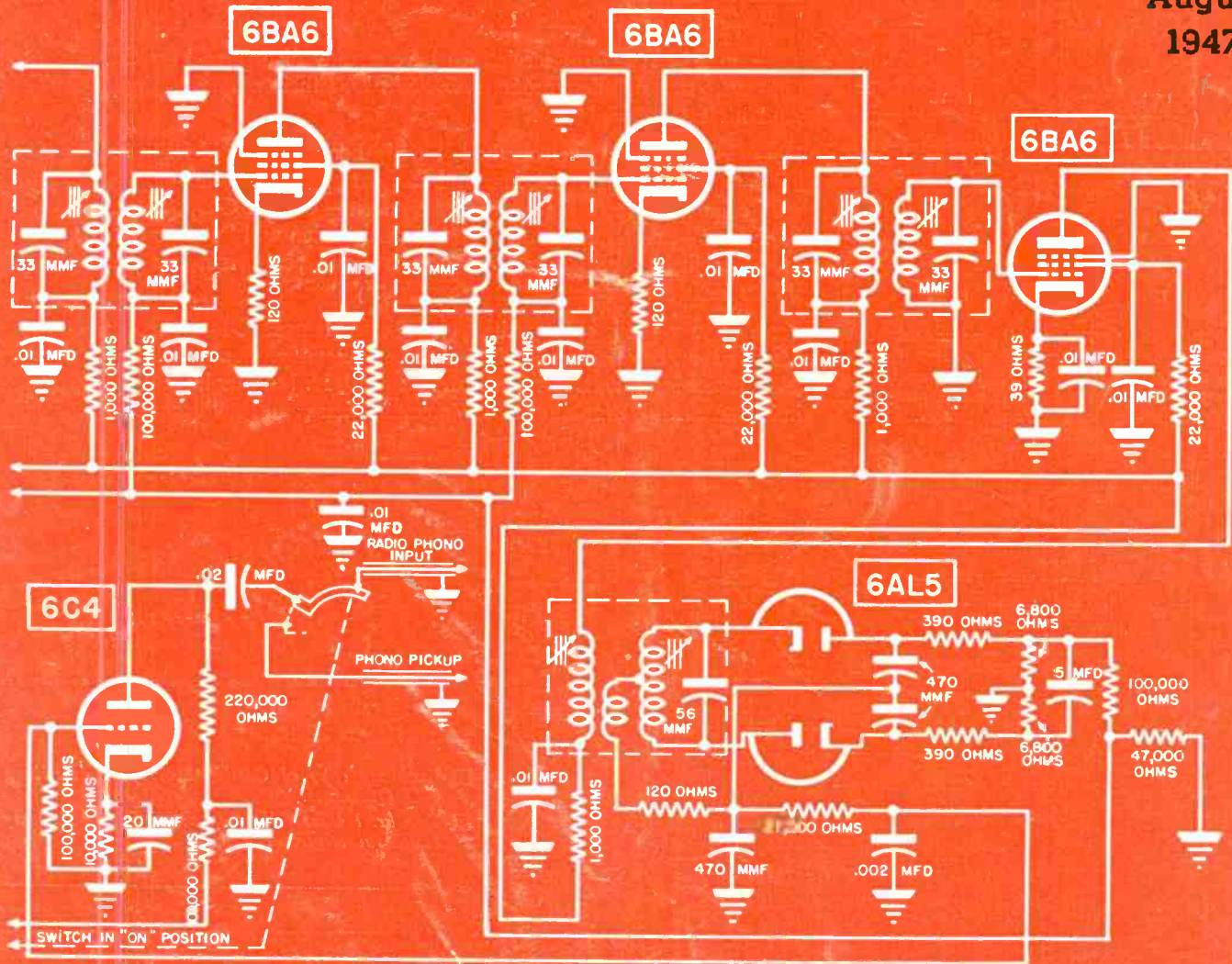


SERVICE

August
1947



The i-f stages, detector and a-f of an f-m tuner employing miniature tubes and featuring a ratio detector.

[See page 2]



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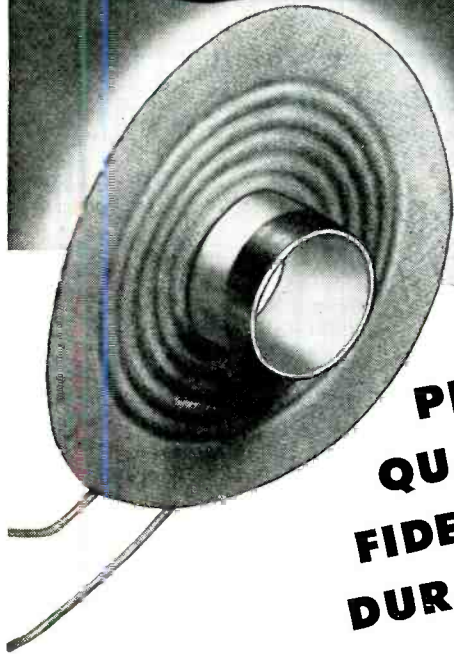
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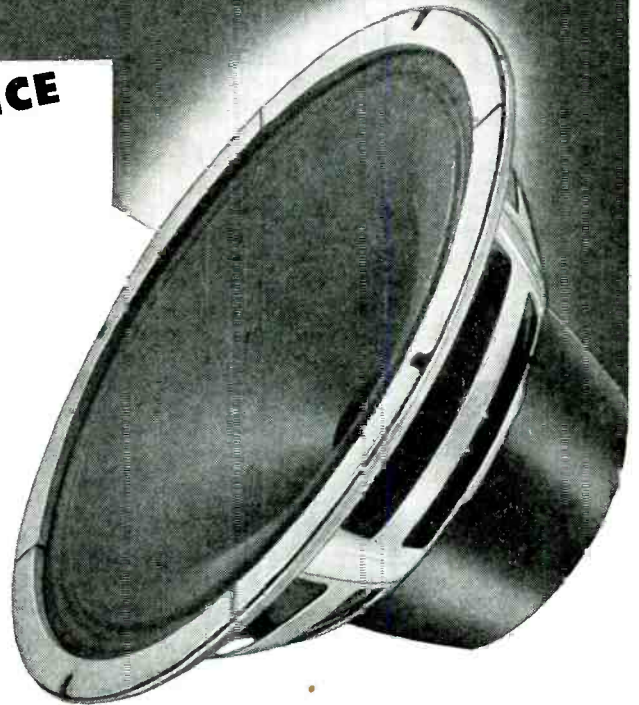


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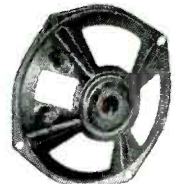
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EDITORIAL

THE VARIETY OF SERVICING OPPORTUNITIES, which exist today and provide for the building of profitable businesses, have been detailed in many editorials of SERVICE. It is gratifying to report that many Service Men have followed these plans with substantial success. Adopting the aviation and marine equipment service program, described several months ago, one Service Man has set up a servicing system which covers several counties, and now looks for continued expansion in other fields such as taxicab and truck radio service. His second-class radiotelephone operator's license, which he secured to test and operate the radiotelephone transmitters, will enable him to service, maintain and operate the transmitter-receiver units which are used in mobile service.

Commenting on the unique possibilities available to the Service Man in the growing taxi and truck radio fields our correspondent says:

"It was difficult to believe that there was so much servicing business to be had in these new fields. A survey soon convinced me, though. Then came the second-class license problem. That frightened me too, but the business slow-down was just as frightening. So I decided to study for the examination. I enrolled in a home-study course and also began studying the columns of SERVICE with more care than ever. I had to become completely familiar with all types of basic circuits, antennas, calculations of values of capacitors, resistors and inductors, amplifiers, etc. It wasn't too difficult a task and the data certainly fortified my knowledge of radio.

"I have already rounded up a taxicab and truck account and hope to have quite a few more soon.

"The taxi boys welcome the local service, for it's handy, prompt and reliable . . . three important factors.

"I've also found that the operators of cabs and trucks, as well as others whom I serve, are excellent prospects for new radio equipment in their home, such as f-m tuners and chassis, and tv kits. These folks prefer the advice of a Service Man with his specialized knowledge. As a result, I am setting up a special home-receiver department. Our plans call for pre-testing of areas, checking of antenna sites, arranging for special cabinets to house the chassis and speaker or speakers where multi-room feeds are required, and providing for installation of wire and disc-recording systems. We've found, by the way, that the wire systems are becoming increasingly popular. They are very versatile. Servicing of them is a bit tricky and requires a rather specialized knowledge of the instrument. The article on wire recording which appeared in the June issue of SERVICE has come in very handy.

"Yes, there are endless opportunities for the Service Man who plans and follows through carefully."

RADIO • TELEVISION • ELECTRONIC SERVICE

Vol. 16, No. 8

August, 1947

LEWIS WINNER
Editorial Director

ALFRED A. GHIRARDI
Advisory Editor

F. WALEN
Managing Editor

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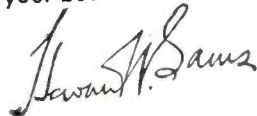
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IMPORTANT ANNOUNCEMENT to my Servicemen friends:

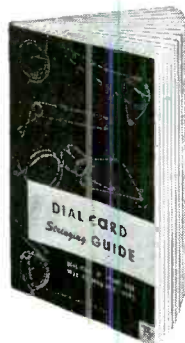
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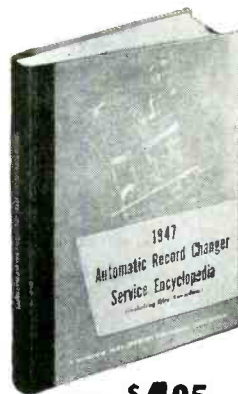
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WANTED—RCA tandem head radio phonograph, machine to be converted for playing special recordings for blind. T. C. Hasbrook, 4455 Marey Lane, Apt. 165, Indianapolis, Ind.

SELL OR TRADE—RME DB-20 pre-selector, \$20; Weston power level indicator 695, \$18; Stancor DC-3 transmitter, \$7; in A-1 condition. Raymond H. Ives, 822 Windsor Ave., Norfolk 4, Va.

FOR SALE—Instructograph, spring-wound, ten tapes, osc., key & phones complete, \$25 or S-38 in trade, used but good; Riders manuals 10, 11, 13 and 14, \$65. Will send C.O.D. plus postage. Richard O. Osborn, Little Cailhou, Route Houma, La.

WANTED—Hickok 188 or 188X signal generator and 510X dynamic mutual conductance tube and set tester. State condition and price. M. Polinski, 4731 S. Wolcott St., Chicago 9, Ill.

FOR SALE OR TRADE—Raytheon 485 tubes made for Spartan radios. Need radios and parts. Walter J. Bartell, 1107 N. Western Ave., Chicago 22, Ill.

FOR SALE—Feiler TS-1 signal tracer, never used; decibel meter; Westinghouse —8 to plus 5 rectifier type and 2-gang tuning condenser 000365. Frank Zika, 23-29—33rd Ave., Astoria, L. I.

FOR SALE—Hickok crystal controlled signal generator 288X, \$135 and Hickok tube and set tester 534, \$125, used only one week, perfect condition. Deloit Swindell, 221 W. Kingshighway, Paragould, Ark.

WANT—Schematic diagram for handie talkie BC-611. Have pair Gammatron 254 for sale, \$10 ea. new; also prewar Philco home recording kit. H. A. Wenzel, 833 Main St., Quincy, Ill.

FOR SALE—HRO-57A1 receiver, power supply, speaker and coils A, B, C & D. used about 25 hours, perfect, \$250 complete. Cameron J. Hare, Turtle Ridge, Beloit, Wis.

WANTED—BC-312 or BC-342 receiver, with or without a-c power supply. Give particulars: condition, price. Arthur Larky, 223 W. Summit St., Somerville, N. J.

WILL TRADE—Complete ICS 10-volume general radio course. Want Rider's 6 to 11. The Radio Repair Shop, 72 Kirin Road, Tientsin, China.

FOR SALE—Precision EV-10P vacuum tube multi-range tester with complete probe accessories, \$65. cash and Precision 920P set tester complete, \$65. Samuel Riley, Box 73, Market St., Port Norris, N. J.

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FOR SALE—Postwar Hallierafters S-20R, in excellent condition. Write for details, \$50 fob. Gerald Park, 4929 First Ave. S., Minneapolis 8, Minn.

FOR SALE—Hallierafters S-38 used 2 months and in perfect condition, \$35. R. F. McLeer, P. O. Box 83, Moose Lake, Minn.

FOR SALE—New Triplett test equipment: 2432 signal generator, \$75; 2413 tube tester, \$35; 625X multimeter, \$35. All prices f.o.b. Box 282, Oswego, Kans.

WANTED—Used television receiver in good condition, Edward Selenis, 1328 N. Campbell St., Chicago 22, Ill.

FOR SALE—New Feiler signal tracer with instructions and batteries, \$25. Julius R. Bartz, 1412 N. 26th St., Milwaukee 5, Wis.

SELL OR TRADE—New Millen R9 with tube, instructions and coils for Gon Set 10 meter converter; also PC375E transmitter complete with instructions, \$35 or trade for SCR-522 with tubes and crystals, David Bell, Andover, Ohio.

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FOR SALE—Stock of radio parts, tubes and test equipment, \$650; wholesale value over \$1000; also CA500, 500-watt all band transmitter like new, \$265. Harry M. Spitzer, P. O. Box 53, Port Republic, Va.

WANTED—J19/ARC-5 transmitter 3.0 mc. to 4.0 mc.; also BC-454-B receiver 3.0 to 6.0 mc. State condition and price. Will pay cash. Arthur Larky, 223 W. Summit St., Somerville, N. J.

FOR SALE—Unused National NC240C receiver, rack mounted with speaker, \$210. Scott SLRM Marine radio, 510 to 20,000 kc. brand new, \$175. BC375E Aircraft transmitter complete, \$30. Will send details. Glen Barnett, Box 582, McAlester, Okla.

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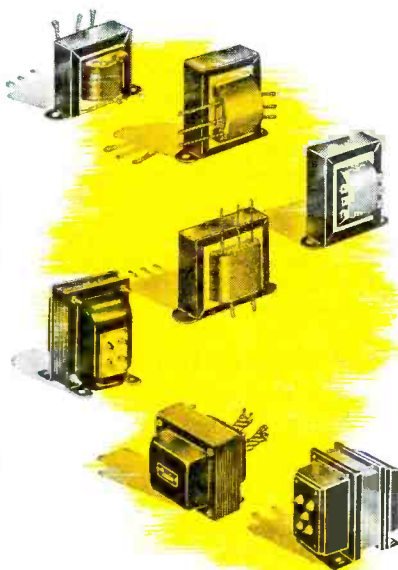
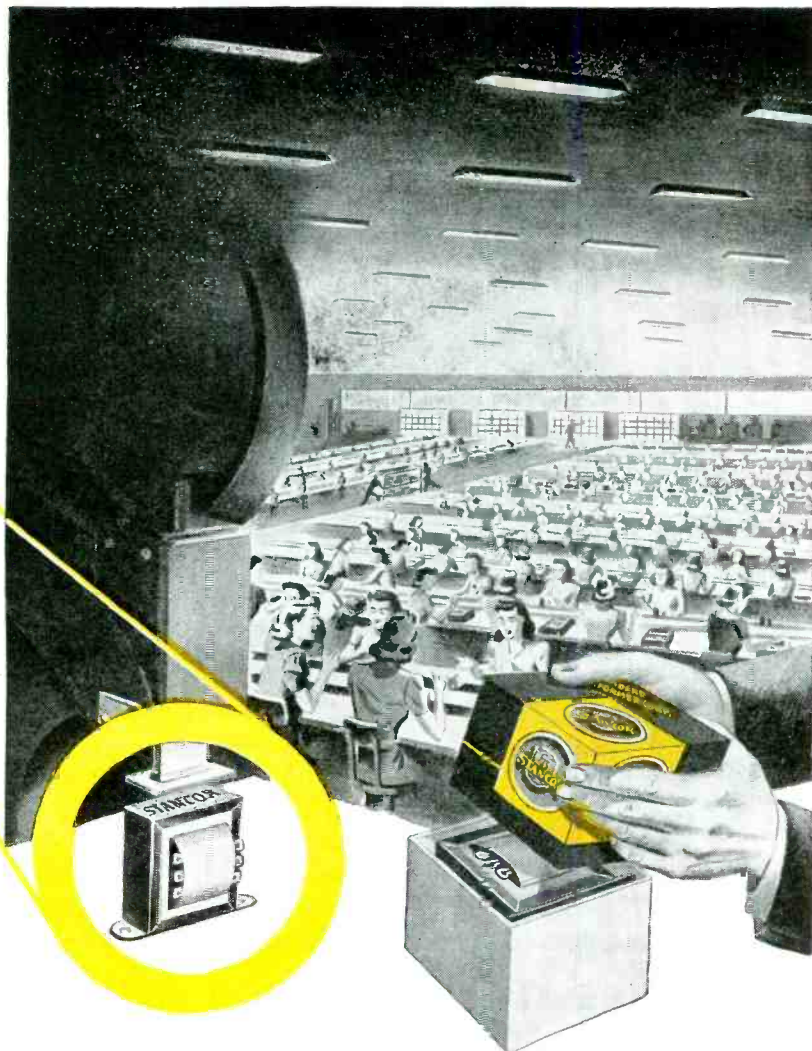
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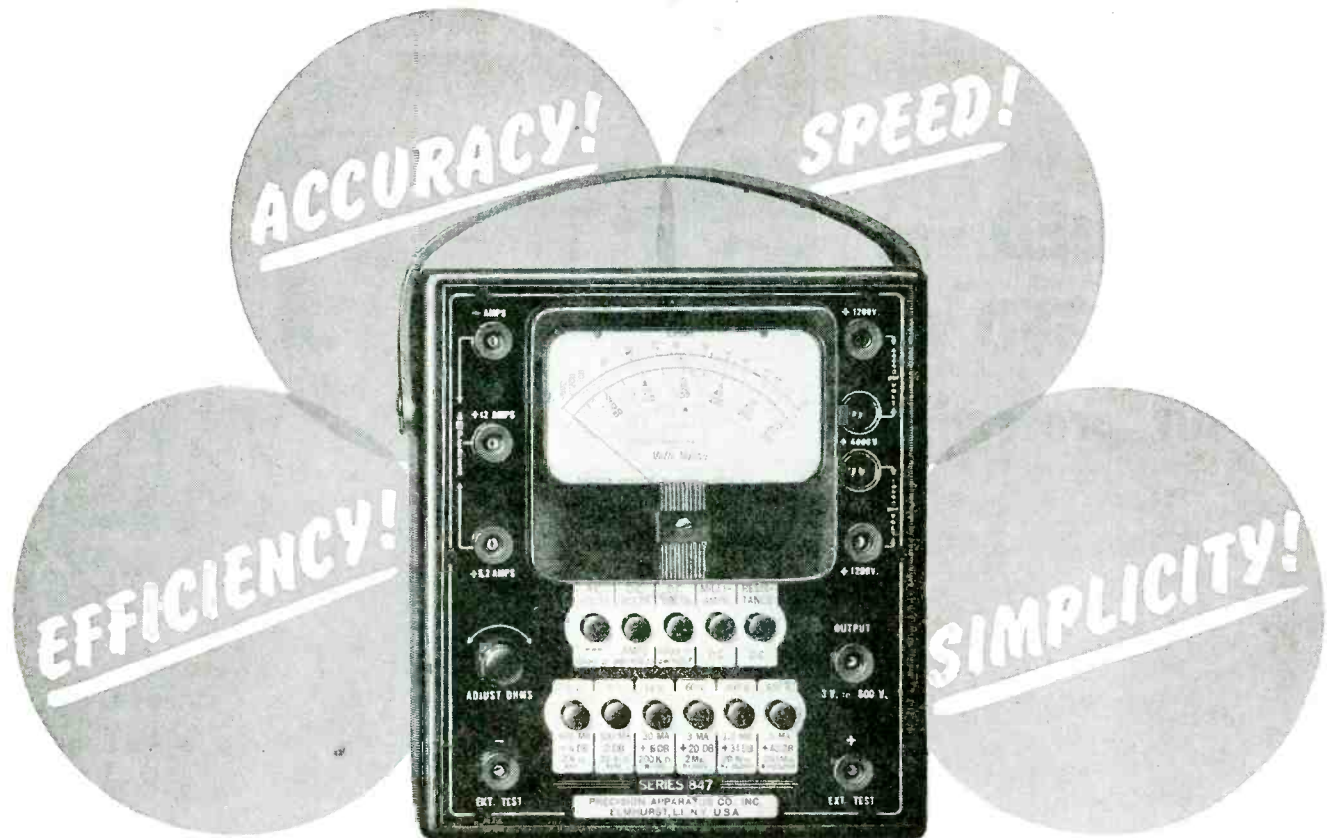
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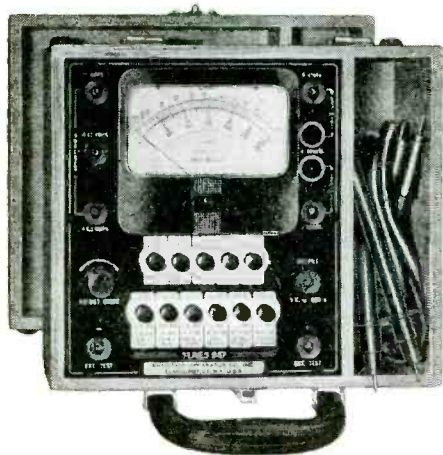
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AUG.

Prepared by SYLVANIA ELECTRIC PRODUCTS INC., Emporium, Pa.

1947

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SERVICE

F-M Ratio-Detector Receiver

[See Front Cover]

A PACKARD-BELL f-m model, 872, featuring a ratio detector with a miniature 6AL5 dual diode, appears on the cover this month. Seven miniature tubes are used in r-f and frequency converter (6BA6 and 6BE6) and in the i-f, detector and a-f stages (6BA6, 6AL5 and 6C4; front cover diagram.)

R-F Amplifier

The 6BA6 r-f amplifier is impedance coupled to the 6BE6 frequency converter which feeds the first i-f 6BA6 at 10.7 mc. The third i-f, using a 6BA6, sometimes called a driver, feeds into the 6AL5 dual-diode ratio detector.¹ (See Fig. 1, below right, and analysis at right, for discussion of this form of detection.)

Isolating Filters

Interstage feedback is minimized by providing isolating filters in all screen and plate i-f circuits, 22,000 ohms and .01 mfd being used for the screens and 1000 ohms and .01 mfd for the plate supplies. The ratio detector provides a low-impedance avc source with 390-ohm series filter resistors and a 5-mfd shunt filter capacitor followed by .1 megohm resistor and two .01-mfd avc bus bypass capacitors. Avc is fed to the r-f and first and second i-f stages. Additional cathode bias resistors are employed in all stages, 120 ohms without bypass being used in the first and second i-f while the driver uses 39 ohms bypassed by a .01-mfd unit.

R/C Filter

The superfluous i-f demodulation products are filtered from the detector

audio output by an R/C filter consisting of 120 ohms, 470 mmfd, 27,000 ohms and .002 mfd.

Audio Amplifier

The 6C4 audio amplifier is a standard resistance-coupled stage delivering

a high-impedance output through a .02 mfd blocking capacitor to the radio-*phono* switch. The sensitivity of the f-m unit is such that a 10 microvolt, 30% modulated signal at 100 mc will deliver 1 volt of audio output.

¹The ratio detector circuit eliminates the need for a limiter stage preceding the detector. In addition, the detector replaces the discriminator type detector.

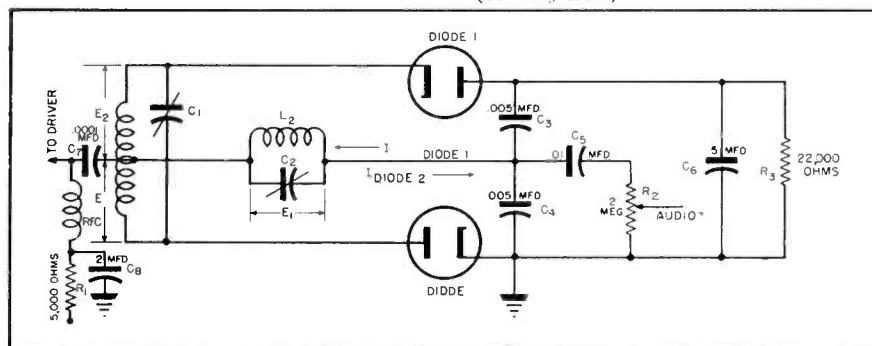
The conventional f-m discriminator stage consists essentially of two diode rectifiers which are differentially connected so that the d-c potentials across their respective load resistors are subtractive. These two d-c voltages are proportional to the a-c voltages applied to the diodes.

Ordinarily, discriminators are preceded by limiters which remove most of the amplitude variation from the f-m carrier, but the discriminator itself is not a device capable of rejecting amplitude modulation, except when the instantaneous frequency of the applied carrier is exactly equal to the resonant frequency of the discriminator transformer. This condition occurs only twice in every modulation cycle.

A schematic of the fundamental ratio detector is shown in Fig. 1. C_1 and C_2 have very little reactance at the intermediate frequency, and thus the parallel resonant circuit, L_2 C_2 , is the true load for the driver stage, this stage being shunt fed. A driver stage, in this case, is nothing more than a conventional i-f amplifier preceding the ratio detector. L_2 is inductively coupled to L_1 .

The voltages across C_3 and C_4 are additive and their sum is fixed by the constant potential across R_3 . Therefore, while the ratio of these voltages will vary at an audio rate, their sum will always be constant and equal to the voltage across R_3 . The potential at the junction of C_3 and C_4 will vary at an audio rate when an f-m carrier is applied to the detector, hence the audio voltage is extracted at this point and fed into the audio amplifier.

Fig. 1. Basic ratio-detector circuit.
(Courtesy RCA)



TV Dipole Antennas

Installation Notes For Folded-Dipole Type Antennas . . . Types of Transmission Lines Required For Indoors and Outdoors . . . Line Matching

TELEVISION DIPOLE ANTENNAS should be located as high as is practical and in an area where the horizon, in the direction of the television transmitter, is not obstructed by buildings or structures. Consideration must be given to ignition interference from vehicles on adjacent streets as well as interference within the building. Tests have proved that it is usually best to locate the antenna on the side of the building away from the street thus allowing the building to shield the antenna from ignition noises. In some cases, in the primary service areas of the transmitters, where the field strength is adequate (usually 1,000 microvolts per meter or better), the antenna may be mounted in the attic.

Orienting the Antenna

Television antennas are directional. This makes it necessary to orient the antenna in such a way that it provides

most efficient pickup for the station or stations which are to be received. Figs. 1 and 2 show the field pattern for the antenna at different frequencies. If only one station is to be received the antenna should be directed so that a lobe point is at the direction of the station. If more than one station is to be received, the antenna should be so directed that a satisfactory signal is received from each station. This will require experimentation.

Ghosts

Ghosts (reflections displaced to the right of the image in the picture) may be caused by reflections from neighboring hills, tall buildings, etc. They can often be eliminated by a small correction in antenna orientation or location. If this does not correct the trouble, the addition of a reflector may do so.

The Transmission Line

A properly-installed twin-conductor polyethylene-insulated transmission

line is essential for good picture quality since *smears* (pronounced echoes and faulty contrast) frequently result from an incorrect installation. This transmission line should usually be kept as short as possible.

Input Impedance

Most tv receivers are designed for an input antenna terminal impedance of 300 ohms, and thus the terminal impedance of the antenna should be 300 ohms. To provide optimum results, the transmission line must have a surge impedance of 300 ohms throughout its length. If it does not, two things will happen: First, less energy will be delivered to the receiver, lowering the signal strength and thereby increasing the undesirable effects of noise and interference; second, the mismatch will permit reactive energy to travel back and forth on the line because of the lack of proper damping. These reflections destroy the character of the original signal which was picked up.

Transmission line is usually furnished in two types; indoor and outdoor. Both are 300-ohm lines,

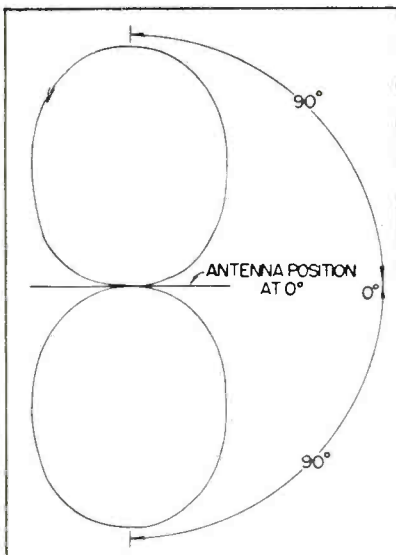
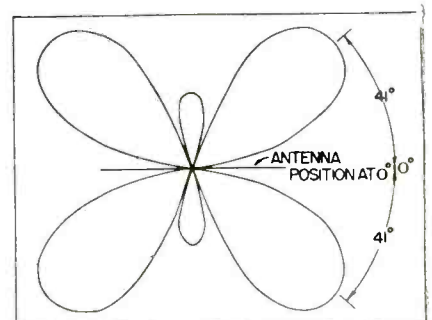


Fig. 1 (left). The approximate horizontal field pattern for the 44 to 88 mc band or channels 1 to 6.

Fig. 2. The approximate horizontal field pattern for channels 7 to 13; 174 to 216 mc.



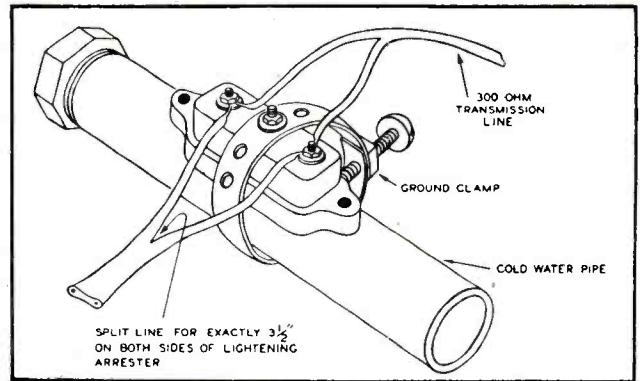
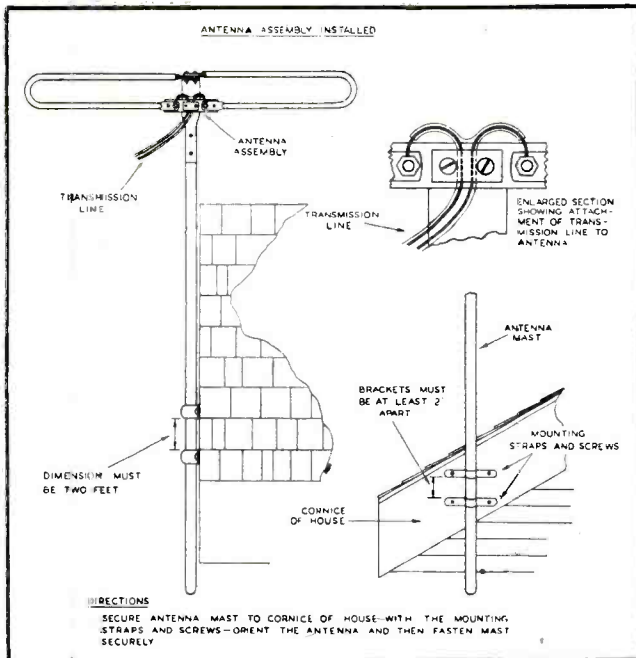


Fig. 3 (left). Mounting suggestions for the folded-dipole antenna.

Fig. 4. Mounting of a typical lightning arrester which has been supplied with a ground clamp.

matched properly to the antenna and the receiver. The task of the installation engineer, therefore, is to install this line so as to preserve its characteristic. He must avoid those things which tend to upset the line impedance.

Installation Notes

Lengths. The longer the line, the greater the danger of mismatch. In addition, a normal loss occurs in the line which loss is proportional to length. It is therefore essential to keep the line as short as is practically possible.

Outdoor Line

Outdoor Line. This type of line is of heavy construction and designed particularly for outdoor use. It is superior to the indoor line although it is more costly and harder to conceal and secure because of its greater stiffness. This line may be used to good advantage as indoor line if it can be installed conveniently or concealed, or if its appearance is not objectionable.

Outdoor lines are recommended for outdoor runs which exceed about 20' or for even small runs if these runs are horizontal so that they can collect rain. Good practice calls for all outdoor runs to be made with the outdoor line.

Indoor Line

Indoor Line. Indoor line is of lighter construction and is more eas-

ily handled. It is intended particularly for indoor runs where it is protected from rain and weather. It may be used outdoors if the outdoor runs do not exceed 20' provided the run is vertical and is protected from direct rainfall as it would be if it ran down the side of a building below the eaves of the roof.

Splicing

Splicing Line. When splicing the indoor and outdoor lines (or any other breaks in the line), it is necessary to maintain the line impedance. This is done by stripping the two lines back about $\frac{1}{2}$ " and then twisting the respective conductors together so that the insulation of one line butts directly

against the insulation of the other. If the splice is made with a large space between the parallel wires, the line impedance will be changed at that point and reflections may be set up. The recommended technique will avoid such an air gap. The exposed wires, which stand away from the line should be twisted tightly, soldered well and clipped short.

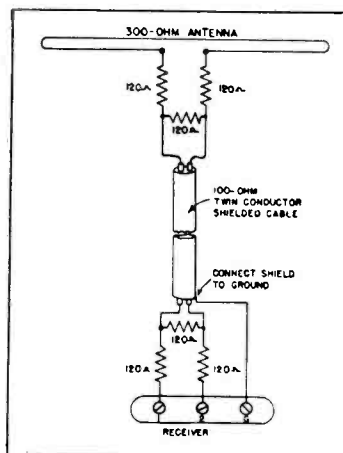
Outdoor Line Placement

Installing Outdoor Lines. Transmission line must not be permitted to bear against objects such as the side of a building (wood or otherwise). It should be suspended so that it clears such objects by at least an inch or two. Insulated eyelets, secured in a threaded support, are ideal for supporting the line. The line must be kept clear of metal objects and in no case be permitted to run against metal surfaces. The line should be run as nearly vertical as possible so that rain will drain off instead of collecting in pools on the surface of the line. If horizontal lines are necessary the lines should run so that they are protected by the eaves of a roof or other cover. Lines must not be placed inside of pipes.

Clearances

The line should be pulled tight so that it will not be swung against walls by wind. If the lines cross a horizontal surface (a roof), it should

Fig. 5. Input alterations when using a 100-ohm shielded cable.



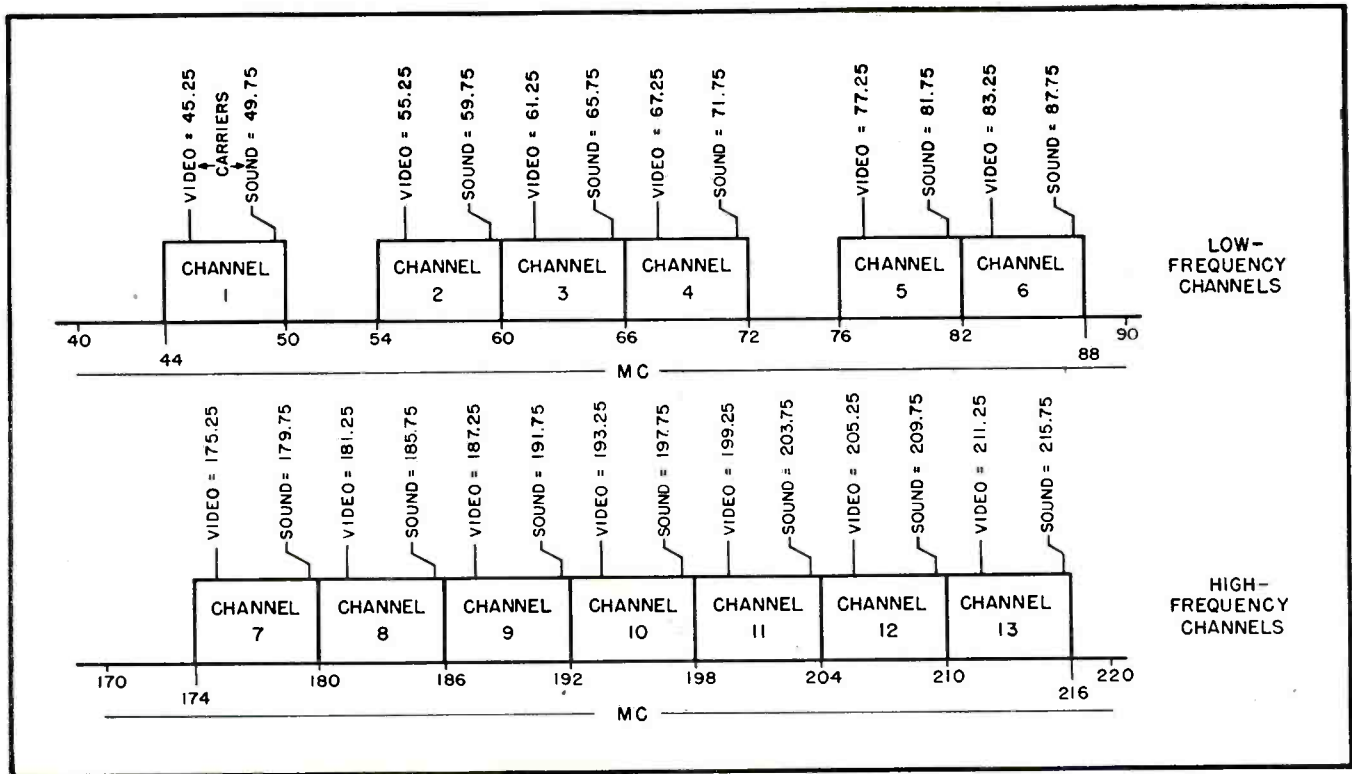


Fig. 6. Frequency allocation chart for tv stations. (Courtesy Leonard Mautner and Russell K. Olsen, Allen B. DuMont Labs.)

clear the surface enough to keep it above the level of the snow in winter.

Placing Indoor Lines

Installing Indoor Lines. The indoor line should be run out through a window or wall where the outdoor line can be spliced to it. The line can enter by crossing the window sill so that the window closes down on it, provided the structure is wood. The line should not be run over a metal window ledge or through a metal conduit, unless the conduit is large enough to space the wire an inch or two from all sides. Lines should never be folded in order to force it through a narrow opening such as a porcelain tube.

Carpets and Moldings

Inside lines should not be run for more than 5' under a carpet. This changes the capacity between lines, upsets its impedance, and causes loss and reflections. Outdoor line can be run up to 20' under a carpet. When running the line indoors, it may be tacked against wooden floor molding, using only as many tacks as are absolutely necessary. The line is far superior electrically if it droops some-

what between tacks; i. e., this is better than having the line pressed firmly against the wood surface.

Use of Beams

An ideal way to run the line is across beams along a cellar ceiling and through the floor directly behind the television receiver. The line must not be pulled around pipes, radiators, or other metal objects—but spaced away from these. Window leadin devices or connectors must not be used for the line. Splices should be made as explained, with the line running directly to the terminal board on the television receiver.

Lightning Arresters

If a lightning arrester is used, the line should be split for exactly $3\frac{1}{2}$ " on both sides of the arrester. The arrester should be mounted directly on a cold-water pipe. Arresters are provided with a ground clamp for this purpose.

Special Leadin Installations

The antenna and leadin recommendations may be altered under cer-

tain circumstances; in apartment house and tall building installations where a long leadin is required and there is a possibility of picking up man-made electrical disturbance generated in the building.

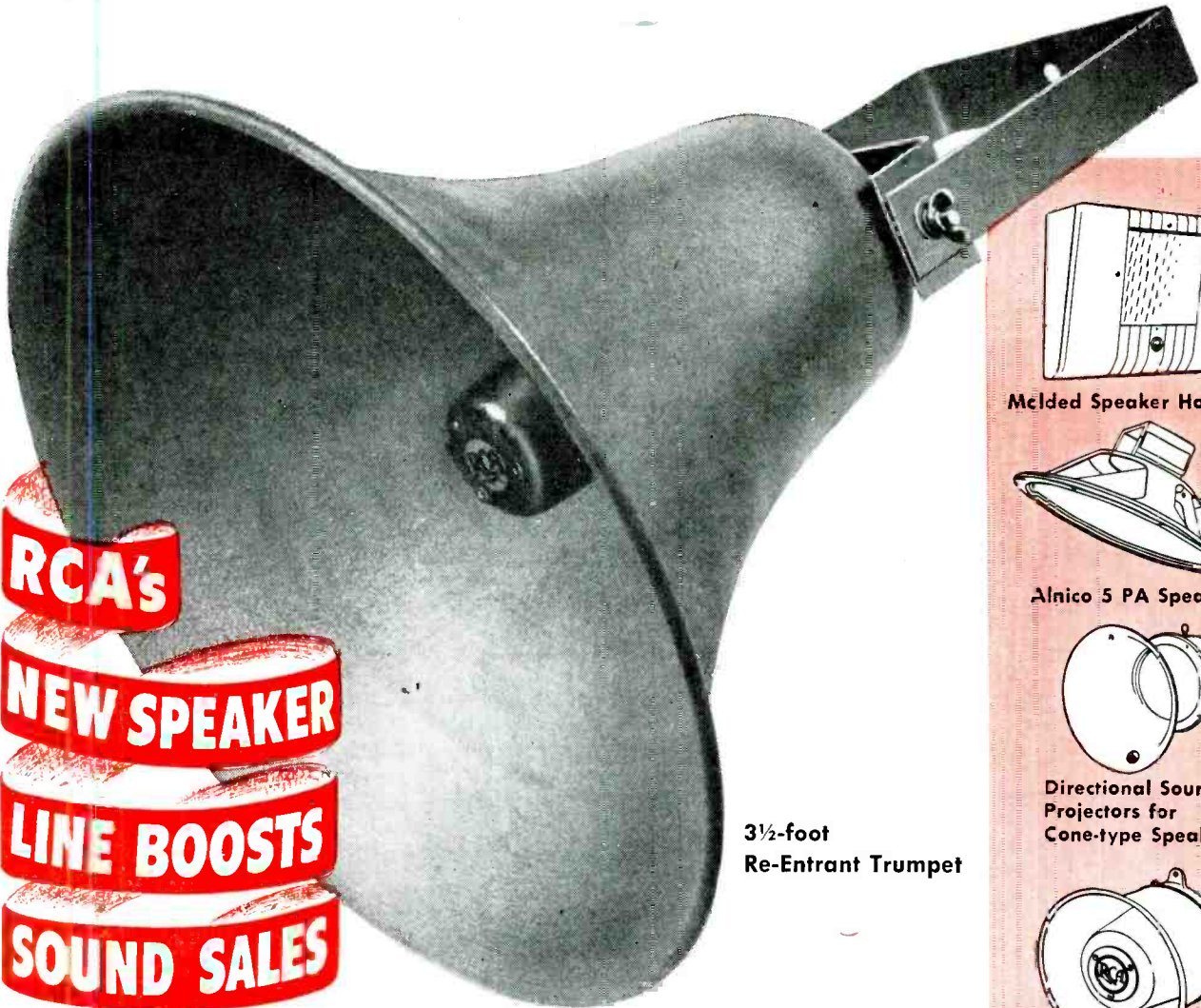
Shielded Cables

Shielded cable, such as RG22U, will in many cases alleviate man-made noise interference so that satisfactory results may be obtained. Since shielded cable has a characteristic impedance of approximately 100 ohms, special impedance matching resistance networks must be installed at both the antenna and receiver input to prevent the undesirable effects of mismatch.

Matching 100-ohm Line

Fig. 5 shows the resistor values and points of installation needed to match a 100-ohm transmission line to a tv receiver and a 300-ohm antenna. This resistor matching network obviously will reduce signal voltage considerably so that the application must be limited to areas only with high signal strength.

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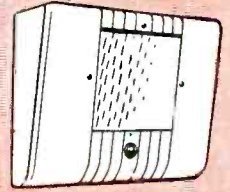
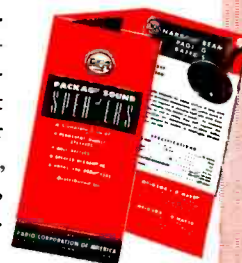
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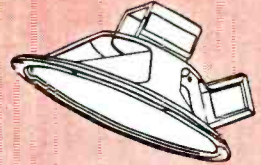
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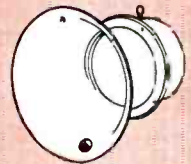
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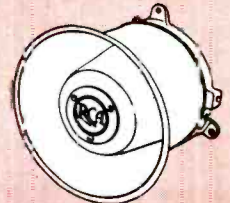
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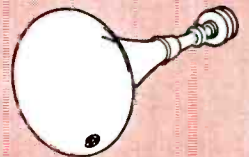
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Choosing The Proper

IN THE FIRST installment¹ of this discussion, general data on amplifiers, microphones and powers of systems were offered. The relative cost-power merits of 10 to 60-watt amplifiers and applications of one or two speakers to one amplifier were analyzed. It was pointed out that it is not wise to use a 30-watt amplifier, as an example, with a 25-watt speaker, since the life of the driver unit would be shortened. A two-speaker system was recommended.

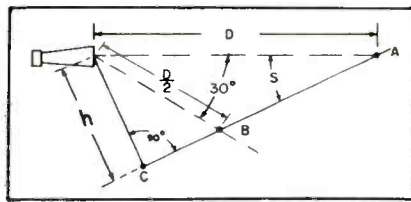
In this month's discussion are presented data on the coverage which can be expected from the appropriate choice of speakers and amplifiers. Offered too are data on matching, microphone placement, etc.

A dual system is adequate for coverage of 3,000 to 5,000 square feet outdoors depending upon the shape of the area, its average distance from the loudspeakers and the surrounding noise level. It is true that systems of this size are often used to cover greater areas, but this is done if the noise level is appreciable, by boosting the average electrical output of the amplifier, which reduces the power margin for peak values of speech, with a resulting increase in distortion. If it is felt that some peak distortion can be tolerated and the average noise level is not excessive; the foregoing coverage areas may be doubled, with due account being taken of the sound distribution pattern of the loudspeakers used, and their relative placement.

In indoor areas, and the like, where the frequency range and distribution pattern of the horn-type loudspeakers are adequate, such a 30-watt system will ordinarily cover an audience of about 2,000 persons, less for noisy places and more for quiet conditions.

The horn-type loudspeakers considered thus far are of the folded variety with diaphragm-driver unit. These are the most extensively used for average p-a work, because of their compactness and their good efficiency. Their response is more suitable for speech than for music, although in the larger size horns, music is acceptable. A table showing approximate sizes, frequency ranges, etc., of the most common types appears in Table III.

Higher power single-driver units and horns are also manufactured, but are usually used only in special applications. Their response range is more



A: Analysis of sound distribution. Listeners at A and B would hear sound signals of the same volume from a loudspeaker, whose pressure output on this signal is 50% at 30° off the axis, compared to the pressure on the axis, at the same distance. In using this plot, figure should be tilted so that line ABC is horizontal, to represent the floor line. Then the required speaker height is h , and the angle of tilt is S .

limited and they do not permit the flexibility for wide angle coverage the use of two or more of the standard power types would permit.

Cone-type driver units with straight projector horns are suitable for many p-a installations. The very short horns, or *directional* baffles of this type, are only justified where low cost and small size are of first importance, for they are relatively inefficient and provide poor-frequency response.

The longer projector horns, the most popular size being approximately 2½' long, used with a heavy-duty 8" cone driver unit, are rated at about 25 watts, and have an efficiency approaching that of the diaphragm-driver and horn type. The sound pressure directly in front of these loudspeakers may measure 10 db less in the middle-frequency range than that of the diaphragm driver-folded-horn type, but the overall sound efficiency, with a suitable cone driver, is not appreciably less, as a wider distribution is obtained than

¹Part I appeared in June, 1947, SERVICE.

A dual speed recorder permitting recording of 12 minutes on a 10" disc at 33½ rpm and copying of a 12" commercial record on a 10" blank at 78 rpm. (Courtesy Bell Sound Systems)



with the folded horn. In addition, with a well-designed back enclosure, the low-frequency response is much better than that of the longer folded p-a horn, and with well-designed cones, the high-frequency range, although somewhat uneven, provides about another octave beyond that of the majority of 25-watt driver unit and folded-horn combinations most commonly used for p-a work.

It must be said, however, that in some cases the rating of 25 watts for the 8" cone and projector combination is on the optimistic side when compared to the same rating on the p-a diaphragm-type unit.

Two such loudspeakers properly connected to the output of a 30-watt amplifier can be directed to cover a fairly wide angle, and are suitable for music and speech reproduction at fair-grounds, skating rinks, etc. Speech will not *cut through* noise as well as will the other type, with the same power input, so that somewhat less coverage should be figured on in noisy areas than that given above, when this feature is important. As most 30-watt commercial amplifiers have one or more microphone inputs and a phono input, systems built around them are popular; separate mikes can be provided for announcers and singers, etc., and a good turntable and pickup can be used to furnish music when desired. Care must be exercised in the placement of microphones with the higher power systems to prevent feedback especially when straight projector horns with a wider sound coverage are used. It is preferable and usually necessary to use microphones with directional pickup patterns and to turn them to a position of minimum feedback.

In connection with the problem of obtaining most uniform sound distribution in front of a horn loudspeaker there is a method by which it can be made reasonably uniform at least on a path between the speaker and a point at a given distance directly in front of it. This requires that the speaker be mounted at the correct height and be directed downward at the proper angle. Doing this by cut and try methods is tedious and lengthy, but the position and angle can be determined beforehand for a given location, provided that the polar distribution pattern of the loudspeaker is known. The method is based on the fact that the sound

P-A SYSTEM

Part II . . . Relation of Costs to Power Capacity; Matching; Voice and Instrument Coverage; Speaker Designs; Voltage and Power Amplifiers, etc.

by **ARTHUR J. SANIAL**

Electronic-Acoustic Consultant

pressure from conventional loudspeakers is greatest on the central axis or *beam*, and falls off progressively as the angle of the listener's position from the loudspeaker axis increases. If with a certain loudspeaker, for instance, the sound pressure at say 1,000 cycles is only 50% at 30° off the *beam* compared to the pressure on the *beam* at the same distance, then to hear the sound with the same volume, as on the *beam*, the listener would have to move to half the distance; Fig. A. By mounting the speaker at the right height and tilting it down, the points *A* and *B* can be made to fall in the same horizontal line, *AC*. Considering this line as the floor level, the required height of the loudspeaker is *h*, and the amount of downward tilt is given by the angle *S*. Thus, at least two points on the floor will have the same sound level. There are several methods of working out the most advantageous setting of the loudspeaker, to achieve the best possible uniformity of sound distribution at all points in front of it. One of the simplest methods for ascertaining this, to any practical degree of refinement necessary, appears in a nomograph prepared by Jensen; No. 5, p. 3.

For installations not requiring a loud source of sound from one position, such as the end of a hall, other types of loudspeakers may be used, in a different manner. For instance, ten to twenty or more direct radiator cones in suitable baffles may be connected to the 30-watt amplifier output depending upon the efficiency and power rating of the cones, and the sound level required. For background music and quiet locations a greater number can be used and more area covered. For the same area, however, less sound pressure will be produced than with the horn types, as the cones are less efficient except in special designs. When microphones are used in

such a system, precautions must be observed in microphone location to prevent feedback as the cones are much less directional than horns.

A large number of the small 12-watt horn-type speakers may also be used where it is desired to cover an area with evenly distributed sound, or to cover a multiplicity of separate small areas. This will be particularly good for speech, and as they are very efficient any number from 4 to 30 may be used on a 30-watt amplifier, depending upon the application. The proper care must be taken in all multiple-speaker installations to provide adequate speaker transformers, so that the impedances of the total speaker load may be reasonably well matched to the amplifier impedance.

It is possible and practicable to use both cone or horn type speakers on the same system, in general, to obtain different kinds of coverage and in some cases to boost the bass response on music in some areas. As cone speakers have various impedances depending usually on their size, extra care must be taken in impedance matching of a mixed speaker system.

The practice sometimes used, connecting transformers of the correct *ratio* between a line and speakers which do not have the impedance values for which the transformers were designed, can often lead to very poor performance. In some cases there is



Newcomb Audio rack-and-panel unit.

a considerable loss of power, and in others serious losses in the high or low-frequency ranges are introduced thus lowering the fidelity markedly.

For covering greater areas, or areas in which the noise level is higher, a 50-watt (nominal) amplifier should be used. The outdoor area or indoor audience covered for the same ambient noise, and other conditions similar, will be almost double that given for the 30-watt class of amplifier.

Where power greater than 50-60 watts is required, amplifiers are multiplied in some cases and the use of twin units is often advantageous in case one unit fails. Other systems use a low-power output-voltage amplifier driving a booster-power amplifier. For instance, some 100-watt boosters require about 3 watts driving power, although a resistance pad, specified by the manufacturer, is required between the two amplifiers. If a particular voltage amplifier is not recommended by the manufacturer of the booster, a good 10-watt amplifier with the gain

(Continued on page 36)

Approximate horn length	1'	1¼'	1½'	2'
Maximum rated wattage of horn with unit	13 watts	25 watts	25 watts	25 watts
Approximate air column length	15"	3½'	4½'	6'
Approximate bell diameter	13"-14"	19"-21"	23"-25"	26"-30"
Approximate frequency range	Between 150-250 to 5000-7000	Between 125-175 to 4000-7000	Between 100-150 to 4000-6500	Between 85-125 to 3500-6500

Table III

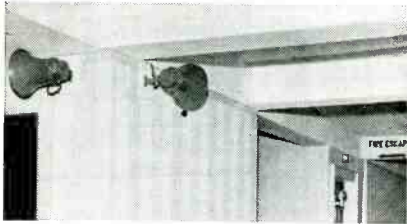


Fig. 2. Reflex loudspeaker trumpets installed in halls of apartment-hotel for fire-alarm service.



Fig. 1. Alarm and speaker setup at telephone switchboard in apartment-hotel.

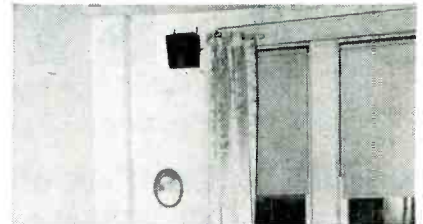


Fig. 3. Interior 5" speakers placed in inside rooms for alarm call.

ALARM-SPEAKER System For Apartment-Hotel

by JAMES CLYDE PORTER

THE UNUSUAL POSSIBILITIES OF P-A were demonstrated quite effectively in a recent installation¹ of a combination alarm and speaker system in a nine-floor 176-unit apartment-hotel in Memphis, Tenn.

With apartments ranging from one-room efficiency apartments to five-room affairs, and many of the occupants elderly and permanent residents, it was decided to install a system which would provide both a calling and alarm service. In view of the numerous fires which have occurred recently in hotels it was felt that the alarm system should be installed as a precaution.

The building is an L-shaped affair with one long corridor running down the long part of the L and a short corridor running down the short portion of the L. This layout simplified installation of the system for apartments opening onto these corridors. However, a problem did appear for the inside one-room apartments, of which there are three on each floor.

To make the alarm audible to the occupants of these inside rooms from a corridor installation it would have

been necessary to operate the corridor speaker at a level which would be quite disturbing. This problem was solved by installing small speaker units in each of the inside rooms.

On each floor in the corridor and at the junction of the long and the short part of the L, two small reentrant projectors² were installed, one facing down each corridor. In the three inside rooms a 5" speaker⁴ mounted, in a wooden wall-type baffle, was installed.

The plumbing shaft came in quite handy as a feed for the wiring, since it came at the junction of the long and short portion of the L. Thus the job was to all appearances a hidden wire job, it being only necessary to bring the wires out into the corridor at the junction point on each floor.

A 90-watt standard sound system⁶

¹Installation designed by J. H. Viser, vice president of Bluff City Distributing Co., 905 Union Ave., Memphis, Tenn. Installation made by E. W. Logan, sound engineer.

²Parkview Hotel Apartments, Poplar and Tucker Streets, Memphis, Tenn.

³, ⁴Stromberg-Carlson; ⁵Stromberg-Carlson SS-725.

output was installed on the first floor alongside of the telephone switchboard, for operation by the switchboard operator.

The combination system is operated by two switches, one to throw on the fire alarm and the other to throw on the public speaker system. The fire alarm consists of a continuous siren type sound with varying pitch.

The two switches for operating this combination system are located to one side of the telephone switchboard but convenient so that the phone operator does not have to leave her chair to throw either or both switches.

The microphone is a portable type that generally lays on top of the switchboard where it can be easily reached by the telephone operator. However, it can be hung alongside of the switchboard mouthpiece so that in case of an alarm, the phone operator could answer such calls and broadcast over the general speaker system at the same time.

The installation has been inspected by the head of the Memphis Fire Department and praised for its dual-purpose services.



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...IT'S A
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MODEL VH-91
Hypex^{*} **SPEECHMASTER**

Delivering good quality, intelligible speech with maximum "punch" to override high noise levels, the Model VH-91 Speechmaster is recommended for paging and intercommunication applications. Hypex horn formula gives useful output over a 100° angle.

Especially efficient for voice, the VH-91 has a frequency range of 400-5,000 cycles. Power handling capacity: 15 watts maximum speech signal input. Designed for both inside and out-of-door use, VH-91 will withstand extreme weather conditions, including exposure to salt spray. Nominal voice coil impedance 8 ohms. Transformer number Z-3345, with 5/8" x 5/8" core available for 45-ohm use. Bell diameter, 8 7/8 inches; height, 9-1/16 inches; weight, 4 1/4 pounds.

Universal mounting bracket adjusts projector to any direction, locks securely in position by a single wing nut, has facilities for mounting transformer.

Jensen VH-91 Speechmaster Projector (ST-171).....\$32.50

*Trade mark registered

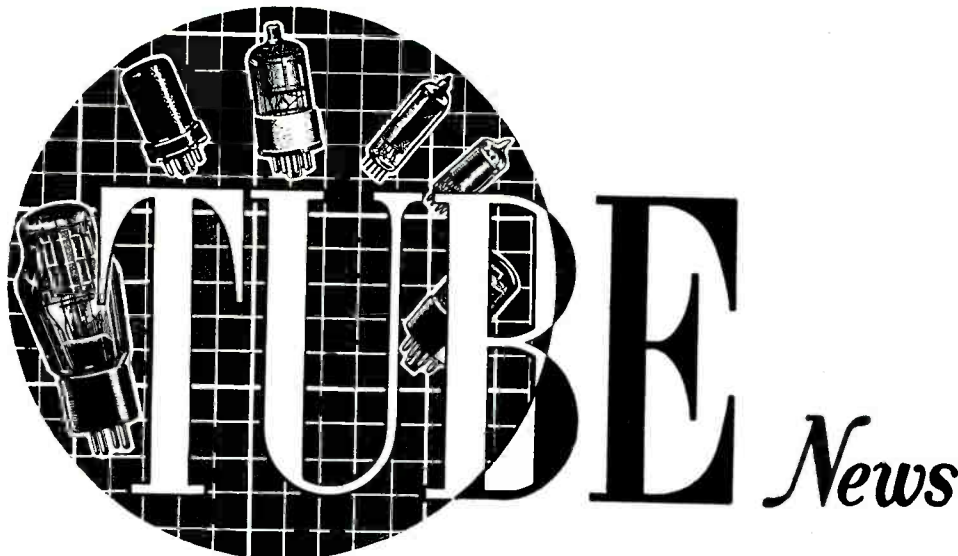
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*Designers and Manufacturers
of Fine Acoustic Equipment*



TUBE News

TUBE CLASSIFICATIONS

Diodes

THE DIODE IS THE SIMPLEST form of tube and consists of a cathode and plate. It is primarily used for detection of a-c signals and rectification of a-c for power supply purposes. If a positive potential is applied to the plate with respect to the potential of the cathode, current will flow through the tube in the form of a stream of electrons. If, however, a negative potential is applied to the plate with respect to the cathode, electrons emitted by the cathode will be repelled by the plate and therefore no current will flow. If the plate voltage is held constant at some value (E_{p1}) and the filament current is varied from zero upwards, the plate current will begin to flow when the filament has reached the temperature necessary for emission and will increase rapidly as the filament current is increased, until the condition of temperature saturation is reached. At this point (Fig. 1) the plate current will no longer increase with increased filament current since the plate is attracting electrons as rapidly as possible at that given plate voltage. If the plate voltage is increased to a new value (E_{p2}) the point of temperature saturation will occur at a higher plate-current value.

If the filament current is held constant at some value (I_{f1}) and the plate voltage is varied from zero upwards, the plate current will increase rapidly until the point of voltage saturation is reached (Fig. 2). At this point an increase in plate voltage will not appreciably affect the plate current since the plate is collecting electrons as fast as the cathode is able to emit them.

A diode operated in such a manner that its cathode is always above temperature saturation is capable of con-

verting alternating current to direct current. A typical diode circuit is illustrated in Fig. 3 and the characteristic curve for this type of operation is shown in Fig. 4.

Gas-Filled Diodes

In gas-filled diodes the electrical characteristics of the tube are affected substantially by the contained gas and result in modified operation. The contained gas is ionized by collision with the electrons traveling from cathode to plate and the slow-moving positive ions resulting are attracted to the cathode, thus neutralizing the negative space-charge in the cathode region. This results in low voltage drop across the gas tube and therefore high efficiency in rectification service.

Triodes

The addition of a grid between the cathode and plate of a diode introduces the element of control in the electronic tube. A typical triode circuit is illustrated in Fig. 5. The grid is operated at a negative potential with respect to the cathode and therefore draws no current. A change in this grid voltage results in a larger change in plate current than could be accomplished by the same change in plate voltage. Therefore, the triode is capable of voltage amplification.

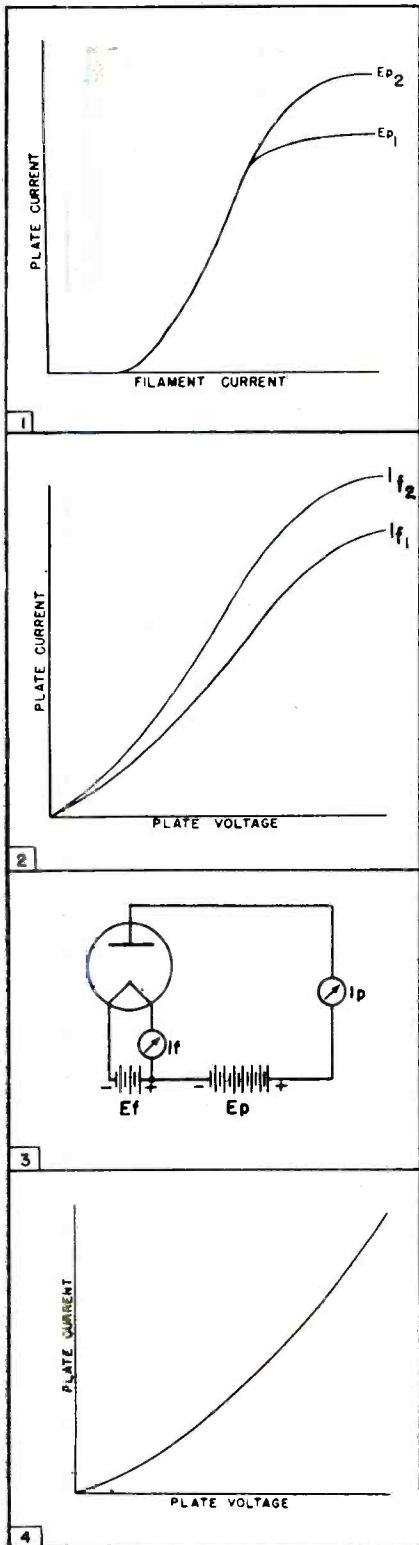
If the grid voltage is held constant (E_{g1}) and the plate voltage increased from zero upward (Fig. 6) the plate current will increase along a given curve. If a new value of grid voltage

is used (E_{g2}) the plate current will increase along a different curve. If the plate voltage is held constant and the grid voltage varied from some negative value, through zero and upward into the positive region, a curve similar to that illustrated in Fig. 7 results. During this operation the grid current follows the oddly shaped curve illustrated in the figure. The odd appearance of the curve is due to secondary emission from the grid which occurs when the grid is sufficiently positive to accelerate the electrons leaving the cathode, which in turn knock additional electrons out of the grid upon impact. The loss of these electrons, which are then attracted to the plate, results in the dip observed in the curve.

The triode has definite limitations when one wishes to obtain a large value of amplification or when one wishes to use the tube at very high frequencies. These limitations show themselves in the following ways:

1. As the frequency to be amplified is increased, the capacitive coupling, illustrated in Fig. 8, from the plate circuit to the grid circuit becomes greater until instability and oscillation occurs.
2. As the amplification is increased larger voltages from the plate circuit are coupled back to the grid through this same interelectrode capacitance until sufficient power is reaching the grid from the plate circuit to cause instability and oscillation.
3. The plate current flowing through the triode is not only a function of the applied grid voltage but is also a function of the plate

[Data courtesy G. E.]



Figs. 1, 2, 3 and 4. In Fig. 1 appears a plate-current/filament-current curve to illustrate how plate current begins to flow as the filament current is varied from zero upward in a diode. Fig. 2 shows how the plate current increases rapidly until the point of voltage saturation is reached, when the filament current is held constant at some value and the plate voltage is varied upwards. A typical diode circuit is shown in Fig. 3, and in Fig. 4 appears a characteristic curve for this circuit.

voltage. The alternating component of the plate current flowing through the load impedance causes the plate voltage to rise and fall accordingly. This plate voltage change opposes the change in plate current caused by the grid, thereby reducing the effective amplification.

Tetrodes

The addition of a second grid between the control grid and plate of a triode effectively reduces the undesirable features of the triode. A tube so constructed is known as a tetrode. This extra grid is usually operated at a positive d-c potential with a capacitor connected between the screen grid and cathode, thus providing a low-impedance a-c path with the screen grid at, effectively, cathode a-c potential. Operating in this manner the screen grid produces a field which accelerates electrons coming from the cathode and acts much the same as the plate except that most of the electrons go through this grid and are collected by the plate. Therefore the current flowing to the plate is almost independent of plate voltage. In addition, this grid, being bypassed to the cathode, serves as a very effective capacitance shield between plate and grid, thus greatly reducing the grid-plate capacitance. A typical tetrode circuit is illustrated in Fig. 9.

If the screen grid voltage is held constant and the plate voltage is increased from zero upward curves similar to those illustrated in Fig. 10 will result. The peculiar shape of these curves may be explained by observing conditions between certain plate-voltage points. As the plate voltage is increased from A to B the plate current increases as would normally be expected. At point B electrons are bombarding the plate with sufficient force to dislodge additional

electrons which are projected into space between plate and screen grid. Since these free electrons are traveling in the direction of the screen and since the screen has a relatively high positive potential most of them are collected.

(Continued on page 37)

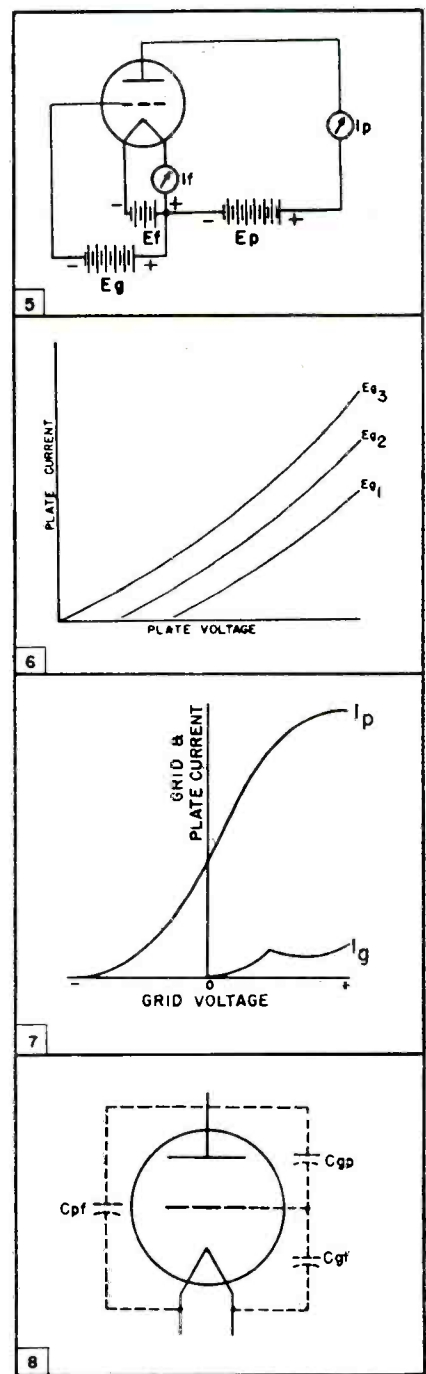
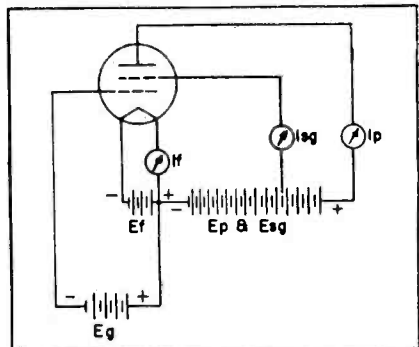
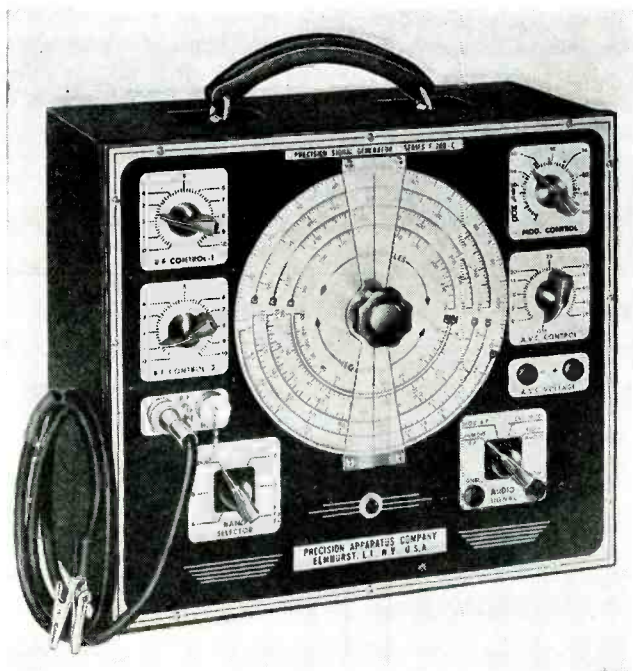


Fig. 9. A typical tetrode circuit.



Figs. 5, 6, 7 and 8. Fig. 5 illustrates a typical triode circuit. In Fig. 6 we see how the plate current will increase along a given curve if the grid voltage is held constant and the plate voltage increased from zero upward. If the plate voltage is held constant and the grid voltage varied from some negative value, through zero and upward into the positive region, a curve similar to that shown in Fig. 7 will appear. Fig. 8 illustrates the problems encountered in using triodes for v-h-f: as the frequency is increased capacitive coupling from the plate to the grid circuit becomes greater until instability and oscillation occur.



F-M Alignment

Step-by-Step Analysis Using a 88-Kc to 120-Mc Signal Generator and a VTVM or a 20,000 Ohms-Per-Volt Multi-Range Meter

IN ALIGNING AN F-M receiver (using limiter and discriminator circuit) with a signal-generator, the discriminator circuit receives initial attention.

The alignment procedure for this circuit is similar to that used for an afc system, it being absolutely essential that the discriminator tube and the i-f stages be adjusted at *exactly* the same frequency.

In the first step, the coaxial output cable leads of the generator should be connected between grid and ground of the limiter tube, and as in the case of the afc discriminator, a 20,000-ohms-per-volt multi-range meter or a vtvm is connected across the two cathodes of the discriminator. An *unmodulated* test signal is employed and the signal generator dial is set to the i-f specified in the manufacturers' data sheets. Then, just as with the afc discriminator, the primary and secondary trimmers of the discriminator transformer are adjusted until *zero voltage* is read on the meter scale.

To elaborate a little more fully on this adjustment, the discriminator transformer *primary* trimmer is first aligned for *maximum* meter reading. Following this the *secondary* trimmer

is rotated until *zero* voltage is obtained.

It will be found that incorrect adjustment of the trimmers can result in either a positive or negative meter reading, dependent upon the manner in which the discriminator circuit is unbalanced.

Without touching the signal generator tuning dial, the coaxial output cable leads are then transferred back to the r-f input grid of the first detector or mixer.

The super-sensitive multi-range tester is now set for either the 60 or 300 microampere range (depending on receiver and test signal intensity) and is connected directly in *series* with the ground return of the grid resistor of the limiter tube. The i-f trimmer alignment is started with the trimmer at the input of the limiter stage and thereafter, back through the trimmer across the output of the first detector (mixer). Each trimmer is adjusted for maximum reading on the 60 or 300 microampere scale of the test meter.³

The foregoing trimmer adjustments should be *repeated* in the same order, with great care given to obtaining *exact peak adjustment*. Doing this will insure symmetrical response of the i-f stages to the incoming frequency-modulated signal. In other words, the output of the discriminator will be ap-

proximately the same on both sides of the average carrier frequency.

When desired, a good way in which to check for symmetry of response is to place the 20,000-ohms-per-volt meter back across the diodes of the discriminator tube. With the signal generator set to the frequency of the i-f system, the reference meter should, as before, read zero. However, shifting the frequency of the signal generator, 50 to 100 kc (.05 to .1 mc) on either side of the specified i-f, should give equal, or nearly equal, but opposite meter readings.

Another way to test for symmetrical response is to leave the meter in the limiter tube grid return and note the change in current reading while the tuning dial of the signal generator is moved 50 to 100 kc on either side of the specified i-f. Approximately the same change in meter reading should occur on both sides of the specified i-f frequency.

If this symmetry does not occur, it is important that each of the i-f stages be again adjusted, because good f-m receiver performance depends upon

(Continued on page 40)

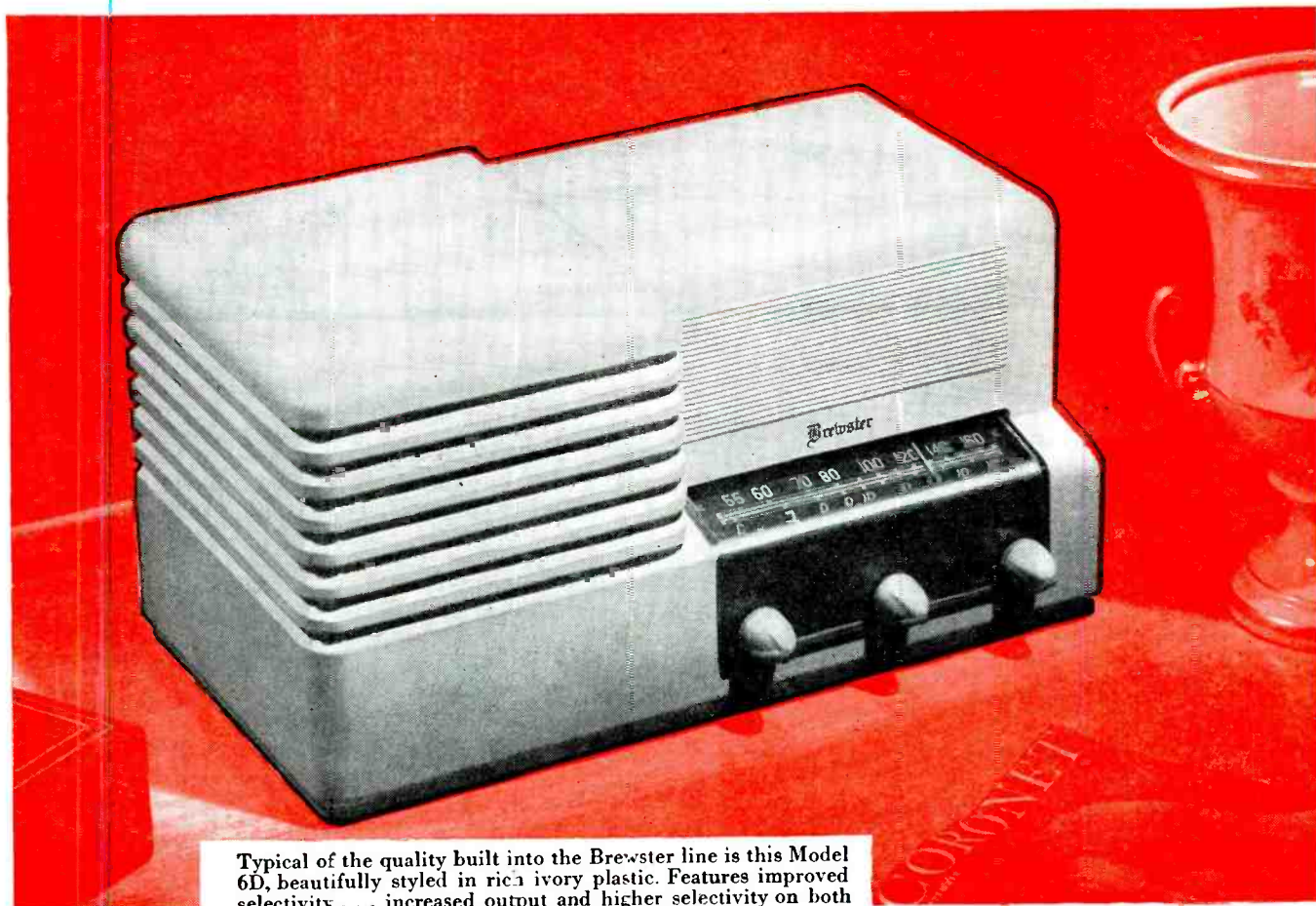
²Precision Apparatus Co. series E-200-C Signal Generator used in this step-by-step analysis.

³If the band-pass characteristics of the i-f transformers are such as provide two consecutive peaks while the individual trimmers are rotated, then it is necessary to adjust for the minimum between these two peaks.

¹From a chapter on *The Adjustment of F-M Receivers*, appearing in the book *Servicing by Signal Substitution*, written by G. N. Goldberger and published by Precision Apparatus Co., Inc.

Meissner

PRESENTS THE NEW BREWSTER LINE OF TABLE MODEL RADIOS



Typical of the quality built into the Brewster line is this Model 6D, beautifully styled in rich ivory plastic. Features improved selectivity . . . increased output and higher selectivity on both broadcast and shortwave bands. Broadcast 540 to 1600 kcs, shortwave 5.75 to 18 mcs. Built-in loop antenna . . . 5 tubes plus rectifier. Operates on 110 volts AC or DC.

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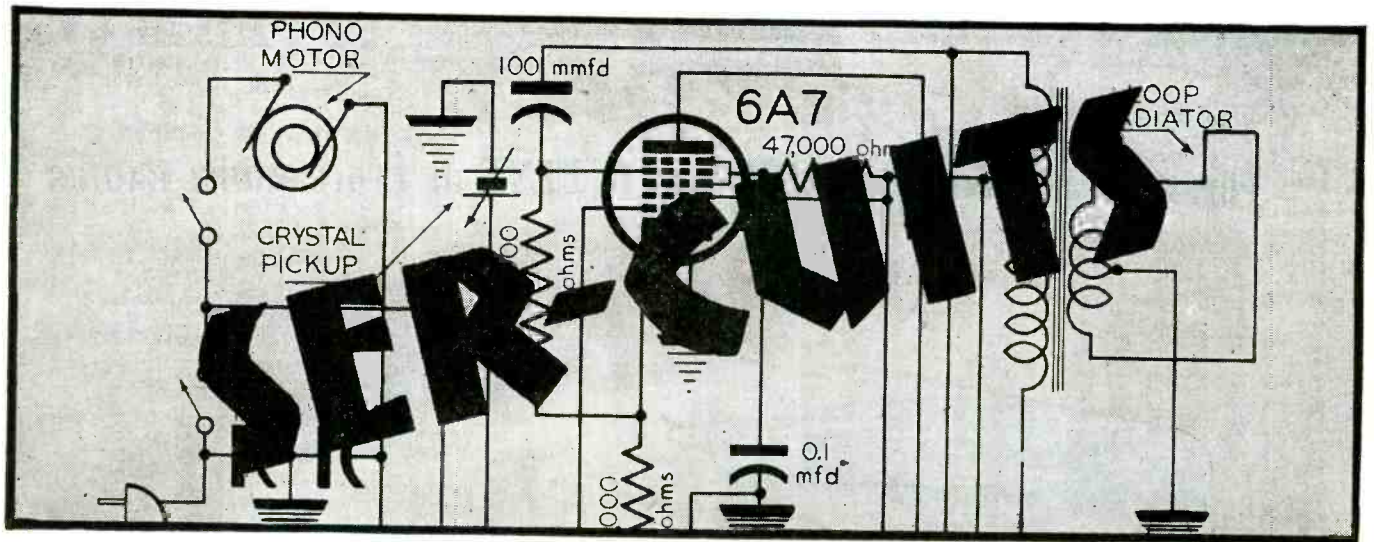
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THE TWO-VOLT STORAGE battery, which with a synchronous vibrator provides battery or a-c operation, has been included in an RCA 5-tube portable, 65BR9, which uses miniature tubes: a 1T4 r-f resistance coupled to a 1R5 converter, regenerative 1T4 i-f, 1S5 det-avc-a-f and a 3V4 power tube.

In this circuit, Fig. 1, three 7.5-ohm filament dropping resistors are used for the r-f and converter, for the i-f and det.-first audio and one for the 3V4. The resistor feeding the r-f tubes is used in conjunction with a

Fig. 1. A 2-volt battery/a-c portable, RCA 65BR9.

.5-mfd capacitor as an isolation filter.

The vibrator-power transformer unit has built-in filter chokes and capacitors for isolating the vibrator from the filament circuit and for spark suppression, and also an r-f choke in series with the *B+* output. The external *B* filter consists of 15 mfd, 1000 ohms and 15 mfd.

A .25-ampere 3AG fuse, in series with the line cord, protects the rectifier transformer against burnout from accidental d-c line connection or overcharged battery.

In calibrating, the dial scale need not be used. Instead three reference

marks on the dial backing are used; *A*, *B*, and *C*, *A* being the point of complete gang mesh, *B* providing the 600-ke mark, and *C* the 1600-ke point.

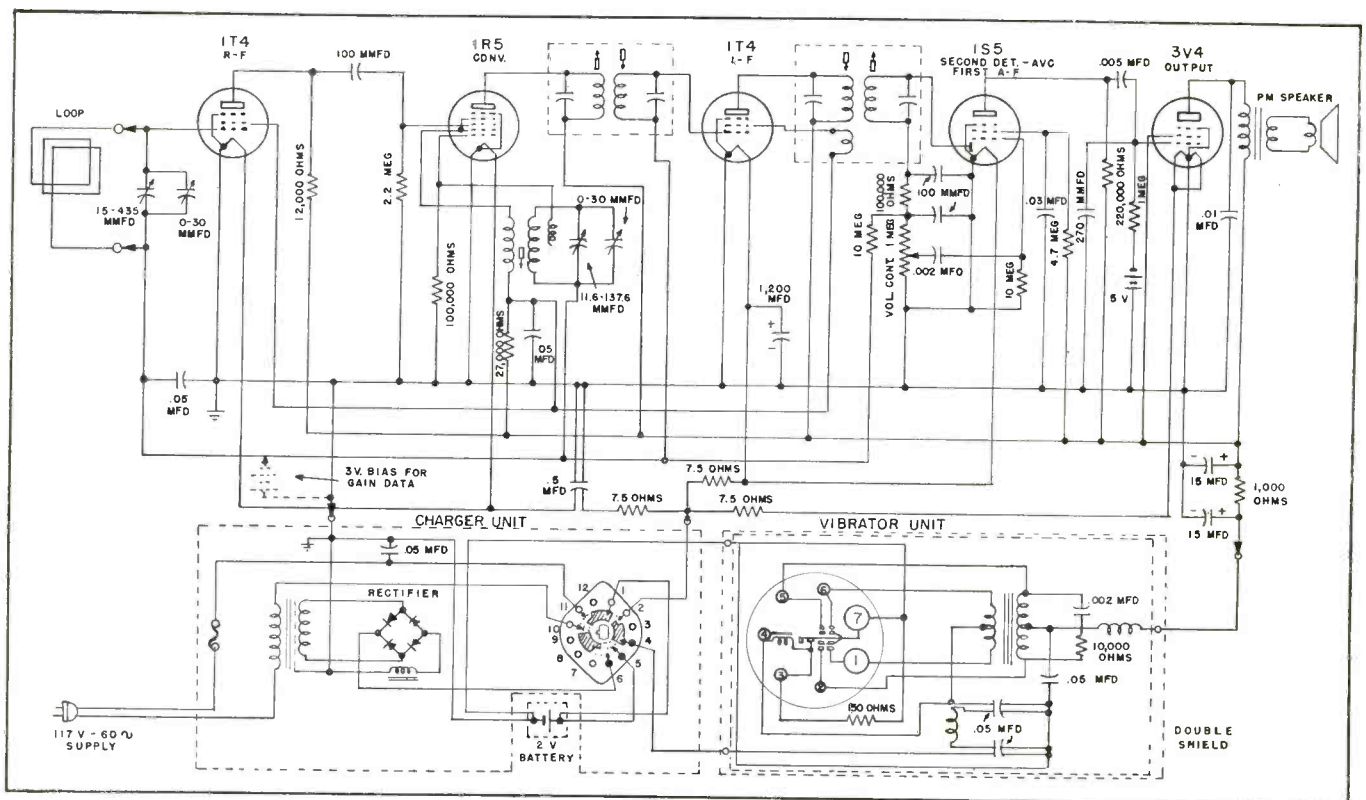
Phono Amplifiers

In response to requests, additional data on phono amplifiers¹ are presented this month.

Selenium Type Phono Oscillator

A phono oscillator using a 1A7 pentagrid converter, and a selenium

¹See June and July, 1947, SERVICE, for feature articles on amplifiers.



rectifier and a filament-type modulated/oscillator for quick heating operation is shown in Fig. 2. Because of the modulation method used, which is, in effect, a mixing of the modulation and the signal proper, it is controlled directly at the crystal pickup output. The pentode portion of the mixer is the oscillator. The signal is taken off the oscillator coil through a 10-mmf capacitor. Since the rectifier supplies the filament, which draws 50 ma, higher values of filter capacitors are required.

Phono-Oscillator Troubles and Cures

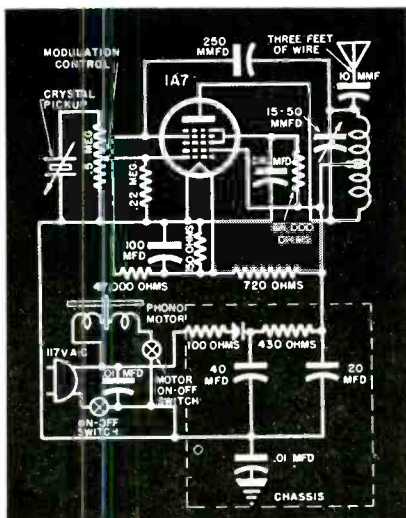
A common trouble in phono oscillators is 60-cycle modulation hum. If this trouble is experienced, it is suggested that the *B* filter network be checked first. An absolute check is to substitute a 90-volt *B* battery for the *B* supply when checking. If the trouble is elsewhere, it may be due to cathode to filament leakage in a-c heated tubes. Changing the tubes, or reducing the filament voltage may help. Another source of trouble is ungrounded phono tables or motors. A short strap to chassis or a return through a .1-mfd capacitor may cure the trouble.

Admiral 3A1

Fig. 3 shows a phono amplifier with a high- μ triode, 14B6, used to drive a 50A5 beam power amplifier. These tubes are equivalent to the 12SQ7 and the 50L5, respectively. A typical am-

(Continued on page 28)

Fig. 2. A selenium-rectifier phono oscillator employing a pentagrid-type tube in a mixer type circuit. Modulation is controlled at the output of the crystal pickup. A high-level crystal pickup is required in this type of circuit. The pentode portion of the mixer is used for the oscillator.



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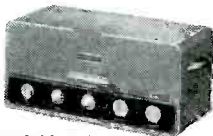
KX-60 Deluxe
60-Watt Amp.



KX-6 Deluxe
Mixer Pre-Amp.



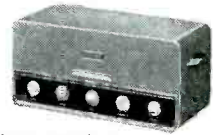
K-60P Deluxe
Power Amp.



KXP-30 Deluxe
Phonograph Amp.



H-10 Standard
10-Watt Amp.



H-14 Standard
14-Watt Amp.



H-30 Standard
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NEW PRODUCTS

TRICRAFT F-M/TV ANTENNA

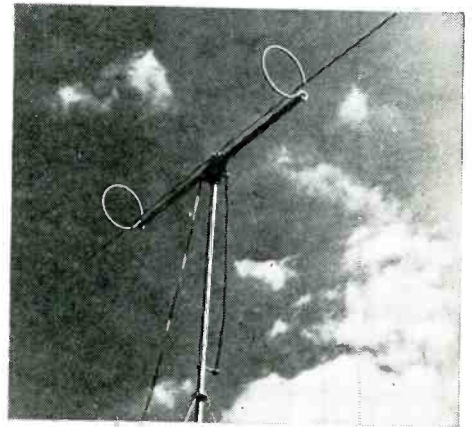
An all-wave f-m/TV antenna has been announced by the Tricraft Products Company, 1535 North Ashland Ave., Chicago 22, Ill. Antenna, model 300, is the result of antenna development work by an engineering group of Belmont Radio Corp.

Antenna consists of a long relatively thin dipole which is a half-wave long at 70 mc placed near a short, relatively thicker dipole, half-wave long at 128 mc.

Thick dipole is connected at its end through inductive rings to the approximate mid points of the thin, long dipole

section. These rings, besides end feeding the short dipole, give mechanical support to the thin dipole. In the lower television band the antenna acts like a broad-band folded dipole resonant at approximately 65 mc with the thin member resonant at approximately this frequency and the short, heavy member end loaded by the inductive rings at its end. In the higher television band the long, thin dipole is $1\frac{1}{2}$ wavelengths in the center of the band. The short member is end fed by means of the inductive rings connecting it to the long member such that

currents flow in the two dipoles approximately in phase, substantially raising the radiation resistance of the antenna above a one and a half wavelength dipole.

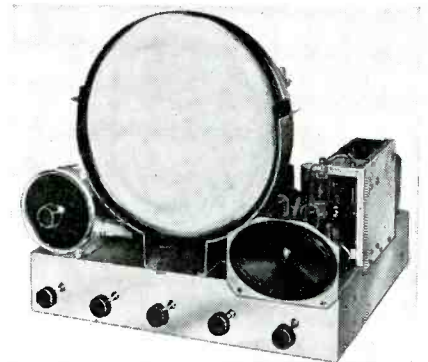


* * *

TRANSVISION 12" TV KIT

A 22-tube tv kit using a 12" magnetic-type picture tube has been announced by Transvision, Inc., 385 North Avenue, New Rochelle, N. Y.

Features a 4 mc bandwidth, three i-f picture stages, two stages pre-tuned and aligned i-f, ratio detector for f-m sound system, stabilized synchronizing circuits and input designed for folded-dipole antenna. One model is designed to cover the tv channels now operating and another is designed to cover the entire tv band of 50 to 216 mc.



* * *

WEBSTER-CHICAGO PORTABLE AMPLIFIER

A 3-tube and rectifier portable amplifier, model 66, featuring a push-pull circuit, 8 watt output and 8" Alnico V speaker has been announced by Webster-Chicago Corporation, 5610 Bloomingdale Avenue, Chicago 39, Illinois.

The amplifier is especially suitable for use with the Webster-Chicago model 65 portable record changer, or as an external amplifier and speaker for model 80 wire recorder.

* * *

MINNESOTA MINING SCOTCH TAPE INSULATION

Scotch electrical tape, with vinyl plastic backing, has been developed by Minnesota Mining and Manufacturing Co.

Tape is said to be weather-resistant and have a dielectric strength of 1,000 volts per mil.

Four types available in thicknesses ranging from seven to 12 mils. Colors

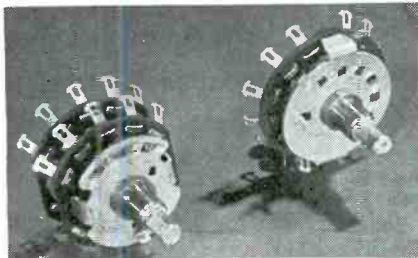
are yellow, white and black. Elongation before break is said to be over 100 per cent.

* * *

MALLORY SWITCHES

Two single and double section circuit selector switches, RSA-50 and RSA-60, have been announced by P. R. Mallory & Co., Inc., Indianapolis, Indiana. Section and terminal design identical to that of the Mallory RS-50 and RS-60 switches. Designed for band and tone control switching.

The RSA-50 accommodates up to twelve terminals on either side of the section and provides from two to six positions. The RSA-60 accommodates up to ten terminals on either side of the section and provides from two to five positions. The RSA-60 has a narrow section design for under chassis mounting.



* * *

WALSCO TEST RECORD

A standard test record which is said to permit accurate adjustment to the proper set-down and tripping position of the pickup through the use of a series of tones, has been announced by the Walter L. Schott Co., Beverly Hills, Calif.

Lead-in grooves are modulated from the outer edge of the record in a series of three consecutive tones. In testing the record changer, proper adjustment is attained when only two tones are heard.

Record has been designed to meet standards of the RMA and NAB.

Playing time for record (10") is approximately 40 seconds. This makes it possible to obtain five change cycles in less time than it takes to play one regular record.

* * *

PICKERING PICKUP

A high-impedance magnetic pickup, which it is said can be installed in practically any conventional record player or changer by means of a keystone clip mounting which permits adjustment of the stylus position for minimum tracking error, has been announced by Pickering and Company, Inc., 29 W. 57 St., N. Y. 19, N. Y. Frequency response is said to be flat within 2 db over the range from 40 to 10,000 cps.

* * *

AMERICAN VOLUME CONTROL CORP. CONTROLS

A line of replacement volume controls has been announced by the American Volume Control Corp., 115 Liberty Street, N.Y.C. Controls feature metallic-carbon resistance element.

* * *

HICKOK PORTABLE ELECTRONIC VOLTOHMETER

A battery-operated electronic volt-ohm-meter, model 214, has been developed by the Hickok Electrical Instrument Co.

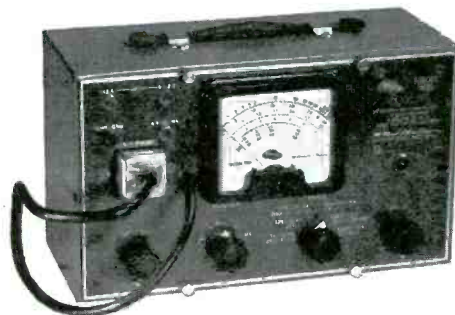
(Continued on page 26)

SILVER AM PLUS FM 90 KC-210 MC

OVERWHELMING ENTHUSIASM greeted first shipments of Model 90a Signal Generator . . . most of which seem to have gone into manufacturers' laboratories, so good is it. Nowhere else . . . at any price . . . can you buy its equal. Check these features: eight ranges dial calibrated to 1% accuracy . . . 50 kc/170 mc. AM . . . 90 kc-210 mc. FM . . . built-in 0.500 kc. FM sweep . . . variable 400 . . . amplitude modulation . . . less than 1 micro-ohm to over 1 volt metered output . . . resistive and capacity-insulated output strays so low it's in the \$500.00 and up laboratory class. Yet price is only \$99.50 net.

"VOMAX"

NEW PENCIL-THIN R.F. PROBE



Now "VOMAX" is equipped with new, pencil-thin, flexible 5-inch r.f. probe extension plus ground clip-lead. It will reach any point in the tightest midjet receiver . . . will even bend around corners! This exclusive new SILVER development maintains "VOMAX" as the finest, most complete meter you can buy . . .

Overwhelmingly, acceptance proves "VOMAX" to stand head and shoulders above any other meter — at any price. It is unbeaten . . . even by its copyists . . . for accuracy,

for d.c., a.c., a.f., i.f. and r.f. voltage ranges . . . as it is for current and resistance ranges . . . for frequency range . . . and for that astronomically high input resistance so necessary to effective AM, FM, and TELE receiver servicing. Price is still only \$59.85 net . . . r.f. probe extension kit \$35.

NEW CATALOG. Mail penny postcard for complete catalog, these and other SILVER top-dollar test instruments. They are the backbone of modern servicing. New transmitters, receivers, exciter, MICROMATCH, pre-tuned frequency multiplier are amateur news! See them at your jobber.

OVER 36 YEARS OF RADIO ENGINEERING ACHIEVEMENT

McMurdo Silver Co., Inc.

1249 MAIN ST., HARTFORD 3, CONNECTICUT

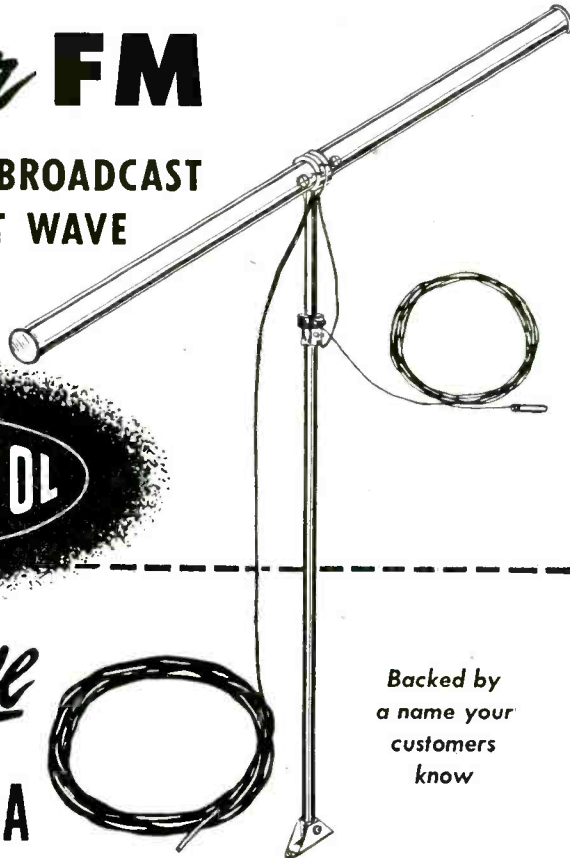
Tops for FM

STANDARD BROADCAST
AND SHORT WAVE

—the New

AMPHENOL

all Wave
ANTENNA

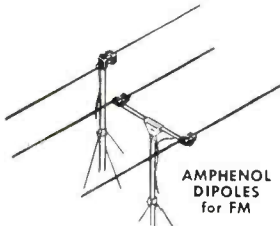


Backed by
a name your
customers
know

• In actual tests over the 500 kc—108 mc frequency range, the new Amphendol All-Wave Antenna out-gains the best double doublet. It sells best because it assures interference-free reception even in areas of low signal strength.

• The All-Wave Antenna combines a horizontally polarized FM dipole with a 65-foot copper wire antenna for standard broadcast and short wave. A special wave-filter channels energy to receiver input. A lead-in of 52 ohms coaxial transmission line reduces interference to the minimum. It's quality built to serve your customers well!

• The All-Wave Antenna is individually packaged for unit sale with installation instructions, all hardware (except guy wires), and a guy-wire clamp. Order a stock today!



AMPHENOL
DIPOLES
for FM

• Amphendol dipoles and reflector arrays are priced for the mass market, yet build up ample gain for finest FM reception. Efficient, even in areas of low signal strength, they virtually eliminate multi-path reception. Mounting bracket and mast-head (of reflector types) swivel allowing antenna plane to be tilted to optimum angle. Kit contains everything for a complete 88-106 mc band antenna except guy wires.

Amphendol Dipole Antennas are available now through your jobber.

AMERICAN PHENOLIC CORPORATION 1830 SOUTH 54th AVENUE
CHICAGO 50, ILLINOIS

COAXIAL CABLES AND CONNECTORS • INDUSTRIAL CONNECTORS, FITTINGS AND
CONDUIT • ANTENNAS • RADIO COMPONENTS • PLASTICS FOR ELECTRONICS

New Products

(Continued from page 25)

10521 Dupont Avenue, Cleveland 8, Ohio.
Uses two size C flashlight unit cells and one standard miniature type 45-volt battery.

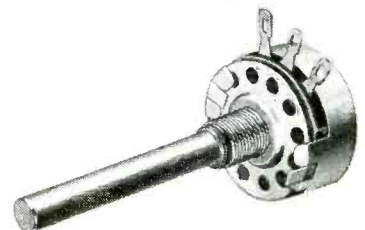
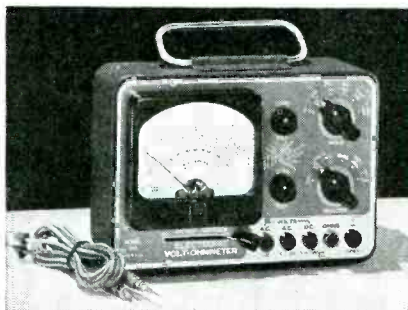
Ranges... (a) volts, a-c: 0-3, 12, 30, 120, 300, 1200; (b)—volts, d-c: 0-3, 12, 30, 120, 300, 1200; (c)—ohms, 1 ohm to 1000 megohms, in 6 ranges.

Input impedance at a-c is 10 mmfd—

15 megohms; d-c, 15 megohms.

Meter has an internal pivot construction. Unit uses one 1S5.

Dimensions: 8¼" x 6" x 4¼".



SILTRONIC PORTABLE P-A

A self-powered portable p-a unit, PA-4, featuring a three-stage amplifier, crystal microphone, and a heavy duty, 6" p-m speaker, housed in a luggage-type carrying case, has been announced by the Siltronic Company, Point Building, Pittsburgh 22, Pa.

Amplifier is said to provide up to 1200-foot coverage. Case is 9" x 7½" x 12"; weight, including batteries, 12 pounds.

ELECTRONIC MFG. V-T VOLTOHMETER

A vacuum tube voltohmmeter, with high ranges for tv tests, type 110, has been developed by the Electronic Manufacturing Co., 140 South Second Street, Harrisburg, Pa.

Ranges... D-C, 3—30—150—300—600—3000—15,000 volts; a-c, 3—30—150—300—volts; resistance, 1000—10M—100M—1 meg—100 meg.

Instrument said to be effective up to 300 mc. * * *

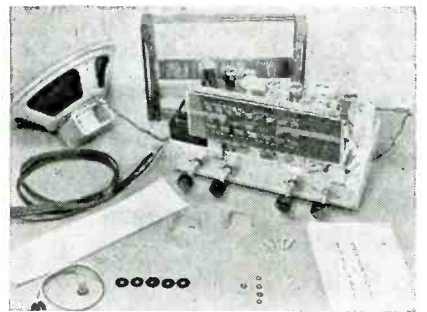
ESPEY F-M/BROADCAST CHASSIS

An 11 tube a-m/i-m chassis supplied with speaker, folded dipole and mounting accessories for mounting in a cabinet has been announced by the Espey Mfg. Company, 528 E. 72 St., N.Y.C.

The receiver features a ratio detector circuit, r-f amplifier stage, two stages of i-f and a pushpull audio output system.

Provision is made for two antennas, a loop for standard broadcast and a built-in folded dipole for f-m.

Tubes used include one 6BA6 f-m r-f amplifier, one 7Q7 a-m oscillator mixer, one 7AH7 i-f amplifier, one 7AG7 i-m detector driver, one 7A6 f-m detector, one 7F8 f-m oscillator mixer, one 7C6 a-m detector, avc and audio amplifier, one 7F7 audio amplifier and inverter, two 7C5 pushpull-power amplifiers and one 5Y3 rectifier.



OHMITE 2-WATT MOLDED COMPOSITION POTENTIOMETER

A 2-watt, molded composition potentiometer, type AB, has been announced by Ohmite Manufacturing Co., 4974 West Flournoy St., Chicago 44, Ill.

Available in sixteen stock resistance values from 50 ohms to 5 megohms with a linear taper. Five stock values from .1 megohm to 2.5 megohms are available in a clockwise logarithmic taper. Three stock values, 10,000, 25,000, and 50,000

ohms are available in a counter-clock-wise logarithmic taper. The unit is 1 1/16" in diameter and extends 9/16" behind the panel. An on-off switch is also available for mounting on the potentiometer.

For complete information, write for bulletin 131.

* * *

SPRAGUE TELOHMIKE CHECKER

A capacitor-resistor checker, TO-3 Telohmike, has been developed by the Sprague Products Company, North Adams, Mass.

Checker is a bridge-type capacitance and resistance analyzer with built-in d-c volt-milliammeter. Direct reading calibrated dial is color coded to correspond with selector switch. Capacity ranges are from 00001 to 2,000 mfd in four steps. Resistance ranges are 25 ohms to 25 megohms in three steps. D-c meter range is 0-15/150/750 volts; 0.15/15 and 75 ma. Insulation resistance range indicated by direct meter reading is 0-2,500 megohms. Electrolytic leakage is measured in ma at rated d-c voltage. Capacity and power factor of electrolytic capacitors are measured with rating polarizing voltage applied. Power factor measurement range is from 0-50% at 60 cycles.



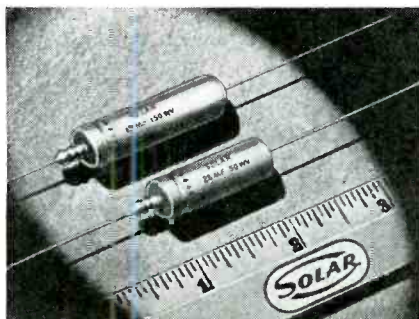
* * *

SOLAR MINIATURE DRY ELECTROLYTICS

A series of miniature dry electrolytic capacitors, type LB, has been announced by Solar Manufacturing Corporation.

Capacitors use etched foil.

Capacitance values available in a 3/8"x 1 1/8" container, range from 8 mfd at 150 wvdc to 200 mfd at 1.5 wvdc; in a 3/8"x 1 5/8" container, maximum capacitances range from 12 mfd at 150 wvdc to 300 mfd at 1.5 wvdc.



* * *

BEYERS SOLDERING-IRON CONTROL STAND

A soldering iron heat-control stand, using an aluminum heat radiator has been

(Continued on page 21)



10-STATION MASTER UNIT

Every Business is a Prospect!

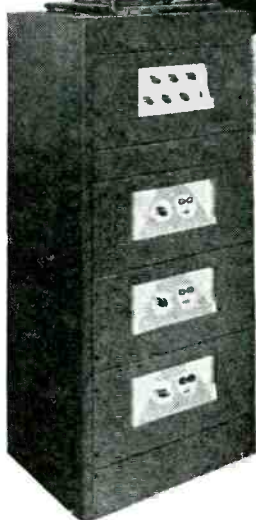
FLEXIFONE

INTERCOMMUNICATION SYSTEMS

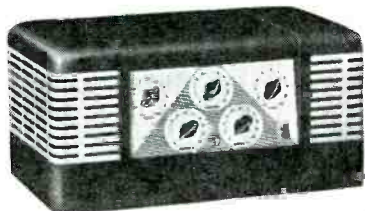
OPERADIO...THE OUTSTANDING SOUND EQUIPMENT LINE FOR YEAR 'ROUND SALES AND PROFITS!

Smart New Designs... New Features!

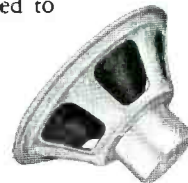
Outstanding... that's the word for the new OPERADIO sound equipment line! Every unit is designed, engineered and constructed to OPERADIO-quality standards... with important new features and smart styling for added sales-appeal. OPERADIO sound equipment is nationally advertised to assure you of steady, successful sales.



PRE-AMPLIFIERS - BOOSTERS AND MOUNTING RACKS



20-WATT AMPLIFIER



SPEAKERS

OPERADIO
Sound Equipment

OPERADIO MFG. CO., Dept. S-8, ST. CHARLES, ILL.

Gentlemen:

Please send us free information on the items checked:

- Operadio Sound Equipment
- FLEXIFONE Intercommunication

Name _____

Address _____

City _____ State _____

SEND COUPON FOR COMPLETE DETAILS

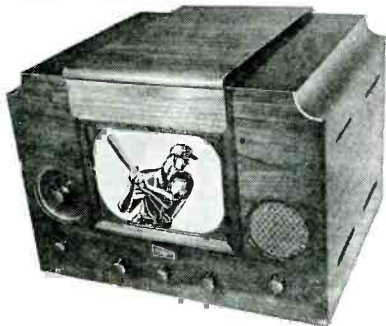
12" TRANSVISION SCOOP!

NEW! SENSATIONAL! 12" TELEVISION KIT by TRANSVISION It's TOPS IN TELEVISION VALUE!

PICTURE IS 1/2 TIMES BIGGER THAN WITH 10 INCH TUBE!

Engineered for Easy, Rapid Assembly
It's the TOPS IN TELEVISION! BUY IT AND
SAVE SEVERAL HUNDRED DOLLARS with
this outstanding television receiver!

CHECK THESE FEATURES—Standard Model:
12 inch picture tube (magnetic type) . . . Picture
size 75 square inches (1/2 times bigger picture
than with 10" tube) . . . R.F. Unit factory wired
and pre-tuned . . . 4 mc. bandwidth for full picture
definition . . . 9,000 volts second anode potential for
brightness and contrast . . . High Fidelity FM
sound reproduction . . . Maximum picture sensitivity
(better than 50 microvolts) . . . Stabilized synchronizing
circuit assures firm picture . . . Advanced
Transvision television circuit provides exceptionally
clear pictures . . . Complete with all tubes, 12 inch
picture tube, SPECIALLY DESIGNED FOLDED
DI POLE ANTENNA with 60 ft. of lead-in cable,
and complete easy-to-follow instructions. List, \$289.



DE LUXE MODEL WITH SUPERB BUILT-IN FM RADIO

Same as above, plus the following **ADDITIONAL FEATURES** . . . 50-216 mc. continuous tuning.
Covers the entire FM band and all 13 television channels . . . Cut-off switch eliminates
unused tubes when set is used only as FM receiver. **LIST \$359.50**

CABINETS—table and console models with beautiful rubbed wood finish. Fully drilled, packed in air-
cushioned carton. Table Model, List, \$44.95; Console Model, List, \$74.50.

See your local distributor, or for further information write to:
TRANSVISION INC., Dept. S, 385 North Ave., New Rochelle, N. Y.

PAPER CONDENSERS		
Part No.	Symbol	Description
64B1-12	C1	.005 Mfd. 600 V.D.C.
64B1-25	C2	.01 Mfd. 400 V.D.C.
64B1-24	C3	.02 Mfd. 400 V.D.C.
64B1-20	C5 & C6	.1 Mfd. 400 V.D.C.
64B1-22	C7	.05 Mfd. 400 V.D.C.

ELECTROLYTIC CONDENSERS		
67A10	{ C4A	50 Mfd. 150 V.
	{ C4B	30 Mfd. 150 V.

RESISTORS		
60B8-106	R2	10 Megohms 1/2 Watt
60B8-274	R3	270,000 ohms 1/2 Watt
60B8-474	R4	470,000 ohms 1/2 Watt
60B14-151	R5	150 ohms 1 Watt
60B14-152	R6	1,500 ohms 1 Watt
61A3-4	R7	130 ohms 5 Watt
60B14-330	R8	33 ohms 1 Watt

Fig. 3a. List of parts for the Admiral 3A1.

ground has been isolated from the line with a .1-mfd capacitor.

Electromatic APH 301-C

A phono amplifier using a 12SK7 as a pentode appears in this circuit. Here there are three points of degeneration. The first is an unbypassed 12SK7 cathode circuit; the second an unbypassed 50L6 cathode circuit; and the third, feedback voltage from the voice coil to the screen grid of the 12SK7. The additional feedback has been made possible by the use of the 12SK7 as a pentode, providing increased gain.

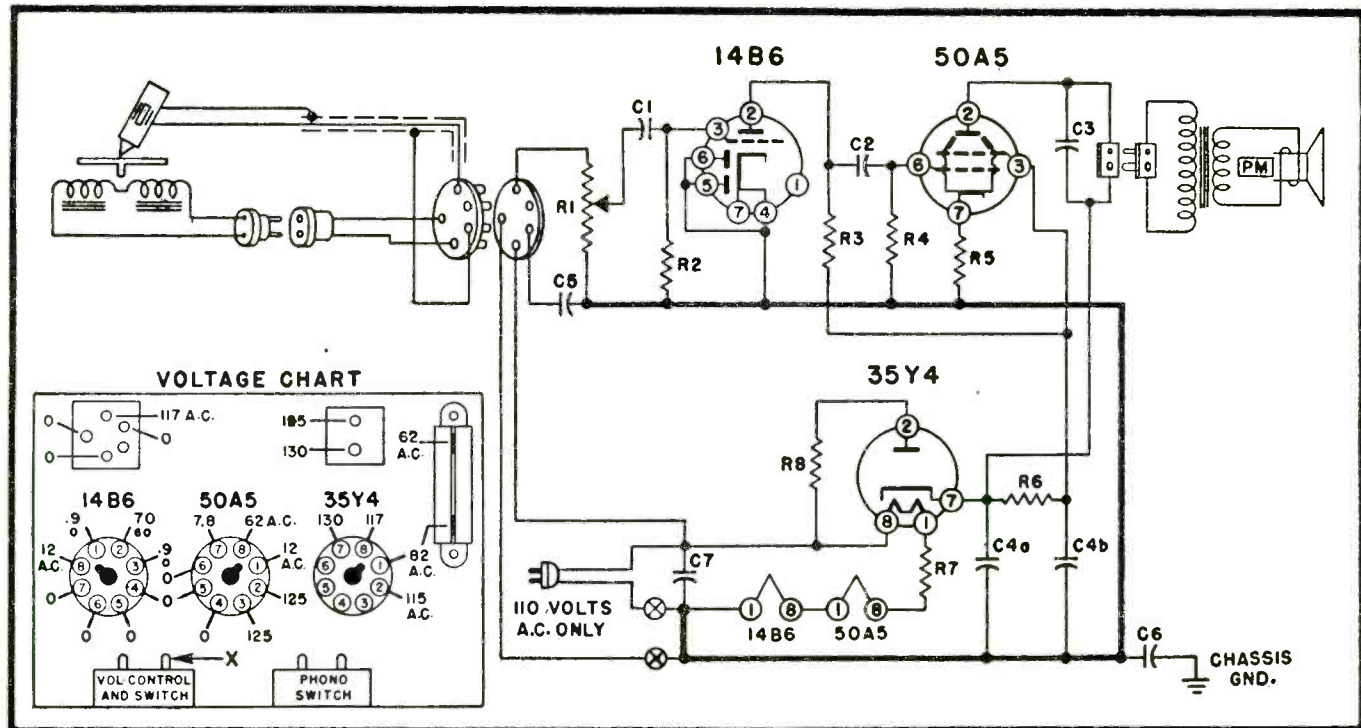
Ser-Cuits

(Continued from page 23)

plifier using the latter type tubes appears in the G.E. 15. Degeneration is introduced in the output stage by omit-

ting the cathode bypass capacitor. Sufficient voltage gain is provided by the high-mu triode to permit the use of a low-voltage pickup. The chassis

Fig. 3. Admiral 3A1 amplifier using a hi-mu triode, 14B6.



LESKIN NOW JOBBER ADV. AND S.M. FOR PERMOFLUX

M. B. Leskin has been appointed head of jobber sales and advertising of the Permoflux Corporation, who are offering a complete line of loudspeakers and transformers to the jobber. The Permoflux line includes a standard replacement line, extended range hi-fidelity speakers and odd size and elliptical speakers.

Permoflux has entered the jobber field after years of engineering and manufacturing experience in supplying the major set producers.

* * *

PYRAMID ELECTRIC CATALOG

An eight-page catalog describing and illustrating d-c electrolytics in cardboard and metal containers in capacities ranging from 5 to 2,000 mfd and in 6 to 600 working-voltage ranges, has been prepared by the Pyramid Electric Company, 155 Oxford, Paterson, N. J.

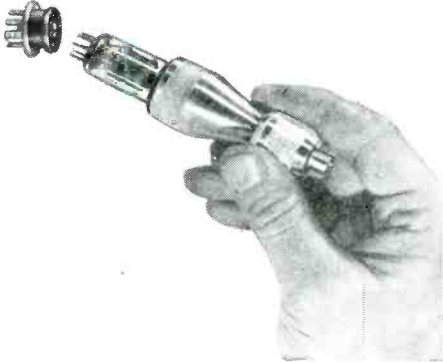
* * *

SALESCRAFTERS NAMED NATIONAL SALES REPS. FOR AMO MINIATURE TUBE PULLER

Salecrafters, Inc., 510 N. Dearborn St., Chicago 10, Ill., headed by Bob Karet and Ray Hutmacher, have been appointed national sales representatives for the Amo miniature tube puller made by the Oliveri Tool Co., Chicago.

The Amo tube puller permits extraction of such miniature tubes as 6AG5, 50B5, etc.

To extract tubes, the Amo is pressed down on the tube, and tube is lifted up. Tube is then released by pressing release button.



* * *

NELSON ELECTRIC CORP. FORMED IN CALIF.

The Nelson Electric Corporation, 1620 Euclid Street, Santa Monica, Calif., was formed recently to manufacture transformers and other electrical products. A. L. Nelson is president.

Other officers include George Otis, vice president and director; Daniel W. Gage, secretary, director and corporation counsel; Jack D. Phelan, sales manager and director; Eugene Leitner, treasurer; and Henry Butz, chief engineer.

* * *

JFD A-C/D-C BALLAST-TUBE MANUAL

A 68-page a-c/d-c ballast tube manual is now available from JFD Manufactur-

FOR FM AND AM SERVICING



TYPE YGS-3

SIGNAL GENERATOR

SERVICE men, research technicians and design engineers find this new General Electric Signal Generator an extremely valuable aid in their work.

Four basic units have been combined to form one compact, labor-saving, portable equipment which is simple in construction and easy to operate.

The General Electric Signal Generator, Type YGS-3, con-

sists of an RF oscillator (fundamental frequency range 100 kc to 150 mc); an FM oscillator (center frequencies of 1, 20 and 50 mc and frequency deviations of ± 20 , ± 300 and ± 750 kc); a 1 mc crystal calibrator and a variable frequency audio oscillator. This combination of units enclosed in a single case will help to simplify and speed up FM and AM receiver analysis.

NOTE FOLLOWING DISTINCTIVE FEATURES:

- Economical and convenient to use.
- Constant output impedance attenuator. Wide Frequency range.
- Extremely wide sweep deviation.
- Lines up any FM or AM receiver, stage by stage by visual alignment methods.
- Reference level indicator for output.

New free booklet on FM servicing available.

Write: General Electric Company, Electronics Department, Syracuse 1, New York.

GENERAL ELECTRIC

164-F4

ing Co., Inc., Dept. 7, 4117 Fort Hamilton Parkway, Brooklyn 19, New York.

* * *

SHURE BROTHERS CATALOG

A catalog, 157, describing and illustrating microphones and pickups has been published by Shure Brothers, Chicago, Ill.

Microphones described include multi-impedance *Unidyne* and *Sonodyne* dynamics and the *Monoplex* and *Versatex* crystal microphones.

* * *

CLAROSTAT CEMENT-COATED POWER-RESISTOR BULLETIN

A bulletin "Why Cement-Coated Power Resistors?" has been issued by Clarostat Mfg. Co., Inc., 130 Clinton St., Brook-

lyn 2, N. Y. Data offered includes simple tests to determine overload capacity, heat-shock immunity, through-coating leakage, corrosion elimination and other advantages of cold-setting cement coating.

* * *

C-D CAPACITOR DISPLAYS

Easel-back display placards illustrating an assortment of C-D capacitors have been released by Cornell-Dubilier Electric Corporation, South Plainfield, N. J.

* * *

DU MONT INSTRUMENT AND TUBE SALES NOW IN CLIFTON, N. J.

The instrument and tube sales division of Allen B. Du Mont Laboratories, Inc., (Continued on page 34)

A HABIT TO JOE...

"NEW IDEA" TO HIS NEPHEW



...YET BOTH WANT THE SECURITY your P.S. Plan Provides

HAVE YOU told all your new or recently hired employees about the benefits of the Payroll Savings Plan for the regular purchase of U. S. Savings Bonds? Wage earners, according to a recent nation-wide survey, want security more than anything else. They prefer security to big pay, soft jobs, authority, "success."

There is no surer way to this peace of mind than systematic savings. And what surer, safer, better means can your employees find than payroll allotments for U. S. Savings Bonds? Bonds that return \$4 at maturity for every \$3 they invest!

Your active support of the Payroll Savings Plan is an investment in employee contentment, in the citizenship of your community, and in the security of America's future. This is practical "employee relations" of the highest type and pays dividends of satisfaction to everyone.

Start a drive today for larger participation in the plan. Many employees may be unfamiliar with its advantages. If you want literature for distribution, contact your State Director of the Treasury Department's Savings Bonds Division.

New Savings Bonds Plan won't affect the P. S. P.

THE Treasury Department and the banks of America are making it possible for farmers, doctors, and other self-employed people to participate in "automatic" Bond buying by special arrangement with their banks. This extension of the Savings Bonds program is not a partial payment plan and is intended *only* for people who are not in a position to take advantage of the Payroll Savings Plan.

The Treasury Department acknowledges with appreciation the publication of this message by

SERVICE



This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and The Advertising Council.

New Products

(Continued from page 27)

announced by Beyers Mfg. Co., 2866 Farnam St., Omaha 2, Neb.

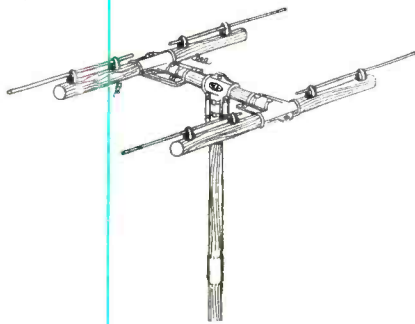
Heat radiation fins are said to draw off excess heat while iron is at rest.

* * *

JFD F-M AND TV ANTENNAS

A line of f-m and television antennas and accessories has been developed by the JFD Manufacturing Co., Inc., Dept. Y, 4117 Ft. Hamilton Parkway, Brooklyn 19, New York.

Antennas feature a multi-position bracket and a snap-lock wall insulator which holds transmission leads in place.

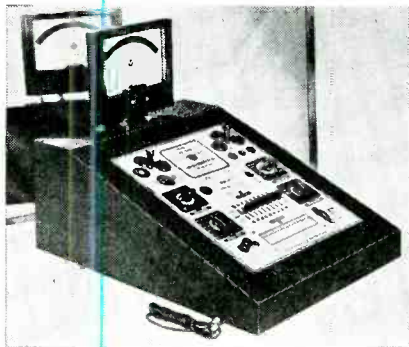


* * *

RCP TUBE TESTER

A counter-type tube tester which shows tube condition on a 7½" double meter which has identical readings on both sides, model 316DL, has been announced by Radio City Products Co., Inc., 127 West 26th St., New York 1, N. Y.

Tester has rotary selector lever type arc switch and mechanical roll chart. Also incorporates the 9- and 7-prong rectangular sub-miniature tube sockets.

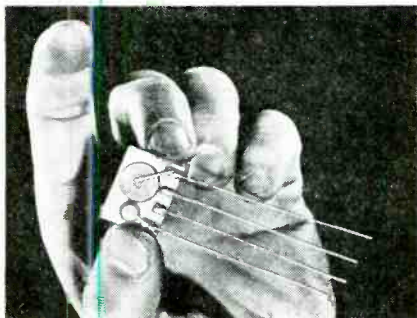


* * *

CRL PRINTED-CIRCUIT UNIT

An interstage a-f coupling plate, the couplare, using a printed circuit, has been announced by Centraiab.

Unit is an integral assembly of two capacitors and two resistors bonded to a



BUILD BIGGER PROFITS

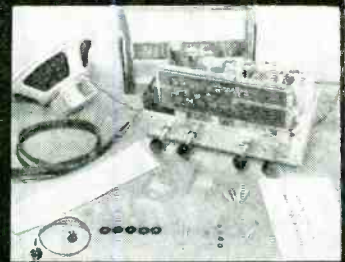
with
ESPEY
CUSTOM
BUILT
CHASSIS

YES! These ESPEY custom-built radio receiver chassis are really designed to make bigger profits for YOU—the Serviceman and Serviceman-Dealer! They are ruggedly constructed of only the finest materials, and are electronically designed to give your customers maximum reception-pleasure over the years ahead, thereby assuring your reputation as "knowing your stuff!"

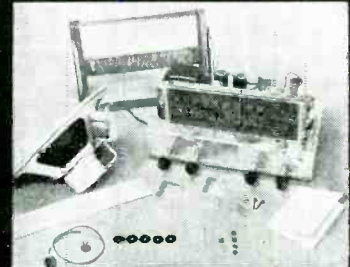
Engineered to meet all requirements for an excellent receiver chassis to be installed in your customer's cabinets, these ESPEY models are priced far within the competitive range. With three models to select from, your replacement worries are over. May we suggest that you contact your regular jobber, and examine these sets at your leisure? We feel certain that you will be just as enthusiastic about them as we are!

In the event that your jobber does not have these chassis as yet, write us for full details!

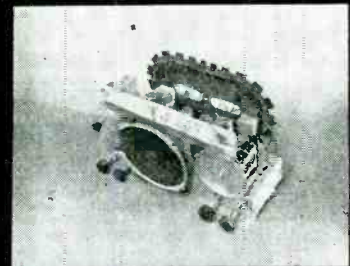
ESPEY MFG. CO., INC.
528 EAST 72ND ST., N. Y. 21, N. Y.



MODEL 7-B: 11 tube Superhet AM-FM. For 105/125V AC. Automatic and full range volume controls. 10" Alnico V speaker, wired for phono. AM-FM antennas supplied. RMA listed. Supplied complete, ready to install and operate.



MODEL RB-14: 8 tube Superbet. For 105/125V AC. Automatic and full range volume controls. 10" speaker. Covers Broadcast and 2 short wave bands. Wired for phono. Built-in loop. All climates.



MODEL 97A: 6 tube Superhet. 105/125V AC/DC. 6" speaker. Automatic and full range volume controls. Broadcast and shortwave. Wired for phono. Built-in loop. Tone control. RMA listed. Complete and ready to install.

steatite ceramic plate and mutually connected by means of metallic silver paths or printed on the base plate. Coupling unit uses a .01-mfd coupling capacitor, 250-mmfid-plate r-f bypass capacitor, ¼-megohm plate load resistor, and ½-megohm grid resistor.

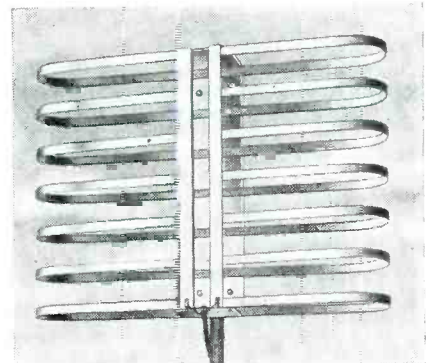
Bulletin 943 contains further details.

RAULAND F-M ANTENNAS

An f-m antenna has been announced by the Rauland Corporation, 4245 North Knox Ave., Chicago, Ill. The antenna, model 150, designed for the 88- to 108-mc band, has an omni-directional pickup pattern.

Antenna is of all aluminum construction and small in size, and can be located indoors.

(Continued on page 43)

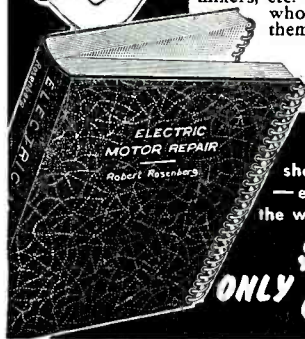


LEARN ELECTRIC MOTOR REPAIR

NO WONDER IT'S A GOOD BUSINESS!



According to no less an authority than the General Electric Co., there are **ELEVEN MOTOR-OPERATED DEVICES** in the average moderate-income American home! Many large homes have twice this many motors — in washers, refrigerators, oil burners, cleaners, fans, clocks, shavers, mixers, etc. Be the man who can repair them! It's a logical addition to any radio business!



This big book shows you how — every step of the way

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Servicing Helps

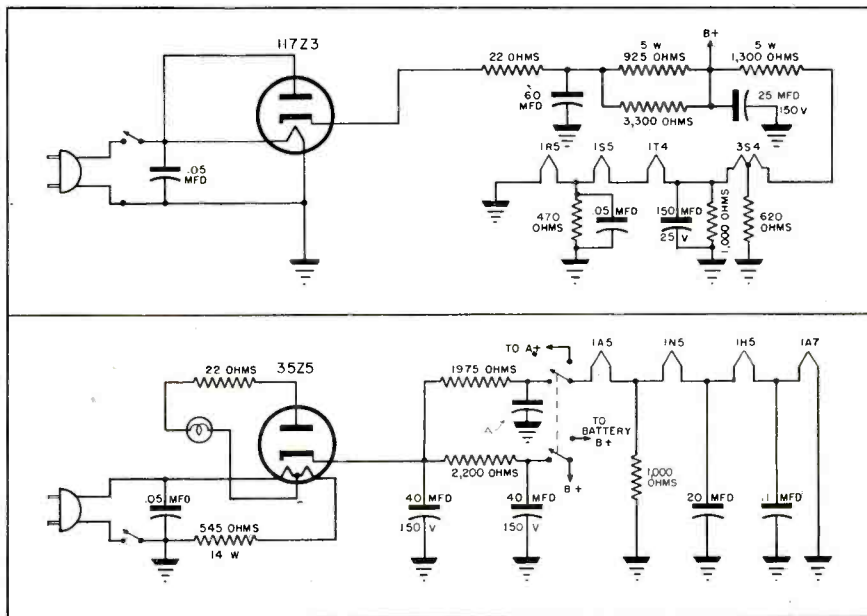


Fig. 1 (top). Filament-supply system of the Garod 5D-3, which can be used as an effective basic circuit to follow in converting battery receivers to line operation.

Fig. 2. The power-supply system of the Grantline 510-series A. In this model the value of the filament-dropping resistor is predicated on the fact that the plate of the rectifier is fed from the line at a reduced voltage of approximately 80. The capacitor, A, has a value of 6f about 200 mfd.

Converting Battery Sets for A-C/D-C

CIRCUITS USED IN THE 1.4-volt receivers are very handy base systems to follow in converting battery receivers for line operation.

In the circuit of Fig. 1, for instance, Garod 5D-3, the filtering used for the B supply (67 volts) supplements the A supply filter.

The sequence of tubes has been so arranged that the required bias voltage for the 3S4 output tube is supplied by the filament drop across the three other tubes. By using a 117Z3 for the rectifier, no filament dropping resistor is required for the line circuit. This circuit employs four tubes with a total filament voltage drop of 7.5. It will be noted that the filament filter capacitor of 150 mfd is installed between the junction of the 1T4 and 3S4 filaments. If no room can be found to install the 117Z3, a selenium rectifier may be used. The results will be the same, and the circuit simplified.

Figure 2 shows a similar power-supply system as used in the Grantline model 510-series A. Here, the value of filament dropping resistor is predicated on the fact that the plate of the rectifier is fed from the line at a reduced voltage, approximately 80 volts. Here, too, the bias voltage for

the output tube, a 1A5GT, is supplied by the filament drop across the other three tubes. The use of a 35Z5 permits the installation of a pilot light. However, if this is not required, a selenium rectifier would simplify the construction, and remove the need for a line-dropping resistor. If it is desired to serve more than four tubes, or increase the filament voltage, all that is necessary is to reduce the value of the 1975-ohm filament. For this purpose a 2,200-ohm adjustable resistor should be used, and the tap adjusted for proper filament voltage. The reduction in resistance amounts to approximately 30 ohms per 1.5-filament drop for any voltage above 6 volts.

An additional filter is employed in this filament circuit. A 20-mfd low voltage capacitor is connected from the junction of the 1N5 and 1H5 filaments to ground. This additional filtering is necessary for proper hum-free reception.

Both of the circuits shown incorporate good circuit design, and should be followed carefully. The installation of a double-pole double-throw switch is advised to permit changing over from battery to line operation;

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News

(Continued from page 29)

is now located in building 16, at 1000 Main Ave., Clifton, New Jersey. Telephone number is Sherwood 2-7440.

* * *

STOCK CABINET AVAILABLE FROM MALLORY

A steel stock cabinet with an inventory and recorder guide and a rack for a copy of the Mallory radio service encyclopedia has been made available to Service Men by P. R. Mallory & Co., Inc., Indianapolis, Indiana, at no extra cost with a purchase of an assortment of fifteen Mallory controls and nine a-c switches. It is said that the fifteen controls and nine switches which are recommended for this assortment will cover more than 90 per cent of average requirements.



* * *

RCA TUBE POSTERS

A series of 22"x28" posters advertising repairs, parts, tubes, and the three RCA tube brands, RCA Victor, Cunningham, and RCA, have been prepared by RCA.



* * *

ARCTURUS RADIO & TELEVISION CORP. FORMED TO MAKE TV SETS

The Arcturus Radio & Television Corporation has been formed as an associate company of Standard Arcturus Corporation of Newark, N. J., to produce tv receivers. The offices and plant of the new company will be at 19 Nesbitt Street, Newark, N. J.

James R. Donahue, formerly sales manager of Standard Arcturus, has been elected president of Arcturus Radio & Television Corp.

John V. Rice, formerly associated with National Union Radio Corporation, has been named sales manager in the tube division of Standard Arcturus.

* * *

MASTER INDEX TO RIDER MANUALS TO BE RELEASED IN AUGUST

A 204-page master index to the *Periodical Troubleshooter's Manuals* pub-

(Continued on page 41)

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Servicing Helps

(Continued from page 33)

is still to be determined. If it has been definitely determined that the hum is being injected by the filament supply, all filters in this circuit should be checked. Here is where a possible error may cause puzzlement. Two precautions must be observed. First, the suspected filter should always be disconnected before the substitute is connected in the circuit. This will prevent any defect in the replaced part from affecting the results. The second precaution is to use a capacitor of equal capacitance when replacing. Most filament-supply bypass capacitors are at least 100 mfd or more. A smaller capacitor may be ineffective.

Hum in B Supply

If the hum is found to be caused by the B supply, then the filter network

should be checked. Here again, the original filter should be disconnected before replacement. In three-way portables, the filter network is usually a simple one, involving a filter resistor, and two filter capacitors. The filter resistor should also be checked for proper resistance value, since often, these resistors short out.

A-C/D-C Sets

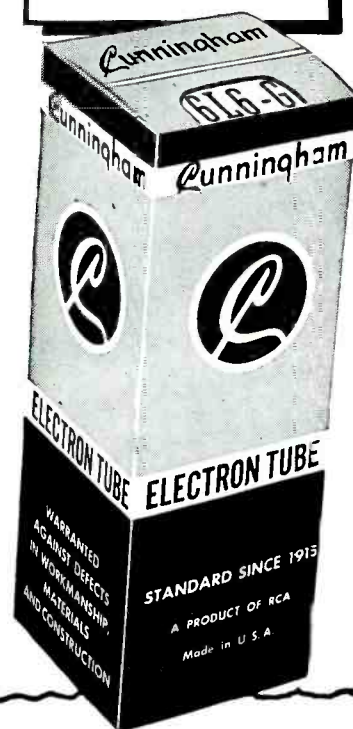
In straight a-c, or a-c/d-c receivers, a more complicated method is required. For quick checking, an electrolytic capacitor of high capacity and appropriate voltage rating should be used. A 20-mfd 450-volt capacitor would be adequate. This capacitor is used to short out progressive circuits to aid in determining the defective component. Two initial steps will immediately isolate the offender in broad, general terms. First, the capacitor should be placed from chassis or ground to the diode detector. If the hum disappears, then the trouble is in some previous circuit. If the hum does not disappear, then the capacitor should be placed from output plate to ground. If the hum disappears, then the trouble is in the audio circuit. To determine just where the hum is being injected, the grid and plate circuits of all the tubes should be shorted out until a point is found where application of the capacitor has no effect. The trouble then lies between this point and the first point where the hum disappears.

Other Hum Sources

Once the offending circuit has been isolated, the number of components requiring checking is minimized. Invariably, the trouble is some filter capacitor, although cathode to filament shorts in tubes are often responsible. Another source of trouble is resistors which have changed value. For example, a plate or grid resistor which has increased in value may create such a high impedance in the circuit, that even a slight hum may be amplified to objectionable proportions.

The possible sources of hum cannot be listed, since they are as numerous as the components in the receiver. However, a systematic procedure should be adopted to reduce servicing time.

BUILT FOR SERVICE



Technical Tips

Why Gassy Tubes Affect AVC Bias

The cancellation of negative bias voltage in an AVC line as a result of gassy tubes is more easily corrected than recognized as a cause of faulty performance. The major symptom—distortion of strong signals—is often diagnosed as due to some other cause.

The condition is brought about by the gassy tube drawing grid current. This current flows through the AVC line where it develops a voltage in opposition to the signal-developed AVC voltage. As a result, all AVC-controlled tubes operate at too low a negative bias voltage and, therefore, draw excessive plate current with resultant distortion.

Not all tube checkers will show up a gassy tube. Therefore it is advisable to track down the bad tube by replacing tubes in the receiver with tubes that are known to be good. Cunningham's are always a reliable choice.

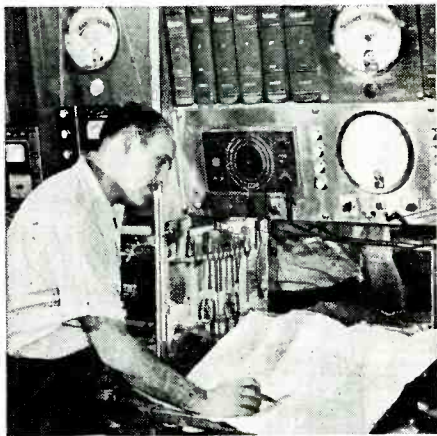
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Choosing P-A Systems

(Continued from page 15)

reduced to limit the average output, or a 3 to 4 db pad between its output and the booster input, may be used with satisfactory results.

More elaborate amplifier systems use a separate voltage amplifier designed to drive one or more power amplifiers, with provision in the voltage amplifier to add booster driver stages when additional power amplifiers are to be added to the system. Preamplifier stages may also be added to some of these voltage amplifiers, to provide additional inputs for low or high-impedance microphones, etc.

There are other types of loudspeakers available for special applications. For instance, the radial or 360° horn loudspeaker is designed to hang overhead to cover a uniform area all around it. Microphone placement, to prevent feedback, is difficult; some designs have the *deadest* dead spot directly under the center of the speaker. Some of these types use diaphragm-type driver units with a 25-watt rating and others use cone units. A few models have fairly good response. Others, however, tend to accentuate the middle bass region due chiefly to design restrictions on size, weight, etc. Radial speakers find considerable application in ice rink installations, and the like.

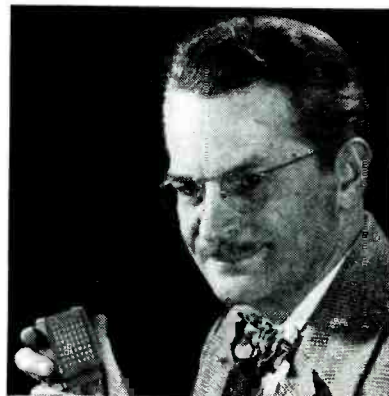
There are also very small horn-driver units available which are efficient, but are strictly for speech reproduction in paging systems, etc. These horns suppress almost all the bass and accentuate the high frequencies which produce the best speech intelligibility with minimum power. They have a wide dispersion angle and are rated at about 5 watts. More expensive p-a systems which are installed with the purpose of furnishing the clearest,

most intelligible speech, utilize high-frequency diaphragm-type driver units on multicellular horns. These systems have a reproduction range to at least 8,000 cycles and higher in the treble register and start cutting off between 300 and 500 cycles on the low end, with a gradual taper of 6 to 12 db per octave. Caution must be exercised in the system design that too low frequency power in excess of the speaker unit's capabilities is not applied. High-pass networks are available for this purpose. However, as these are primarily high-quality speech systems, the amplifiers and loudspeakers must be operated well below their maximum output power capabilities as distortion created in any part of the system is more apparent than in the average commercial p-a system where some distortion is present even at low power outputs. Needless to say, the amplifiers used in these systems should be of the best design and manufacture available, for the same reason. Assuming that the loudspeakers are thus operated below their distortion limit, as specified by the manufacturer, coverage should be based on the maximum power the amplifier will produce, with low distortion content preferably not more than 3 to 5% intermodulation distortion.

To sum up, then, adequate p-a systems can be designed as soon as a survey is made of the premises, under the conditions in which the system will operate. Coverage and power required can be determined on the basis given, with the additional note that *dead* and highly damped rooms

Miniature microphone, announced by Wilcox-Gay, which can be used for stand or lapel applications.

Unit of unitized amplifier system developed by Fairchild Camera and Instrument Corp. Units now available include a 35-watt power amplifier and a microphone preamplifier with a gain of 40.



Tube News

(Continued from page 19)

lected by the screen. This results in a net decrease in current at the plate which continues from point *B* to point *C*. At point *C* the plate has obtained a potential sufficiently positive to re-attract many of the electrons and therefore the plate current again swings upward to point *D*. An increase in plate voltage above point *D* has little effect on the electron stream through the screen due to the shielding influence of the screen. Therefore, further increases in plate voltage do not appreciably affect the total plate current of the tube. In normal operation tetrodes are operated beyond the region of point *D*.

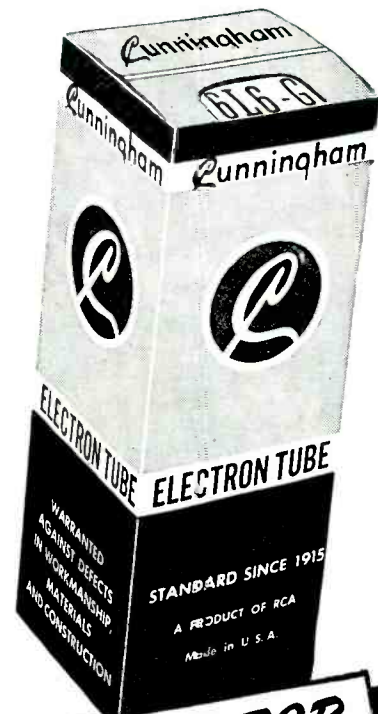
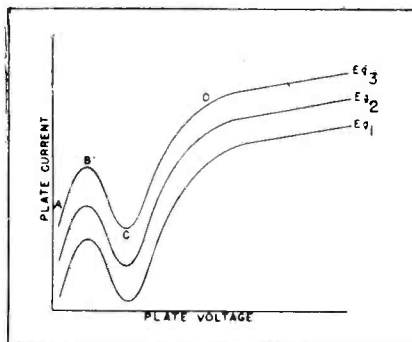
Pentodes

The addition of a grid, operating at low potential, between the plate and screen of a tetrode prevents secondary-emission electrons from being attracted to the screen and therefore eliminates the undesirable dip in the lower portion of the characteristic curve and allows wider swings in plate voltage. A tube with this third grid is known as a pentode; typical circuit is shown in Fig. 11, with average characteristics shown in Fig. 12. Since the plate voltage may swing over a wide range without seriously affecting the performance of the tube, pentodes permit high-voltage amplification at normal values of plate voltage in voltage amplifiers and high power output with relatively low grid-driving voltage in power-amplifier operation.

Fig. 13 illustrates a variation in pentode construction. This type is known as a beam-power tube because the electron stream is formed into

(Continued on page 38)

Fig. 10. Here we have curves of tetrode operation: if the screen grid voltage is held constant and the plate voltage is increased from zero, the curves shown in *a*, *b*, *c* and *d* will result.



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or halls will require more power than live ones. A ratio of 6 db either way from average may not be unlikely. In some live halls, the power must be markedly reduced to avoid the results of bad reverberant conditions. This situation can often be helped by attenuating the lower frequencies, starting sometimes as high as 1,000 cycles with gradually tapering reduction of the frequencies below. When all these factors have been carefully weighed, the p-a man will then have enough data to choose the necessary amplifiers, loudspeakers, etc., for making up the most economical system that he knows will perform well.

Power and cost go hand in hand, and it is true that a few dollars can be saved on the initial installation by running the system to the overload point of amplifiers and speakers. This, however, is extremely poor economy both for the short and long view. The added cost of the next size amplifier is usually insignificant compared to the total cost of the installation, to say nothing of cost of subsequent free service often required to keep a marginal system sold. Most important to the p-a man, the system that is *just getting by* is extremely poor advertising for those who installed it.

Tube News

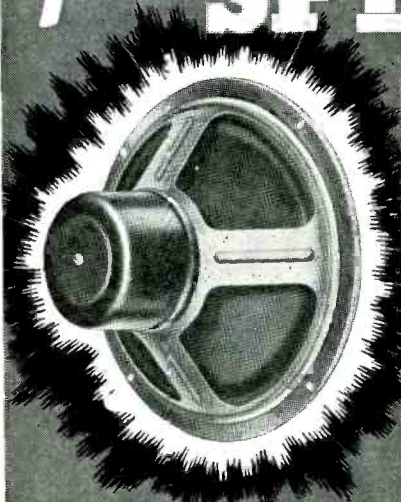
(Continued from page 37)

beams, or sheets, as it travels from cathode to plate. The beam-forming characteristic is accomplished through alignment of grid and screen windings so that few electrons come in contact with the screen but rather are projected between the screen windings, thus resulting in very low screen current and ultimately in high operating efficiency. Suppressor action is accomplished in beam-power tubes through a space-charge effect rather than through the use of a suppressor grid. This space-charge is set up in the tube by beam-forming plates and by the rapid deceleration of electrons as they pass from the high-potential screen to the plate. The space-charge repels secondary electrons from the plate and the operation of the tube is similar to that of most pentodes with the exception of the lower screen current.

Multigrid Tubes

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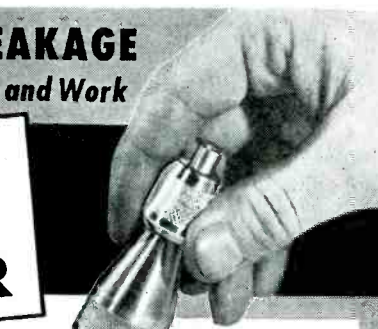
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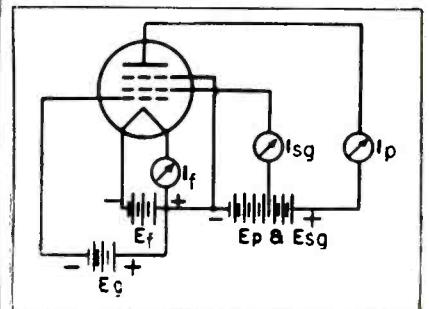
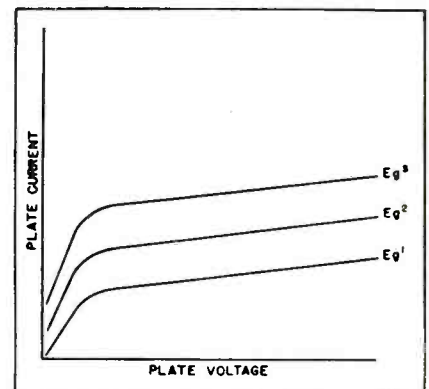


Fig. 11. A typical pentode circuit.

Fig. 12. Characteristic curves for the pentode circuit of Fig. 11.



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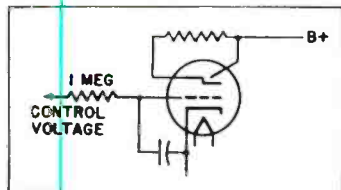
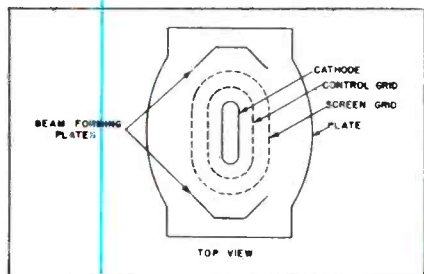


Fig. 14. Indicator-tube circuit.

Fig. 15. Beam power-tube construction.



AT A RECENT SIMPSON SALES CONFERENCE



Direct factory representatives of Simpson Electric Company, Chicago, who met at a recent sales conference at Lac du Flambeau, Wisconsin. Among the products discussed at the conference were the new Simpson 390 volt-amp-wattmeter, volt-amp-milliammeter in carrying case, and roll top model 260. Ray S. Simpson, president, was host.

Tube News

(Continued from page 38)

stream. Examples of multigrad tubes are the hexode, heptode, and octode varieties which may perform such functions as the mixing of two signals at different frequencies resulting in an output frequency equal to the difference between the two, and may even perform the function of oscillation and mixing within the same tube.

Multunit Tubes

Recently tubes have been produced with more than one unit in the same envelope in order to conserve space and provide short connecting paths between electrodes performing related functions. A few examples of these types are diode-triodes, rectifier pentodes, twin diodes, triode-hexodes.

Indicator Types

The most popular of the line of indicator types is the so-called eye tube. Through the use of this tube precise tuning of receivers and visual indication of test conditions are made possible. The eye tube usually consists of a triode amplifier with an auxiliary fluorescent screen visible through the top of the glass tube.

Eye-Tube Circuit

A luminous pattern is varied on the fluorescent screen by a deflection electrode internally connected to the output of the triode amplifier. A typical circuit for this tube type is illustrated in Fig. 14. The control voltage for the indicator tube is usually obtained in receivers from some point in the avc system so that exact tuning of a station is possible even with the volume control in the low position.

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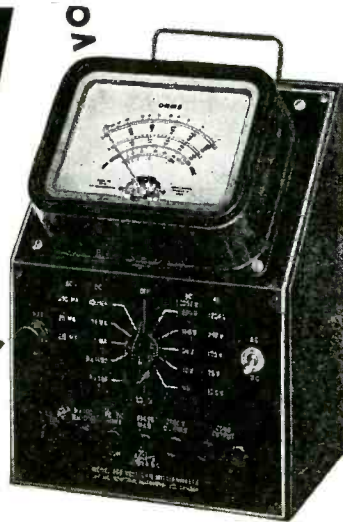
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F-M Alignment

(Continued from page 20)

best possible symmetrical response of the i-f and discriminator circuits.

The remaining few adjustments are not very critical and are much the same as those associated with the alignment of the first detector and oscillator of regular high frequency bands. The signal generator is set in accordance with the receiver manufacturers' service notes, to let us say, 90 mc, and the oscillator trimmer and r-f input trimmer adjusted for maximum reading of the resonance indicator which is still a microammeter in series with the limiter stage grid resistor return. The receiver dial is, of course, tuned for the reception of the same frequency at which the signal generator is set.

Note of Caution

This completes the adjustment of the receiver. However, there is one note of caution in connection with the operation of an f-m receiver once it has been installed with the proper antenna system; tuning of an f-m set is a bit different from the process usually associated with the tuning of receivers designed for amplitude-modulated carriers.

F-M Tuning

When tuning for and approaching an f-m station carrier, the speaker output will slowly become louder and louder, and in the event that external noises are present, these noises will at the same time be quite discernible. However, continuing the tuning process, a point will be reached where the station signal will seem to grow a bit weaker, but simultaneously the noise level will almost automatically and practically disappear. At this point the receiver is properly tuned and if the operator continues to turn the dial the signal will again appear to increase but with consequent increase in noise level. Then as tuning is continued further past the station, the signal will slowly pass out entirely.

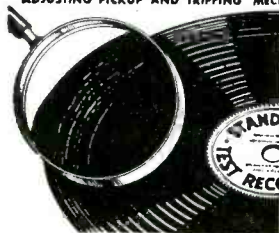
If the f-m receiver incorporates a single or multiple shadow tuning eye, the operator should then tune, per the set manufacturer's instructions for the required eye pattern, instead of by ear.

**NUMBERS 4 and 5 OF THE
WALSCO Hit Parade**

THE SENSATIONAL, NEW, SCIENTIFIC

WALSCO STANDARD TEST RECORD

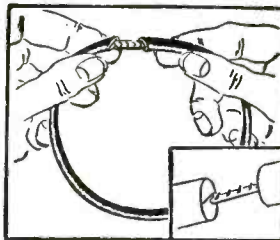
FOR IMMEDIATE . . . ACCURATE . . . AUDIBLE ADJUSTMENT OF RECORD CHANGERS AND COIN OPERATED PHONOGRAPHS SOLVES THE PROBLEM OF ADJUSTING PICKUP AND TRIPPING MECHANISM THROUGH



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- Made to RMA and NAB standards.
- Record plays in less than 40 seconds.
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The WALSCO Standard Test Record saves time and increases efficiency in the adjustment of record changers and coin operated phonographs. Write for full information.

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THE UNIVERSAL DIAL DRIVE
BELT CAN BE CUT TO FIT
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Will not Slip or Stretch**



"UNIBELT" comes in 5-foot length spools and can be installed without taking dial mechanism apart. A real time and money saver. Eliminates the need for stocking numerous sizes of belts.

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*For Timely and Authoritative Analyses of the Latest
in F-M, A-M and TV Circuits, You Must Read Every
Issue of SERVICE*

CIRCULATION NOW OVER 20,000 ABC NET PAID

News

(Continued from page 34)

lished by John F. Rider, Publisher, Inc., 404 Fourth Ave., New York 16, N. Y., will be released in August.

Master index will cover all editions of Rider manuals through volume XV, which appeared in 1946, and will include the RCA-Cunningham and the abridged I-V manuals.

Index will cover sets from 1919 through 1946.

* * *

G. E. PARTS CATALOG

A 24-page brochure on universal electronic parts, ESD-93, has been published by the specialty division of General Electric.

The publication lists the price, specifications and other data on sixteen parts in the division's line. Resistors, controls, antennas, the variable reluctance pickup, and loudspeakers are among the parts described in the new brochure.

Copies may be secured from G. E. distributors or by writing the Specialty Division, G. E. Electronics Department, Syracuse N. Y.

* * *

T. P. CUNNINGHAM BECOMES SYLVANIA AD MANAGER

Terry P. Cunningham has been appointed advertising manager of the radio tube, electronics and international divisions of Sylvania Electric Products, Inc. He served as advertising manager for the radio tube division for two years before becoming sales manager for the home radio division of Colonial Radio Corporation, a Sylvania subsidiary, in 1944.



* * *

CONCORD RADIO CATALOG SUPPLEMENT

A 72-page catalog supplement with data on sets, parts, record players, changers,

sound equipment, test equipment, etc., has been published by the Concord Radio Corporation, 901 West Jackson Blvd., Chicago 7, Ill.

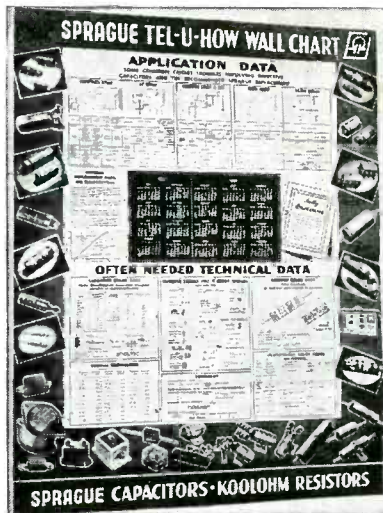
* * *

SPRAGUE SERVICE DATA WALL CHART

A 22"x28" wall chart for service shops is now being offered by Sprague Products Company, North Adams, Mass.

Chart includes handy service application data; diagrams and descriptions of common circuit troubles involving capacitors and their remedies; general replacement data on electrolytics; formulas; transformer, resistor and capacitor color codes; schematic symbols, etc.

Charts are now in the hands of Sprague distributors throughout the country and Service Men can obtain free copies from them on request.



* * *

IRC CONTROL CABINET

A popular-price kit of controls, the junior control cabinet, has been introduced by the International Resistance Co., 401 N. Broad St., Philadelphia. Kit contains an assortment of nine 1/2-, 1- and 2-megohm controls, plus four switches and four special shafts.



* * *

LAFAYETTE RADIO FLYER

A summer flyer, C-39, featuring listings on tubes, transformers, inductors,

(Continued on page 42)

JOHN RIDER SAYS ...

Don't Starve Your Business

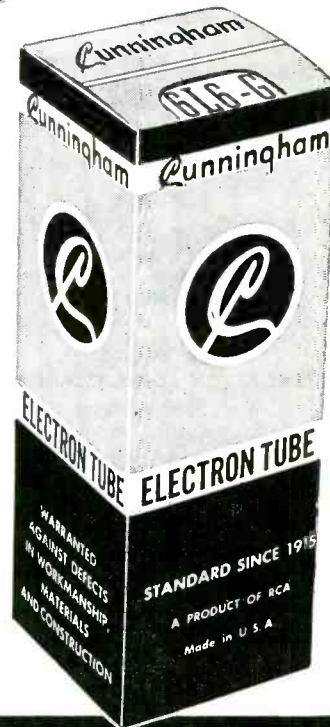


Generally speaking, a business must spend money to make money.

This does not mean a wanton waste of money, but it does mean recognizing the full requirements of business. No organization can mark time without incurring financial losses—for expenses continue as long as the business is alive. Frugality, at the sacrifice of operating efficiency or of expansion of activity, is not sound business.

If national economics appear uncertain, and definite planning seems almost impossible, new ventures may be unjustified. But, those activities which are sound must be kept vigorous. Any act which tends to reduce income may lead to eventual liquidation, whereas every act which tends to reduce the cost of producing the income paves the way to greater success.

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News

(Continued from page 41)

capacitors and resistors, sets, phono players, magnetic wire recorders, etc., has been published by Radio Wire Television, Inc., 100 Sixth Ave., New York City.

C. W. HENDERSON JOINS CLAROSTAT

C. W. Henderson has joined Clarostat Mfg. Co., Inc., as sales engineer in the Philadelphia area. For the past thirteen years he has been with RCA.

RCA REVISED EDITION OF MINIATURE-TUBE CHART

A revised edition of the *Quick-Reference Chart* on miniature tubes has been published by the RCA commercial engineering tube department, Harrison, N. J.

Covering RCA's line of 48 miniature types, this new edition features a functional classification of the various types; representative tube illustrations; and charted fundamental data, characteristics, text description, as well as socket-connection diagrams for each type.

JFD CATALOG

A 44-page catalog describing battery plugs, cements and solvents, neutralizing tools, f-m and tv antennas, auto antennas, dial pointers, dial belts, dial cable, etc.,

has been published by the JFD Manufacturing Co., Inc., 4117 Fort Hamilton Parkway, Dept. Y, Brooklyn 19, New York.

ELWES NOW MANAGER OF RCA COMMERCIAL SOUND SALES

Herbert C. Elwes has been appointed manager of commercial sound sales in the RCA engineering products department.

Mr. Elwes was formerly merchandise manager in the RCA theatre equipment section.

ELECTROPARTS CATALOG

A 4-page catalog covering cements, solvents, lubricants and cleaners has been released by Electroparts, Glendale, Calif.

AEROVOX MOTOR-CAPACITOR SERVICING KIT

A motor-capacitor servicing kit that determines the right capacitance in the absence of such information or identification, and then provides that capacitance until standard replacements are available, has been announced by Aerovox Corporation, New Bedford, Mass.

Kit features a capacitor selector which clips in place of the defective motor-starting capacitor. Five toggle switches are flipped until the quickest start is ob-



tained within safe voltage limits as indicated by the voltmeter. Correct capacitance value is read from the *on* switches.

RCA PARTS CATALOG SHEETS

Four catalog sheets on the RCA p-m speaker, television parts, television antennas and accessories, and the *magic tone* cell phonograph modernization kit, have been released by the renewal sales section of the RCA tube department.

New Products

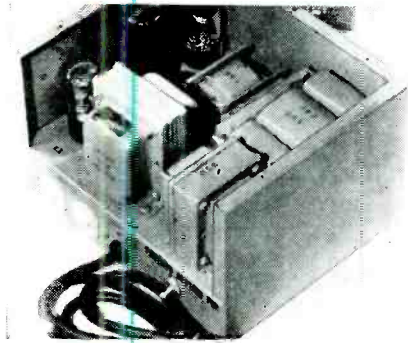
(Continued from page 31)

SORENSEN A-C VOLTAGE REGULATOR

A portable a-c voltage regulator, model 150, has been announced by Sorensen & Company, Inc., 375 Fairfield Ave., Stamford, Conn.

Regulator has an input-voltage range of 95 to 125 volts a-c with an output of 115 volts. Regulation accuracy is said to be 1/2 of 1% and maximum harmonic distortion is 5%.

Unit measures 9"x7 1/2"x6".



RCA INTERCOMS

A line of selector type intercom systems (masters and remotes) has been announced by RCA's sound equipment section.

Systems feature cabinets 10 3/8" x 7 1/8" x 5 7/8". Selector keys have transparent identification strips for numbers, initials, names or titles of personnel.

Models MI-12596-1 and MI-12596-2 are master stations with six selector keys and may be connected to as many as six other masters, remotes or a combination of these; MI-12596-2 has an earphone for listening privacy.

Models MI-12596-3 and MI-12596-4 are master stations with twelve selector keys and may be connected to as many as twelve other master or remote sta-

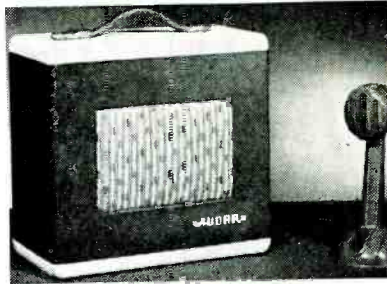
tions; MI-12596-4 has the earphone for privacy.

Model MI-12595 is a remote station.

AUDAR PORTABLE DISC RECORDER

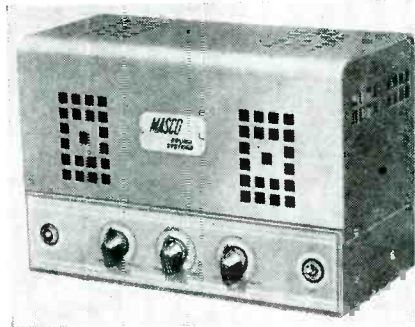
A portable disc recorder, RE-8, featuring a high output amplifier, neon recording level indicators, 6 1/2" p-m dynamic speaker, and hand microphone with seven feet of cable, has been announced by Audar, Inc., Argos, Ind.

Switching from recording to playback is governed by a single control.



MASCO 12-WATT PHONO AMPLIFIER

A 12-watt amplifier, MA-121, featuring separate bass and treble equalizers; 1 input compensated for crystal pickup; 2 input for constant amplitude signal; push-pull output; overall negative feedback; separate line and voice coil impedances, and bass-compensated volume control, has been announced by the Mark Simpson Manufacturing Co., Inc., 32-28 Forty-ninth Street, Long Island City 3, New York.



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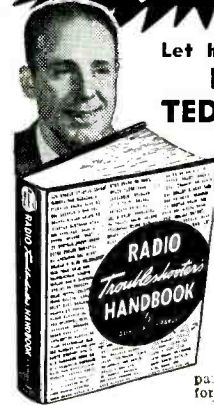
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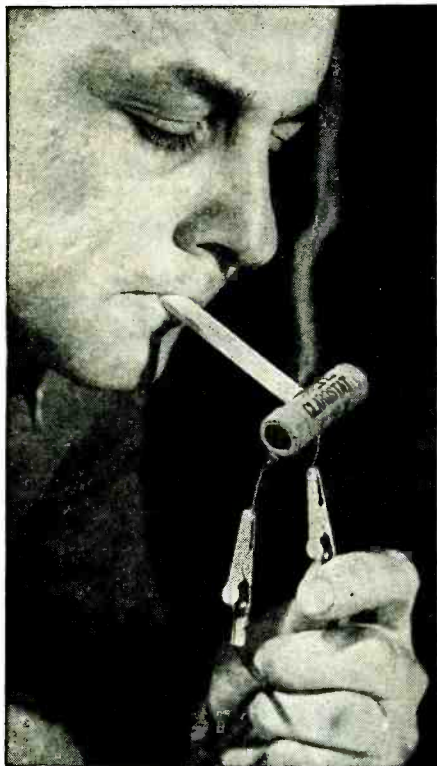
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SERVICE, AUGUST, 1947 • 43



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JOTS AND FLASHES

THE REALLOCATION OF F-M STATIONS, which will double station spacing will be placed into effect on October 1. According to R. B. Dome, consultant to the receiver division of G.E., this increase in separation should permit the production of lower priced f-m receivers. He says that the doubling of the frequency spacing from the present 400 kc to the new 800 kc will permit the reduction of the number of tuned circuits from eight as needed at present to about four. This reduction will provide for a smaller chassis and cabinet, additional factors which will probably cut receiver cost. . . . B. Altman & Co., New York, will serve as a dealer for Industrial Television, Inc., Nutley, N. J. . . . A series of new streamlined boxes and cartons have been designed for RCA parts. Cartons will contain complete technical data such as voltages, capacities, etc. . . . General Distributors have moved to a new location at 26 10th Street, Wheeling, W. Virginia. . . . A "wall view display" holding bags of hardware and parts has been designed by General Cement Manufacturing Co., 919 Taylor Avenue, Rockford, Ill. An 8-page catalog describing and illustrating the card displays, as well as the various items (screws, bolts, nuts, springs, dial drives, clips, plugs, tack bumpers, phono needs, alignment tools, rubber grommets), which are mounted on these display cards, has also been published by General Cement. . . . R. N. Wiesenberger has resigned from the Ward Products Corp. (division of the Gabriel Co.), 1523 E. 45th Street, Cleveland 3, Ohio. R. B. Unger is now sales manager. . . . Jack Poff, service manager, Astatic Corporation, Conneaut, Ohio, has been visiting distributors and conducting service meetings during the past few weeks. . . . Leroy W. Beier, 600 S. Michigan Avenue, Chicago 5, Illinois, is now sales representative for the Mueller Electric Co., 1583 E. 31 Street, Cleveland 14, Ohio, for the Illinois, Indiana and Southern Wisconsin areas. . . . A 4-page bulletin describing high-frequency converters, No. C20, has been published by Columbus Electronics Corp., 229 S. Waverly Street, Yonkers, N. Y. . . . The Insuline Corporation of America have opened another plant in Long Island City at 19th Avenue and 36th Street. . . . Robert Gunderson has become affiliated with the Newark Electric Co., 115 W. 45th Street and 212 Fulton Street, New York City. Bob will act as a consultant on amateur equipment. . . . A 16-page booklet, "What's Your Television I.Q.?" has been released by RCA. The brochure covers such problems as costs, installation, programs, networks, tuning, picture sizes, etc. . . . H. W. McKeague has been named purchasing agent for the home radio division of Westinghouse Electric. . . . Sam Norris is now executive vice president of Amperex Electronic Corporation, Brooklyn, N. Y. Mr. Norris has been sales manager of Amperex since 1942. . . . The New York Office of P. R. Mallory & Co., Inc., is now located at 41 E. 42nd St., N. Y. C. (Suite 1215). . . . John I. Crockett, Jr., has been named sales manager of Merit Coil and Transformer Corp., Chicago. Herb Becker, 1406 S. Grand Ave., Los Angeles 15, Calif., will represent Merit Coil in Southern Calif. and Arizona.

* * *

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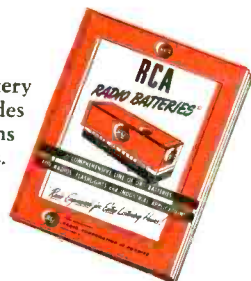
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6. They're backed by the greatest name in radio—RCA.

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Flashlight Portable A's Portable B's Portable AB's Farm A's Farm B's Farm AB's Industrial



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RADIO CORPORATION of AMERICA

HARRISON, N. J.