-694	24 VDC.	300	1A/5 AMPS.	1.50
R-704	2/6 VDC.	.25	2B/5 AMPS.	1.35
R-297	115 VAC.	....	2C.	2.80
R-173	2/6 VDC.	2	1A.	1.55
R-280	6/8 VDC.	77	1A DOUBLE BREAK.	2.45
R-647	6/12 VDC.	15	1B/20 AMPS.	1.45
R-273	20 VDC.	160	2A/15 AMPS. Dbl-BK.	3.55
R-169	24 VDC.	200	1A	2.45
R-570	24 VDC.	230	1B.DOUBLE BREAK.	2.70
R-171	24 VDC.	230	2C/10 AMPS.	2.70
R-529	24/48 VDC.	1020	2C	3.10
R-715	24 VAC.	....	2C.CERAMIC.	3.70
R-584	6 VDC.	20	1A. DOUBLE BREAK.	1.30
R-192	12 VDC.	44	3C/10 AMPS.	1.70
R-204	12 VDC.	66	2A.	1.45
R-224	12 VDC.	85	1A	1.45
R-221	18/24 VDC.	5000	1A	1.45
R-205	24 VDC.	260	2C	1.55
R-536	27 VDC.	230	2C	1.55
R-220	75 VDC.	5000	1C	1.50
R-627	115 VAC.	....	1A.DOUBLE BREAK.	3.10
R-698	12 VDC.	75	1C	1.20
R-734	24 VDC.	150	3C/10 AMPS.	1.30
R-598	28 VDC.	185	2C.	1.30
R-622	20/30 VDC.	200	3A & 2C/10 AMPS.	1.45
R-274	24 VAC.	....	2A	1.55
R-270	24 VAC.	....	1A.	1.55
R-269	24 VAC.	....	1A/15 AMPS.	1.55
R-277	12 VDC.	30	2C. Dbl—BK. CERA.	2.20
R-594	12 VDC.	50	2C.	2.00
R-668	12 VDC.	50	1C/10 AMPS.	1.30
R-613	12 VDC.	50	1C.	1.30
R-772	12 VDC.	70	1A/15 AMPS.	1.45
R-293	12 VDC.	150	1C.DOUBLE.BREAK.	3.10
R-697	12/24 VDC.	100	1A/10 AMPS.	1.45
R-580	12/24 VDC.	150	1C.DOUBLE BREAK.	2.45
R-276	24 VDC.	100	2C.Dbl-BK. MICA.	3.10
R-752	24 VDC.	150	2C/3 AMPS.	1.45
R-768	24 VDC.	175	2A/5 AMPS.	1.45
R-699	24 VDC.	200	3C/5 AMPS.	1.55
R-700	24 VDC.	200	2C/8 AMPS.	1.55
R-282	24 VDC.	325	1A-DOUBLE BREAK.	1.25
R-286	115 VAC.	950	2C	2.80
R-612	2/6 VDC.	1	1A.	1.55
R-815	2/6 VDC.	1.5	1A/10 AMPS.	1.55
R-263	6 VDC.	12	2C/15 AMPS.	1.55
R-279	14 VDC.	250	1A/15 AMPS. Dbl-BK.	1.55
R-278	18/24 VDC.	260	2C, 1A, 1B.	1.55
R-706	24 VDC.	150	4C/10 AMPS.	2.45
R-177	24 VDC.	250	4C.	2.05
R-609	250 VDC.	5000	1A-DOUBLE BREAK.	2.45
R-779	12 VAC.	....	1B/10 AMPS.	1.70
R-272	24 VAC.	....	1A, 1B/5 AMPS.	1.55
R-271	24 VAC.	....	2A, 1B/3 AMPS.	1.55
R-685	115 VAC.	600	1A/6 AMPS.	2.50
R-663	12 VDC.	40	2C/10 AMPS.	1.30
R-757	12 VDC.	44	2C, 1A, CERAMIC.	1.45
R-152	12 VDC.	50	2C, 1B, CERAMIC.	1.35
R-624	12 VDC.	50	1C	1.45
R-268	12/24 VDC.	260	3A,1B	1.55
R-805	18 VDC.	200	1A/10 AMPS.	1.30
R-644	18/24 VDC.	275	1A/25 AMPS.& 1A/5A	1.45
R-687	26.5 VDC.	125	2C/15 AMPS.& 3A/10A	2.45
R-674	24 VDC.	250	1C/5 AMPS.	1.45
R-593	28 VDC.	125	2C/10 AMPS.	1.45
R-191	28 VDC.	125	2C/10 AMPS.CERAMIC.	1.50
R-248	28 VDC.	150	1A/20 AMPS.	1.30
R-615	32/40 VAC.	....	3A/15 AMPS.	1.55

STK. NO.	VOLTAGE	OHMAGE	CONTACTS	UNIT PRICE
R-582	120 VAC.	....	1A.	$2.45
R-812	115 VAC.	....	1A-Dbl-BK.15A.	2.45
R-260	115 VAC.	500	3A/15 AMPS.	2.80
R-249100	/135 VAC.	600	2A CERAMIC.	2.80
R-665	115 VAC.	500	2B/10 AMPS.	2.80
R-693	2/6 VDC.	125	1C/3 AMPS.	1.10
R-597	4/12 VDC.	16	1A/25 AMPS.	2.45
R-193	5/8 VDC.	11	2C.1A/10 AMPS.	1.30
R-595	5/8 VDC.	18.5	3C.	1.30
R-692	6/24 VDC.	1280	1C/3 AMPS.	1.35
R-793	12 VDC.	42	2C/10 AMPS.	1.55
R-599	12 VDC.	67	3A/15 AMPS.	1.45
R-559	24 VDC.	95	1A/10 AMPS.&1A/20 AMPS.	1.30
R-560	24 VDC.	160	1A	2.80
R-795	24 VDC.	160	2A/10 AMPS.	1.55
R-796	24 VDC.	160	2A/15 AMPS.	2.80
R-562	24 VDC.	160	4A/10 AMPS.	1.60
R-797	24 VDC.	160	8A/8 AMPS.	2.80
R-549	24 VDC.	160	1C/10 AMPS.	1.55
R-758	24 VDC.	160	2C/10 AMPS.	1.55
R-242	24 VDC.	170	1C/20 AMPS.	1.55
R-675	24 VDC.	180	2A/10 AMPS.	1.50
R-649	24 VDC.	265	1A	1.30
R-744	24 VDC.	265	1A/20 AMPS.	1.50
R-530	24 VDC.	265	2A/10 AMPS.	1.45
R-574	24 VDC.	265	2B	1.30
R-791	24 VDC.	375	2C/10 AMPS.	1.55
R-775	28 VDC.	180	2C. CERAMIC.	1.55
R-776	28 VDC.	265	2A	1.55
R-701	22/28 VDC.	425	2B/10 AMPS.	1.70
R-802	24 VDC.	160	3A.DOUBLE BREAK.15 AMPS.	2.80
R-792	24 VDC.	200	1A/15 AMPS.	1.30
R-798	24 VDC.	500	1C/5 AMPS.	2.40
R-695	12 VDC.	70	2C/3 AMPS.	1.30
R-288	18/24 VDC.	175	2A.CERAMIC	2.20
R-558	24 VDC.	280	2C/3 AMPS.	1.55
R-299	6 VDC.	24	2A	1.55
R-267	12 VDC.	65	2C/5 AMPS.	1.55
R-206	24 VDC.	150	5C.	1.50
R-207	24 VDC.	210	4C.	1.35
R-219	50 VDC.	1500	2A/15 AMPS.	1.55
R-531	12/24 VDC.	80	2A/10 AMPS.	1.50
R-506	24 VDC.	300	2A/6 AMPS.	1.20
R-581	24 VDC.	4500	1A/5 AMPS.	1.20
R-825	115 VDC.	....	1A/6 AMPS.	2.45
R-819	115 VAC.	....	2A/6 AMPS.	2.45
R-652	115 VAC.	....	1A DOUBLE BREAK/20 AMPS.	2.80
R-217	115 VAC.	....	1C	2.80
R-824	2 VDC.	.75	1C	1.55
R-600	8/12 VDC.	5000	1C	2.80
R-820	10 VDC.	20	1B DOUBLE BREAK/6 AMPS	1.30
R-821	18 VDC.	2000	1A, 1B/2 AMPS.	2.45
R-587	24 VDC.	160	2C/10 AMPS.	1.55
R-739	24 VDC.	200	1A	1.35
R-724	75 VDC.	2200	2B/3 AMPS.	2.40
R-823	110 VDC.	5000	1B	2.45
R-617	12 VDC.	600	1C, DOUBLE BREAK.	1.30
R-729	12 VDC.	80	1A/10 AMPS.	1.25
R-722	24 VDC.	300	1A/10 AMPS.	1.30
R-577	48 VDC.	220	2C	2.45

MIDGET RELAYS

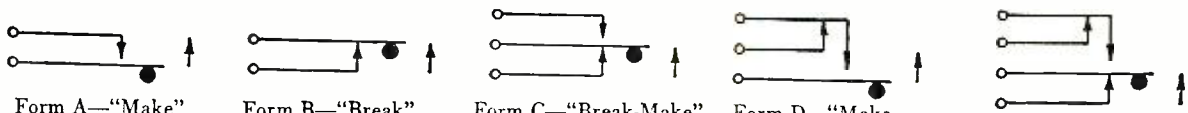
R-572	24 VDC.	256	1C	$1.25
R-291	6 VDC.	5	1A	1.25
R-738	12 VDC.	60	3A	1.20
R-144	12 VDC.	228	1A	1.45
R-145	18/24 VDC.	250	2A-CERAMIC	1.45
R-298	21 VDC.	300	1A	1.25
R-296	21 VDC.	300	1A	1.25

STK. NO.	VOLTAGE	OHMAGE	CONTACTS	UNIT PRICE
R-586	21 VDC.	300	1A & 1C	$1.25
R-137	24 VDC.	300	1C	1.45
R-142	24 VDC.	400	2C	1.50
R-785	24 VDC.	200	2C/10 AMPS.	2.00
R-607	24 VAC.	....	1A	1.20
R-606	24 VAC.	....	1A & 1B	1.20
R-605	24 VAC.	....	3A	1.20
R-728	6 VDC.	30	1A	1.25
R-807	6 VDC.	30	2C	1.25
R-625	6 VDC.	45	1C/3 AMPS.	1.35
R-732	12 VDC.	120	1A	1.45
R-733	12 VDC.	120	2C	1.50
R-281	12 VDC.	126	2A	1.25
R-818	18/24 VDC.	300	1B	1.25
R-139	24 VDC.	200	4C	1.45
R-135	24 VDC.	250	1B	1.45
R-133	24 VDC.	300	NONE	.75
R-138	24 VDC.	300	4A	1.45
R-132	24 VDC.	300	2C	1.50
R-731	24 VDC.	300	2C	1.55
R-730	24 VDC.	300	2C & 1A	1.55
R-292	24 VDC.	350	1C	1.25
R-626	24 VDC.	400	1A/5 AMPS.	1.55
R-786	60 VDC.	1300	2C	2.00
R-588	90/125 VDC.	6500	4C	2.70
R-755	24 VDC.	300	1A	1.45
R-150	6 VDC.	30	1A	1.20
R-640	24 VDC.	330	1C/3 AMPS.	1.50
R-148	12 VDC.	100	2C & 1B	1.35
R-285	12 VDC.	75	3A	1.35
R-222	12 VDC.	100	2A	1.20
R-639	6 VDC.	20	3C/3 AMPS.	1.45
R-696	24 VDC.	230	1A/8 AMPS.	2.00
R-143	24 VDC.	280	1A	1.45
R-141	24 VDC.	280	3A	1.45
R-140	24 VDC.	280	1C	1.45
R-590	24 VDC.	300	2B	1.25
R-540	24/32 VDC.	300	2C	1.50
R-543	24/32 VDC.	300	4C	1.50
R-743	110 VDC.	5000	3B & 1A	2.05
R-783	100 VDC.	6500	1C-MICALEX.	2.40
R-782	100 VDC.	6500	4C & 1A	2.45

SPECIAL RELAYS

R-503	12/32 VDC.	100	3A, 2C	$2.80
R-749	600 VDC.	....	MAX.28 AMPS.	7.45
R-804	550 VAC.	....	1B/38 AMPS.	4.35
R-250	115 VAC.	....	ADJ.C1R.BREAK-.04-.16A	17.50
R-579	220 VAC.	....	1B	8.70
R-294	27.5 VDC.	200	1B	5.35
R-686	115 VAC.	....	2C	6.10
R-246	115 VAC.	....	1B	11.20
R-246A	115 VAC.	....	1A	11.20
R-611	24 VAC.	....	1A/30 AMPS.	5.35
R-283	12 VDC.	125	1C/10 AMPS.	1.25
R-614	18/24 VDC.	60	1A/15 AMPS.	4.35
R-262	....	200	1C	4.70
R-245	12 VDC.	25	4" MICALEX LEVER.	1.20
R-527	6/12 VDC.	50/50	1N SERIES.	1.20
R-544	12/24 VDC.	60/60	1C.	2.05
R-255	....	.	1A	1.20
R-669	75 VAC.	400 CYCLE	1B, 1A	1.20
R-660	6 VDC.	.	3/8" STROKE.	1.20
R-651	24 VDC.	100	SOLENOID VALVE.	3.10
R-295	12 VDC.	275	ANNUNCIATOR DROP.	2.70
R-230	5/8 VDC.	2	2A, 1C.	2.70
R-813	12 VDC.	12	WAFER.	5.35
R-275	12 VDC.	750	1A, 1B, 1C.	3.45
R-716	24 VDC.	70	2A/5 AMPS.	1.60
R-620	6/12 VDC.	35	2C, 1A.	1.30
R-629	9/14 VDC.	40	1C/10 AMPS.	1.55
R-720	24 VDC.	50	2C. CERAMIC.	1.70
R-500	12 VDC.	10/10	2C/6 AMPS.	3.55
R-816	12 VDC.	10/15	2C/6 AMPS.	3.55
R-524	24 VAC/DC.			1.20
R-566	115 VAC.	COIL ONLY		1.00
R-710		150 COIL DNLY		.75
R-811	48 VDC.	8000	1C	2.05

BASIC CONTACT ASSEMBLES SHOWN IN UNOPERATED NORMAL POSITION



Form A—"Make" (Single Throw, Normally Open)

Form B—"Break" (Single-Throw, Normally Closed)

Form C—"Break-Make" (Double-Throw)

Form D—"Make-Before-Break"

Form E—"Break-Make-Before-Break"

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in all adjudicatory proceedings and possibly in rule-making proceedings as well." It was pointed out that this proposal would actually place the Commission in an isolation ward which, according to Coy, was based on the premise that the Commissioners can be influenced by the Commission's staff, and that the staff is in turn . . . "prejudiced and irresponsible." Coy indicated that he was quite riled at this implication, apparently recalling the statements made during the color-restraining trial which implied that a staff engineer had influenced the Commission in their decision. He declared that . . . "these attacks on the Commission's staff are, in reality, attacks upon the integrity and ability of the Commissioners." "If the members of the Commission are not doing an honest job, as I think we are, then you should get new Commissioners," he told the committee. "However," he added, "it's not going to be possible to get a better body of men by cutting them off from the . . . people upon whom they must rely in order to arrive at the informed and intelligent judgments which the parties involved, as well as the public, are entitled to expect."

There was no doubt, he explained, that in contested proceedings, those members of the Commission's staff who process or investigate or even try a case before an examiner, must occupy to a certain extent, an adversary position. To allay suspicion, then, it was agreed that members of the staff should not participate directly in the decisional process, Coy pointed out. But, he added, it is important that the Commission should be allowed to consult with officials and personnel such as the chief engineer, general counsel and chief accountant. The Commission should not be deprived of the opportunity of consulting with these specialists who can, he declared, facilitate the evaluation of conflicting and highly technical claims. The removal of this access would, in the opinion of the Commission . . . "stultify one of the principal objectives of establishing a Communications Commission in the first place—the need for a specialized body, capable of calling on impartial expert assistance, to decide the complicated and technical issues raised in the communications field, and to formulate and maintain consistent and adequate policies to safeguard the 'public interest, convenience, and necessity.'"

In one section of the amendments to the act appear new recommendations for policing power, permitting the issuance of firm cease and desist orders to those who disobey licensee provisions. While this new power was declared to be a necessary one, the Commissioners felt that a still tighter control was necessary, a control which would permit the imposing of reasonable fines for violation of the Act or the Commission's rules. Describing the need for such teeth in the law, Coy said . . . "The present law, by providing only an

extreme type of administrative sanction, fails in deterring evasions of Commission requirements because of the very fact that the potential evader is willing to gamble the act of evasion against the known reluctance of the Commission to apply a death penalty. It is to be hoped that the marginal licensee may be kept up to standard by the knowledge that if he doesn't, he will either be hurt by the imposition of the fine or in more serious cases by temporary suspension of his authority to operate. Authorizing the Commission to utilize such lesser sanctions is all the more important in the light of the great increase in radio use by persons who are not primarily engaged in radio as a means of livelihood, like the taxicab owners and industrial users, and other people who have been using radio more and more as an aid to their primary activity. The enforcement problems with respect to these classes of special radio services are particularly troublesome. By authorizing the Commission to impose fines for violations of its rules and regulations, we hope to command greater respect for these rules and regulations."

RADIO CONTROL will soon be used to man lifeboats dropped by parachute during air-sea rescue operations. The radio system, operated from the airplane dropping the lifeboat, can bring the dropped boat to the survivors, allowing them to board and then provide a course for the boat. The vessel has been described as an all-metal affair, 30-feet long, designed to carry fifteen, and powered by a four-cylinder water-cooled engine. Before development of the radio-controlled system, lifeboats were simply dropped to survivors, allowing for drift. A sea anchor served to hold the boat in place, and if all went well the survivors drifted down to the boat.

In the new system, after the chute is jettisoned, the operator in a carrier plane starts transmitting on a five-frequency unit, whose signals can be picked up by a five-frequency receiver in the boat. The first signal is sent from a control box. This, in order, releases stabilizing fins holding the lifeboat steady during descent, frees a rudder board, opens the engine's air vents and cranks the motor intermittently. When the motor catches and is running at a fast idle, a sea anchor is released. At the operator's next signal, the engine speeds up, a reduction gear goes into forward and the boat moves ahead. The operator can control its direction right and left, a flux-gate gyro compass connected to a servo-electric system on the boat keeping it on whatever course is selected. The plane operator can stop the boat when it arrives at the survivor's raft, and idle the motor, while survivors board.

Lifeboats will be equipped with walkie-talkies with a range said to be great enough for constant contact between the boat and the plane. The boat, with controls and a manual override enabling the survivors to break

off radio control at any time, will have a cruising range of 800 miles.

RADIO SIGNALS from the sun, moon and stars will soon be surveyed with a 600-inch radio telescope at the Naval Research Laboratory in Washington, as part of a new program of radio astronomy designed to provide answers to such puzzling problems as the cause and nature of solar outbursts and the times and nature of emissions. It is expected that this data will be of practical help in long-range weather forecasting and radio communication. The solar outbursts, known as flares, have been cited as the cause of communication interference, but there is a lack of knowledge as to why the interference exists.

The NRL reflector (see page 16), mounted on one of the Navy's five-inch gun mounts, has been arranged to rotate a full circle in a horizontal direction or azimuth and also to move vertically, or in altitude, from below the horizon to five degrees beyond the zenith. An axis converter corrects for the inclination of the earth's axis, and permits the reflector automatically to track or follow the sun in its path across the sky. The radio telescope can be controlled manually or connected to a five-inch astronomical telescope by remote control.

The reflector consists of thirty aluminum sections which are bolted together to form a solid surface.

It is expected that with the high sensitivity and directivity obtained with the fifty-foot dish, radiation will be detectable at 1000 megacycles.

A NEW ERA IN FM FACSIMILE transmission, over network facilities, has appeared on the horizon, thanks to the efforts of two true pioneers in the art. Major E. H. Armstrong and John V. L. Hogan.

With the aid of a *Hogan* multiplexer installed in the experimental headquarters of the Major at Alpine, N. J., facsimile signals, carrying news programs, weather maps, etc., have been airpiped to WQAN-FM in Scranton, Penna., and then to WCHU-FM in Ithaca, N. Y. During these faxcasts, the regular musical programs were continued without any interference from the additional transmission.

There are plans afoot to attempt to extend the link-to-link circuit over a chain of FM stations in New York, and perhaps to adjoining states.

MICROWAVES FOR RELAYING CONTROL and communication are now being used in one of the most extensive transmission systems in the Pacific Northwest by the Bonneville Power Administration. Over 200 miles of microwave circuits are in operation for many purposes.

To keep a continuous flow of power from the generating stations to customers, it is necessary that the load dispatcher be continuously in touch with system conditions. Instruments in the load dispatcher's office provide con-

tinuous readings of power conditions at widespread points on the network by means of signals from one microwave station to another over the airwaves, which are reflected from point-to-point. Up to twenty or more simultaneous conversations can be carried over the same circuit.

The microwave system is also linked to instruments which automatically reveal the exact location of trouble on the major transmission lines. Within seconds after lightning or other trouble has caused one of the transmission lines to open up, the recording equipment will provide the exact location of the trouble and permit repair crews to be dispatched, without the previous long delay when lines were patrolled in a search of the cause of trouble.

PLANNED MUSIC, featuring programs specifically designed for stores, restaurants, and shops, during which ultrasonic tones can be used to cut off signals and permit the transmission of sales or other messages of interest to shoppers or diners, has been cited by FCC as a violation in a letter recently mailed to WRLD, Miami, Fla.; WACE-FM, Chicopee, Mass.; WFMF, Chicago, and KDFC, Sausalito, Calif.

Declaring that the beep services, in which the stations are engaged, are inconsistent with basic rules, the Commission noted that the special service committed the FM station to provide . . . "subscribers with predominantly planned music . . . during stipulated periods" . . . and that the arrangements . . . "must be considered to constitute an invalid abdication of your duty as a licensee to retain discretion, responsibility, and control, and to remain free to alter your service as the changing needs of the public in your area may require."

The letter also pointed out that since payment was made for the service, the transmission was of a sponsored type and must be recorded as such over the air and in logs. The contention that station operators should enjoy equal privileges, under the Communications Act, to employ mechanical or electronic devices to eliminate undesired broadcast material from programs at the request of listeners, was called inadmissible. The government body declared that . . . "members of the public are free to tune in or tune out any material they desire. . . . Obviously this obligation is not carried out when you broadcast a signal, the very purpose of which is to prevent a portion of the audience from hearing those announcements."

The blunt warning issued in the letter, which technically was an official action, approved by Commissioners Coy, Walker, Hyde, and Webster, appeared to spell the doom of all storecasting services, and perhaps transmission to buses and street cars, too, unless immediate modifications were introduced into the systems, removing the restricted coverage provisions.

. . . . . L. W.

NEW TV PRODUCTS on the Market

INDOOR ANTENNA

A new "tip-proof" indoor television antenna has been announced by *JFD Manufacturing Company* of 6101 Sixteenth Avenue, Brooklyn 4, New York.

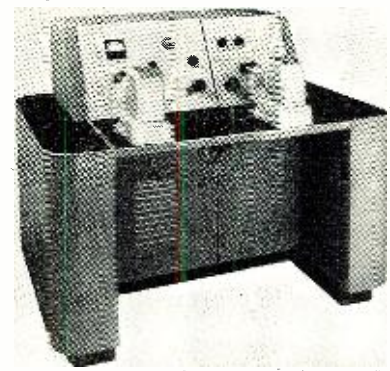
A specially designed base, perfectly balanced and weighted, keeps the antenna from tipping or rocking despite full extension of the dipoles. Constructed of engraved satin finish mahogany plastic, the new antenna harmonizes with most decorative schemes. The three-section, triple chrome plated telescopic dipoles can be adjusted from 15 to 41 inches for quick and easy orientation. A unique tension design holds the dipoles in any position—collapsed or extended. A felt pad cushions the base of the antenna and protects furniture surfaces.

FLYING SPOT SCANNER

Federal Telecommunication Laboratories, Inc. of Nutley, New Jersey, has developed a new type of television flying spot scanner that converts slide information to a video signal suitable for television broadcasting.

Console-mounted for smooth operation, the single or basic scanning unit (FTL-35A) is designed to handle, semi-automatically, from one to thirty-six 2x2 inch double frame, 35 mm. slides which may be shown in or out of sequence. An important feature is an automatic signal cut-out which blanks out the picture while the slide is in motion.

By means of an "add-a-unit" feature, this equipment may also be used as a dual scanner consisting of a single scanner plus an auxiliary unit. Designated as the FTL-82A, this unit may be



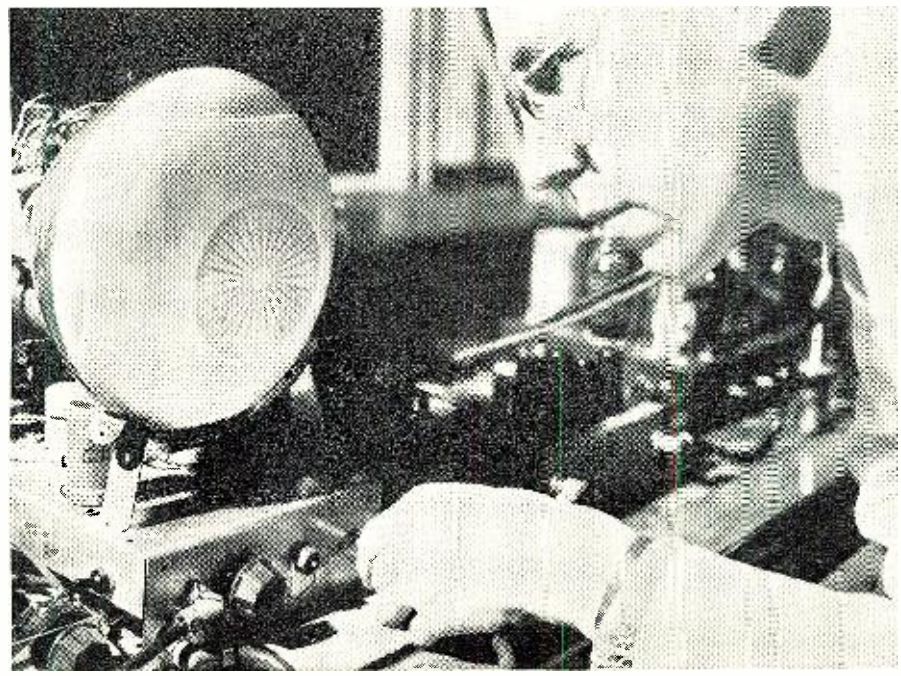
used to obtain lap dissolves, fades, and other flexible arrangements between two scanner units.

DISTRIBUTION SYSTEMS

Javex of Garland, Texas, has announced a new line of antenna distribution systems for various installation applications.

Designed to mount flush, with or without the use of the usual wall box,

Dr. Frank Roberts, a Scotch electronics engineer in Britain, has designed a system of magnification which uses both a microscope and television. His television-microscope is said to be capable of magnification up to 25,000 times an asset in the observation of living tissues. The unit is already being used to count and sort the number of cells in the human brain The photo shows Dr. Roberts observing a distom (a microscopic plant) through his television-microscope.



Ungar's little Angels

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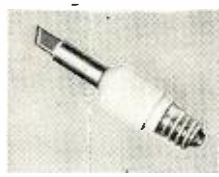
Pick any job and you'll find a pip of a tip to use with the trim, slim Ungar Pencil. Any of the 8 Ungar Angels interchange in the No. 776 Handle to make a honey of a tool that does work faster and better than larger, heavier irons. Whatever your problem, you'll bless the day you discovered these saintly soldering cherubs!

No. 540 COMBINATION KNIFE

Primarily recommended for cutting and stripping vinyl plastic insulation from specialty wire. Also ideal for cutting and marking various plastics and wood, cutting and sealing woven plastic materials. Consists of Part No. 122 which threads onto Heating Unit No. 267.



Write for Catalog No. 400

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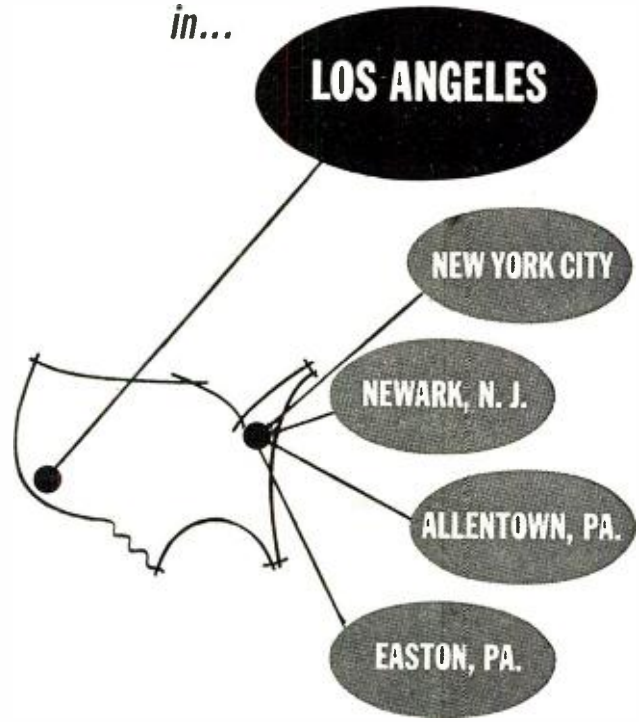

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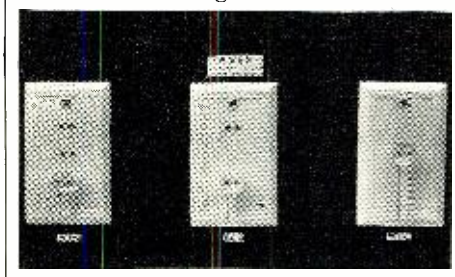
New York City	Los Angeles	Newark, N. J.	Allentown, Pa.	Easton, Pa.
66 Dey St.	911 S. Grand Ave.	114 Hudson St.	1115 Hamilton St.	701 Northampton St.

this new product incorporates a 300 ohm distribution system integral with the wall plate. The units come in ivory or brown, complete with plugs and mounting screws.

A unique feature centers around a surface box design which eliminates



cutting into a wall or using a wall box. A ¼" lead-in hole is easily covered by the plate, making a neat and simple installation.

In addition to this unit, double and triple arrangements for multiple or bi-directional installations are also available.

LOW-BAND YAGI

Radio Merchandise Sales, Inc. of 1165 Southern Blvd., New York 59, New York, has announced a new low-band yagi television antenna.

Featuring high gain together with sharp directivity, the new unit comes completely pre-assembled with snap-out construction for ease of installation.

The antenna construction features include rib reinforcement, with double brackets to provide sturdy, stress-proof performance. Both sides of each element are locked in the clamp support, in three positions. The new units are available with either ½ or ⅜ inch elements.

The company will supply full details on request.

TV BOOSTER ANTENNA

City Tool Accessories Corp., 3831 W. Lake Street, Chicago 24, Illinois, is currently offering a new indoor TV booster antenna which has been tradenamed the "Tele-tune."

This compact unit is said to reject or reduce ghosts, noise, and snow. It

can be used separately or with another indoor or built-in antenna, with an outdoor antenna, or in pairs. When used with an outdoor antenna the additional pickup it provides is particularly advantageous in fringe areas.

INSTALLATION KITS

Insuline Corporation of America, 36-02 35th Avenue, Long Island City, New York, has recently introduced a series of eight television antenna installation kits which have been designed to meet

practically all receiving requirements for either primary or fringe areas.

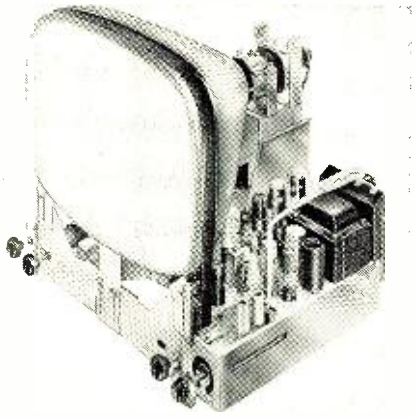
The simplest kit contains a single conical antenna, a five foot steel mast, and fifty feet of lead-in wire. The other kits are progressively more elaborate, the largest containing a stacked conical antenna, a ten foot mast, base mount, guy wire, 100 feet of lead-in, lightning arrestor, clamps, insulators, etc.

All of the kits are packaged for ease of handling by both the jobber and the technician.

NEW TV CHASSIS

Video Products Corporation of Red Bank, New Jersey, is currently marketing a new television chassis, the "Super-Video 630-DX."

The development of the powerful 30 tube chassis into a long-range receiver is a culmination of over two years' research. Designed to provide a clear, sharp picture at distances up to 200 miles from the transmitting station,



the new chassis does not require the use of boosters or complex antenna arrays.

Complete information on this new chassis is available from the company.

TV "TRANSLATOR"

General Electric Company has developed a small television "translator" which will tune in ultra-high-frequency telecasts when attached to any TV receiver ever made by the company.

The "translator" looks like a small table radio. It will receive all the proposed new u.h.f. channels and can be installed by the set owner in most cases. Although commercial u.h.f. stations are not expected to go on the air before late 1952 or early 1953, the company will supply the new translator to its distributors for demonstration purposes when the company introduces its fall line of TV receivers.

NEW TV ANTENNAS

Snyder Manufacturing Company of 22 and Ontario Streets, Philadelphia 40, Pa., has introduced two new television antennas to the trade.

One of the units is the radically new "Directronic," a motorless TV antenna system with a 360 degree, electronically-switched beam. Said to provide all of the benefits of a motor-driven antenna but without motors or moving

parts, the "Directronic" abolishes electric power, roof orientation, and ghosts. Mounted on or near the set, the beam selector gives remote control of element combinations. Only a single line need be installed.

The second of the new antennas is a yagi which is being incorporated into both the "Redi-Mount" and "Head-Line" series. In both high and low band antennas, these new units are preassembled and feature an exclusive space-saving design which allows easier and more economical handling and storage.

CROSLEY "ULTRATUNER"

The *Crosley Division, Avco Manufacturing Corporation,* has announced a new ultra-high-frequency converter

unit which is designed to allow all television sets having continuous-type tuners to receive the u.h.f. bands.

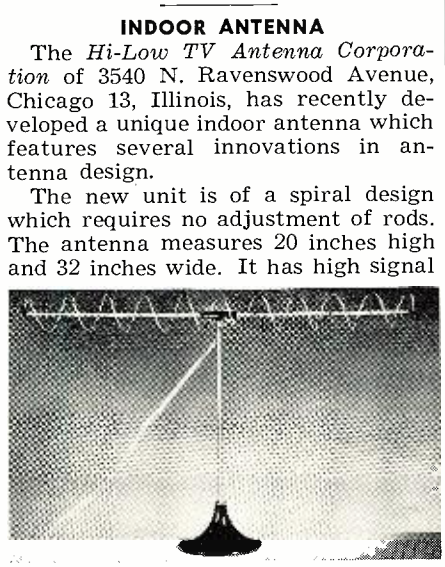
Tradenamed the "Ultratuner," the small unit is designed to be placed unobtrusively on or near the receiver. Installation can be made by anyone with a screwdriver being the only tool required. The unit measures 7x6⅞x9½ inches and is housed in an inconspicuous cabinet.

The company has advised that when the u.h.f. bands are opened to telecasting, production quantities of the new converter will be available to the public.

INDOOR ANTENNA

The *Hi-Low TV Antenna Corporation* of 3540 N. Ravenswood Avenue, Chicago 13, Illinois, has recently developed a unique indoor antenna which features several innovations in antenna design.

The new unit is of a spiral design which requires no adjustment of rods. The antenna measures 20 inches high and 32 inches wide. It has high signal



gain, a bakelite base, and aluminum bars and can be tuned to both high and low television channels.

The antenna is also available in a floor model which is similar to the unit designed to be used on top of the receiver.

TWIN-DRIVEN YAGI

Technical Appliance Corporation of Sherburne, New York, has announced a new antenna which has been especially designed to minimize and in most cases entirely eliminate co-channel interference.

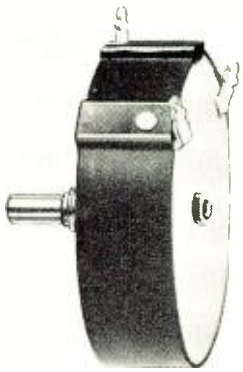
The new antenna has a front-to-back ratio of 30 db throughout the entire 6 mc. bandwidth without sacrificing forward gain. Terminal impedance of this new *"Taco"* special twin-driven yagi has been maintained at 300 ohms to match the standard lead-in.

Available for any one of the low-band channels, the new unit may be used as a single antenna or as a stacked array. The elements consist of a director, two driven elements, and a reflector. The terminals are located at the rear folded dipole driven element.

FOCUSING CONTROL

Chicago Telephone Supply Corporation of Elkhart, Indiana, has just developed a new high voltage control for electrostatic focusing.

Designated the Type 85, this unique control is made principally of insulating materials, using a minimum amount of metal. By conserving these scarce metals for military use, the new control will help to maintain TV production for civilian use.



"EAVE MOUNT"

Kenwood Engineering Co., Inc. of Kenilworth, New Jersey, has developed a new antenna eave mount which can be installed at the apex of the eave.

The new mount can be installed on the hanging rafter or trim board of the eave and eliminates the need for drilling in brick, masonry, or asbestos shingled walls. The mount clears attic louvres and windows, without loss of mast height and eliminates costly sidewall brackets.

Only four lag screws are required to mount the unit. U-bolt slots in the long lower member permit vertical alignment of the mast after the mount has been secured to the eave. A reinforcing step in the long lower member foots the mast for easy orientation of the antenna.

—30—

TV Reception

(*Continued from page 49*)

pulses riding on top of the signal are amplified. These amplified noise pulses will, in turn, be passed on to the sync circuits, causing either vertical jitter and instability or horizontal tearing out.

Some good results have been obtained in noisy fringe areas by using an experimental system as shown in Fig. 7. A potentiometer is substituted for the plate load resistor, R_1, in the sync preamplifier circuit and the pot is varied until a point is reached where the picture shows the best stability both horizontally and vertically. The pot should be removed from the circuit and checked for resistance. A fixed resistor may now be substituted for this value. The same stunt may be tried with the voltage divider resistor for the sync separator. It will be found that reducing the voltage to the sync preamplifier helps to clip the noise. An oscilloscope should be connected to the sync separator plate and the degree of clipping, as the potentiometers are varied, should be noted.

Video Circuits

Changes can also be made in the video circuits of a television receiver to improve the screen presentation, but usually these changes are only recommended in the extreme fringe.

Fig. 8 shows a typical video strip from the video detector to the CRT grid. The load resistors for the video detector, video amplifier, and video output tube, R_1, R_2, and R_3, respectively, are shown as variable resistors. Actually the resistors are fixed, but several values of resistors can be substituted one at a time until the picture presentation is improved. The video detector load, R_1, is critical and too great a value here may cause smearing. Some slight amount of smear may be introduced by increasing the value of R_2, but this small amount of smear may be desirable in some cases to hide a very snowy picture. The author has found that careful selection of load resistor values sometimes causes white snow presentation, which may be objectionable, to appear black. This is due to phase shift which may occur in the video strip.

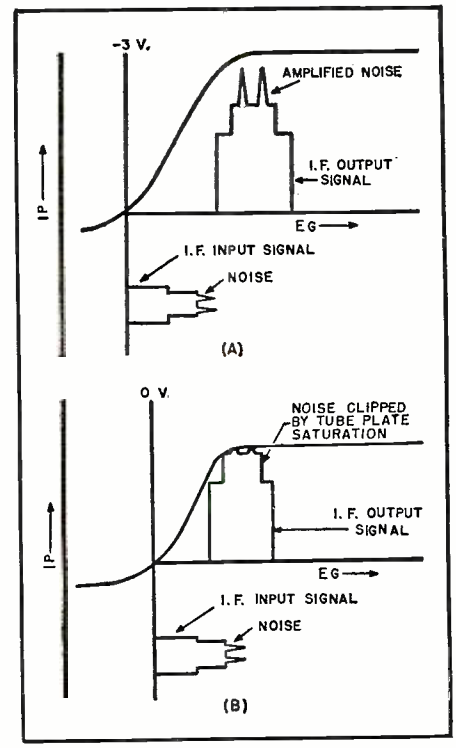


Fig. 6. Noise clipping in the i.f. stage.

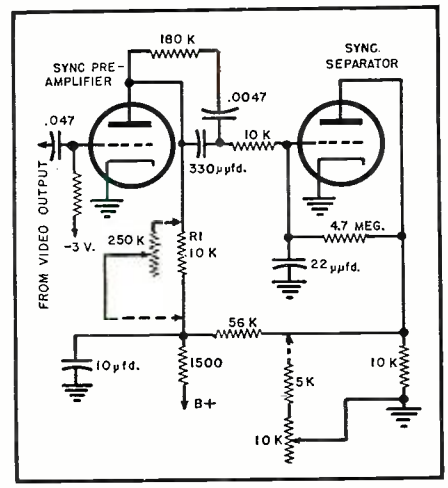
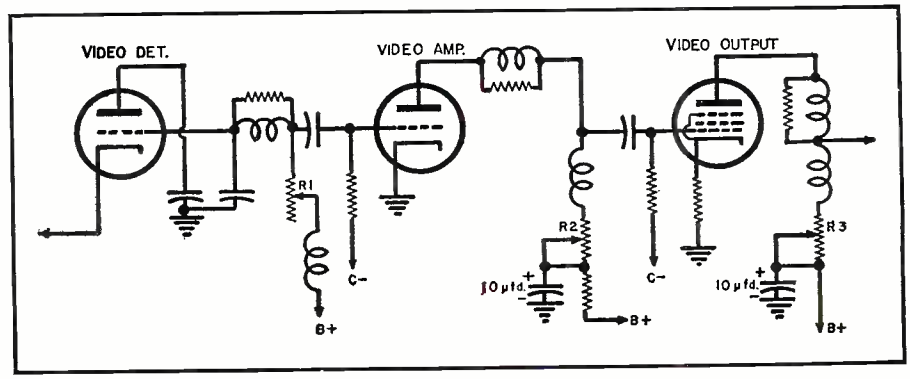


Fig. 7. Method of clipping for noisy areas.

Various combinations of all the factors concerned may be used to produce in a fringe area a picture which, although it may not be of the highest quality, is good enough to make television acceptable to the majority of people. —30—

Fig. 8. Circuit changes in video strip, from detector to the CRT grid.



Plugging Power Leaks

(*Continued from page 65*)

them to the lowest amount consistent with practicability and cost. The carrying capacity of all low voltage conductors was increased by replacing the original single conductors with four stranded cables. All conductors were shortened to the minimum permissible length. An additional fuse and holder was placed in parallel with the original fuse. The switch contacts were cleaned and filed perfectly flat, likewise the relay contacts. A heavy stranded lead was run directly from the negative battery lead to the dynamotor. The net result of the whole operation was to reduce the voltage loss from 1½ volts to a negligible .190 millivolts when operating under a full load. As to the net gain in output, the antenna r.f. meter now registers a constant 1.3 amperes, as compared with a previous reading of .9 ampere. And while it is not to be implied that this increase has resulted in a comparable increase in the range of the transmitter, a "before" and "after" check with a field strength meter showed a very worthwhile gain in signal strength.

For the mobile operator who desires to get the utmost from his rig, the foregoing outlined checks will more than repay him for his time and effort. As to how far he may wish to proceed in reducing voltage losses will depend largely upon his particular installation. In the author's case a four-fold increase in conductor size was considered to be the maximum consistent with flexibility. But regardless of what increase is made in the conductor capacity, the periodic cleaning of all switch, relay, and fuse contacts will insure that the low voltage circuit remains at the peak of operating efficiency. While at times this may seem to be a tedious and thankless task, in the long run such "preventative maintenance" really pays off. The results I have obtained have sold me on the value of such work.

—30—

Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

MIKE BULLETIN

A new bulletin, No. 160, has just been issued by *Electro-Voice, Inc.* of Buchanan, Michigan illustrating and describing the company's new Model 636 "Slimair" dynamic microphone.

Photographs show how the modern and slender design of the new unit can be adapted for use on a stand or boom, vertically or tilted, or for applications when a hand-held microphone is desirable.

Details are also given on the special "Acoustalloy" diaphragm and the new "pop-proof" head which is said to insure smooth response and make the mike extra rugged for indoor and outdoor use in all climates. Complete specifications and data are given.

ELECTRONIC PARTS

The *A. W. Franklin Manufacturing Corp.* of 43-20 34th Street, Long Island City 1, New York has recently issued a 20-page catalogue covering its line of electronic parts.

Detailed specifications are provided on a wide variety of acorn, cathode-ray tube, ceramic, laminated, miniature, molded, octal, and wafer type sockets; terminal strips; connectors; plugs and pin board assemblies; and a new miniature tube socket suitable for automatic mass production dip soldering of circuit components.

Four pages of the catalogue are devoted to illustrations and descriptions of the company's circuit stamping process with application data for its use in the production of loop antennas, amplifier circuits, cable assemblies, and television tuners.

Requests for copies of this catalogue must be made on company letterhead.

STACKPOLE CATALOGUE

In addition to its standard lines of fixed and variable resistors, line and slide switches, iron cores, choke forms and gimmick condensers, the new 42-page catalogue recently issued by the Electronic Components Division of *Stackpole Carbon Company* of St. Marys, Pa. lists a number of items which are catalogued for the first time.

The new Catalogue RC-8 includes information on several single, dual shaft, and special purpose volume controls; new 3-ampere slide switches; and the company's "Ceramag" non-

metallic cores in "U", "E", width control, and segmented deflection yoke types for television use.

Complete mechanical and electrical specifications are given in order to simplify component selection in addition to related engineering data. Copies are available without charge. Please specify the *"Stackpole* RC-8 Electronic Components Catalogue."

DEFENSE BOOKLET

Leece-Neville Company of Cleveland 14, Ohio is currently offering a public service booklet, entitled "A Guide to Mobile Communications for Civil Defense," to civil defense and government officials and to other interested persons.

This booklet provides valuable information on how two-way mobile radio serves to coordinate all operating services and gives complete data on how the company's a.c.-d.c. alternator system contributes to trouble-free service by providing mobile power with a high current output at low engine speeds.

SELECTING TECHNICIANS

Whittingham Bros., Inc. of 1618-20 Fairmount Avenue, Philadelphia 30, Pennsylvania is currently making available reprints of an article "How to Select a TV Technician" by Paul H. Wendel of the Television Technicians Lecture Bureau and editor of the "Radio-TV Service Industry News" column in RADIO & TELEVISION NEWS.

Designed to equip the consumer with a yardstick by which he can measure servicing standards, the reprinting of this article is particularly timely in view of the keen interest being displayed by the public in this subject.

TUBE IDENTIFICATION

The Receiving Tube Division of *Raytheon Manufacturing Company,* 55 Chapel Street, Newton 58, Massachusetts has recently published a new and modern "Tube Shelf Identification System" which is currently available from the company's radio and television tube distributors.

Printed on pressure-sensitive labels in bold type are over 480 popular and current *Raytheon* radio and television receiving tube type designations, bound in standard booklet form for easy handling. The size of the labels has been carefully determined to be one that will fit most shelf-end surfaces and give maximum visibility for quick reading. Each label is designed to be easily detached from the book and affixed by the distributor or dealer to his stock shelves. Designations are alphabetically arranged for quick selections. The labels are removable for use at other locations.

"KLIPZON" REPRINT

United Technical Laboratories of Morristown, New Jersey is currently offering reprints of John T. Frye's article "The Versatile Crystal Probe" which originally appeared in the April 1951 issue of RADIO & TELEVISION NEWS.

In addition to this four-page reprint the company will also send another four-page folder describing the various units manufactured by the company, such as, the "self-holding" test prod, the "Mini-Prod" connectors, and "Mini-Prod" adaptors.

CRYSTAL DIODE USES

Of interest to the hobbyist, experimenter, and model maker is the new booklet just released by the Electronics Division of *Sylvania Electric Products Inc.*, Emporium, Pa.

Titled "Electronic Shortcuts for Hobbyists," this booklet provides data on twenty-four applications of germanium crystal diodes. Written in simple and straightforward language, the booklet contains information on building an interval timer, polarity checker, polarity reversal alarm, spark quenchers, charger for small dry batteries, low current relay circuit, door chime "pepper," photoelectric relay, crystal radio receiver, electronic metronome, radio-controlled relay, wired radio control transmitter, etc.

This 54-page, illustrated booklet is available from the Advertising Department of the company for 25c a copy, postpaid.

SELENIUM RECTIFIERS

The Seletron Division of *Radio Receptor Co., Inc.*, 251 West 19th Street, New York 11, New York has prepared a comprehensive new 16-page catalogue covering its Seletron Selenium Rectifiers.

Printed in two colors and fully illustrated, the catalogue includes listings of dimensions and ratings for all miniature selenium rectifiers, as well as a large selected group of power stacks.

TV TRANSFORMERS

The new 1951 edition of the *Stancor* TV transformer catalogue and replacement guide is now available from

MULTIPLE-TV INSTALLATION IN WASHINGTON

AS a sequel to the article "How TV Came to Panther Valley" by E. D. Lucas, Jr., appearing in the March 1951 issue of RADIO & TELEVISION NEWS, we have received an interesting letter from Rogan Jones, president of the company which is furnishing similar multiple-set service to subscribers in Bellingham, Washington.

Mr. Jones felt that his company's experience in providing this service would be of interest to readers because of the slightly different problems his organization encountered.

According to Ernest E. Harper, chief engineer in charge of the project, the similarity between the Lansford activity and the one in Bellingham is remarkable inasmuch as the Bellingham group was completely unaware of the fact that a group of technicians in Lansford was undertaking the same type of service.

The Bellingham project was first conceived late in 1947. Many experienced engineers in the organization insisted at that time that such a plan was not feasible. Upon learning of the existence of a successful cable installation in Astoria, Oregon, the group at KVOS in Bellingham went into action and work started on the cable in October of 1949.

The Bellingham system now includes 20,000 feet of mainline cable, 35,000 feet of branchline cable, 70 sets connected to the cable with 300 expected, and 20 amplifiers in use, not counting distribution boxes. The over-all distance from the antenna to the farthest subscriber is 20,000 feet.

Informed people in Seattle state that the KVOS-TV picture quality and stability exceeds a large percentage of the pictures received in Seattle. The lack of local interference on the cable in Bellingham is pronounced.

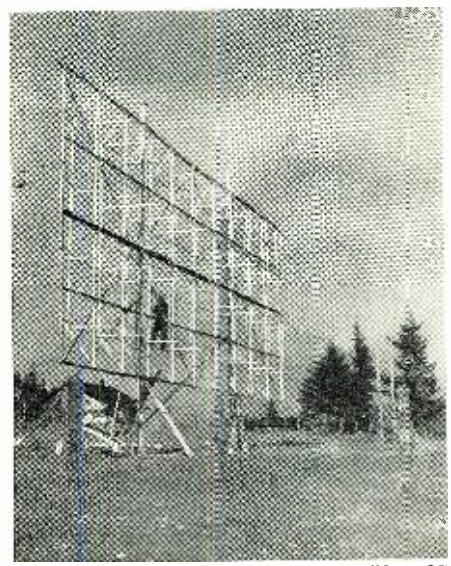
Additional points of interest include the fact that the costs and charges of the Bellingham system are comparable to those set up in Lansford despite a continent between the operations. The Bellingham antenna, which is 75 airline miles from KING-TV, is in a "hole." In direct line with the transmitter, about one mile from the receiving antenna, is a hill approximately 2000 feet higher than the antenna itself. Much time and money was expended in finding the signal and locating the antenna.

In addition, KING-TV, Seattle, tried to force the group to sign a long-term contract providing that when more than one TV station was on the air in the Seattle area that KING-TV would have exclusive rights to the audience of KVOS-TV. The other bottleneck is that Pacific Telephone and Telegraph Company will not permit KVOS-TV to use any pole in which they have any degree of ownership. As a result the Bellingham group has been forced to use the poles of Puget Sound Power & Light Company. This caused a delay of several months, lengthened the cable route, and increased costs by between $5,000 and $10,000.

When completed, the cable will serve a limited portion of the city of Bellingham at a cost of $25,000 including all experimental work. According to estimates by the company, the plant could be duplicated now, on the basis of present knowledge, for under $15,000.

-30-

Side view of Bellingham's TV antenna. The reflector screen, which measures 25 x 60 feet, consists of 32 half-wave elements. The screen is now 7 feet from the ground although tests indicate optimum elevation to be about 20 feet. Position of the screen was determined only after exhaustive tests.



Standard Transformer Corporation, 3580 North Elston Avenue, Chicago 18, Illinois or from any of the company's distributors.

The new 36 page guide contains replacement information on over 1500 TV receiver models and chassis produced by 71 manufacturers. Complete specifications, dimensions, and prices of 75 *Stancor* transformers and related components for TV replacements and conversions are listed.

PYRAMID CATALOGUE

Pyramid Electric Company of 1445 Hudson Blvd., North Bergen, New Jersey has just released a comprehensive catalogue covering its line of condensers for various applications.

Included in the binder are data sheets on the company's hermetically sealed miniatures, the "Glasseal" line, oil-paper units in metal tubes, oil-paper units in rectangular metal containers, bathtubs, hermetically sealed paper condensers in rectangular metal containers, high voltage filter condensers, and the company's "Long-Life" line.

PARTS CATALOGUE

A new catalogue covering radio, television, and electronic parts has been published by *The Muter Company* of 1255 South Michigan Avenue, Chicago 5, Illinois.

This permanent listing of components is being issued in sections, the first three sections being currently available. Form 100 covers the company's temperature compensating, general purpose, disc, and variable ceramic condensers. Form 200 lists wirewound "Candohm" and "Zipohm" resistors and sensitivity controls. Form 300 contains information on the company's "Spirashield," a specialized wiring shield for critical r.f. and a.f. circuits.

Copies of sections now available as well as sections to be released later may be secured without charge by making your request on company letterhead.

TV TUBE CHART

Tel-O-Tube Sales Corporation of 580 Fifth Avenue, New York 19, N. Y. is offering a new television picture tube conversion and replacement chart for technicians.

Available through parts jobbers, the new chart lists the characteristics of all picture tube sizes from 14 through 20 inches (both round and rectangular) and portrays graphically the circuit and component changes that must be made in order to convert to any desired size. By means of this chart the technician can make replacements or convert to larger screen sizes by simply referring to the chart and following the simple directions.

Designed for wall mounting, the new chart is available without charge to parts jobbers for free distribution to their technician-customers. Write the sales manager of the firm for a free supply. -30-

Admiral Set Conversion

(*Continued from page 39*)

the bracket as far to the rear of the chassis as possible before tightening.

The next step is to replace the 50 degree deflection yoke with a 70 degree deflection yoke. Suitable replacement units include the *Todd* Type J-70, the *Merit* Type MD-70, or a *Stancor* DY-7 yoke may be used. At the present time the *General Electric* replacement line does not contain a 70 degree yoke which will match the impedance of the horizontal output transformer used in this receiver although one is being developed.

The focus coil can now be remounted and the picture tube inserted. Due to the fact that the 14CP4 requires a single magnet ion trap instead of a double magnet type, this should be replaced with a *General Electric* No. RET-003 ion trap magnet. All other electrical connections to the picture tube should be made and the black fabric strap refastened to hold the 14CP4 picture tube in place. Now turn the receiver on and adjust the focus coil and ion trap for brightest picture and removal of any neck shadow.

The range of the focus coil will be inadequate with the new tube. To correct this remove the 3900 ohm resistor (R_{439}) connected across the focus coil and short out the 1200 ohm resistor (R_{437}) connected in series with the focus control, as shown in Fig. 3.

At this time place a chalk mark or a piece of *Scotch* tape at the edges of the raster. Replace the 5U4G tube (V_{501}) with a new tube. If the width is increased more than ⅛ inch on each side, the new tube should be used.

The width can be increased by disconnecting and taping both leads of the width control L_{401} which is located in the high voltage shielded compartment. The width and height can be extended by connecting a condenser across terminals #4 and #5 of the horizontal output transformer. As this capacitance is increased, the high voltage decreases which causes the picture size to increase and the brightness to decrease. The change in brightness will, therefore, limit the amount of capacitance which can be used. The width can also be extended by opening the damping resistor (R_{435}) across the 5V4G tube shown in Fig. 3.

Since none of these expedients produced an entirely satisfactory picture, the horizontal output transformer was changed in order to provide increased high voltage and sweep width. A *Stancor* No. A-8128 horizontal output transformer, which will fit into the same mounting holes, was used as a replacement.

A 500 $\mu\mu$fd. condenser was inserted across terminals #4 and #5 in order to obtain a satisfactory picture, however this much capacitance may not be necessary in all conversions. The sides should extend at least ¼ inch beyond the edge of the tube screen, otherwise

variations in the line voltage may result in a service call because of insufficient picture width.

Cabinet Changes

There are at least two ways in which the front panel can be changed. The first is to cut the panel along the dark line which shows below the picture tube mask in Fig. 1. The rib which extends to the back along this line must then be recessed so that the fourteen inch mask will mount flush on the cabinet. The second way is to obtain an *Admiral* No. 23D48-2 escutcheon. This is the bottom section of the two piece front panel used on the 12 inch model and is already recessed so that the 14 inch mask will mount flush on the cabinet. This is shown in Fig. 2. The latter method is preferred as sawing and filing plastic can be a time-consuming operation. The mask used was a No. 14SG manufactured by the *Deitz Miracle Lens Co.*, 141 President Street, Passaic, New Jersey.

A template should then be made using the larger perimeter of the beveled portion of the mask for size. This template should be used to mark the wooden panel of the cabinet. The panel should be marked so that the top of the mask will be flush with the top of the panel. Cut out this section of the panel with a keyhole saw. The plastic mask can now be mounted by drilling a hole in each corner and attaching the mask and escutcheon to the cabinet using the screws which were part of the original assembly.

The plastic mask used was not quite as wide as the original. The difference in size is visible in Fig. 2. This is not serious though because the wood panel is already stained. It is only necessary to fill the visible holes with plastic wood and touch up these spots with a little dark stain.

The receiver can now be reassembled and the conversion is completed.

EDITOR'S NOTE: *Since the original work on this Admiral conversion was completed, a new horizontal output transformer, the Stancor A-8129, has appeared. Chances are that, although it has not been tried, in this particular application, this new transformer will provide greater over-all width, and higher anode voltages than the Stancor A-8128 specified in the text. This new unit should simplify the conversion and provide better results.*

One word of caution which applies not only to this set but to every conversion job attempted—since it is very seldom that there are two sets which exhibit the same characteristics, the individual making the changeover will no doubt run into many variables that will mean additional work on his part before he can satisfactorily complete the conversion.

An idea of some of the difficulties that may be encountered include such matters as: 1. Insufficient width and poor linearity. To remedy this condition it is at times necessary to increase the drive. This will require the changing of several components in the horizontal sweep circuits. 2. Low second anode voltages and poor second anode voltage regulation. 3. Faulty horizontal sync. This requires juggling of different component values in the horizontal sync circuits.

The conversion notes as presented herein worked out very well; however, each set is an individual problem.

—30—

International Short-Wave

(*Continued from page 56*)

3 a.m. She was quite surprised to hear the station on so late, as Modesto usually closes down earlier. However, station personnel were still handling flood reports.

One hour later, Sylvia, under an oxygen mask, wrote the station and commended the staff members on their help in the emergency. In the letter, she introduced herself and asked if it might be possible to request listeners to send her their used greeting cards, in order that she could make scrapbooks for hospitals. The appeal was broadcast and hundreds of beautiful cards poured in.

Now at last, the original plan resolved itself into a project. Four days before Christmas, Sylvia finished two colorful scrapbooks. She sent one—composed of restful winter scenes—to her fellow-patients at the Medical Center. The other—made up of gay cut-out animals—went to Del Puerto Hospital in her home town, Patterson. Both books were finished in time to be in the hospital wards on Christmas morning.

Our best wishes go to *ISW DEPARTMENT* Monitor Sylvia C. Grischott, who is helping herself by helping others, and who has found happiness in knowing some lonely persons—near-by or far away—can turn the pages of her scrapbooks and also find happiness!

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New Receiver

RADIO & TELEVISION NEWS has just acquired a *Hammarlund* SP-600-JX *Super Pro* for use of your short-wave editor. Our thanks go to Bill King and the *Hammarlund Manufacturing Co., Inc.,* for making possible the purchase of this fine communications receiver for *ISW DEPARTMENT* monitoring work.

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Club Notes

England—Arthur E. Bear, secretary, *International Short Wave Club,* 100, Adams Gardens Estate, London, S.E. 16, England, reminds that he is always happy to send full details about ISWC, and a specimen copy of the monthly publication, to anyone who requests such information. He reports that ISWC is growing steadily.

Sweden—I recently received the mimeographed "DX News Bulletin" of the *World Radio Society,* Box 19033, Stockholm 19, Sweden; staff includes S. Zetterlund, B. Pihlo, A. Cederquist, J. Karlsson, and A. Kling.

USA—Anson Boice, editor for the *United 49-ers Radio Society,* of 28 Eisenhower Drive, New Britain, Conn., says he still has available copies of "OP-AID" (published by *Short Wave News,* London) for 30 cents a copy, postpaid, and ISWL short-wave report pads at 50 cents per pad, postpaid.

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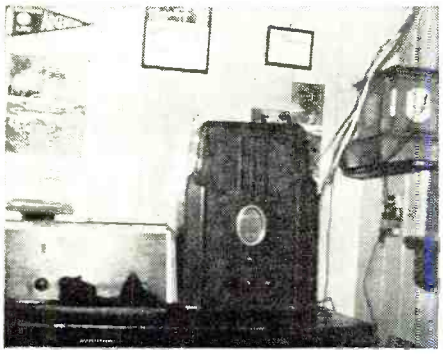
This Month's Schedules

Albania—ZAA, 7.852, Tirana, now has news 1615-1630 instead of former



With this relatively simple and rather old equipment (a Philco 630 table receiver of 1935 vintage covering 550 kc. to 18 mc., an RCA t.r.f. broadcast receiver made in 1930, and a 40 ft. horizontal triangle antenna), Edward F. Bellington, Jr., of Brooklyn, New York, listens to and verifies short-wave broadcasting stations from all corners of the world. His experience is concrete proof that skill in tuning, patience, and perseverance really pay off for the SWL. He has long been a valuable contributor to the ISW Department. Ed has logged 139 countries since 1935. Countries verified include Hong Kong, Fiji Islands, Thailand, French Indo-China, Albania, Saudi-Arabia, Syria, China, Japan, Iran, Iraq, Israel, India, Ceylon, Pakistan, Mozambique British New Guinea, Anglo-Egyptian Sudan, and many others. Considering his poor reception location, Ed's record is remarkable.

1515-1530. (Pearce, England) Scutari, 8.215, noted 1340 with music; suffers CWQRM. (Catch, England)

Andorra—Radio Andorra, 5.990, noted to *after* 1900 lately. (Stark, Texas) *Short Wave News*, London, lists schedule 1300-1900.

Argentina—Latest SIRA schedules—9.690, Spanish 1000-1100, French 1100-1200, Italian 1200-1300, Swedish 1300-1400, *English* 1400-1700, German 1700-1800, Spanish 1800-1900, *English* 1900-2400; 15.290, Spanish 2100-0100, 1215-1545; 11.880, Portuguese 0800-1300, French 1300-1430, *English* 1430-1600, French 1600-1700, Portuguese 1700-2230; 9.455, *English* 1600-1750, 2130-0100.

LRX1, 6.120, noted 1945 with native program. (Russell, Calif.) LRX, 9.660, noted 2116. (Machwart, Mich.)

Australia—The North American "morning" beam now is radiated 0700-0945, VLC7, 11.810, to Eastern, Central, and Mountain Time Zones; 1000-1115, VLA8, 11.810, to West Coast. The weekly program *"Australian DX-ers Calling"* is now broadcast at an *additional* time—Sundays 0200 for British Isles, Europe, New Zealand, 9.580, 11.760. (Radio Australia)

Austria—Blue Danube Network, 9.617, Salzburg, excellent with news 0400. (Catch, England) Noted 1535 giving QRA of APO 777. (Pearce, England)

Belgian Congo—OTM2, 9.400, strong 0000 but around 1400 has bad CWQRM. (Hannaford, South Africa) Station noted recently on approximately 17.500 at 1300 announcing as OTC3, Leopoldville. (Kroll, N. Y.) Was recently heard on approximately 21.700, calling Korea in Flemish 0145, signed off 0215. (Hannaford, South Africa)

Bolivia—La Paz, 9.497, noted recently signing off 2116, but may run later some days. (Stark, Texas)

Brazil—A *new* 500-watt transmitter, operated by *Radio Difusora Brasileira*, at Uberlandia, State of Minas Gerais, is radiating on 2.32. *Radio Quitandinha*, 5.045, wants reports from any place in the world, no matter how poor reception may have been; now has *new* Swedish session Wednesdays 1800-1830; QRA is Avenida Rio Branco 311, 90 Andar, Rio de Janeiro, Brazil. (Serrano, Brazil) Heard to 2100 sign-off. (Machwart, Mich.)

Bulgaria—Sofia, 7.671, noted with news 1615-1630, then in native. (Sutton, Ohio) Also noted with news 1500-1530 on 7.671 and on *additional* outlet of approximately 7.255. (Pearce, England)

Burma—Rangoon, 6.035, good lately with news 1000. (Baker, Calif.) Sundry overseas sources list *Radio Mandalay* on approximately 7.400 with *English* 0630, French 0715.

Chile—OTC says CE1515, 15.15, is scheduled 1100-1900. (Grischott, Calif.)

China—*Radio Peking*, 15.060V, noted with news 0430 followed 0445 with messages from U. S. prisoners-of-war in Korea; closes 0455; also heard with news 0830; announces 11.69 (actually nearer 11.685—KRB) in parallel. (Catch, England)

Colombia—HJFK, 6.103, Pereira, noted with music 2010. (Russell, Calif.)

Cuba—*Union Radio*, Havana, noted more recently on about 9.437 to *after* 2000. (Stark, Texas)

Czechoslovakia—Prague, 6.010, noted 0005-0025 and 0035-0054 at fair level in So. Dak. (Lane) Prague noted signing on 1930 to North America on 9.550; news 1940; *English* ends 2000. (Hoffman, N. Y.; Hooker, Sask.) The 11.84 channel should parallel.

Denmark—The North American Service is still over OZF, 9.52, 50 kw., Copenhagen, weekdays 2100-2230, Sundays to 2200. (Garcia, N. J.) The DX session is now *every Tuesday* around 2220 or 2230. (Bellington, N. Y.)

Dominican Republic—HI4T, 5.970, noted signing off 2357, good level in Saskatchewan. (Hooker) HI4T, 5.970, and HI2T, 9.735, seem to have *English* on Mondays 2200. (Bellington, N. Y.) HI9T, 6.190, Puerto Planta, noted on a Sunday 0030. (Rastorfer, N. Y.)

Ecuador—HC1AC, 6.210, Quito, noted 0000-0130 sign-off; HC2FB, 6.130, Guayaquil, heard 0040-0115 sign-off (runs to 0200 Sundays). (Rastorfer, N. Y.)

French Equatorial Africa—Brazzaville, 11.970, has news 0015, 1100, 1745 for North America, usually followed by various features in *English*. (Baughn, Ky.)

Germany—*"Radio Free Europe,"* is heard in Sweden around 1445-1530. (*DX-Radio*, Sweden) Still noted from 1020. (Pearce, England)

Gold Coast—ZOY, 15.430, Accra, noted with varied musical program 1030-1100. (Sutton, Ohio) Ridgeway, South Africa, reports Accra on 5.979 at 1600, fair level.

Greece—Dvorak, Ohio, reports a Greek station on 6.339 at 1615 with music. Bellington, N. Y., notes Athens has replaced 9.607 with 11.718 for *English* 1430-1445 and French 1445-1500.

Greenland—OXI, 5.942, noted recently 1718; on 6.676 at 1805, with CWQRM. (Bellington, N. Y.) Latter channel measured 1805 by Oskay, N. J., as 6.677.

Larissa, 6.745, is still scheduled to carry *English* 1530-1545 on Thursdays —but some weeks does *not* have it. (Pearce, England)

Guatemala—TGNA by this time should be using its *new* 11.850 channel with *English* 2200-2230 (Mailbag, Wed. 2230-2300 or later); other channels are 6.040 (should be used now with Spanish and other languages), and 9.668 (for *English* in parallel with 11.850).

Haiti—4VRW, 9.838, Port-au-Prince, noted in *English* on Mon., Wed., Fri., 2100-2150, news 2135; announces as "Voice of the Republic of Haiti"; fair to good signal; signs off 2202. (Hooker, Sask.) 4VCM, 6.407, noted 1920-2300 sign-off. (Rastorfer, N. Y.)

Holland—Officials of *Radio Nederland*, Hilversum, write—"We broadcast daily in *English*, Dutch, Afrikaans, Arabic, French, Indonesian, and Spanish. We especially draw your attention to our *English* transmission at 2130-2210 which is beamed to North America on 11.73, 5.59. We know that reception in the U. S. has been very poor lately, but the latest reports show that conditions are gradually improving. . . . Our programs not only consist of news and information from or about Holland, but also of interviews, actualities, and music—both in the serious and lighter vein. Listeners who are interested in our program can obtain a monthly illustrated bulletin free-of-charge."

Honduras—HRQ, 6.125, San Pedro Sula, heard with much QRM in Oregon 2145-2200; has many commercials. (Callarman) HRD2, 6.235, La Ceiba, noted recently with *English* around 2230-2300 interspersed with marimba music. (Bellington, N. Y.) HROW, 6.675. *Radio Monserrat*, noted nightly to 2300 sign-off. (Rastorfer, N. Y.)

Hungary—Oskay, N. J., recently measured Budapest's 41-m. outlet as 7.2208 at 2300.

India—AIR, 7.29, noted with news 0730. (Guentzler, Fetzer, Ohio, others) Noted signing on 2300 on 15.16, 17.74, news 2315, fades 2330. (Balbi, Calif.)

Indo-China—Radio France-Asie, 9.524V, Saigon, noted with news 1730-1800. (Chapman, Texas) Station officials recently informed Betty Jennings, Okla., that there is a request program for *English*-speaking listeners each Friday 0420-0445 on 11.830 and 1745-1830 in the 25-m. band (however, latter may be heard on 9.524V—KRB).

At the time this was written, another Saigon outlet was noted on 7.26 (after being on 7.24 for a few days), heard mornings; *Radio Hue* was still using 7.205. (Balbi, Calif.)

Iran—EPB, 15.100, is again carrying short *English* newscast 1500, followed

by dance music; news in Russian 1515 (jammed when last monitored), and signs off 1530. (Saylor, Va., others) Good signal in West Virginia.

Teheran is scheduled on EQB, 6.155, 2145-2330, 0830-1330; EQC, 9.660, 0330-0700 (Fri. 0130-0700); EPB, 15.100, 1330-1530; EPP, 3.940, relays m.w. EQA at 0930-1315. (Bluman, Israel, via Radio Australia) Verified in 20 days by registered mail. (Jenson, Wisc.)

Iraq—Bluman, Israel, lists Kurdish National Radio on 7.040 and Baghdad No. II on 7.092, both heard around 1500-1600 or later. (Radio Australia) Noted by Pearce, England, on 7.092 to 1400 sign-off (with a few bars of country's National Anthem).

Ireland—At the time this was compiled, *Radio Eirrean*, 17.840, Dublin, was still using this channel with news 1330-1345A (may be on Summer Time by now and changed to 1230-1245A), often in the clear lately and with improved signal. *May be testing new high-powered transmitter by now?*

Italy—Rome continues to be reported on sundry channels. Noted on 9.575 with news 2145-2200 for Pacific Coast, announcing news for East Coast at 1900; asked for reports to Radio Roma, Roma-56, Via Venete, Rome, Italy. (Dary, Kans.) Noted on 7.110 at 1625 and signing off 1630. (Oskay, N. J.)

Jamaica—Radio Jamaica, 3.360, appears to relay BBC news 2300-2310 sign-off *when conditions are favorable*; otherwise, music is heard at that time. (Bellington, N. Y.)

Kashmir—Radio Kashmir is scheduled on 4.860 at 2130-2330, 0630-1200, and on 7.270 at 0100-0230; *English* news 2130, 1030; announces "This is Kashmir Calling." (OTC via Grischott, Calif.)

Lebanon—Beirut, 8.026, noted 0100 with news in Arabic, news in French 0130. (Catch, England) *English* session 1030-1100. (Pearce, England)

Liberia—ELBC, 6.025, Monrovia, still being heard widely in the USA when this was written, daily to 1845A sign-off; *by now, however, may also be testing new transmitter in the 25- and/or 19-m. band.*

Luxembourg—The 15.352 outlet noted 0735 in French; woman announcer. (Dvorak, Ohio) His *English* on 6.090 at 1730-1900 weekdays, 1530-1930 Sundays. (WRH Bulletin)

Madagascar—Tananarive, 9.515, is widely reported, opening with "La Marseillaise" 2230, followed by setting-up exercises in French.

Malaya—Radio Malaya, Singapore, noted now on 7.200 with *all-English* programs; news 0630. (Balbi, Calif.)

Malta—FBS, Middle East, was not being heard on any channel when this was compiled; believed closed down preparatory to moving to the Suez Canal Zone. (Pearce, England) Not reported to me for some time.—KRB.

Mauritius—Forest Side station officials have informed Pearce, England, that the station has moved from the 19-m. band to 11.840 with Overseas

Service at 0930-1230; wants reports via airmail. Pearce can *not* hear the 11.84 outlet due to QRM.

Mexico—XEMC, "La Estacion mas Espanola del Mundo," ("The Most Spanish Station in the World"), Mexico City, announced 15.205, true to its slogan, transmits exclusively Continental Spanish (mostly Andalusian) music and songs (Flamenco, and so on), with the inevitable commercials, invites reports to Apartado Postal 22717, Mexico, D. F. (Rastorfer, N. Y.) Measured recently by Oskay, N. J., as 15.205143; previous measurement was 15.2055.

Mozambique—OTC reports Lourenco Marques with Portuguese programs on 15.183 at 1145; says 15.195 and 15.226 are *tests only.* (Grischott, Calif.) CR7BJ in the 31-m. band, with Portuguese programs daily from 0000, is shifting about; when this was written was on 9.85. (Balbi, Calif., others) The listed 4.920 channel, used from 2300 with *English* programs (from 0000 Sundays), moves about, too—noted 4.915 to 4.925 at times. (Stark, Texas, others)

New Zealand—ZL3, 11.78, ZL8, 9.62, noted parallel 0400. (Guentzler, Ohio) And signing off 0615. (Shanahan, Wisc.) Open 0200. (Bellington, N. Y.) Noted on ZL4, 15.28, with recordings around 0045. (Russell, Calif.)

Nicaragua—Callarman, Oregon, reports YNOW, Managua, on a *new* (announced) channel of 6.055; on Saturdays at least leaves the air 0300; may have earlier sign-off other days; *no English noted* but announces frequently in Spanish as "YNOW, La Voz de la America Central."

Nigeria—Short Wave News, London, reports Lagos lately has been on only 6.035, but soon was to transmit on 7.255 at 2000-2130, 0100-0200; on 9.655 at 2000-2130, 0100-0800; on 4.990 at 0800-1200; the 6.035 outlet was then to be dropped. (Radio Australia)

Pakistan—The 15.335 outlet fair to good 2100 with news; improving. (Lane, South Dak., others) Noted parallel on 7.140, 11.749 with news 0700. (Sutton, Ohio) Noted daily on approximately 7.010 in Arabic 1115-120 sign-off. (Pearce, England) Balbi, Calif., Hooker, Sask., more recently have noted the 1015 news on approximately 11.720. ISWC, London, lists Pakistan on 9.506 with news at slow speed 1210-1230.

Panama—HO50, 6.044, noted with music 2327; announcements in Spanish by man. (Tanczos, Ohio)

Paraguay—Radio Encarnacion, 11.945, noted in Oregon with poor signal 2000-2105 sign-off; relays *Radio Belgrano*, Buenos Aires. (Callarman)

Peru—Radio America, Lima, verified with nice card after 6 months, from Cia. Peruana de Radiodiffusion, S. A., Apartado 1192 or Ocona 479, Lima, Peru; listed frequencies as OAX4U, 1010 kc., OAX4V, 5.925 (moved from 5.907), and OAX4W, 9.360. Is noted on *new* 5.925 channel now to after 2330, using many popular U. S. tunes. (Callarman, Ore.)

Poland—Warsaw, 9.727A, now has *English* for North America daily beginning 1745, 1930, 2300, 0015. Between its own *English* sessions, Warsaw now relays Moscow's North American (*English*) evening beam, irregularly. (Duxbury, R. I., others)

Portugal—CSA27, 9.744V, noted 1900-2100; previous measurement was 9.746. (Oskay, N. J.)

Sao Tome—CR5SB, 17.680, noted Thur., Sun. *only* at 0700-0800; CR5SC, 4.8075, heard around 1500 to 1615 close-down (some days closes 1600). (Catch, England)

Saudi-Arabia—Djeddah, 11.85, noted signing on 1200 with Arabic music. (Lane, South Dakota.) Pearce, England, notes this *new* (1200) sign-on on the 11.950, 5.959 channels also.

South Africa—The SABC's 11.927 outlet verified from Johannesburg and QSL said is located at Roberts Heights (presumably a Johannesburg suburb). (Baker, Calif.) Cape Town's channel is 5.89, not 5.88, according to station officials. (Ridgeway, South Africa) Johannesburg III, 4.895, still noted signing on 2345 in *English* and Afrikaans; setting-up exercises in Afrikaans follow. (Saylor, Va.)

Southern Rhodesia—Salisbury, 3.320, still noted with relay of BBC news 1880. (Catch, England)

Spain—After testing on 9.585, Madrid returned to 9.369, where still has *English* daily 1515, 1800-1840. *Short Wave News*, London, lists as *news*, "Radio Murcia" on 7.160, noted with call "Transmite Radio Murcia" at 1800; has both male and female announcers and a signal of three identical gong-notes. Pearce, England, notes Alicante now on approximately 8.140 around 1500.

Syria—Damascus, 6.000, 12.000, has dance music 1500 followed by news 1530. (*DX-Radio*, Sweden) Uses 7.135 irregularly, and 6.000, 12.000 at 0000-0130, 0600-0800, 1100-1700. (Bluman, Israel, via Radio Australia)

Tahiti—Papeete, 6.135, appears scheduled now 2300-0045 when signs off with "La Marseillaise." (Balbi, Rosenauer, Calif.; Bellington, N. Y., others)

Taiwan—Taipeh's Home Service is scheduled on 6.095 at 1800-1930, 2255-0100, 0430-1000. (*WRH* Bulletin) Heard by Balbi, Calif., some days with Bible lesson in *English* 0630-0700. Taipeh, 15.235, 11.735, now has *English* 2300-0000, and Chinese 0000-0200. (Rosenauer, Balbi, Calif., others)

Tangier—Radio Africa, 7.125, noted ending "mid-day" session 1100. (Pearce, England)

Thailand—Bangkok, 6.24, still noted with news 0615, signing off around 0632; weather report approximately 0620. (Ferguson, N. C.)

Trans-Jordan—Ramallah, 7.075A, is heard in Sweden 0930 and with news in Arabic 1000. (*DX-Radio*, Sweden) Scheduled 0000-0110, 0630-0730, 0930-1430, according to verification; *English* 0930-1030, remainder Arabic. (Radio Sweden)

USI—At the end of *English* news

1020-1030, YDE, 11.77, gives QRA as Broadcasting House, Box No. 7, Djakarta, Indonesia. (Hooker, Sask.) According to announcement, *English* session 0930-1030 now is over 15.15, 11.77, 4.910; to Europe 1400-1500 on 15.15, 11.77. (Pearce, England) *Radio Padang,* 7.240, Sumatra, signs off 1130 daily; *has no English.* (Radio Sweden) YDK, 4.855, Palembang, noted 0920 with (*English*) recordings, then talk in Indonesian. (Catch, England)

USSR—Latest schedules of *Radio Moscow* in *English* for North America are 1820-2300 on 15.23, 11.89, 9.67, 7.29 (this one from 2100), 7.25, 9.76 (*new*). This transmission is now relayed irregularly, in part, by such satellite outlets as Warsaw, Prague, Budapest. (Grischott, Calif., others) Mailbag Program is Sat. 2100-2130.

Noted recently in *English* 1630-1758 sign-off on approximately 5.915 in parallel with 6.000, 6.090, 6.110; announced next *English* in this (European?) service for 0115. Home Service noted recently on about 7.165, 7.18, 7.28 with setting-up exercises in progress 2020. (Bellington, N. Y.)

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Last Minute Tips

A station noted on approximately 4.96 with *English* (by man) around 1905, with terrific QRM, may be Belize, British Honduras. (Bellington, N. Y.)

Latest schedule of *Radio Sweden* is 1900-2030, 10.780, 15.155; 0015-0235, 6.065, 15.155; 0235-1015, 11.705, 15.155; 1015-1300, 10.780, 15.155; 1300-1330, 6.065, 10.780; 1330-1400, 10.780; 1330-1400 with separate program on 6.065; and 1400-1700 relaying Home Service, 10.780, 6.065.

A QSL from Baghdad, Iraq, 7.092, listed transmitter as *Marconi* Type S.W.B. 10, 16 kw. to antenna, high-level Class B modulation; antennas are omni-directional; scheduled 2330-0100, 0430-0600, 0830-1500 in Arabic and occasional European music and talks; interval signal, bird call; time signal, clock striking. (Bellington, N. Y.)

Sutton, Ohio, reports a station on 15.225 with news 1045-1050 that may be *Radio Belgrade,* Yugoslavia; notes Belgrade on 9.505 with news now 0015-0035, then into native.

Lahore, Pakistan, APL2, 6.075, is scheduled 2100-1230; *English* at least some days around 0930. (Radio Australia)

TGTQ, 6.285, Guatemala City, "Radio International, La Voz de la Capital," noted 0030-0115 and later. (Rastorfer, N. Y.)

Springbok Radio, 4.945, Johannesburg, South Africa, noted opening 2300. (Bellington, N. Y.) Uses chimes-gongs frequently.

According to *Radio Australia,* the Far East Broadcasting Co., Manila, Philippines, now has increased time on the air to 2200-0100, 0300-1200, and is using 32 languages and dialects; mentions *new* channel, DZH9, 11.855; is missionary station.

Radio Sweden lists (clandestine) *Yugoslav Emigrant Station* on 7.530 signing off 1630; and *Radio Republica*

Espanola on 6.460 on Sundays, Thursdays 1630-1700.

Moscow noted on 9.53 in *English* for Southeast Asia 0930; Hindustani 0945. (Balbi, Calif.)

Radio Australia reports ZOY, Accra, Gold Coast, as on 9.640 in parallel 1784 kc., in *English* 0530-0630, and on 7.300 in parallel 15.430 at 1000-1300.

Radio Tabriz, Iran, approximately 6.080, sent schedule of 2215-2315, 0315-0745, 0900-1300; wants reports to V. Shafyi, Dean of Azarbaygan, Press & Propaganda Dept., Radio Tabriz, Tabriz, Azarbaygan, Iran. (Bellington, N. Y.)

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Press Time Flashes

Petropavlosk, 6.07, USSR, noted with Home Service, 0300-0530, then Chinese to 0615, followed by further Home Service relay. BED29, 6.095, Taipeh,Taiwan, heard irregularly with *English* religious service 0430-0500, 0600-0700, schedule is 0430-1000; BCSF, 6.334, Taipeh, signs on 0430, and at times parallels BCAF, 8.99; BED22, 7.000, Taipeh, signs on 0430, heard late as 1100; Taipeh, 7.34, noted from 0700. Saigon, Indo-China, has been moving about the 41-m. band (7.24, 7.25, 7.26, 7.175) and at press time was noted mornings on 7.19. *Radio Peking*, 15.-06A, noted from 1630-1900 in Chinese; 11.685 heard weakly at 2300-2400. Communist-Chinese outlet noted on 6.34 with Chinese news 0630-0700 parallel 9.73, 7.10, 6.155, 6.10, 5.99 (Shanghai), and 5.915 (Mukkden, Manchuria). (Balbi, Calif.)

Ponta Delgada, 11.090, Azores, is definitely now on summer schedule 1400-1500. Athens, 7.30, noted with setting-up exercises 0015. Innsbruck, 6.000, Austria, noted opening in German 0000. AIR, 15.16, 11.85, has *English* for West Indies 1930. (Bellington, N. Y.)

Radio Clube de Mocamedes, 7.775, Pt. West Africa, heard in South Afr., 1230-1400 closedown; is CR6RM; Portuguese *only*. HVJ, 17.84, Vatican, has *English* on Tuesdays for Africa, India, Ceylon, 1030-1050. (Ridgeway) Nova Lisboa, 9.705, Angola, is good in South Africa to 1500 closedown. (Hannaford)

HJKD, 6.000, Bogota, Colombia, "Emisora Nuevo Mundo," noted 2200-2231; HJDE, 6.145, Medellin, "La Voz de Antioquia," heard 2210-2237 sign-off. (Patterson, Ga.)

Rome noted 1345 in *English* to South Africa on 15.420. (Chatfield, N. Y.)

Rosenauer, Calif., flashes he has noted HLKA, 4.780A, Soeul, Korea, 0730-0900, mostly in Korean.

BED32, 8.960, Taiwan, noted 0515 with Chinese news; Kuala Lumpur, 6.025, Malaya, has news 0630; ZBW3, 9.525, Hong Kong, relays BBC news 0600; HVJ, 5.970, Vatican, heard 1530 in French, 1545 with Italian; TAV, 17.830, Ankara, Turkey, noted 0515. (Sanderson, Australia)

Moscow is heard in N. Z. with *English* principally at 0115-0130, 11.630, 9.640, 7.320, 6.110; 0215-0230, 15.400, 11.630, 9.680, 9.640; 1230-1300, 7.360,

7.340, 7.320, 6.110, 6.090, 5.910; 1400-1500, 9.670, 7.360, 7.340, 7.320, 7.240, 6.110, 6.090, 5.910; 1530-1600, 9.670, 7.340, 6.110, 6.090, 5.910; 0900 on 9.530 for Asia. (Cushen, N. Z.)

Papeete, 6.135, Tahiti, 2300-0045, some days has *English* around 2330-2345. (Rosenauer, Russell, Calif.; Dary, Kans., others)

A San Jose, Costa Rica, station, TILS (or TIMS?) was noted testing recently on announced 6.990 (seemed higher) around 0000. (Dary, Kans.; Stark, Texas; Bellington, N. Y.) 4VM, 6.005, Port-au-Prince, Haiti, noted 1800-2130 sign-off; all-French program with occasional announcements in *English*. (Saylor, Va.)

Berne, Switzerland, is now scheduled to North America 2030-2300, 15.305, 11.865, 9.535; will make slight changes in frequencies September 1 to provide better reception at the equinox.

Although not confirmed, ISWC, London, reports *Radio Kabul,* Afghanistan, is now on 5.980, 11.800 daily 2100-1400. *Radio Euzkadi,* "La Voz de la Resistencia Basca," clandestine, on 6.090, is now heard 0230-0300. The Socklot Short Wave Listeners Club, Nykarleby, Finland, offers a sample of its magazine. (Radio Sweden)

HC2CA, 6.891.6, Salinas, Ecuador, noted 2125 with Latin American music. (Treibel, Washington State)

At the time this was written, Kol-Israel seemed to be on Summer Time with *English* 0600 on 6.830; 1415 on 6.830, 9.012; 1600-1700 on 9.012. (Bellington, N. Y., others)

Radio Congo Belge, Leopoldville, Belgian Congo, sent schedule—OTM1, 3 kw., 6.295, 0000-0200, 0515-0730 (Sun. from 0500), 1100-1500 (Sat. to 1600); OTM2, 20 kw., 9.380, 1100-1500 (Sat. to 1600); OTM4, 20 kw., 11.720, 0515-0730 (Sun. from 0500); uses French, Flemish, Portuguese for Europe, with native xylophone beat as interval signal; also radiates on OTH, 7.5 kw., 9.210, 1200-1330 for native listening, in French and Congo dialects. PJC2, 5.010, Curacao, still has *English* on Mondays 2000. (Fetzer, Ohio)

Radio Tamandare, Recife, Brazil, is now on the air on 3.265. Ribiero, Brazil) *Radio Brasil,* Campinas, Sao Paulo, Brazil, is now on 4.755 with 1 kw., call of ZYY3; all-Portuguese; closes 2200; QRA is Box 625, Campinas, Sao Paulo, Brazil; old channel was 2.46. *Radio Corporation,* Calle Huercanos 1248, Santiago de Chile, Chile, sent a large flag QSL; is heard on CE1515, 15.15, from before 0750 to after 2230; also operates on CE619, 6.19, and CE950, 9.50 (latter now *inactive*). (Serrano, Brazil)

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Acknowledgement

Sorry, fellows, that space limitations prevent the use of many fine reports received this month. Nonetheless, please keep the most important items coming to me during the summer. Address Kenneth R. Boord, 948 Stewartstown Road, Morgantown, West Virginia, USA. Thanks! . . . KRB.

New HORIZONTAL DEFLECTION CIRCUIT

Its use is not new, but now that the circuit's early faults have been overcome RCA employs it in TV sets.

By
ROBERT K. SEIGLE
National Broadcasting Company

SAM SERVICEMAN may be moderately surprised the first time he removes the cover of the horizontal deflection and high-voltage compartment of some of the newer television receivers. The familiar bulky output-high voltage transformer with its iron core is gone. In its place is a relatively small air core coil with but three terminals and the customary rectifier filament loop. What happened? Only the latest of a succession of quick-changes in this important section of the receiver.

Probably no other circuity has undergone as much investigation with resultant improvements as the horizontal deflection and high voltage system. Designers have continuously been achieving reduced chassis size, lower manufacturing costs, and decreased power consumption. The horizontal yoke coils necessarily have a considerable power demand since their impedance is high at the line scanning frequency, and it is the ampere-turns which yield beam deflection. However, studies have shown that even this actual power is considerably smaller than the total heretofore expended in the horizontal output circuit. Furthermore, the culprit seemed to be the deflection transformer. Much work was done to improve the operating efficiency of this component; the original

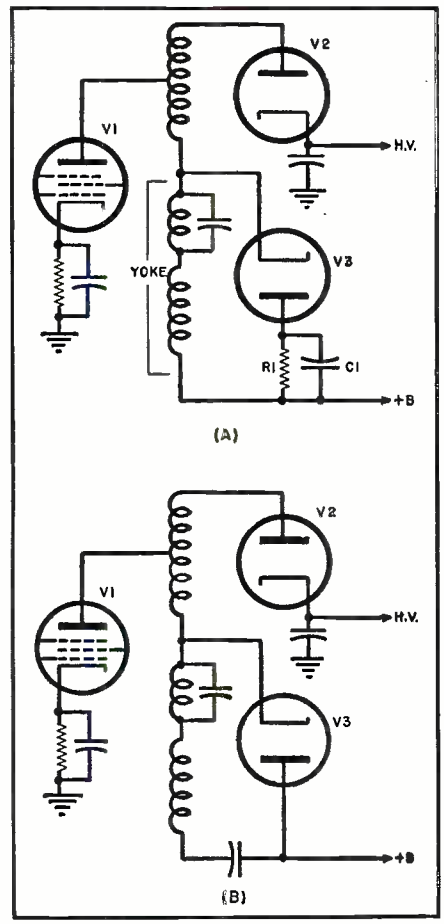
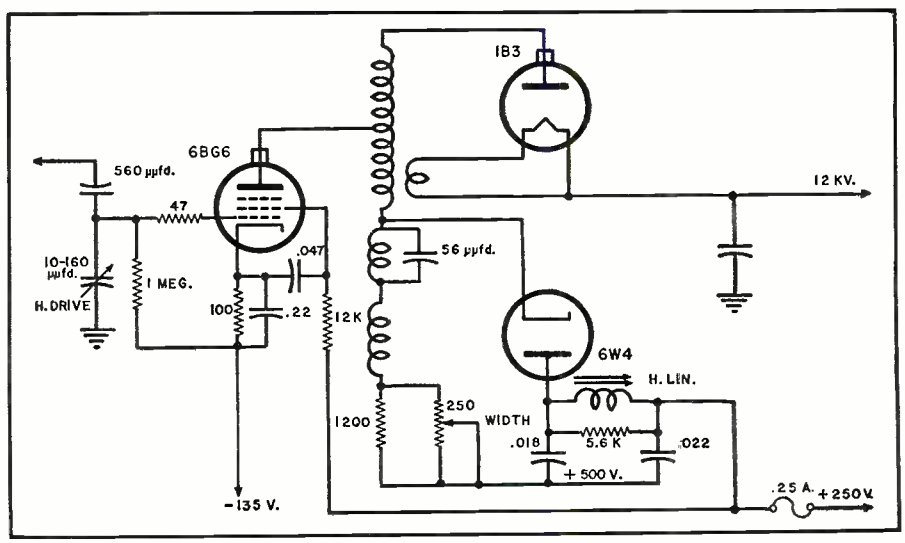


Fig. 1. (A) Early model direct-drive system. (B). An improved version of circuit of (A).

Fig. 2. Complete diagram of horizontal deflection circuit as used in RCA receivers.



powdered-iron core, followed by the ferrite type core were notable advances. The development of better damping and bootstrap voltage circuits increased the over-all efficiency.

The latest work by *RCA* engineers was directed toward possible elimination of the horizontal output transformer entirely. This would mean driving the yoke coils directly as the plate load of the horizontal output tube. However, this usage alone cannot be satisfactory for several reasons. Plate current flowing through the yoke coils results in decentering of the scanning beam; a separate source of high-voltage must be available; damping of yoke transients cannot be done efficiently; and linearity is not readily accomplished. The first laboratory improvement on the direct-drive scheme was one to secure high-voltage from the sweep. This was done by inserting the primary of an autotransformer in series with the yoke winding and the plate circuit of the output tube as shown in Fig. 1A. The secondary of the autotransformer yields a large pulse voltage in much the same manner as earlier widely used systems. Tube V_3, R_1, *and* C_1 form a damping arrangement. The designers found the circuit of Fig. 1A to be rather inefficient due to loss of power in R_1, and poor in linearity. Direct current still caused decentering.

An improved version is shown in Fig. 1B. Note that the damping resistor R_1 has been eliminated and that C_1 has been moved into a series position between the yoke and the damper tube V_3. Thus the efficiency and the centering conditions were immediately improved. Also, however, the average plate voltage which in Fig. 1A had been essentially that of the "B+" supply is now increased by as much as 50 percent. This is due to the addition of a reactive "kick" component which adds to the "B+" voltage. An important boost in efficiency results from this use of otherwise wasted energy and permits the "B+" requirements of the receiver to be substantially reduced. However, the system of Fig. 1B still suffers from poor linearity.

In order to achieve linearity, use was made of the basic circuit type of linearizing network which has been in almost universal application since 1946. It consists of a small variable iron core inductance resonating with two condensers near the line scanning frequency. The circuit operates so as to insert a correcting waveform in series with the damping tube and increase the rate of change of the current through the yoke during the time the beam is in the central portion of its scanning cycle and decrease the rate of change at the left and right ends of the beam path.

Fig. 2 illustrates the final system as found in many of the newer receivers. The width control varies the "*Q*" and the current distribution. In the circuit shown, a 16" 70° kinescope is deflected and supplied with 12 kv. second anode potential. The current at "B+"

voltage is only about 85 milliamperes. The power consumption is then equivalent to that of the 630 type system when deflecting a 10" 50° tube at 9 kv.

Devices and arrangements encompassed in this article used patents and inventions of *RCA* and were developed by Messers. W. E. Scull, Sr., R. G. Wolcott, and S. I. Tourshou of *RCA Victor* and A. A. Barco of *RCA Laboratories.*

—30—

DX-ING TV

M. L. Stevensen of Wichita, Kansas has added DX-ing to his televiewing and recently had the unusual experience of bringing in XLTV, Mexico City.

He uses an Admiral 21B1 receiver with a Ward yagi cut to Channel 4, and two homemade boosters hooked up in series. The same evening Mr. Stevensen was enjoying the programs from "South of the Border," his son, who lives 6 miles away, was also receiving Mexico City.

Both men report excellent reception of the sound and picture.

—30—

HAM WINS SUIT

FREDERICK W. Wright, Jr. of Haworth, New Jersey and the ARRL have won their suit to permit hams to erect any height antenna irrespective of the zoning ordinances in their communities.

The New Jersey State Supreme Court ruled that since a private radio station antenna was not used for commercial purposes, it was not the intent of zoning ordinances to limit the height of their construction.

The two-year court battle started in the summer of 1949 when Mr. Wright was refused permission to erect a 60 foot tower in the backyard of his two and one-half story home. The set is now operating with a 40 foot antenna built onto the rear of his house.

While the ruling applies specifically to New Jersey communities, the favorable decision may establish a precedent in similar cases in the future.

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HAMFEST IN WALES

OF particular interest to hams is the announcement just received from Graham F. Wilson, Cardiff Town Representative of The Radio Society of Great Britain, concerning an unusual amateur activity to be held in conjunction with this summer's "Festival of Britain."

The Welsh Amateur group will run an exhibition booth at the Welsh Industries Fair, Sophia Gardens, Cardiff, from the 4th to the 14th of July. An amateur station, operating on all bands, will be in action throughout the Fair and there will be an exhibition of amateur-constructed equipment.

The station will operate under the call letters GW3WIF and special QSL cards will be sent for every QSO.

American and Canadian amateurs visiting Britain for the Festival are cordially invited to visit this ham booth. Wilson will also arrange inspection visits to South Wales amateur stations if interested persons will drop him a line at 120 Cardiff Road, Llandaff, Cardiff, Wales. —30—

Technical BOOKS

"TELEVISION" (Volumes 5 and 6) by *RCA* Staff. Published by *RCA Review, Radio Corporation of America, RCA Laboratories Division,* Princeton, N. J. Vol. 5, 458 pages. Vol. 6, 422 pages. Price $2.50 each plus 20 cents each foreign postage.

Two new volumes in the *RCA* series on television have been released—Volume 5 which covers the years 1947-48 and Volume 6 which deals with developments made during 1949-1950.

Like the other volumes in the series these texts are symposia of technical papers written by *RCA* engineers on the subject of television.

Each of the books is divided into sections dealing with pickup, transmission, reception, color television, and general information. Volume 6 contains a listing of some 506 technical papers written by *RCA* authors from 1929-1950 on television and related subjects.

The material presented in these volumes is written at an engineering level and should prove to be a valuable addition to engineering libraries, both industrial and academic.

* * *

"TV MASTER ANTENNA SYSTEMS" by Ira Kamen & Richard H. Dorf. Published by *John F. Rider Publisher, Inc.,* New York. 352 pages. Price $5.00.

Here is a thoroughly practical "how-to-do-it" text which covers all phases of the installation, maintenance, operation, construction, and merchandising of master antenna systems for television reception.

Designed as a handbook for engineers, service technicians, TV installers, manufacturers' technical and sales personnel, etc., the text material covers complete details on all of the popular amplified and non-amplified multiple antenna systems currently on the market.

The book is clearly written and both technical and non-technical personnel should experience no difficulty in grasping the material.

* * *

"COLOR TELEVISION" by Edward M. Noll. Published by *Paul H. Wendel Publishing Company, Inc.,* Indianapolis. 45 pages. Price $1.00. Paper.

This "notebook" on color television has been prepared especially for the experimenter, hobbyist, and television technician. In it the author has presented the fundamentals of the various proposed color systems in easy-to-understand language, illustrated by photographs and diagrams.

Included is a description of the basic elements of color television; the adaptation of standard video receiver for black and white reception of color signals; adapters and converters for color signals; details on the *CBS, RCA, CTI,* and other color television systems; tri-

color picture tubes, color wheel assembly and control units; tabular summaries of performance characteristics of different color TV systems; and a brief summary of television highlights.

With the current interest in color television, the appearance of this timely little book will undoubtedly be enthusiastically welcomed by television enthusiasts.

* * *

"RADIO AND TELEVISION RECEIVER CIRCUITRY AND OPERATION" by Alfred A. Ghirardi and J. Richard Johnson. Published by *Rinehart Books, Inc.,* New York. 650 pages. Price $6.00.

This is the first book of a new series which will constitute the "Modern Radio and Television Servicing Library." Written by Alfred A. Ghirardi and J. Richard Johnson, this text provides all of the basic information required to understand present-day radio and television receivers, recorders, record changers, and pickups.

The subject matter has been handled clearly and in easy-to-understand language, making the text suitable for the student and the tyro technician, as well as the old timer in the radio game who wants to brush up on his radio and television theory. By means of carefully worded explanations the authors have managed to present their subject in non-mathematical terms and without resorting to highly technical language.

The book is divided into 16 chapters covering such subjects as AM, FM, r.f. amplifiers and t.r.f. receivers, superhets, AM detectors and a.v.c. systems, FM receivers, a.f. amplifiers, speakers, power supply systems, TV principles, antenna systems, home recorders, phono pickups and record players, record changers, and the mechanical construction of receivers. A glossary of terms is a particularly valuable adjunct to the text material.

As a teaching aid or as a self-check for the home-student, there are test questions at the end of each chapter. Answers are provided for the odd-numbered questions.

We believe this book deserves a place on the reference shelf of any well-equipped service shop. As the technician grows familiar with its contents he will find more and more occasions to turn to this text for the answer to his day-to-day problems.

* * *

"TELEVISION AND FM ANTENNA GUIDE" by Edward M. Noll & Matthew Mandl. Published by *The Macmillan Company*, New York. 308 pages. Price $5.50.

This comprehensive antenna guide performs a two-fold function in that it provides a thorough and basic course on antenna theory and a practical handbook on antennas and their installation, all within a single volume.

The first part, which covers the principles of antenna systems, has chapters on wave propagation, transmission lines, antenna principles, and directive antenna systems and arrays.

The reference guide deals with antenna site surveys, choice of antenna type, antenna erection, transmission line installation, input systems, booster amplifiers, antenna type dimension and gain charts, dipoles, folded dipoles, the "V" antenna, the conical antenna, fanned antennas, circular antennas, directors and reflectors, stacked and in-line units, phased antennas, long-wire antennas, yagi construction, u.h.f. antennas, omnidirectional units, indoor antennas, diversity antenna systems, rotating antennas, multiple output antenna systems, and interference reduction.

The text material is lavishly illustrated with charts, line drawings, and photographs. The text itself is clear and concise and the technician studying the subject independently should experience no difficulty in grasping the subject matter.

—30—

ESFETA JOINS NETSDA

RADIO service technicians of New York voted their organization, the Empire State Federation of Electronic Technicians Association (ESFETA), into the new national radio service federation, the National Electronic Technicians and Service Dealers Association (NETSDA).

The decision to join the national federation was made at a recent business meeting attended by twenty-five members, representing eight associations.

—30—

VETERAN GROUP MEETS

ON FRIDAY evening, June 8th, the New York Quarter Century Wireless Association will hold a dinner meeting at the historic Fraunces Tavern, Pearl and Broad Streets, in downtown Manhattan.

The bar will be open at 6 p.m. with dinner served promptly at 7. The program will include talks by several real old timers. Non-members are welcome as guests of members. The group now has a membership of over 350, with a chapter in Cleveland.

Details or reservations may be obtained from the association's president, John DiBlasi, W2FX, 259 West 14th Street, New York, New York.

—30—

W.U. TO SERVICE SETS

ANNOUNCEMENT was made recently of the formation of a new Western Union subsidiary, Western Union Services, Inc., which will install and service television receivers.

Thomas F. McMains, vice-president and assistant to the president of Western Union and president of the new subsidiary, revealed that arrangements have been made with Allen B. Du Mont Laboratories, Inc., whereby Western Union Services, Inc. will be authorized to install and service Du Mont receivers in Essex, Passaic, and Union counties in New Jersey.

For the present, operations will be limited to the three New Jersey counties. Experience during the initial operating period will be the basis for planning expansion to new areas.

—30—

RADIO-TV Service Industry News

AS REPORTED BY THE TELEVISION TECHNICIANS LECTURE BUREAU

Service Looks at U.H.F. TV

THE Federal Communications Commission's table of proposed frequency allocations for v.h.f. and u.h.f. television warmed the hearts of seasoned independent service business operators in fringe, far-fringe, and non-television areas. The picture it paints of more than 1800 TV broadcasting stations spotted across the country in more than 1200 cities and towns spelled out opportunities—opportunities to build up their own businesses and for the birth of more small service businesses than any industry ever created before.

A careful study of the cities and towns that are slated for channel assignments promised television programs in practically every nook and cranny of the country. With channel allocations proposed for such small, far-flung towns as Bottineau, North Dakota; Millinocket, Maine; Alpine, Texas; Hancock, Michigan; Douglas, Arizona, and Brewton, Alabama—to cite only a few—the miracle of television as a vehicle of entertainment and as the Aladdin's lamp lighting the way to new levels for service business, would work its wonders on the Main Streets of America as it did in its early days in the metropolitan areas.

But what does it mean in terms of new business opportunities in the installation and service business?

The new channels—numbers 14 to 65—are in the u.h.f. band. This band will start at either 472 megacycles or 500 megacycles depending upon the FCC's final decision on the need for this section of the spectrum for multi-channel, common carrier, broadband, mobile telephone service. This is the service that would enable you to have telephones installed in your installation trucks so that you could communicate with your field service or installation men at any time.

The u.h.f. television channels will be spread across 400 megacycles, more or less, of the spectrum up to the top frequency of 890 mc. These u.h.f. frequencies pose a number of propagation and reception problems. In the first place, it is difficult to develop a lot of transmitting power at these frequencies of operation which limits the effective range of the transmitters. In the second place, there is less bending of the waves than there is at v.h.f. television frequencies so that your "signal line of sight" is not far off from the "optical line of sight."

It is quite probable that every installation where u.h.f. reception is desired will require an outdoor antenna. So the television service business will require adequate facilities for the installation and maintenance of antennas just as the television contract organizations in the large cities have found it necessary.

U.H.F. Tube Developments

For a long time we have heard that u.h.f. television would be a long time in developing even after the channels were selected and assigned. It was said that little progress had been made in developing transmitting tubes that would generate a satisfactory volume of power at these frequencies.

But it is interesting to note that both *Westinghouse* and *G-E* announced and displayed transmitting tubes capable of operating at these high frequencies, at the IRE convention in New York City earlier this year.

G-E, as a matter of fact, announced both a transmitting tube and a (comparatively) high-powered transmitter for u.h.f. The tube is said to be capable of operating at frequencies up to 900 megacycles with a 1 kilowatt output. The transmitter, which is now undergoing preliminary tests, utilizes a new type of u.h.f. velocity-modulated 5-kilowatt tube working into a radically new type of transmitting antenna that is claimed to increase effective radiated power by 20 times.

The *Westinghouse* tube—a reflex "resnatron"—is still in the laboratory stage. Its development is said to be pointed primarily toward color television transmissions in the u.h.f. range. It is claimed that this tube in laboratory tests has delivered approximately 1500 watts of power and with modifications now contemplated it may be possible to increase this output by as much as six or seven times.

These developments are very important in appraising the element of "time" in the building of stations for u.h.f. telecasting after the construction freeze is lifted. In the *RCA* u.h.f. field experiments a modified standard 500-watt *RCA* v.h.f. broadcasting trans-

mitter was used. The modifications enabled them to produce approximately 1 kw. of output power and to develop an effective radiated power of 14 kw. through the use of a high-gain transmitting antenna.

The rapid development of satisfactory transmitting equipment for u.h.f. will probably follow the pattern of v.h.f television. When the first TV stations went on the air it was thought that years would be required to build the transmitter equipment for all of the stations that had been granted CP's. Yet in about three years' time all of the valid CP's were completed and the stations were on the air with television programs.

The unstable world situation makes it impossible to forecast potential developments with any reasonable degree of accuracy. However, since it is the avowed objective of the national defense planning boards to try to expand the country's economy at the same time they are building up our defense potential, it is reasonable to assume that u.h.f. television will move forward rapidly after the station construction freeze has been lifted, channel assignments granted, and CP's issued. There are a number of economic and military reasons why it should. Possibly the only serious deterrent to a rapid renewal of telecasting development and expansion in both the v.h.f. and u.h.f. regions after the freeze is lifted would be an all-out shooting war.

What to Do

If nothing stops the expansion of telecasting facilities, the most dramatic effect of the new allocations will be when stations are built in the present far-fringe and non-television areas. Radio service businesses in these areas will be lifted to new levels of activity with the first flush of receiver sales. The management practices that are put in effect immediately when this business gusher starts to flow will be the determining factor in whether a long-range, profitable business is created or one that will pass out as a failure when the sales boom subsides.

There is little time available for installing an accounting system or for guarding against the stock shrinkages and losses that can devour the normal earnings of the business after TV telecasting starts. Once the drive starts to sell receivers in the reception area of a new station the service shop operator and all of the technicians he will be able to hire will find each day far too short to handle the installations he is called on to make.

The time to plan a television service business is before it starts.

Fortunately, new television service operators have available to them a wealth of service business operating information that was unavailable to operators entering the business four and five years ago. This information is the hard-won product of experience. It is the sum of practical "do's" and "don't's" learned the hard way by

men who safely steered their service businesses through the seas of their mistakes and from the lessons gleaned from the records of the businesses that failed.

Contract Service

The annual service contract, if the monies involved are properly handled by the service contractor, will provide the set owner with the best kind of continued service and the contractor with an assured income to maintain his organization during the lull seasons that are part and parcel of the radio and television business.

Unfortunately, the mishandling of many television service businesses with the resultant loss of service to those who paid for it, has thrown the annual service contract into a bad light in many areas. And many receiver retailers with low moral business standards, treated the service contract monies they collected on receivers they sold as part of their business profits. They farmed out their service calls to men who were poorly equipped to handle television service with the result that the Better Business Bureaus have been swamped with customers' complaints stemming from these unscrupulous practices.

Many of the fast-dollar schemes that badger legitimate service operators in the metropolitan areas will not be a factor in the smaller cities and towns. This is particularly true of retailers' relations with their customers because the complaints of a few dissatisfied customers in a small town can ruin a dealer's business.

There is a possibility that the interest in contract service will be revived with u.h.f. television. The prospective television service contractor or operator will do well to study the methods of handling contract monies that have proven most satisfactory for the successful TV service contractors in the large cities.

Antenna Installations

The most profitable antenna installation that any service operator can make is one that will weather any storm that may strike his community. There are always antennas that can be bought at a price that might appear to add a dollar or two to the profit from installations but when a lot of them fold up in one bad storm it wipes out not only that seeming extra profit but may jeopardize your entire business.

In making antenna installations you become involved in an important new factor in any successful television service business. That is "customer relations." You can leave a happy or a disgruntled customer each time you finish an antenna installation. If you leave a disgruntled customer you have trouble on your hands throughout the life of that service contract.

Fundamentals of TV Service

The television service business is a technical *business* enterprise. For the shop owner the emphasis is definitely

on the *business* part of the activity; for his employees the accent is on technical knowledge and skills but with a very new and important element added—customer relations.

From the over-all technical standpoint, u.h.f. television introduces a whole new series of circuits and components and their peculiarly individual problems. A television receiver will be tunable to the 64 channels in the proposed series of allocations plus either 13 or 18 "flexibility" channels that have been reserved for special applications or assignments. Frequency-wise, it will have to tune from 54 megacycles to 890 megacycles.

By the time the new u.h.f. areas get broadcasting stations combination receivers will probably be available. At the moment, it appears as if some type of dual receiver will be provided. This would employ a converter to tune in the u.h.f. frequencies and a chassis similar to the present receivers for the v.h.f. band.

U.H.F. in Metropolitan Areas

The ten million receivers now in use undoubtedly will be adapted for u.h.f. reception through the use of converters. The conversion of receivers in any metropolitan area spells out a business that will run into hundreds of thousands of dollars. This tremendous volume of business will probably spawn a lot of conversion "specialists" —businesses which concentrate on converting particular television receiver models with a production line system for handling them. This type of specialization was very effective in handling receivers for picture tube conversions and it will probably prove even more so in converting receivers for u.h.f.

Present television service contractors will probably gear up quickly to handle this type of business. They hold a decided edge over any new competition that may develop in that they have the installation and service facilities already available to accomplish the antenna installations and to service the converted receivers under contract.

The antenna installation business in metropolitan areas will probably acquire a new vigor with the advent of u.h.f. Physically, the antennas necessary for these high bands are small and some of the most successful in experiments have been simple "V" types. When they find it imperative to put up an outdoor antenna to receive u.h.f. many people who have continued to view poor pictures because they would not install an antenna will undoubtedly arrange for multiple units and see the first really good pictures on v.h.f. on their own receivers.

Management Bulletin Available

The business management and technical requirements for a successful installation and service business are much too extensive to be fully covered in this department. The editors feel, however, that the thousands of men who will be expanding their radio ser-

vice businesses to handle television installation and service would greatly benefit from a study of good service business practices before TV reaches their localities. The first television service contractors had to acquire their management "know-how" through trial and error. Many of their mistakes were costly and in some cases ended in business failure even though other management factors were sound.

A special bulletin has been prepared, "Television Service Business Management," that includes the important facts for successful service business management proven by practical experience. You may obtain a copy of this bulletin without charge by sending a stamped, self-addressed envelope to the Service News Editor, RADIO & TELEVISION NEWS, 185 North Wabash Ave., Chicago 1, Ill.

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PETITION DENIED

THE Federal Communications Commission has denied the petition of the American Radio Relay League to reopen proceedings on Docket No. 9295 for the purposes of rearguing the matter of providing an Amateur Extra Class of amateur operator license.

The Commission held that the petition did not raise any question or supply any pertinent information not already brought to the attention of the Commission in this proceeding in written comments filed by the ARRL and arguments presented to the Commission in its behalf by counsel at the oral argument held before the Commission en banc on June 2, 1950.

Commissioners Sterling and Hennock voted to grant the petition while Commissioners Walker, Hyde, Webster, and Jones dissented.

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STUDY QUESTIONS

THE Federal Communications Commission has announced that study questions for the newly-established "Novice" class amateur licenses are now available without charge.

The list of study questions is being distributed by all of the Commission's field examination offices or may be secured by writing the Secretary, Federal Communications Commission, Washington 25, D.C.

The examination for the Novice class license will consist of a code test, at the rate of five words-per-minute, and a written examination consisting of twenty questions of the multiple-choice type on the subjects of rules and regulations essential to beginners' operation, including sufficient elementary radio theory for the understanding of those rules.

The new Technician class license, announced simultaneously with the new Novice license, will require successful completion of the same examination as that given for the existing General and Conditional classes with the exception that the code requirements will be five words-per-minute instead of thirteen.

Licenses for these new classes are not available until July 1, 1951 and the field offices of the Commission will not be prepared to conduct these examinations prior to that date.

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100-Watt Transmitter

(*Continued from page 45*)

the shielded wire. The 3x6 inch hole in the chassis for the output coils, and the shielded compartment for the oscillator coils and condenser are about the only sheet metal work involved. The bandswitch is a *Centralab* unit, and can be assembled to switch the r.f. coils as well as the oscillator and FM sections if desired. A separate three-gang unit was used for the oscillator grid and FM, as shown in the photographs, but this could be an extension of the plate switching.

The final tank coils are arranged as a turret around the three switch wafers, but this is subject to the ingenuity of the individual. In general, keep all of the r.f. leads short, keep all the bypass condensers as close as possible to their circuits, and form the shielded wire of the a.c. and power leads into bundles close to the chassis. Make all grounds to the bus, which can be a copper strip or a heavy wire. A single 0-100 ma. meter is switched to read currents, with a shunt of No. 32 wire wound on the 10 ohm resistor in the 1000 volt lead to double the reading.

Those results? 100 watts of clean r.f., right on the table, with single dial control (except for touching-up the final at band edges) that so far has worked just about everything we have called.

—30—

RADIOMEN NEEDED

FROM the American Radio Association, C.I.O., 5 Beekman Street, Room 313, New York 7, New York comes word of the urgent need for ship radio officers for assignment virtually anywhere in the world.

According to the ARA, the FCC has announced an order re-establishing the Temporary Limited Radio Telegraph Second Class Operator License, otherwise known as the TLT. Any person who held a First or Second Class Radio Telegraph Operator License between January 1, 1940 and January 1, 1951, which has since expired, is eligible to apply for a TLT whether or not he has had experience under such license. Written application must be made to a district FCC office. A minimum examination, consisting mainly of 16 wpm code test, is required. The TLT will be valid for shipboard operation only.

Any holder of a First or Second Class License which has expired since Jan. 1, 1951, may renew without examination and without any service time.

Holders of regular or temporary telegraph licenses are invited and urged to apply for current openings as ship radio officers, paying between $100 and $200 per week, including overtime and bonus. Interested persons should write or wire the ARA at the above address for full details or contact the ARA offices in San Francisco, Seattle, Houston, New Orleans or Baltimore.

The need is urgent as sailings are being delayed because of this radio officer shortage. —30—

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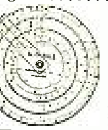

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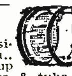

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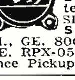

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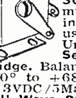

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130	120	.09	.69
130	120	.2	.98
130	120	.225	1.29
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6B5	1.29	6V6GTY	1.65	12SL7GT	1.07	45Z3	.89
6B6G	.98	6V7G	1.18	12SN7GT	1.22	45Z5	.90
6B7	1.29	6W4GT	.98	12SQ7GT	.91	46	.99
6B8G	1.39	6W4WGT	1.70	12SR7	.98	47	.89
6BA4	1.08	6W5GT	.98	12X3	.90	48	3.90
6BA5	1.98	6W6GT	1.35	12Z3	.98	RK48A	14.85
6BA6	1.00	6W7G	1.33	14A4	1.19	49	.83
6BA7	1.20	6X4	.69	14A7/12B7	1.08	50	1.19
6BC5	1.11	6X5GT	.75	14AF7/XXD	1.18	EF50	.98
6BD6	1.11	6Y5	1.85	14B6	1.08	50A5	1.22
6BE6	1.00	6Y6G	1.25	14B8	.98	50B5	1.11
6BF6	1.49	6Y7G	.89	14C5	1.19	50C5	.98
6BG6G	1.85	6Z5/12Z5	1.18	14C7	1.09	50C6	1.49
6BH6	1.35	6Z7G	.89	14E6	1.10	50L6GT	.81
6BJ6	1.35	6ZY5G	.89	14E7	1.33	50X6	1.10
6BL7GT	2.75	7A4/XXL	.98	14F7	1.10	50Y6GT	.90
6BQ6GT	1.78	7A5	1.10	14F8	1.19	50Y7GT	.99
6C4	.91	7A6	.85	14H7	1.09	52	.99
6C5GT	.83	7A7	1.45	14J7	1.23	53	.78
6C6	.89	7A8	.90	14N7	1.35	55	1.06
6C7	1.26	7AD7	1.56	14Q7	1.10	56	.85
6C8G	.98	7AF7	.87	14R7	1.19	57	.89
6C21	42.50	7AG7	1.98	14S7	1.33	58	.89
6C86	1.11	7AH7	1.15	14W7	1.23	59	1.78
6SD6G	2.98	7B4	.83	14X7	1.23	RK65	24.95
6D4	2.85	7B5	1.23	14Y4	1.20	HY69	2.75
6D6	.89	7B6	1.00	15	.98	70A7	1.59
6D7G	.89	7B7	.90	15E	1.98	70L7GT	1.95

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6E5	1.54	7C4/1203A	.79	FG17	3.98	72	.95
6E6	1.39	7C5	1.00	RK18	.98	CRP72	1.37
6E7	1.39	7C6	1.00	18	.98	73	1.67
6F4	5.95	7C7	1.49	19	.65	NR74	.29
6F5	.83	7C23	72.00	19BG6G	2.98	75	.83
6F6	1.04	7E5/1201	1.25	19J6	2.49	HY75A	4.59
6F6GT	.85	7E6	.98	19T8	1.98	76	.83
6F7	1.39	7E7	.98	20	1.17	77	.75
6F8G	1.49	7F7	1.15	RK20A	8.95	78	.83
6G6G	1.48	7F8	2.25	RX21	2.50	79	.89
6H4GT	.98	7G7/1232	1.33	PJ22/CE1C	1.49	80	.74
6H6	.91	7H7	1.11	22	.99	81	1.75
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6J4	6.98	7K7	1.33	24	.85	82	1.29
6J5GT	.93	7L7	1.23	24A	1.10	82V	1.39
6J6	1.98	7N7	1.22	24G/3C24	1.90	83	1.89
6J7	1.11	7Q7	.95	RK25	4.45	83V	1.98
6J8G	1.29	7R7	1.07	25A6	1.09	84/6Z4	.94
6K4	3.49	7S7	1.23	25A7	3.17	85	.98
6K5GT	1.16	7T7	1.03	25AC5GT	1.61	89	.75
6K6GT	.91	7V7	1.33	25BQ6GT	1.78	VR92	.25
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845	5.95
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864	.38
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930	1.05
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954	.25
955	.49
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957	.39
958A	.98
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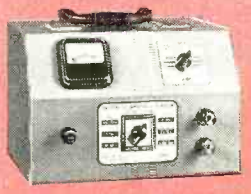

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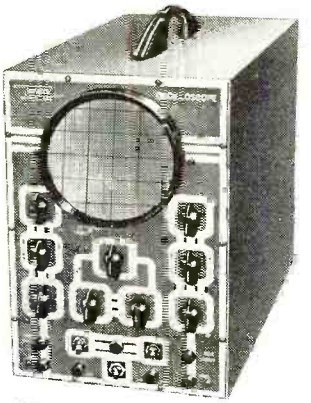

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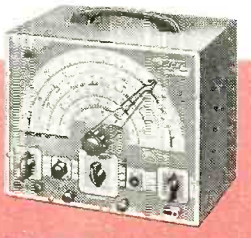

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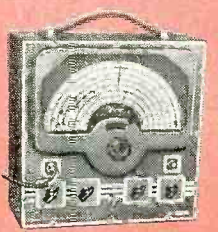

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