

JUNE

1941

Radio

SERVICE DEALER

This Month

ELECTRON MULTIPLIER

SELF-CHARGING SET

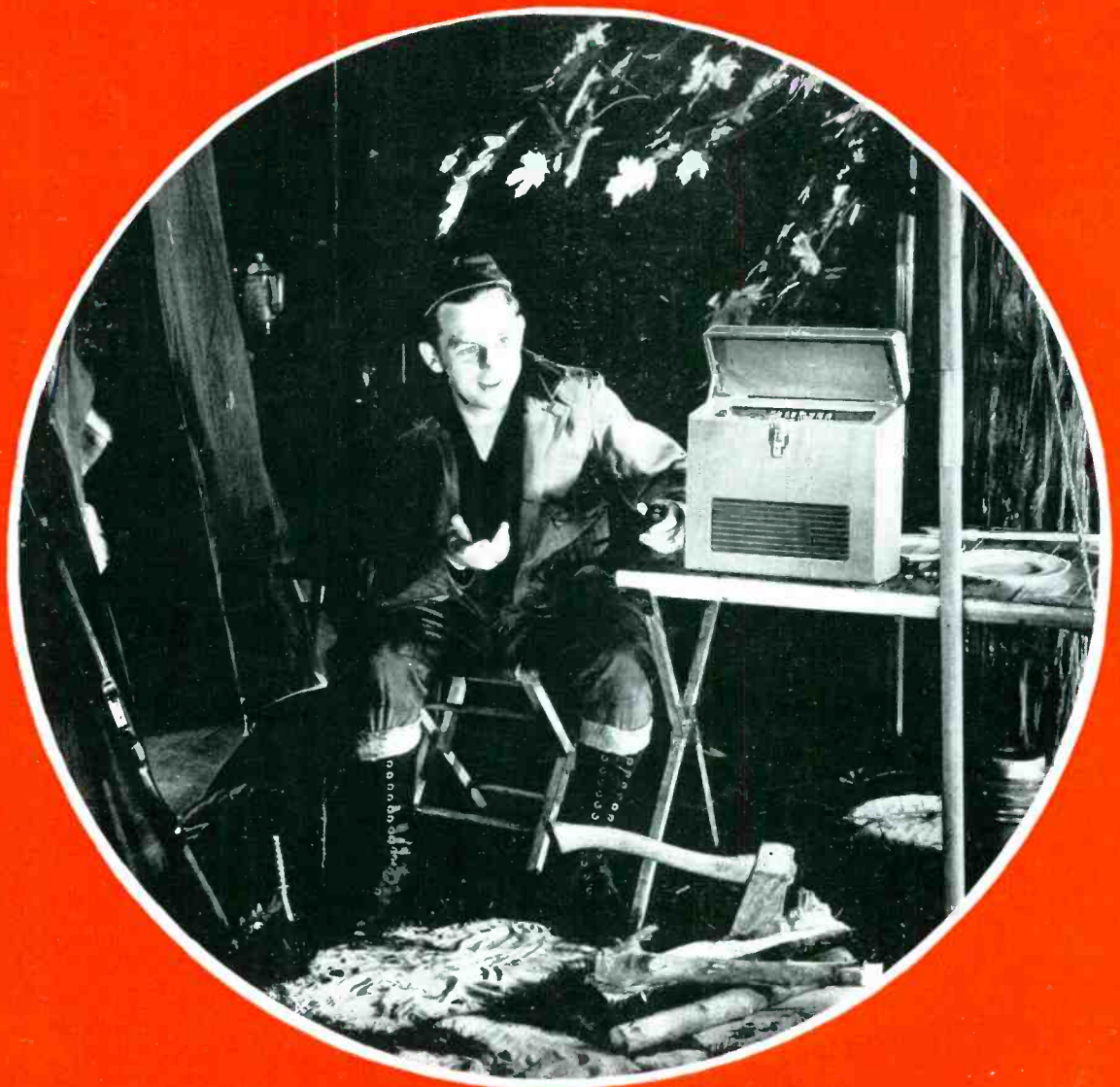
KATYSCOPE ALIGNMENT

SERVICING CHANGERS

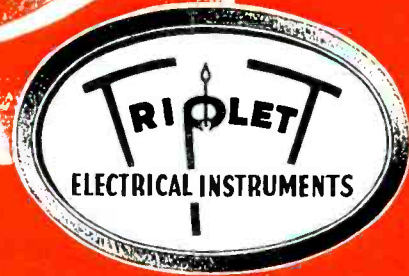
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**CHECK THESE
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- 10,000 OHMS DC PER VOLT**
- 5,000 VOLT FULL SCALE AC-DC**
- 11,000 VOLTS BREAKDOWN TEST**
- CARTRIDGE LOADING BATTERIES**

The Model 625-T Volt-Ohm-Ammeter

DC VOLTS—0-2.5-10-50-250-1000-5000 at 10,000 Ohms per Volt.
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Radio

SERVICE-DEALER

SOUNDMAN AND JOBBER

Reg. U. S. Pat. Off.

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Cover Photo



★ New in the way of outdoor sets is this self-charging portable receiver, by General Electric. It contains a miniature 2-volt storage battery and synchronous vibrator, and operates from a.c. as well. See article on page 18.

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VOL. 2 No. 6 ★ JUNE, 1941



Racon's New Sound Reproducers Fill A Need Long Felt By All Jobbers and Soundmen

On land, at sea, and in the air—for every type of sound installation—RACON speakers are preferred, specified and used by leading Soundmen. RACON, the oldest, largest and foremost manufacturer of air-column speakers in the world makes a speaker, driving unit, horn and baffle for every kind of sound installation imaginable. RACON's patented, exclusive features such as Storm-proof, Weatherproof Acoustic Material and our line of Unbreakable Horns cannot be duplicated—and every RACON speaker delivers maximum output and response for the size of driving unit used.

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RACON ELECTRIC CO. 52 EAST 19th ST. NEW YORK, N. Y.

TRANSIENTS

TELEVISION

TELEVISION CAN make its nation-wide commercial debut on July 1st under the auspices of regulations adopted by the FCC, now that the Commission and the Industry have agreed upon standards.

The standards fix the line and frame frequencies at 525 and 30, respectively. The 525 lines provide for greater detail in the picture transmitted than the 441 lines advocated a year ago. This change will be helpful in view of the trend to larger screens on current receivers.

Frequency modulation is required for the sound accompanying the pictures. Thus, television is now benefited by the recent developments made in f.m.

Other developments are provided for in the requirement that the standards be accorded six months of practical tests, at the conclusion of which further changes may be considered, with particular reference to color television.

On the record made at the March hearing, the Commission fixes 15 hours a week as a reasonable minimum for program service.

On the plea that more than the seven lower channels in the present television band are needed for adequate development of commercial service, the Commission is making the eleven upper channels likewise available.

Our recent prediction that television would get under way commercially by Labor Day may prove correct, unless a state of national emergency forestalls further activity.

COOPERATION

ELSEWHERE IN THIS issue is an interesting news item regarding the tie-up between servicemen and stations WOWO-WGL, in Fort Wayne, Indiana. Meetings are held regularly in one of the studios, and subjects of interest and benefit to both the servicemen and the station officials are dealt with.

If you will stop to consider the matter, broadcast stations must rely to a great extent upon servicemen to maintain optimum program service in the stations' areas. Conversely, the serviceman's business is dependent upon broadcast-station activities. It seems logical, therefore, that the two groups should cooperate.

Though the tie-up mentioned is attributed directly to the Radio Moving Day campaign, no such other stimulant should be necessary to establish more station-servicemen meetings in localities where such get-togethers are feasible.

SERVICE CHARGES

SERVICEMEN CAN no longer afford to ignore the upward swing in the prices of consumer commodities, and continue the sale of parts and services at substandard scales. Radio servicing is a business like anything else, and if one wishes to stay in business, it is essential that he place a price on his product or service that will permit him to keep going. Many servicemen do not seem to understand this.

The present is no time to fail, nor is it a time to sink below the normal living standards. Your bread and butter, and the products you purchase for resale are going to cost you more, and you must get more to make up the difference. On the whole, service charges have been ridiculously low, and it is high time they were brought up to a common-sense level.

You're not helping national defense if you fail. Good servicemen are needed, so keep your head above water.

Suppose *YOU* Were the Customer...



... Which Serviceman Would You Deal With?

IRC Type D Universal Controls give you the edge on competition. With them you can give customers the kind of prompt, accurate service they like—the kind that means better business for you. For Type D's with their famous Tap-in Shafts are the first truly all-purpose controls.

A small stock equips you for the big majority of jobs. No lost time—no wasted motion. Often, you avoid waiting for more costly special replacements to arrive. Type D's are easier to install in crowded chasses. Although smaller in size, they are exact mechanical duplicates of the larger IRC Type CS Controls and equally dependable. Nothing has been changed or cheapened. Type D's have the same 5-finger "Knee Action" element contactor, the same Silent

Spiral Connector between center terminal and rotor shaft, the same type of Metallized element and the same protection against moisture.

IRC Tap-in Shafts are equally dependable—and by far the easiest, most practical of all to use. Choose the shaft position, drive them in with a hammer and the job is done. They stay put—because they employ the same taper socket principle used to hold cutting tools in lathes for heavy work.



60% TO 75%

The 18 controls, 6 switches and 5 extra shafts of special design included in this IRC Master Radiotician's Control Cabinet handle from 60% to 75% of all control replacement needs—as proved by actual count in the IRC Guide! Best of all you get the control cabinet FREE. You pay only the standard price for the controls, switches and shafts, \$14.97 net (\$24.95 list). Ask your IRC jobber about it today. Don't miss it!



TYPE "A" DOUBLE-FLATTED SHAFTS

This exclusive new IRC design gives you a shaft that eliminates the use of inserts and will fit practically any knob without filing. It's a time-saver that will account for tangible savings to the busy service man.



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INTERNATIONAL RESISTANCE CO. • 401 N. Broad Street • Philadelphia, Pa

THE MULTIPLIER PHOTOTUBE

Combination Electronic Pin-Ball and Slot-Machine Game Cracks Jackpot at Every Post

FORECASTING the trend in electrical amplification have been the occasional rumors regarding the laboratory development of electron-multiplier tubes capable of amplifying weak currents far beyond the gains that can be derived from present-day vacuum tubes. A tube of this sort has now been made commercially available.

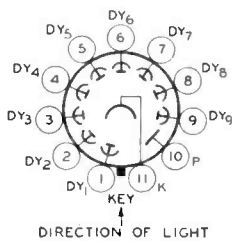


Fig. 1. The RCA-931 socket connections. DY-1 to DY-9 are dynodes, P the anode, and K the cathode.

The first specimen to reach the market is not a radio tube, as many anticipated, but the RCA-931 Multiplier Phototube of the high-vacuum type. It is capable of multiplying feeble currents produced by weak illumination as much as 230,000 times. The multiplying action is created by the harnessing of secondary emission, and the resultant output current is a linear function of the exciting illumination under normal operating conditions. Since secondary emission occurs instantaneously, the frequency response of the 931 is flat up to frequencies at which transit time becomes a limiting factor.

CONSTRUCTION OF TUBE

This remarkable tube contains a total of eleven elements, as shown in Fig. 1. Elements 1 to 9 inclusive are dynodes, element 10 the anode, and element 11 the light-sensitive photocathode. The latter employs the S4 photosurface which has a much higher sensitivity to blue-rich light, such as that from a mercury-vapor lamp.

All elements, with the exception of the photocathode, are voltage-operated, though the tube functions as a current or electron multiplier. The voltage on each dynode is

progressively higher than the one preceding it in the series. Finally, the voltage on the anode is higher than the voltage impressed on dynode 9. In practical application, the anode supply voltage is in the vicinity of 1250 volts, the voltage between dynode 9 and the anode approximately 400 volts, and the voltage difference per dynode stage somewhere around 125 volts.

One method of deriving these voltages for the operation of the 931 is shown in Fig. 2. A uniformly-tapped power transformer is used for the dynode supply, and a separate power supply, not shown, is used for the anode. Since the 931 has approximately equal sensitivity for a-c and d-c voltages having the same rms value, the circuit of Fig. 2 is particularly suitable for relay operation.

HOW IT WORKS

An electron multiplier is a vacuum tube which utilizes the phe-

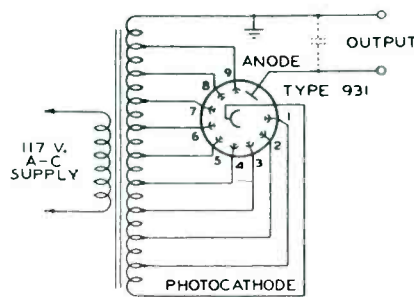


Fig. 2. An a-c power supply for the 931, with uniformly tapped transformer.

nomenon of secondary emission to amplify signals composed of electron streams. The detailed operation of the 931 is depicted in Fig. 3, and a study of the action may be likened to a combination electronic pin ball and slot machine game wherein the jackpot is cracked at every post (dynode). More precisely, the electrons emitted from the illuminated photocathode **O** are directed by the fixed electrostatic fields along curved paths to dynode 1. The electrons impinging on this dynode surface produce many other electrons, the number depending on the

energy of the impinging electrons. These secondary electrons are then directed to dynode 2 where they knock out more new electrons, and these in turn are focused on to dynode 3 where a still greater number of new electrons are released. This multiplying process is repeated in each successive dynode stage, with an ever-increasing stream of electrons, until those emitted from dynode 9 are collected by the anode and constitute the current utilized in the output circuit.

In order to prevent the fluctuating potential of the anode from interfering with electron focusing in the interdynode region, dynode 9 is so shaped as to enclose partially the anode and to serve as a shield for it. Actually the anode consists of a grid which allows electrons from dynode 8 to pass through it to dynode 9. Spacing between anode and dynode 9 is close and, as a result, dynode 9 creates a collecting field such that all of the electrons it emits are collected by the anode. Hence, the output current is essentially independent of the instantaneous positive anode voltage over a wide range. As a result of this characteristic, the 931 can be coupled to any practical load impedance.

The mica shield, shown in Fig. 3, which extends between the photocathode and the anode, shields the photocathode from the anode and prevents ion feedback. If positive ions produced in the high current region near the anode were allowed

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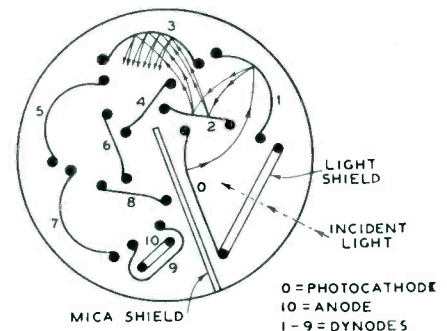


Fig. 3. Schematic arrangement of the 931 structure, showing how the tube functions.

FARNSWORTH P-2 RECORD CHANGER

FARNSWORTH P-2 automatic record changer is a drop mechanism type with the records supported by the spindle and the right-hand record shelf, as shown in Fig. 1. The complete cycle of operation is easily followed by playing a few records so that the mechanism may be seen in action.

MECHANICAL ADJUSTMENTS

Adjustments are seldom necessary, but where servicing is clearly required, a complete reading of the following notes will serve to point out the difficulty and its cure.

To Remove the Turntable 13-51, (Fig. 1)

The Turntable unscrews from the Record Spindle, 56-123 (Fig. 6) by rotating the Turntable counter clockwise. The Spindle Gear, 57-8 (Fig. 6) should be held by a screwdriver while unscrewing or while replacing the Turntable. Under no circumstances should you attempt to hold the Record Spindle in a pair of pliers when removing the Turntable. Care should be exercised while holding the Spindle Gear not to damage the teeth of the gear.

When replacing Turntable make sure that it is securely screwed down against the stop washer.

To Adjust or Replace Idler Pulley 36-72, (Fig. 3)

The Idler Pulley is used to transfer power from the Motor Pulley

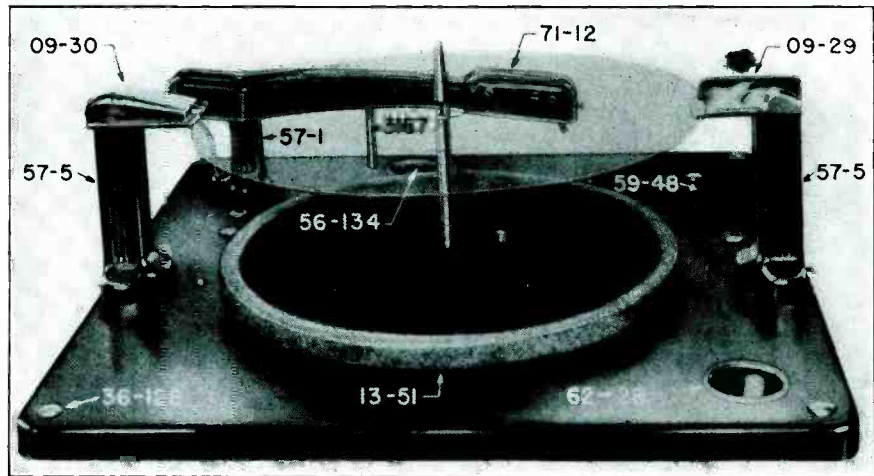


Fig. 1. Top view of P-2 record changer.

36-71 (Fig. 3) to the Turntable. Unless it is held under proper tension by the Idler Spring the turntable speed may be too high or too low; it should fall between 76.59

the Spring Holder to secure the required tension. Be sure to tighten screw holding the Spring Holder.

To replace the Idler Pulley remove the Hair Pin Cotter 99-34-14 (Fig. 3) and the Thrust Washer 50209 (Fig. 3). After removing the Idler Pulley remove the other Thrust Washer 50209 underneath the Pulley. When replacing the Pulley it is best to replace both the Thrust Washers with new ones. A single drop of oil should be used on the Pulley Stud when the Pulley is replaced.

Caution—Do not allow any oil to get on either the Motor Pulley 36-71 (Fig. 3) the Idler Pulley, or rim of the Turntable.

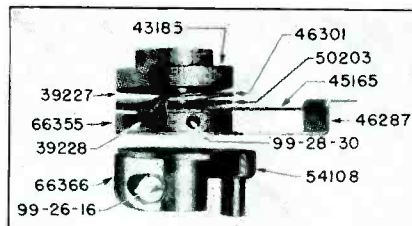


Fig. 5. The trip mechanism.

rpm and 80.00 rpm. This tension is adjusted by loosening screw 99-19-3 (Fig. 3) holding the Spring Holder 45176 (Fig. 3) and turning

To Replace Turntable Drive Bracket and Stud Assembly 64216 (Fig. 3)

After removing the Idler Pulley and Spring 39245 (Fig. 3), remove the Motor by removing the three RHMS 99-19-3 (Fig. 3), then remove the two nuts and the brass washer which are normally covered by the Idler Pulley. Next remove the Screw 99-19-7 (Fig. 3) and the Spacer 42165 (Fig. 3). When replaced, the Bracket and Spindle Assembly must move in all directions without binding or sticking. Be sure the double nuts are locked securely.

Adjustment of Record Shelves 09-29 and 09-30

The center line of the record shelves should form a straight line passing through the center of the Record Spindle. They should be

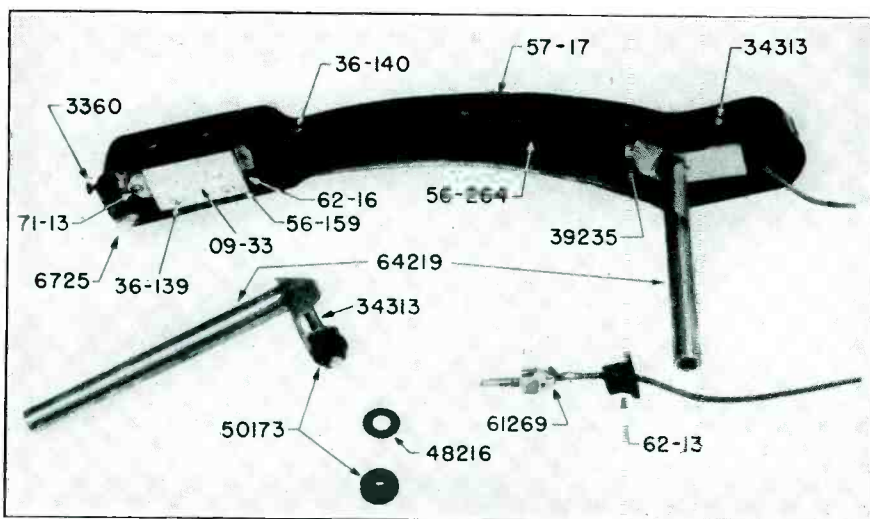


Fig. 4. Tone arm and pickup brush.

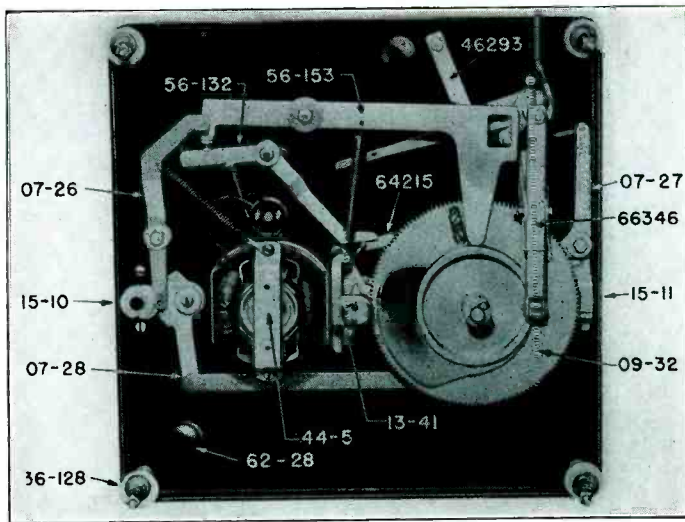


Fig. 2. Under view of record changer, showing mechanism.

exactly $9\frac{21}{32}$ " apart when in the 10" position and equidistant from the spindle. The shelves may be lined up by loosening the set screws on the shelf locking Cam and Gear 15-10 or 15-11 (Fig. 2). After alignment tighten set screws.

Adjustment of Locking Levers and Shelf Locking Cam. 07-26 and 07-27—15-10 and 15-11 (Fig. 2)

The Front Record Shelf 09-29 (Fig. 1) should be lined up with the Record Spindle in the 10" position. The Shelf Locking Cam 15-10 (Fig. 2) is lined up with the center line of the Gear Sector assembly 07-28 (Fig. 2) and adjusted until the Locking Lever is properly seated in the Shelf Locking Cam 15-10. The set screws of the Cam and Gear assembly are then tightened.

The rear record shelf 09-30 (Fig. 1) should be lined up with the Spindle and in the 10" position. The Locking Lever Hex-Head mounting screw 36-114 may be loosened if the adjustment of the Locking Lever to the Cam and Gear Assembly need be changed.

Adjustment of Non Trip Cam of Starting Lever 13-38 (Fig. 6)

This Cam shown at A in (Fig. 6) should be adjusted so that when

38 (Fig. 6) without touching. The front end of the Starting Lever must also clear the bottom of the Resetting Dog and the top of the Starting Pin, both part of the Spindle Gear 57-8 (Fig. 6.)

Adjustment of Trip Pin Assembly 17-10 (Fig. 6)

Both the 10" plunger 56-116 and the 12" plunger 56-117 (see 09-30 Fig. 1) should extend over the edge of the Record Shelves from .010" to .025". This distance may be changed by adjusting the Trip Pin Assembly 17-10 on the Main Cam. Care should be exercised to see that the Trip Pin assembly is not set over too far as it can bind on the plunger cam and jam the changer.

The Trip Finger Stop 46293 (Fig. 2)

The Trip Finger Stops 46293 should be $2\frac{1}{4}$ " from the inside of

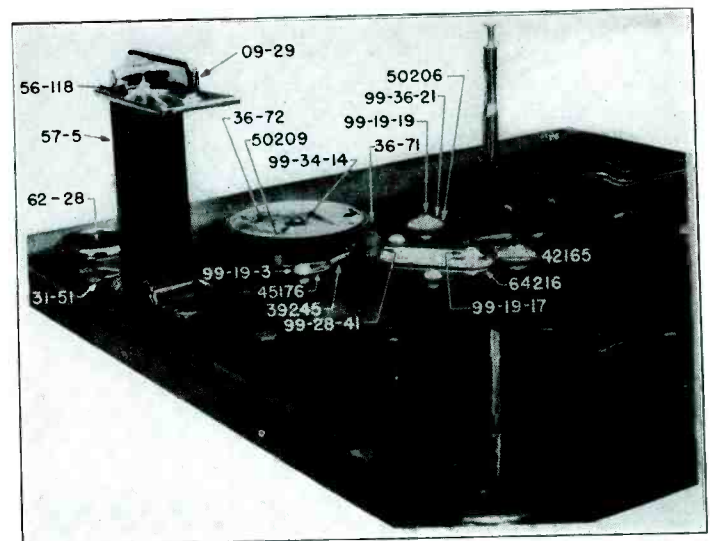


Fig. 3. Record changer with turntable removed, showing mechanism above motor-board.

the machine is in the "Manual" position, the Starting Lever Release Trip 64215 (Fig. 6) will pass over the end of the Starting Lever 13-

the base plate to the inside face of the 90° bend at the end of the Stop.

Needle Landing

In 10" position, adjust the Tone Arm Crank 66366 (Fig. 5) so that the needle lands $4\frac{7}{8}$ " from center of the Record Spindle. To adjust, have record changer in playing position, loosen Tone Arm Set Screw 99-26-16 (Fig. 5) set needle $4\frac{7}{8}$ " from center of Record Spindle. Hold Tone Arm Crank firmly against Tone Arm Swing Lever 56-153 (Fig. 2) and at the same time hold the Tone Arm Crank firmly against the Trip Finger 46287 (Fig. 5). Tighten the Set Screw 99-26-16. There should be a small amount of play up and down in the tone arm. Next set the 12"

(Continued on page 27)

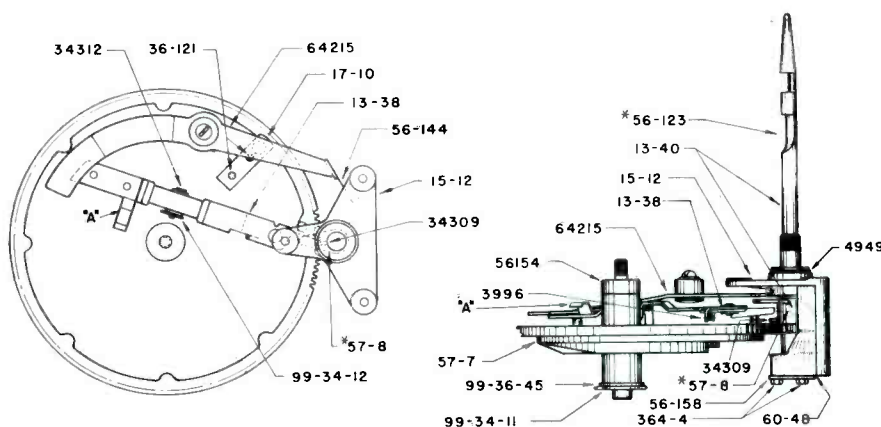


Fig. 6. Details of the principal mechanisms.

Serviceman's Diary

J. P. Hollister

MONDAY—Arrived at the shop a little late. And I'm not making any excuses for it, either. After all, when you've spent your Sunday visiting relatives, and one of them gets you in a corner and asks you please to take just a little look at the radio—not that there's anything very much wrong with it; I wouldn't have to tell you that, you're an expert. But, you see, once in a while the music fades out and when you turn the knob which makes it loud and soft it makes a lot of noise and sometimes when Raymond Gram Swing talks it makes him sound as if he had a mouthful of hot mush. Of course it's only a little set and it wouldn't be worthwhile spending any money on it. Maybe you have an old tube you don't need which you could spare. If we could make it play just through the Summer—you know, we don't play it much during the

Summer anyhow—maybe in the Fall we could trade it in.

So you take a look at it. And you tell them that the cabinet and knobs seem to be in very good condition. The whole trouble, it seems, must be in the chassis. Maybe the easiest way out would be to put in a new chassis. After all, that saves the price of the cabinet and then you've got what is practically a new set for a couple of dollars less than what it would cost for a complete new job. And no more trouble until something goes wrong with the new one, which is guaranteed for three long months. And then your wife chimes in and tells them that, of course, you are only fooling and that you'd really be only too glad to fix it. And when she gets you alone she reminds you that, after all, once upon a time they were nice to Junior, bought him a piece

of candy or something, and you ought to be tickled to have the opportunity to do something in return, especially since it was only a simple little radio, anyhow, which you could fix up in a few minutes.

Just as I told Jerry, I'm not making any excuses. This is just one of the things that crops up in most all businesses. Except, perhaps, undertaking. The undertaker has a pretty good job in that respect. No free service, no call-backs, and the customer never kicks.

But Jerry is never very sympathetic. There was a lot more I wanted to tell him, but he shoves a call slip across the desk and says: "Listen, brother, snap out of it! Squawking won't bring in any dough. If you don't feel well, see a doctor. And if you feel OK, see one anyhow. It so happens that your first call is on this doctor. You're to hook up the f-m combination which I sent out Saturday night. No, you wouldn't know about it—you went home early."

"Is this a real sale or did you just send the set up on spec?" I asked suspiciously. I know Jerry.

"The money's as good as in the bank," he replies. "All you've got to do is connect up the set. The only condition is that it mustn't pick up any X-ray or other interference."

"Yeah, you would!" I told him. "You always promise plenty and leave it to me to make the sale stick. And then you take the credit. Take that Chinese laundryman, for instance. You promised that twenty-dollar midget would bring in Hongkong. And when it wouldn't, you told him the station there had just been bombed and would be out of commission until the end of the War. And when he said he would wait until the War ended before he'd pay for the set, I had to switch my laundry to him to straighten things out. Now he charges enough extra on each week's bill to cover the instalments on the set. Why don't you finish what you start—you take the installation for the doctor, not me!"

"Whatever you say," Jerry answered. "But take a look at the ticket first."

I glanced at the name on the call slip. It was that of a woman doctor,

(Continued on page 25)



"I have an ailment right down the doctor's alley," I told her, "and I'd like to see her in her office."

U. S. GEODETIC SURVEY

USES **RAYTHEON** TUBES

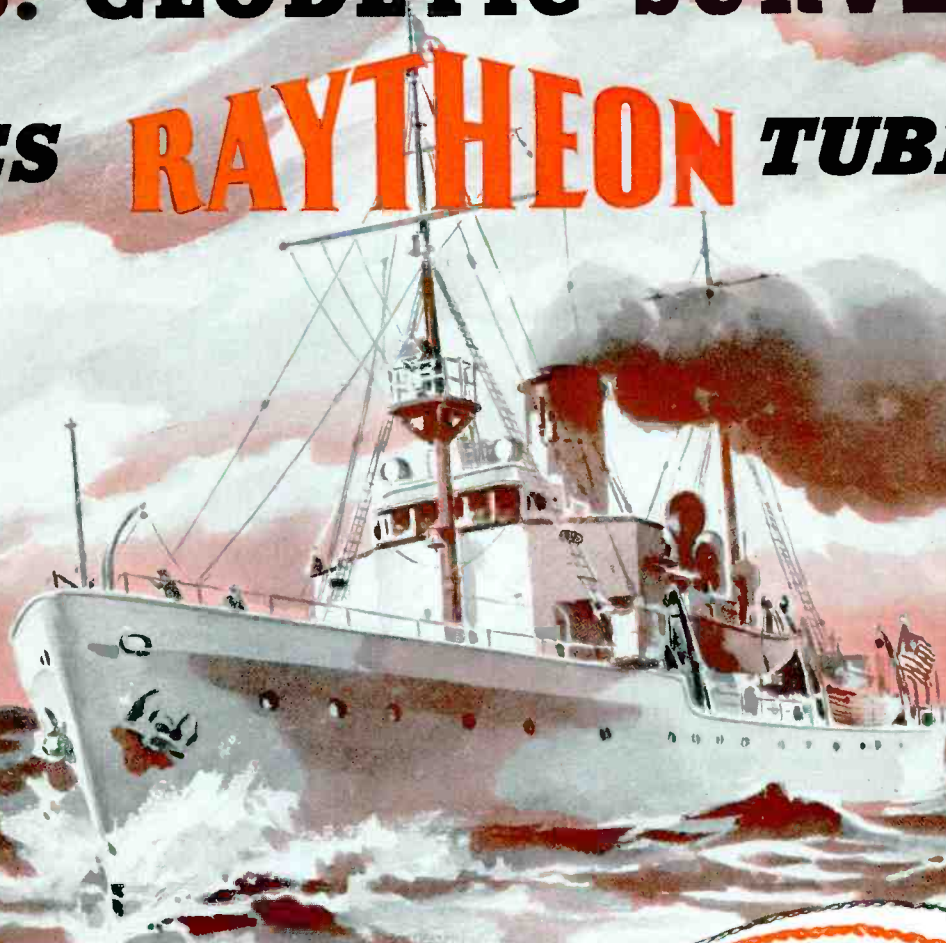


Chart making by the United States Geodetic Survey is an exciting job! Sono-Radio-Buoys have been devised to obtain the Survey Ship's position when working beyond the sight of land. The buoys, containing radio transmitting apparatus, are anchored at specific positions—sound transmitted through the water at intervals reaches the buoys and is picked up by a submerged magnetophone—the amplified sound keys the transmitter—and the signal picked up by the ship is used to determine the distance from the ship to the buoy.

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WESTON TUBE AND BATTERY TESTER (MODEL 777)

An impressive looking instrument for the counter, and one which provides utmost in convenience, utility and long dependability. Tests over 430 commercial tubes, including bantams and high filament voltage types . . . tests for shorts, for noise, for open elements, etc., etc. Also provides for testing all radio batteries under load. Has special self-wiping, knife edge toggle switches. Large WESTON Meter with "good-replace" scale, and separate arc for batteries. Counter type has convenient, quick reference rotator type tube chart. Portable model (illustrated below) has all the above features except the rotator chart. Both models supplied in handsome polished-wood carrying cases.



"When Buying TUBE CHECKERS AND OTHER TEST EQUIPMENT *we look at the Record!*"



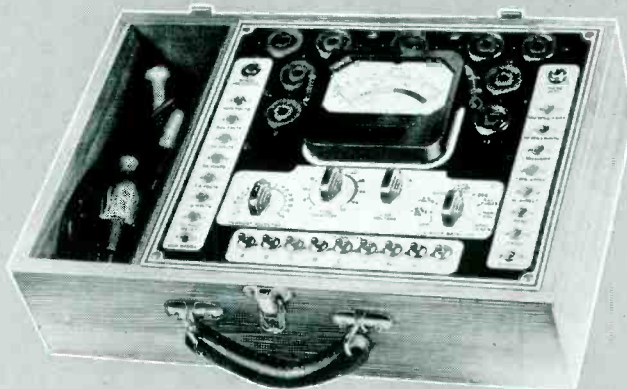
"We find ourselves many dollars ahead at the end of each year," says this successful serviceman, "by applying the same basic thinking to the purchase of test equipment as, for example, our own customers apply when they repeatedly call on us for sales and service. Our record with these customers has been dependable and satisfactory in every way."

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WESTON Radio Instruments

A Portable Tube Checker with Complete Analyzer Ranges



WESTON (MODEL 774) CHECKMASTER

Has all the features of the Model 777 Tube Checker, plus 23 circuit testing ranges for trouble-shooting. Furnished in sturdy and compact carrying case, with spare tube compartment. Ideal for bench and field servicing. Inexpensively priced!

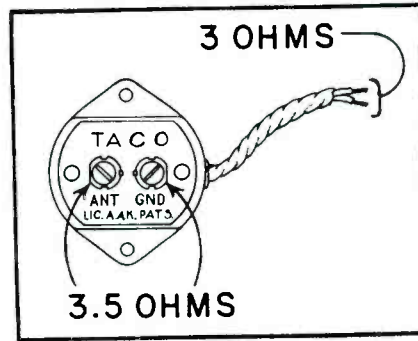
SERVICING MASTER ANTENNA SYSTEMS

YOUR EDITOR would have just such an experience! Of the thousands of master antenna systems operating efficiently day in and day out in the metropolitan New York area alone, your editor had to move into an apartment with a radio outlet from which he couldn't get any sort of signal! When the trouble-shooter came on the scene, he found that the leads were reversed in this particular outlet. Hence no signals. Hence a questioning editor. Hence the demand made upon us to supply the following dissertation on the servicing of master antenna systems.

It is very rare indeed that anything goes haywire with a master antenna system of the patented licensed variety. In the first place, these jobs are thoroughly engineered as regards the basic circuits involved and the components employed, as well as the specific installation. Of course there may be non-licensed systems, purporting to be accurate copies of the genuine article, but that is another matter. In the second place, the installations these days are made by competent workers, generally electrical contractors but sometimes ambitious radio men willing and ready to tackle such jobs, working with precise specifications and using only the approved materials and methods. In the third place no installation is really complete until it has been thoroughly inspected and checked, usually with an actual portable receiver at each outlet. That's the normal and anticipated

Carl Goudy

Engineering Dept., Technical Appliance Corp.



Type 344 Master Coupler for exposed wiring; standard broadcast and short wave.

setup. But human nature being what it is, there may be an occasional slip-up, as was the case with your editor's outlet.

LOOKING FOR TROUBLE

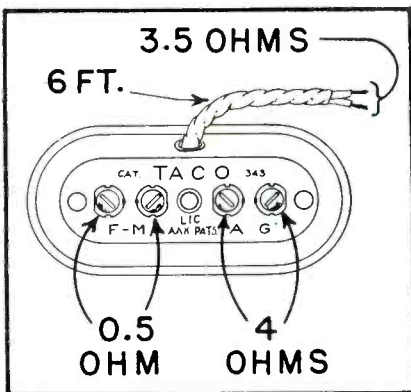
When you are called upon to install a set or to service an existing set in a home that enjoys radio outlets, you can invariably take that form of antenna for granted. You can be certain that it is a first-class antenna, for usually the master antenna system has a pickup far superior to the individual antenna that can be erected on the roof and connected by a long downlead through a noise-infested zone. You can be certain that such a radio outlet positively minimizes noise pickup, and that is vitally important in the average apartment house with its many electrical appliances. At least you can take the radio outlet for granted and plug in your radio set. If, on that very rare occasion, you get no signal from the outlet, then it's time to look for trouble in that direction, and then only.

A carefully installed master antenna system should last for many years. We tell property owners that such an installation should be written off in five years, but only because of the rapid progress of the art which results in obvious obsolescence long before the system is actually worn out or defective. We believe it pays to re-

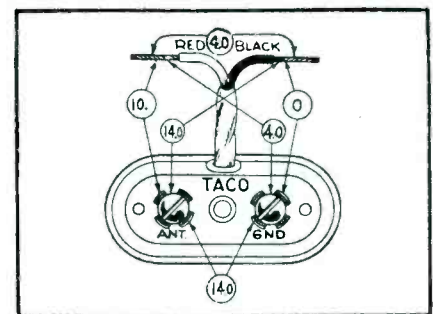
place a master antenna system every five or six years, so as to provide tenants with the best reception obtainable, and to provide for new program services, such as f-m and television.

The first thing to do is to look for a broken transmission line. Check the twisted-pair leads from transmission line to the outlet. (Incidentally, house painters have been known to cut a transmission line which happened to be in the way of their brushes, not realizing what they were doing. Roofers, too, seem to lack a proper sense of respect for our transmission lines, at times.) See that the red lead from the outlet coupler connects with the red conductor of the transmission line, and the black lead with the black conductor. Follow up the transmission line to the roof. Notice how the cable passes over any coping or wall corners where it may possibly be damaged by rubbing. Be particularly critical of the connection between transmission line and the antenna transformer.

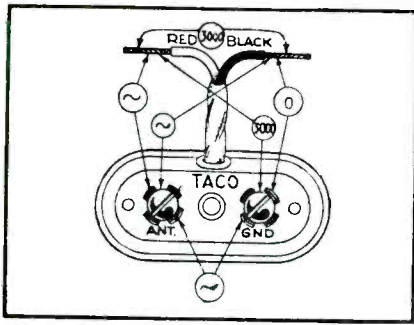
One or both conductors of the transmission line may break, due to crystallization from continuous swaying in the wind. This usually results in intermittent reception, so that the system may work quite satisfactorily for days and then go off during other days, because of making and breaking contact. The



Type 343 Master Coupler for exposed wiring; a-m and f-m terminals. Resistance values indicated.



Type 302 Master Coupler for exposed wiring, and also Type 318. Resistance values are given



Types 325 and 326 Couplers. Type numbers are stamped on units for identification. Note resistance values.

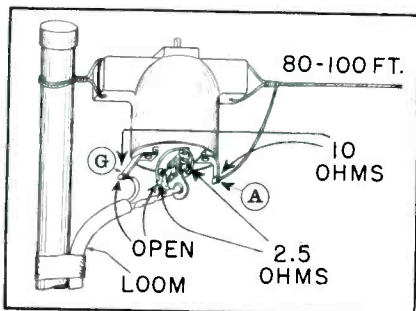
most likely place for a break to occur in the transmission line is where the cable enters the foundation unit or antenna transformer, or again where the transmission line is anchored to the top of the building.

OPENS AND SHORTS

Intermittent breaks in the transmission line show up by jumpy readings on an ohmmeter when the transmission line is subjected to pulling and twisting.

There is really little that can go wrong with the antenna transformer. However, this unit can be readily checked to make sure that the trouble does not reside here. To test it, lower same to within reach, and disconnect the transmission line from the lightning arrestor if a separate one is used. Also disconnect the antenna transformer from the transmission line feeding the couplers. Check for shorts or opens, as per the accompanying diagrams which indicate the resistance values of different types of units, and how to identify the different models.

Remove wires from the lightning arrestor and the lightning arrestor should show "open" between either of the outside posts and the center post, or between the outside posts. If defective, the lightning arrestor will, of course, short the

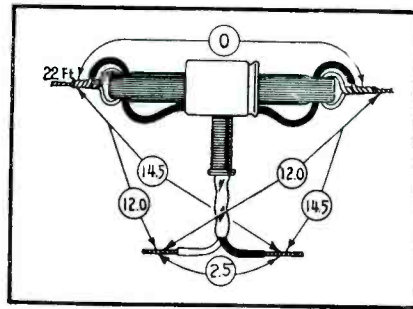


Type 340 Master Roof Kit with built-in lightning arrestor. Relieves aerial of swinging weight.

transmission line and kill the response of the system. Make certain that the connection of the two like conductors (black - black and red - red) of the transmission line are soldered to each other and make good contact with the binding posts of the lightning arrestor. If the connections are poor, the transmission line will prove noisy.

In our new No. 341 antenna transformer, in which the lightning arrestor is incorporated, the danger of a damaged lightning arrestor is very remote and the foregoing checkups are not required.

As far as broken aerial wires are concerned, these can be checked at a glance. Furthermore, in the more recent installations, wire breakage is minimized by placing the antenna transformer close to the support, and connecting same with an L-type aerial, preferably 80 to 100 feet in length. This replaces the former unbalanced doublet, in which the antenna transformer was



Type 301A Antenna Transformer with transmission line attached.

suspended at the point where the two arms of the aerial came together, resulting in a virtual pendulum which could cause strain and gradual crystallization of the conductors in the transmission line with the swinging effect. In the present L-type aerial installations, the transfer unit mounts close to the mast, while the transmission line is protected from the wind by anchoring it to the mast. This mounting also makes the checking and repairing of the installation much easier in case trouble should develop. Meanwhile, the design of the private residence installation has been changed from an X-type aerial to a V-type aerial, to facilitate the erection and to shorten the transmission line.

OUTLET COUPLERS

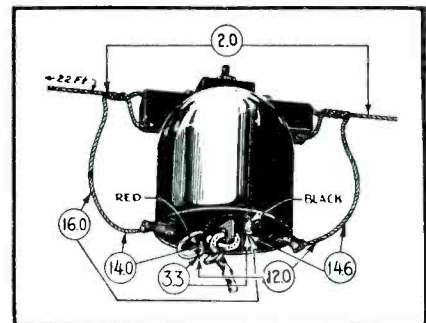
Coming down to the couplers for the outlets proper, it is extremely rare that the circuits in a coupler open up, but if doubt exists, check

the circuit according to the resistance values shown in the coupler diagrams herewith, after first disconnecting same from the transmission line riser. The readings for 16c apply to our Type 302 couplers sold after April 1st, 1937, and also to all Type 318 couplers. The readings for 16d apply to all Type 325 and 326 couplers. The 16e and 16f are the latest style couplers. These couplers are identified by the catalog number stamped on each unit.

If results in any one line are less than is considered necessary for satisfactory reception, the usual fault lies in the location of the aerial proper. If several aeri- als are strung in the same horizontal plane, sometimes a shielding effect is present which robs one of the aeri- als of considerable signal strength. The usual way to overcome this condition is to change the location or direction of the faulty aerial so as to clear it of the shielding effect. If possible, elevate at least one end of the aerial, because the signal pickup increases rapidly with the effective height. Change the direction of the aerial until the best result is found. On tall buildings where space is not available due to penthouses, etc., it may be necessary to use a vertical antenna properly insulated and connected in parallel with the horizontal antenna.

After couplers are installed and connected with the transmission line, it is impossible to test the entire line for continuity. Therefore, the line should be tested for continuity and free of ground before any couplers are installed. If wire is suspected to be open, the only way to test it is by disconnecting the couplers and measuring parts of the circuit at a time. A partial break in the transmission line will be noticed through the intermittent

(Continued on page 23)



Latest Type 321 Antenna Transformer. The resistance values apply also to the Type 301A units sold after Aug. 15th, 1937.

TECHNICAL SERVICE PORTFOLIO

SECTION XII

VISUAL ALIGNMENT

ALTHOUGH VISUAL alignment of radio receivers has been used almost universally in radio factories for the past ten years, this method has not been so widely adopted in the radio service field. Not that the superiority of the visual system is not realized—thousands of cathode-ray oscillographs have been bought by servicemen—but in many cases the apparatus is infrequently used simply because its operation is not thoroughly understood. It is a fascinating device to operate and there is perhaps no other instrument which can be applied to such a bewildering variety of tests; but often, in an attempt to master too many of the applications at once, the operator finds that he has mastered none. Peculiar traces may appear on the screen, often simply because some minor adjustment of the instrument or connection to the apparatus under test has not been properly made, and because he cannot immediately interpret the image, the operator becomes discouraged and puts the oscillograph aside. Yet the oscillograph is fundamentally a relatively simple instrument, and once we see just how it operates, just what causes the images to assume such a variety of shapes, it becomes possible to make efficient use of the most scientific and accurate method of alignment yet devised.

OPERATION OF TUBE

The manner in which the cathode-ray tube operates may be un-

derstood from the diagrams of Fig. 1. In A, which is a simplified representation of the tube, a beam of electrons from the cathode shoots out and strikes the cathode-ray screen, which is covered with a fluorescent substance which glows at the point where the beam strikes. Note that the beam forms only a single, glowing spot.

The beam passes between a pair of deflecting plates, P1 and P2. When no voltage is applied to these plates the cathode ray shoots forth in a straight line and strikes approximately at the center of the screen. But when a voltage is applied to the deflecting plates P1 or P2, the beam will be drawn toward the plate which is positive.

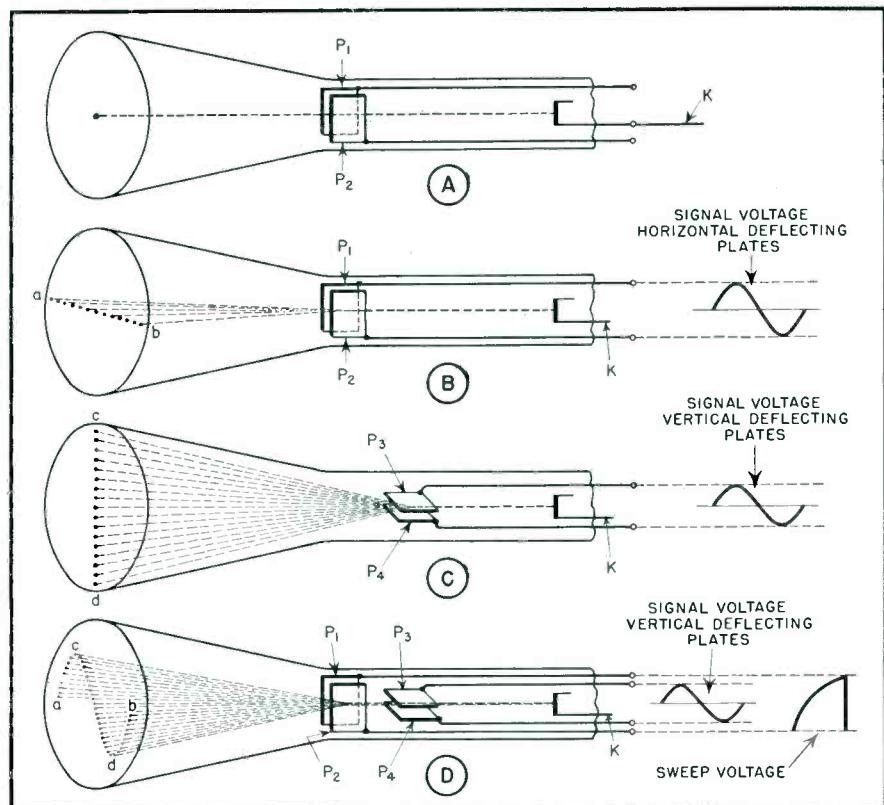


Fig. 1. How the electron beam in a cathode-ray tube is made to form a pattern.

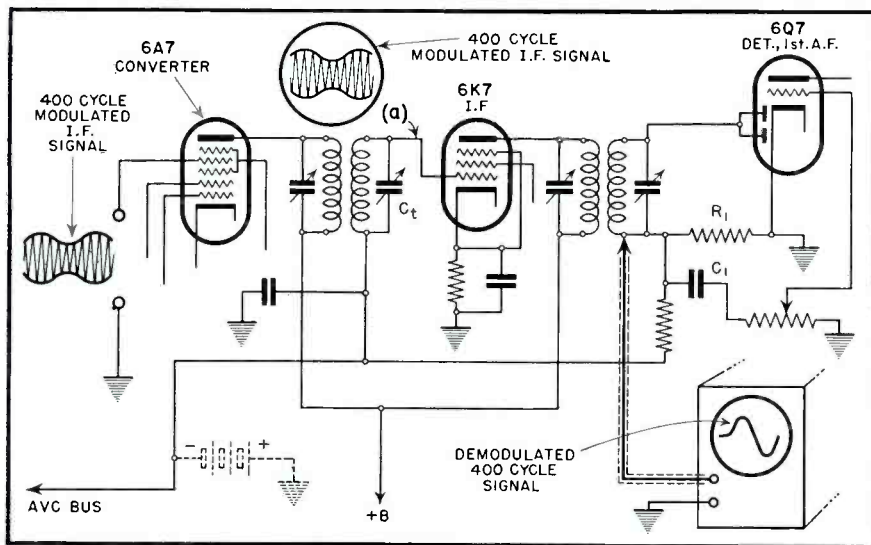


Fig. 2. Manner in which a cathode-ray oscillograph may be used as an output meter.

In the case of a d-c potential, this would cause the spot to move from the center of the screen to some point to the left or right of center, depending upon which plate is made positive. For d-c, the beam would simply take its new position and stay there. But if an a-c voltage were applied to the deflecting plates, P1 and P2, the spot would move alternately to the left and right of center, as shown in Fig. 1-B. The distance between the points a and b on the screen depends upon the alternating voltage applied to the deflecting plates. Point a corresponds to the maximum a-c peak in a positive direction and point b to a maximum a-c peak, for the same wave, in a negative direction. Since the spot travels very rapidly from points a to b, much faster than the eye can follow for frequencies greater than 10 cycles per second, it traces out a line.

Note that the plates P1 and P2 in Fig. 1-B are placed vertically either side of the beam. When the a-c wave is applied to these plates, the beam is caused to move across the screen, horizontally. These are known as the horizontal deflecting plates because they make the spot move in a horizontal plane. The plates P3 and P4, in Fig. 1-C, serve also to deflect the beam, but in a vertical direction rather than horizontally. Therefore they are known as the vertical deflecting plates. When an alternating voltage is applied to P3 and P4 the spot is caused to travel up and down on the screen, the

limits being shown in Fig. 1-C as points c and d. Again, for an a-c wave, the movement of the spot is so rapid that it appears as a line on the screen.

Thus the cathode-ray beam may be acted upon by voltages applied to either, or both, pairs of deflecting plates. In fact, the beam may also be deflected magnetically, by placing a magnet or solenoid carrying current near the neck of the tube. But in practice, at least insofar as commercial cathode-ray oscillographs available for the radio service field are concerned, provision is made for alternating voltages to be applied either to the horizontal or vertical deflecting plates.

Customarily the signal voltage is applied to the vertical plates, either directly or through an amplifier, while a "sweep" voltage, generated inside the cathode-ray oscillograph, is applied to the horizontal plates. The result of the interaction of the "sweep" voltage and the signal voltage is shown in Fig. 1-D. When the sweep frequency is the same as that of the signal frequency applied to the vertical plates, a single replica of the signal wave is traced out on the screen.

Usually blocking condensers are built into the oscillograph, so that it is not convenient to apply d-c directly to the deflecting plates. This is no disadvantage, since, as stated before, d-c simply causes the spot to change position. Though this permits a rough measurement of the d-c voltage without drawing

current from the circuit, by noting the distance which a given d-c potential causes the beam to move, the same result can be achieved more accurately and conveniently with the electronic voltmeter. Furthermore, it is not advisable to let the beam remain concentrated at a single spot on the screen for any appreciable time, since it may cause the fluorescent material to flake off at that spot, particularly when an intense beam is employed.

As used in receiver aligning, the cathode-ray oscillograph serves as an output meter but, when used with the proper type of signal source, it gives an indication of the response of the circuits under test, not only at a single frequency, as is the case with the conventional type of output meter, but over a wide band of frequencies. Since the latter condition is the one in which we are most interested, because it represents the actual operating conditions when a broadcast signal is being received, visual alignment is superior.

AS OUTPUT METER

An example of the application of the cathode-ray oscillograph as a simple output meter, using a 400-cycle amplitude-modulated signal, is shown in Fig. 2. A conventional test oscillator is adjusted to produce a 400-cycle modulated signal at the intermediate frequency, which is fed to the mixer grid. The cathode-ray oscillograph vertical deflecting plates (or the vertical amplifier input) are connected across the second detector load, R1. Since the detector serves to rectify or demodulate the incoming i-f signal, only the 400-cycle wave is fed to the oscillograph. The resulting single audio wave is traced out on the screen when the horizontal sweep frequency is adjusted exactly to the 400-cycle modulating frequency.

The modulated wave itself may be viewed if the oscillograph input is connected at some point ahead of the detector, such as point a (Fig. 2). It is then necessary to adjust the horizontal sweep frequency to the intermediate frequency, or some submultiple thereof, in order to obtain a stationary image. Since none of the commercial oscillograph horizontal sweeps function much above 100 kc, it is necessary to use a sub-

multiple of the i.f. For instance, if the i.f. is 450 kc, adjustment of the sweep frequency to 50 kc will cause a train of nine waves to appear across the screen. Each will have the appearance of the modulated wave shown at point a on the diagram.

Actually this form of connection has no practical value. It is necessary to make the leads from the oscillograph to the amplifier extremely short. Even then, the circuit to which the oscillograph is connected is detuned so that it is necessary to decrease the trimmer capacity to compensate—and often this cannot be done.

Even when the oscillograph is connected across R1, it is no better than an ordinary output meter when an amplitude-modulated signal is employed, at least insofar as aligning is concerned.

WOBBLED FREQUENCY

To obtain the fullest advantages of the cathode-ray oscillograph, a frequency-modulated signal must be used. This is done in the conventional setup shown in Fig. 3. The test oscillator is adjusted to produce a frequency-modulated signal, having a bandwidth of 40 to 80 kc, which is fed to the i-f amplifier. The oscillograph is connected across the diode load, R1, as in the previous example, but the wave reproduced now represents the response of the amplifier over the band of frequencies encompassed by the frequency-modulated wave. It is, in fact, a resonance curve of the i-f amplifier.

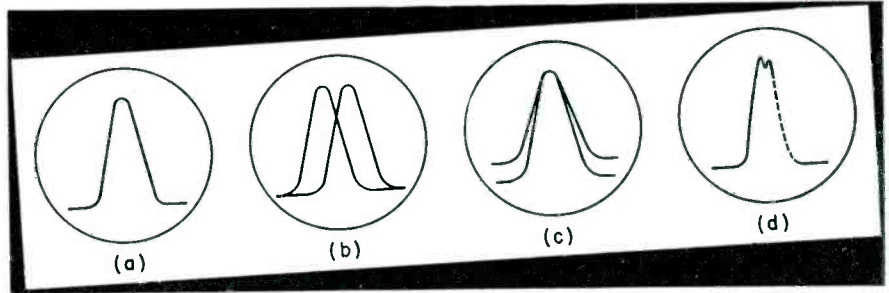


Fig. 4. Various i-f amplifier response curves.

Before we take this matter under detailed consideration, let us for a moment consider the frequency-modulated signal itself. In most commercial signal generators the frequency modulation is obtained by "wobbling" an oscillator by applying a 60-cycle wave to it. Since the amount of frequency deviation which can be secured in such manner would normally vary with the frequency to which the oscillator were adjusted, it is customary to employ a fixed-frequency oscillator, which is wobbled over a limited range, and to beat this wobbled frequency with a variable-frequency oscillator in much the same manner as is done in the superheterodyne converter. For example, in a standard type of frequency-modulated oscillator, the fixed frequency oscillator is set at 800 kc, which may be wobbled 40 kc either side of 800 kc. This signal is fed to a converter tube inside the test oscillator, where it combines with the signal produced by a variable-frequency oscillator. If the variable-frequency oscillator is adjusted to 1250 kc, a difference frequency of 1250-800 or

450 kc appears at the output terminals of the test oscillator. Since the 800-kc component of the two frequencies producing the 450-kc output is frequency modulated, the 450-kc output is also frequency modulated.

The desirable feature thus gained is that the amount of frequency modulation is always the same for the same bandwidth setting, regardless of the resulting output frequency of the test oscillator. If the variable-frequency oscillator sections were tuned to 975 kc, beating with the 800-kc frequency-modulated signal to produce a difference frequency at the output terminals of 175 kc, the bandwidth would still be the same as was secured when the variable-frequency oscillator was adjusted, as described previously, to produce an output difference frequency of 450 kc. Actually the calibration of test oscillators of this type, which are called beat-type oscillators, is in terms of the difference frequency resulting from the beat action, except for some high-frequency ranges, where the sum frequency is sometimes employed.

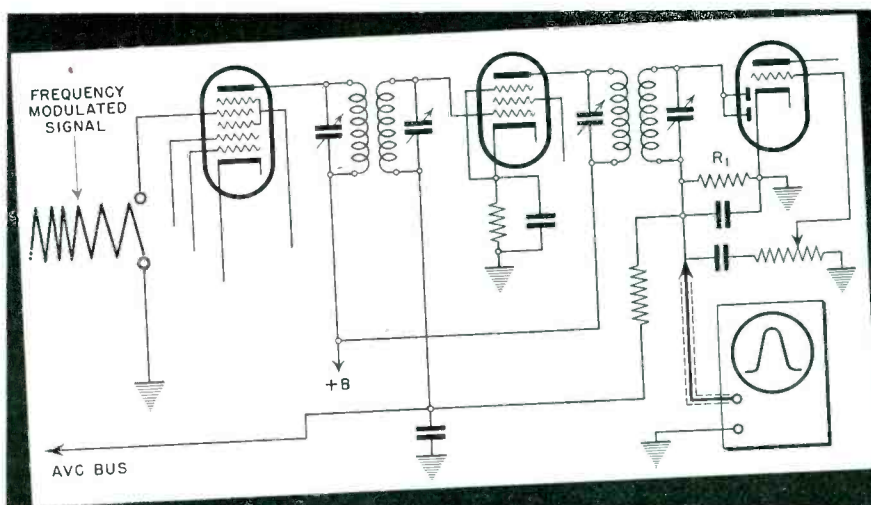


Fig. 3. The oscillograph should be used with a frequency-modulated signal for alignment purposes.

ALIGNING WITH 'SCOPE

In practice, the last i-f stage should be aligned first. This is done by feeding the signal from the test oscillator to the last i-f grid, using a blocking condenser in the same manner as described for conventional alignment last month, the only difference being that the signal is frequency modulated rather than amplitude modulated. The bandwidth of frequency modulation is adjusted to be sufficient to cover the range specified in the service notes for the receiver under test. This will normally be about 40 kc either side of the i-f frequency, except for f-m receivers where an overall bandwidth of

around 300 kc is desirable. More about this later. The oscillograph is connected across the diode load, the volume control is set at a minimum or thereabouts, to avoid overloading the a-f stages and incidentally to relieve the boredom of the "thump-thump" of the f-m signal being reproduced by the speaker. After a symmetrical curve is obtained for the last i-f stage, the test oscillator signal is fed to each preceding grid until the mixer input is reached, adjusting the associated trimmers in each i-f stage until a symmetrical overall curve is obtained. The procedure is described in greater detail in service manuals.

During the course of adjusting the trimmers, various images will appear on the cathode-ray screen. The correct response curve, for a typical i-f amplifier, is shown in Fig. 4-A. If the test oscillator should become slightly detuned, an image such as that shown in Fig. 4-B will result. In Fig. 4-C, the peaks coincide but the bases of the images do not. This is incorrect adjustment. The trimmers should be readjusted until both the peaks and the bases coincide, even though the height of the resulting image may be somewhat less than is obtained by incorrect adjustment.

Sometimes an image such as that shown in Fig. 4-D appears. This sputtery, sharp peak is characteristic of regeneration in the amplifier being adjusted. Proper alignment will not be obtained until the cause of the regeneration is found and corrected. Before blaming the set, make certain that the trouble is not due to the mode of connec-

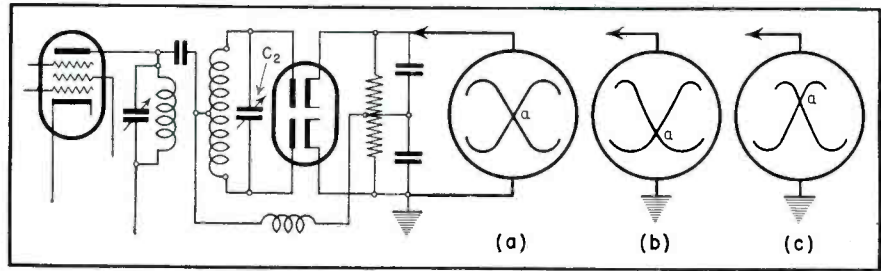


Fig. 5. Various patterns that may be obtained when aligning the discriminator in an f-m receiver.

tion of the oscillograph. Remember that there is a very strong i-f signal at the second detector load, to which the oscillograph is connected, and even a short length of unshielded wire may result in sufficient feedback to cause the amplifier under test to oscillate. The hot lead from the 'scope should be shielded right up to the connecting clip, and the shield itself should be carefully grounded to the receiver chassis.

The images discussed above result from what is known as the double-image type of trace. There are others employed, depending upon the design of the sweep circuit in the cathode-ray oscillograph, described in detail in the instruction books accompanying such apparatus. There are the single image, folded image, etc., but they all produce substantially the same ultimate result. When the double image system is not employed, improper adjustment results in a distorted curve which becomes symmetrical after the adjustments have been properly made. It should be emphasized that the proper curve is not necessarily the highest curve which is secured; when broad-band, overcoupled trans-

formers are being aligned, the overall curve for proper adjustment will not be as high as that secured by simply peaking the stage. But it will be symmetrical. And the response will be better.

In the case of receivers employing tuned circuits which are designed merely to be peaked, and where the circuits are under-coupled, proper alignment will be obtained when the trimmers are adjusted to produce an image of maximum height upon the cathode-ray screen. In such applications, the 'scope acts as a simple output meter and an ordinary amplitude modulated signal may be employed just as well.

R-F ALIGNMENT

So far we have discussed i-f alignment only. It is possible to use the same method for aligning the antenna and r-f stages of the receiver, feeding the signal to each preceding stage, but changing the signal frequency to correspond to that of the required aligning frequency. This applies particularly to the broadcast band. The use of such a frequency-modulated signal for the short-wave bands often causes trouble, because the harmonics of the 800-kc (or other frequency to which the fixed-frequency oscillator in the signal generator is tuned) causes confusing beats which interfere with proper alignment. Since there is no point in using a frequency-modulated signal for alignment of r-f and antenna stages anyhow, it is better to use a conventional 400-cycle amplitude-modulated signal for such bands, particularly when the test oscillator is of a type which permits the frequency-modulated fixed oscillator to be cut out of the circuit when tuning to the extreme high-frequency bands.

However, some of the harmonics of the fixed-frequency oscillator (Continued on page 25)

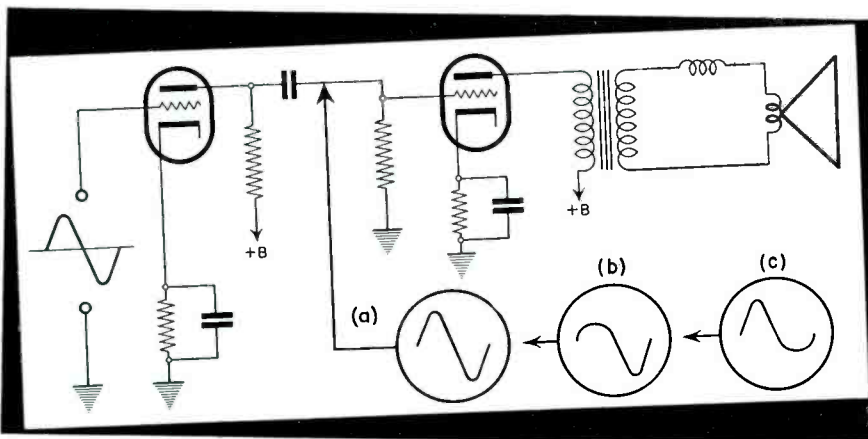


Fig. 6. Patterns show types of audio distortion.

CIRCUIT COURT

Dual Speaker System

In some of the General Electric Musaphonic receivers, a 14-inch and a 6½-inch p-m speaker are used in series connection, as shown in Fig. 1. The smaller speaker is mounted at the top of the baffle, to cut down absorption by furniture, carpets, and draperies of the high-frequency output.

Adequate distribution of high frequencies over a wide angle has been a problem because the speaker cone radiated such frequencies in the form of a beam, its width depending upon the ratio of the diameter of the cone to the

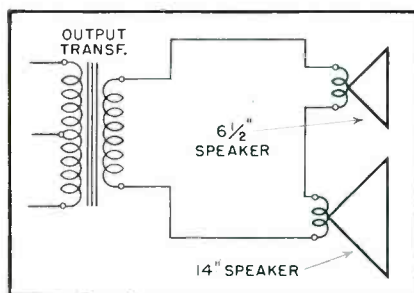


Fig. 1. Dual speakers in series connection.

wavelength of the sound radiated. The larger this ratio, the sharper the beam. If a single speaker were used, of sufficiently large diameter to make it function well for the low frequencies, the high frequencies were correspondingly restricted. Dual speakers offer the solution.

Speaker resonances are staggered to provide compensation over a wider frequency range, one filling in where the other is restricted. In the combined speakers frequency characteristics are made complementary to each other. The speakers are connected in series because the current fed to the speaker which is not resonating is reduced by the impedance rise of the one that is; this further reduces the peaking effect.

"B" Battery Eliminator

With the introduction of the G. E. Model LB-530 Self-Charging

Portable (described in this issue), emphasis is again placed on the modern type of "B" Eliminator operated from dry cells or storage battery.

The circuit of the ATR Portable "B" Battery Eliminator is shown in Fig. 2. It is composed of a synchronous vibrator connected to the step-up transformer T, the combined hash and ripple filter L2-L3 and its associated filter condensers, and a socket and switch terminal providing the choice of dry-cell or storage-battery operation. The complete unit is small enough to fit into the average dry-cell type receiver.

Hum Bucker

In the Emerson Model EX-386, a 20,000-ohm bleeder, R9, is connected from the cathode of the 35Z5 rectifier to the high side of the 50L6 cathode resistor R10, as shown in Fig. 3.

We would venture the guess that the effect of this bleeder is two-fold; first, it provides a semi-fixed bias on the beam-power tube which is independent of the self-bias, and would permit a greater undistorted power output, and, second, introduces a hum voltage across the unbypassed cathode resistor that is out of phase with the self-developed hum voltage, thus introducing a degree of cancella-

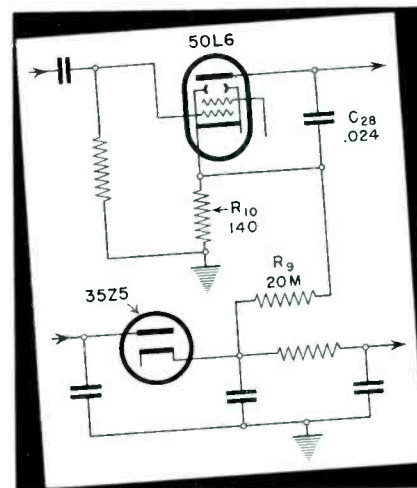


Fig. 3. Bleed through cathode resistor from input of power supply.

tion and a lower hum voltage on the grid of the 50L6.

Mixer-Dubber-Fader

The Howard Model 302-RA Console Phono-Radio-Recorder is equipped with a combined recorder and automatic record changer plus an additional phonograph pickup and turntable so that home- or commercial records can be "dubbed" or copied on the recorder unit. Provisions are also made for mixing, so that voice or music can be interjected.

The circuit of the mixing-dub-
(Continued on page 30)

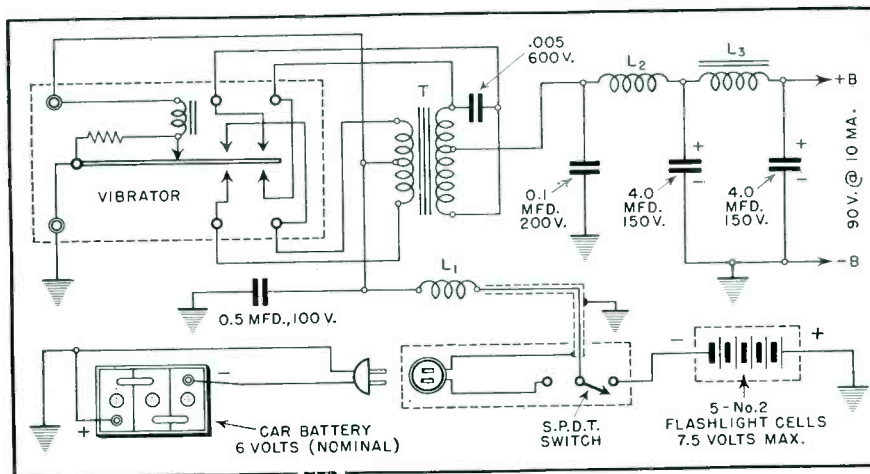
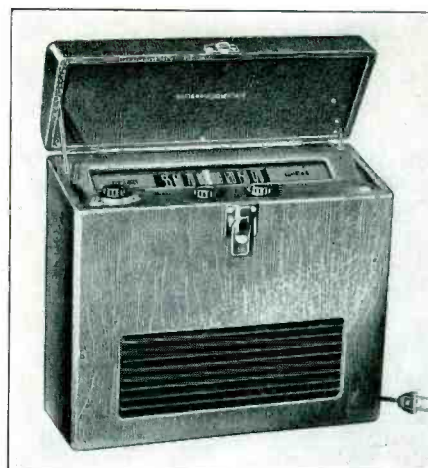


Fig. 2. Circuit of ATR Portable "B"-Battery Eliminator. Operates from storage battery or dry cells.

Set of the Month—

GENERAL ELECTRIC LB-530

Self-Charging Portable



SOMETHING NEW in the way of indoor-outdoor radios is the **General Electric Model LB-530 Self-Charging Portable**—a receiver designed around the principles of a car radio, but using a compact, 2-volt, 20 ampere-hour, non-spillable storage battery. It may be operated directly from any a-c line, during which time the battery is on trickle charge, or operated from the battery alone which thereafter may be replenished by placing the receiver back on a-c operation or, if the battery has been well drained, placing a switch on "Charge" position and restoring the battery to full charge overnight, from the a-c outlet.

SPECIFICATIONS

The receiver uses five tubes, has two i-f stages, a 5-inch p-m dynamic speaker, a tuning range of 550 to 1750 kc, and an output of 225 milliwatts. The power unit, including the storage battery, charging transformer, copper-oxide rectifiers, synchronous vibrator, filters, etc., is self-contained. A supplementary cable (Model LM-1) is available so that the receiver battery can be charged from the 6-volt battery in an auto (or the receiver operated from this source of power).

The receiver power consumption is 1.3 amps at 2.1 volts, or 2.7 watts. It draws 1.4 amps at 6

volts when charging from a car battery; and 6 watts when charging from a 50-60 cycle a-c line.

THE CIRCUIT

The circuit is shown in Fig. 5, on the opposite page. Normally, the receiver is loop-operated, but an external antenna, L7, in loop form, is provided for additional pickup in locations where signal levels are low.

The signal circuits of the set are, on the whole, conventional, but it should be noted that resistance-capacity coupling is used between the second i-f stage and diode detector—an unusual arrangement. The 47,000-ohm resistor R6 serves as the diode load at i.f. The total d-c load is composed of R6 and R1 (the volume control) in series. Automatic control voltage is taken from the midpoint of these two resistors.

It should also be noted that bias for the 1Q5GT output tube is supplied by a 5-volt bias-cell assembly, B1, connected in series with the grid resistor R9.

The power-supply portion of the circuit is controlled by a 4-position switch, the positions being "Off," "Battery," "AC," and "Charge." The operation of the switch can be readily traced by reference to the Selector Switch Chart, just to the left of the diagram of Fig. 5.

All power necessary for the operation of the receiver is supplied by the 2-volt storage battery. The tube filaments are heated directly, while the necessary high voltage for the plates and screens of the tubes is furnished by the synchronous vibrator V1, used in conjunction with the step-up transformer T2 and its associated filter circuit.

The battery-charging unit consists of the step-down transformer T3, which has an output of 5.5 volts a-c, and the full-wave copper-oxide rectifier X1, which supplies the storage battery with a d-c charging current.

The degree of charge of the battery can be determined by the removal of the back cover of the receiver and referring to the charge ball indicator visible through a hole in the battery case. If the battery is fully charged, the red, white and green balls are visible at the surface of the liquid in the battery. As the battery discharges, first the green, then the white, and finally the red ball will sink and disappear, indicating a 10 percent, a 50 percent and a 90 percent discharge, respectively. On charge, the balls rise or float in the reverse order.

CHARGER CHARACTERISTICS

A 1/4-ampere fuse is used in series with the primary of the charger transformer. If the battery does not take a charge, this fuse should be checked, and replaced if blown.

If one or more of the copper-oxide discs of the rectifier unit are defective, the charger will not operate properly. To test the rectifier unit operation, proceed as follows: Remove the two black leads from the negative terminal of the battery (See Fig. 3) and connect a d-c ammeter which will read 2 amps, in series with these leads to the negative terminal of the battery. Plug power cord into an a-c outlet and turn the selector switch to the "Charge" position. With the line voltage at 117, the average charging current should be about 1.35 amps at 2.1 volts. If the cur-

(Continued on page 29)

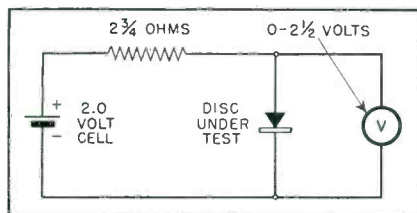
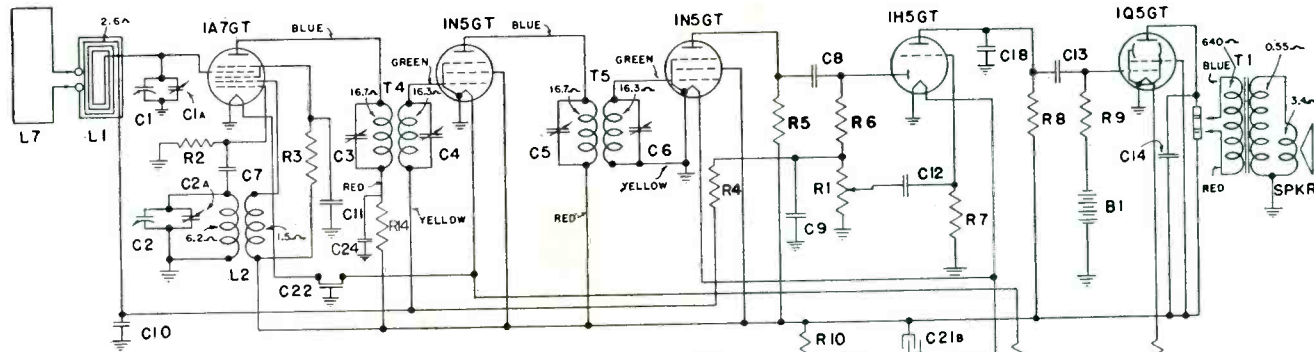


Fig. 2. Circuit for testing copper-oxide rectifier discs.

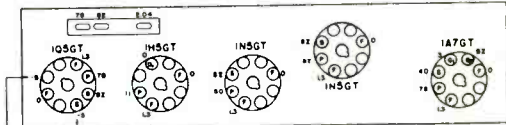


**FIG. 5
CIRCUIT
DIAGRAM**

POWER SELECTOR SWITCH OPERATION

POSITION	CONTACTS CONNECTED
"OFF"	ALL CONTACTS OPEN
"BATTERY"	#1 to #2; #4 to #5; #7* to #8
"AC"	#1 to #2 to #3; #4 to #5; #8 to #9
"CHARGE"	#2 to #3; #8 to #9

* #7 terminal is not connected to circuit



BIAS BATTERY - MEASURE WITH 2500 OHM CURRENT VOLTMETER ONLY.

POWER SWITCH ON "AC" WITH CHASSIS OPERATING BATTERY VOLTAGE - 8.1

VIBRATOR "A" VOLTAGE - 8.6

DIAL AT 1000 KC, ZERO SIGNAL, ZERO VOLUME.

ALL MEASUREMENTS EXCEPT BATTERY AND FILAMENT MADE WITH 1000 OHM PER VOLT VOLTMETER, 100 OHM SCALE.

Fig. 1. Socket Voltage Diagram

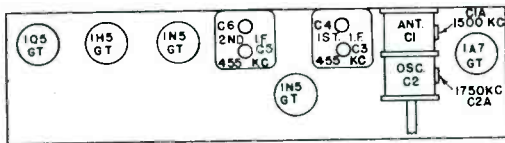


Fig. 4. Trimmer Location

SPRING GROUND BETWEEN CHASSIS AND BATTERY BOX

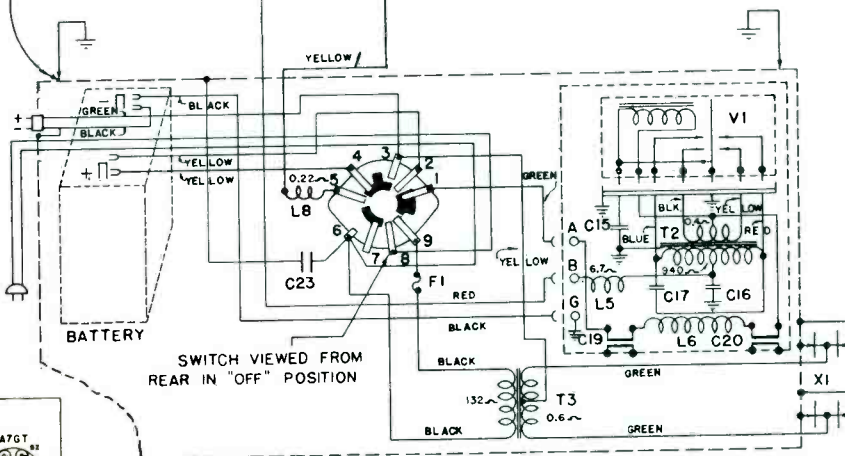
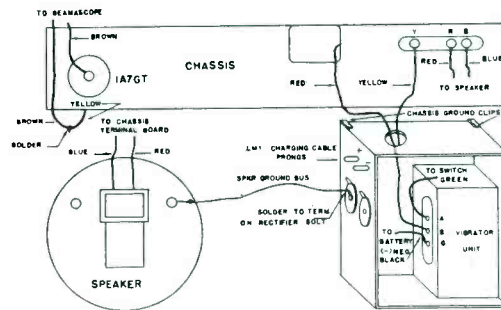


Fig. 3. Assembly Wiring



Symbol	Description
C-1, 2	CONDENSER—Tuning condenser and trimmers
C-7	CAPACITOR—47 mmf., mica
C-8, 9	CAPACITOR—100 mmf., mica
C-10	CAPACITOR—.05 Mfd., 200 V. paper
C-11	CAPACITOR—.01 Mfd., 200 V. paper
C-12, 13	CAPACITOR—.005 Mfd., 600 V. paper
C-14	CAPACITOR—.01 Mfd., 600 V. paper
C-15	CAPACITOR—.01 Mfd., 200 V. paper
C-16	CAPACITOR—.05 Mfd., 200 V. paper
C-17	CAPACITOR—.006 Mfd., 100 V. paper
C-18	CAPACITOR—100 mmf., mica
C-19, 20	CAPACITOR—.5 Mfd., 120 V.
C-21A, 21B	CAPACITOR—15 Mfd., 150 V. dry electrolytic

C-21C	CAPACITOR—1200 Mfd., 2 V. dry electrolytic
C-22	CAPACITOR—.05 Mfd., 120 V. paper
C-23	CAPACITOR—.05 Mfd., 600 V. paper
R-1	VOLUME CONTROL—.05 megohm
R-2	RESISTOR—220,000 ohm, 1/4 W. carbon
R-3	RESISTOR—47,000 ohm, 1/4 W. carbon
R-4	RESISTOR—2.2 megohm, 1/4 W. carbon
R-5	RESISTOR—27,000 ohm, 1/4 W. carbon
R-6	RESISTOR—47,000 ohm, 1/4 W. carbon
R-7	RESISTOR—4.7 megohm, 1/4 W. carbon
R-8	RESISTOR—1.0 megohm, 1/4 W. carbon
R-9	RESISTOR—2.2 megohm, 1/4 W. carbon
R-10	RESISTOR—1,000 ohm, 1/4 W. carbon
R-11, 12, 13	RESISTOR—8.2 ohm, 1/4 W. carbon
B-1	CELL—5.0 V. bias cell assembly
L-1	BEAM-A-SCOPE—Loop antenna assembly

L-2	COIL—Oscillator coil
L-5	CHOKE—B choke
L-6	CHOKE—Vibrator choke
L-7	BEAM-A-SCOPE—External loop antenna
L-8	CHOKE—Filament supply choke
SW1	SWITCH—Power selector switch
T-1	TRANSFORMER—Output transformer
T-2	VIBRATOR—Vibrator power transformer
T-3	TRANSFORMER—50-60 cycle rectifier step-down transformer
T-3	TRANSFORMER—25 cycle rectifier step-down transformer
T-4	TRANSFORMER—1st I.F. transformer
T-5	TRANSFORMER—2nd I.F. transformer
V-1	VIBRATOR—Power supply synchronous vibrator
X-1	RECTIFIER—Copper oxide rectifier
Spkr	SPEAKER—PM speaker

Shop Notes

G.E. MODELS 60 & 80 Audio Howl

Audio howl is usually traceable to the 6Y6G audio driver tube. In making new tube replacements, it may be necessary to try several before a quiet tube is found.

Drift-Proof Adjustment

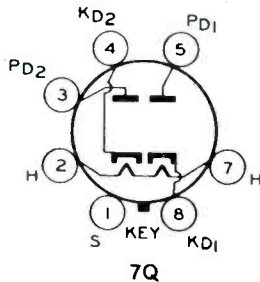
A method of setting up broadcast station automatic selector buttons which will assure drift-proof adjustment is to screw the iron core all the way out and then turn slowly inward until the desired station is tuned in.

Speaker Connections

The black speaker lead should be connected to the 10-inch speaker terminal which is grounded to the speaker frames. When replacing a speaker, make sure of the proper phasing. With the speaker terminal boards facing each other, the interconnecting leads should be crossed.

RCA 12H6 Tube

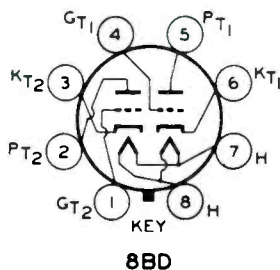
The 12H6 is a twin diode similar to type 6H6 except for its heater rating of 12.6 volts and 0.15 ampere. It is particularly adaptable to receivers having series heater circuits.



Socket connections are shown in the accompanying drawing.

RCA 12SN7-GT Tube

The 12SN7-GT is a single-ended, twin-triode amplifier having separate cathode terminals for each triode unit. It is recom-



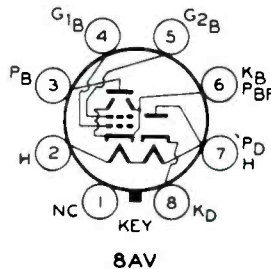
mended for use in resistance-coupled circuits as a voltage amplifier or phase inverter. Since this tube has separate cathodes which are brought out to terminals in the base, it offers much greater flexibility from the circuit designer's stand-

point than do other twin triodes having only a single cathode connection.

Socket connections are shown in the accompanying drawing.

RCA 117P7-GT Tube

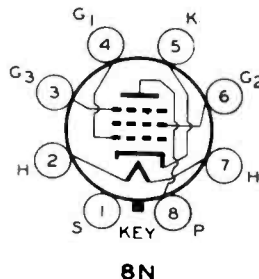
The 117P7-GT is a combination half-wave rectifier and beam-power amplifier similar to type 117N7-GT but having a somewhat lower power output.



Socket connections are shown in the accompanying drawing.

RCA 6SS7 Tube

The 6SS7 is a remote cut-off, r-f amplifier pentode of the single-ended metal type having a 6.3-volt, 0.15-ampere heater. This new tube provides for a further degree of flexibility in the design of ac-dc receivers utilizing single-ended metal tubes, where the total heater voltage of a complement of 0.15-ampere types heretofore available would exceed 117 volts.



Socket connections are shown in the accompanying drawing.

STROMBERG-CARLSON NO. 555 Service Notes

The servicing data provided for the No. 455 may be used for the No. 555. These receivers are essentially the same except for the following changes:—The f-m band coverage is 42 to 50 mc; the f-m i-f frequency is 4.3 mc; r-f aligning points for f-m band are 48 and 43 mc; one 6AB7 r-f tube replaces one 6SK7 r-f tube.

Voltage Table Changes

Terminal No. 8 of the 6SA7 modulator-oscillator should read zero.

Terminal No. 8 of the 6AC7 first i-f

tube (fm and am) should read plus 240 volts.

Terminal No. 8 of the 6SJ7 limiter tube (fm) should read plus 100 volts.

WELLS-GARDNER 6C17, 6C18 Improved Performance

To secure improved performance, the following changes are made in issue B chassis:

The oscillator grid resistor is increased from 20,000 ohms to 40,000 ohms. The r-f plate resistor is decreased from 20,000 ohms to 15,000 ohms.

The r-f screen is disconnected from the modulator screen and connected to the i-f plate. In the Series 6C18 only, the modulator screen resistor is increased from 10,000 ohms to 12,000 ohms.

WELLS-GARDNER SERIES 6D3-1 Eliminating Oscillation

When an especially high-gain i-f tube is used for replacement in some of the later production of Models O4WG-610 & 611, some trouble may be experienced with oscillation at the low-frequency end of the dial, or in extreme cases over the entire dial.

To eliminate this condition, a 170-ohm, 0.25-watt resistor should be connected between the cathode of the 12SK7 i-f tube and B—. Some late production models are factory-equipped with this resistor.

WELLS-GARDNER AUTO RADIOS Reducing Ignition Noise

If excessive motor noise is encountered in the cars listed below, the procedure given, in addition to the regular steps taken for the suppression of motor noise, may prove helpful.

Pontiac—1940

These cars have an under-seat heater hose which must be shielded to reduce radiated interference. This heater hose must be wrapped with braided shielding starting at the motor block, continuing through the motor compartment and for about one foot under the car body. Ground this shielding at both ends.

Ford

In some models the battery wire to the heater and the low-tension wire to the distributor are run through the same conduit that carries the spark-plug wires. Remove the heater wire and low-tension distributor wire from this conduit and run them over separately to the heater and distributor, adequately spaced from the conduit which carries the spark-plug wires.

Studebaker—1941

Ground the radiator core and place the heater hose as close as possible to the car frame.

(Continued on page 33)

DEWALD 1941 Models

sold in lots of 1 or 3 (or more)

at exceptionally low **NET PRICES**
direct from **Distributor to YOU**



Model 565—AC-DC, Battery Superhet

Versatile, compact, 3-way portable. Streamlined luggage construction with completely concealed radio unit; easy slide disappearing lid cover; choice of 2 coverings—natural and alligator with contrasting simulated leather tuning panel.

Advanced super-het circuit; 5 low drain tubes; built-in Looptenna; AVC; beam power output; large PM speaker. Many other features.

Retail list price \$24.95

Your net price each

\$16.75

YOUR NET PRICE

EACH LOTS OF 3

\$15.95



Model 670—3-Band AC-DC Superhet

Latest style tilt-top, easy vision slide-rule dial model in beautiful hand rubbed cabinet. Band spread tuning on two short wave bands; Tuned RF stage on all bands. Advanced superhet circuit; 6 low-drain single ended tubes; built-in Looptenna; large PM dynamic speaker; AVC; beam power output; variable tone control; built-in Wave Trap Code rejector.

Retail list price \$33.50

Your net price each

\$20.95

YOUR NET PRICE

EACH LOTS OF 3

\$19.95

We are now prepared to supply every legitimate Radio Service Dealer with any type brand new 1941 factory cartoned DeWald receiver in any quantity desired.

Our policy is timely . . . geared to present day conditions. Every radio service dealer stocks, sells and rents Nationally Known Brands of receivers. There is no finer line than DeWald . . . and at the especially attractive **LOW NET PRICES** quoted here you can't go wrong. Hundreds of our local service dealer accounts will attest to that.

We sell at wholesale only, give factory guarantees, do not require a franchise or contract for a specified number of receivers. We have sufficient stocks on hand to meet your requirements . . . most important, all merchandise is shipped on the same day that order is received.

Send for literature describing the many new 1941 DeWald receivers not illustrated here. List prices range from \$9.95 to \$149.50 . . . net prices are much lower.

20% deposit required with order. All prices quoted here are **NET, F.O.B. Jamaica, New York. Save 2%, send check or M. O. with order.**



Model 410

Battery Miniature "COMPANIONETTE"

Streamlined 4 pound personalized model in beautiful simulated cowhide leather case with saddle stitching. One of the best sellers in the field.

4 tube superhet; PM dynamic speaker; AVC; iron core high gain IF transformer; self-contained Looptenna; uses 2 flashlight cells for "A" supply. Gives long battery use; has easy vision tuning dial. Tunes 1700 to 540 kc.

Retail list price \$19.95

Your net price each

\$12.95

YOUR NET PRICE

EACH LOTS OF 3

\$12.45



Model 562 AC-DC "JEWEL" Series

Five rich jewel-like Catalin colored cabinets that emulate precious stones to choose from: Model 562-AI, Alabaster with Ivory trim—Model 562-AB, Alabaster-Blue trim—Model 562-OB, Onyx with Ivory trim—Model 562-MI, Maroon-Ivory trim.

5 new type high-efficiency single ended tubes; advanced superhet circuit; new tilt-top easy-vision slide rule dial; high ratio Vernier Tuning; AVC; beam power output; large dynamic speaker; built-in Looptenna; tuning range—General Broadcast and Extended State Police Bands.

Retail list price \$19.95

Your net price each

\$12.95

YOUR NET PRICE

EACH LOTS OF 3

\$12.45

CHANROSE RADIO

[WHOLESALE ONLY]

170-16 JAMAICA AVENUE

JAMAICA, NEW YORK

RADIO SERVICE-DEALER, JUNE, 1941

21

NEW PRODUCTS

OF THE MONTH

TRIPLETT

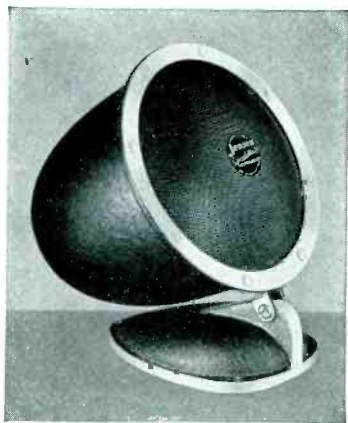
Model 625-T—A new Volt-Ohm-Milliammeter with 12 a.c. and d.c. voltage ranges to 5000 volts (d.c. at 10,000 ohms-per-volt). Attractive black molded case and panel; fully insulated.



Checked for 11,000 volts breakdown. New cartridge battery loading feature permits replacing batteries as easily as in a flash-light. Remove snap-on cap and drop them in the compartment. No soldering; no wiring; no need to open the tester. By The Triplett Electrical Instrument Co., Bluffton, Ohio.

JENSEN

"Speech-Master"—Type AP reproducers, for reproduction of speech, using a special p-m unit in conjunction with the Jensen Peri-Dynamic principle. Power rating is 5 watts maximum.



Type AP-10 for desk or wall mounting. Type AP-11 for panel mounting. By Jensen Radio Mfg. Co., 6601 S. Laramie Ave., Chicago.

GENERAL TRANSFORMER

Porta-Power—Model C, supplies 1½ volts "A" and 90 volts "B" to battery radios when connected to a 6-volt d-c source. Especially adaptable to receivers in rural districts away from the high lines. By General Transformer Corp., 1250 W. Van Buren St., Chicago.

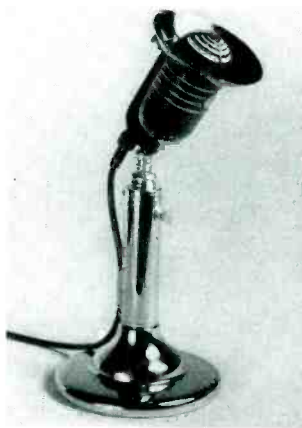
NATIONAL RECORDING

"Slik"—A new liquid preparation to be used on blank discs previous to cutting. Improves recordings by virtue of its lubrication properties. By National Recording Supply Co., Hollywood, Calif.

RCA

Mike Control—A new "push-mike" adaptor and stand for mobile or portable operation of p-a systems, or other services where it is desirable to cut the mike in and out of circuit at will.

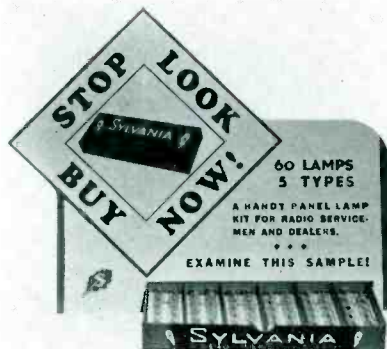
The switch adaptor is fitted with a heavy-duty dpdt low-capacity leaf switch, with a push-to-talk button that can be locked in "talk" position. As an adaptor



it may be fitted to any stand with 5/8"-27 thread. By RCA Manufacturing Co., Inc., Camden, N. J.

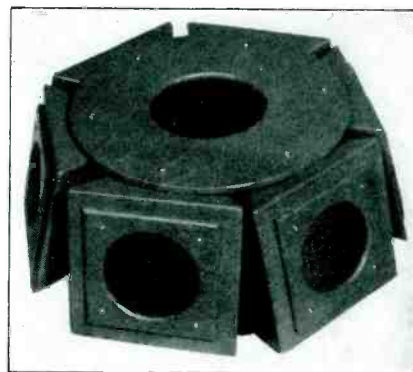
SYLVANIA

Panel Lamp Kit—In a handy kit that a serviceman can easily carry with him on every service call, Sylvania packs 60 Panel Lamps. These 60 lamps include 5 of the most popular types encountered in regular servicing work. Distribution is through Sylvania jobbers. On jobber counters you'll find Panel Lamp Kits being merchandised to the trade with the aid of a counter card that slips over the open kit. By Hygrade Sylvania Corp., Emporium, Pa.



VIBRALOC

Speaker Clusters—Tri-Tilt speaker clusters supplied in kit form or assembled, for



3, 4, 5 and 6-unit operation, with over-size down baffle. "Clusterette, Jr.," illustrated, takes speakers up to 9". "Clusterette, Sr." takes speakers from 8" to 12". Furnished in choice of several colors. By Vibraloc Mfg. Co., 325 Miguel St., San Francisco, Calif.

AMERICAN MIKE

New Mikes—Model C-7, a crystal mike having a more efficient coupling system between diaphragm and element, providing double the output of conventional, direct-drive types. Available with high or low-impedance output, and transformer to provide impedances of 200 to 500 ohms.



Model D-220, a new dynamic mike employing two units and having an overall range of 25 to 10,000. Features a selector switch permitting the use of either the high section or low section as desired, or



both units as a high-quality full-range mike. By American Microphone Co., Inc., 1915 S. Western Ave., Los Angeles, Calif.

(Continued on page 33)

MASTER ANTENNAS

(Continued from page 12)

increasing and decreasing of signal strength usually accompanied by loud crashes.

It seems hardly necessary to warn against the operation of two or more sets on a given radio outlet, yet that is a frequent source of trouble. Very definitely, there should be a radio outlet for each set. Two or more sets will not operate satisfactorily on one outlet, especially so if one or both happen to be ac-dc sets which often cause troublesome interference.

Then there is the question of operating f-m sets on the usual master antenna system. Such sets will operate, but perhaps not up to expectations, because of the more special antenna requirements for such reception. With the older installations it will be necessary to change the antenna transformer and even perhaps the aerial layout to avoid shielding effects. Also new a.m.-f.m. combination outlets may have to be installed. In this connection it is well to note that our present master antenna system is designed for either a-m or f-m reception, with a choice of terminals provided at each outlet. Unless you note the availability of terminals plainly marked FM, the system is not adaptable to f-m reception, although improvised reception may perhaps be had, depending on many circumstances.

BACKGROUND NOISE

Lastly, as for background noises, that is something rarely experienced with a properly installed and maintained system. At the time of installation the contractor has adequate ways and means of suppressing any troublesome noise sources, while the system itself effectively avoids or at least cancels out inductive interference. Particularly is this true of metropolitan areas, with powerful broadcasting stations close at hand, and where master antenna systems are most prolific.

Of course noises can always reach the set quite independently of the master antenna system proper. Too often the radio set may be connected to the outlet through long leads, in which case such leads may pick up electrical disturbances which have otherwise been avoided or cancelled out by the master antenna system. Therefore it is good practice, with the master antenna system — and, for

ASTATIC'S *New* N-SERIES MICROPHONES



Made in Wide
Range N-30
and Voice Range
N-80 Models.
List Price, each
\$17.50.

Both models in the N-Series are available with convenient on-off switch as illustrated at left. Complete as shown: List Price, each \$20.00.

Because of an exceptionally smooth frequency response and other improved characteristics, Astatic's new N-Series Crystal Microphones are especially desirable for modern public address installations. Swivel joint tilting head, cushion protected internal diaphragm, concentric cable connector, low cost and grand performance, make the N-Series highly desirable from every angle.

Astatic N-Series Microphones will be displayed at the Radio Parts National Trade Show, and are included in Astatic's new 1941 Catalog, now available.

ASTATIC

THE ASTATIC CORPORATION

In Canada: Canadian
Astatic, Ltd., Toronto, Ont.

YOUNGSTOWN, OHIO

Crystal Products Licensed Under Brush Development Co. Patents

that matter, with any kind of noise-reducing antenna system—to keep the connections between receiver and outlet as short as possible, even if this means moving the set to a less desirable location. Remember, too, that inductive interference can also reach the set over the power line, in which case a line filter may be required.

However, if the background noises persist despite all you can do with the master antenna system itself, then you will have to check up on the electrical equipment in the vicinity and proceed to clear up the noise source in conventional ways. Such noise sources may have developed after the master antenna system was installed, and therefore constitute an entirely new situation.

All in all, however, the master antenna system is one of the least of the headaches in the servicing game. Properly installed, it will perk along for years, provided it isn't unduly disturbed. Particularly so with the recent installations, in which further engineering progress has just about eliminated whatever "bugs" that were encountered in the earlier art.

931 PHOTOTUBE

(Continued from page 5)

to reach the photocathode or the initial dynode stages, they would cause the emission of spurious electrons which after multiplication would produce undesirable and often uncontrollable regeneration.

Convenient control of amplification can be obtained with slight sacrifice in sensitivity through defocusing the electron paths by mak-

ing the voltage step of one dynode unequal to that of others.

PRECAUTION

In the use of the 931, as with other tubes requiring high voltages, these high voltages may appear at points in the circuit, which are normally at a low potential, due to defective circuit parts or to incorrect circuit connections. Therefore, before any part of the circuit is touched, the power supply switch should be turned off and both ter-

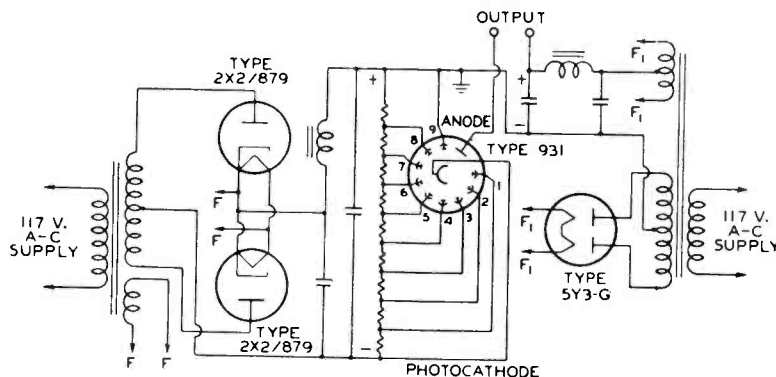


Fig. 4. Typical circuit for the 931 phototube.

minals of any charged condensers grounded. The high voltages involved are dangerous. Also, the use of a protective resistor having a minimum value of 10,000 ohms in the output circuit is recommended as a desirable procedure to prevent possible damage to circuit components during adjustment.

For sensitive measurements and in applications where a low signal-to-noise ratio is important, the circuit of Fig. 4 is satisfactory. In this circuit, the d-c power supply is arranged so that the dynode voltages are furnished by the 2X2/879 rectifiers while the anode-stage voltage is supplied by the 5Y3-G rectifier. The equal-step potentials for the dynodes are provided by a tapped voltage-divider resistor connected across the output of the high-voltage power supply. The bleeder current through this resistor will depend on the voltage regulation required by the application, but generally the current in the divider should be about 10 times the maximum output of the multiplier phototube.

APPLICATIONS

Because of its small size, rugged construction, enormous sensitivity, low noise level, low dark current, and freedom from distortion, the 931 has practical application in light-operated relays, in sound re-

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production from films, in facsimile transmission, and in research involving low light levels. It will unquestionably find wide use in the commercial field in the near future, and it's well that you understand its operation now.

SERVICEMAN'S DIARY

(Continued from page 8)

a girl—and a swell dancer—who had sewed up my finger when she was an interne at the hospital.

"Never mind," I said. "Maybe I had better handle this after all. These noise problems can't be handled by ordinary salesmen, like you."

I hopped in the car and was over at the doctor's house in five minutes. I rang the bell and a trained nurse let me in.

"The doctor wants the set put up on the third floor," she said. "I don't see how you're going to manage it alone. The stairs are steep and there's no man here to help you."

"Don't let that worry you," I remarked. "I'm stronger than you think."

But it was no easy job. I took the chassis and speaker out of the cabinet and brought them up separately. But the cabinet was awkward to handle. I worked up a real sweat on the job and was pretty tired when I finished. Luckily, it played quietly after I got it installed. I called the nurse and showed her how to work it.

"You know," I told her, "I used to be one of the doctor's patients. She sewed up my finger when she was an interne at the hospital."

"Is that so?" she answered. "That must have been some time ago. The doctor is now a g-u specialist and takes only women patients."

This was not good news. I wanted to talk to her—and privately.

"But I have an ailment which is right down her alley," I told her, "and I'd like to see her in her office."

"In the first place," she laughed, "the doctor is not in. And do you know what 'g-u' stands for?"

"Why," I answered, "general utility, I suppose. And, if that's the case, it certainly covers the field pretty well."

"Not quite," she answered, "it means 'genito-urinary'."

There didn't seem to be any point in carrying the conversation any further along that line. So I left and went back to the shop.

PORTFOLIO

(Continued from page 16)

may be put to good use. This is the case when aligning the i-f stages of f-m receivers. Here a 300-kc bandwidth, at frequencies of from 2.1 to around 11 mc, may be required. While the average f-m oscillator will not produce a bandwidth of anywhere near this amount at the fundamental frequency, the use of harmonics will automatically give a wider band.

Thus, for an 800-kc oscillator frequency modulated plus or minus 40 kc, the overall band would extend from 760 to 840 kc on fundamentals. But the fourth harmonic of 800 kc would be 3200 kc, and of 760 and 840 would be, respectively, 3040 and 3360, so that the bandwidth becomes four times as great, or 320 kc; ample for f-m alignment purposes.

If some frequency not a harmonic of the fixed frequency of the test oscillator is desired, this may be secured by opening the test os-

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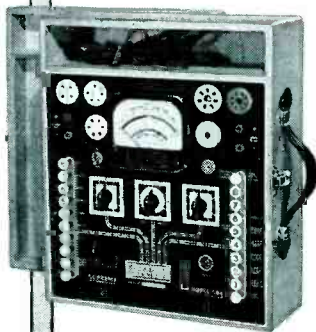


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CLARIFIED SCHEMATICS

As an example of the thoroughness of the Rider Manual service look at Volume XII. This, the latest volume, covers sets made since May 1940. In it you will find "Clarified Schematics." Bound right in the

volume, this section breaks down over 200 models that had had original schematics so involved that they would heretofore have taken you hours to decipher them. From Rider's "Clarified Schematics," however, you can see at a glance which coils, condensers, resistors and switch contacts are used in the r-f, mixer and oscillator sections for each setting of the wave band switch.

Be sure your production flows through smoothly—keep increasing your profits and lowering your operating costs. Be sure you have complete servicing information—Be sure you have all twelve Rider Manuals.

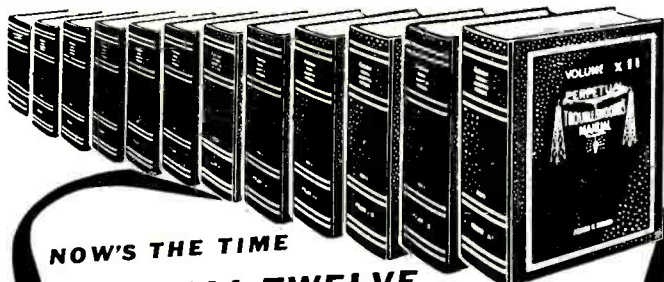
An Apology

The advance orders for Volume XII exhausted our first two printings. The third printing is now on press. If your jobber does not have copies available he will be able to supply you by the end of June.

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cillator and shunting the tuned circuit of the frequency-modulated oscillator with a variable condenser, increasing the capacity until the frequency is lowered to the point where a harmonic is equal to the i.f. desired. The variable-frequency oscillator may be rendered temporarily inoperative to avoid spurious beats. This is a little inconvenient, it must be admitted, but, after all, there are no test oscillators on the market, insofar as we know, which are capable of producing an f-m signal of the proper characteristics for the alignment of the newer f-m sets. And by this means satisfactory results can be secured.

F-M ALIGNMENT

In Fig. 5, the connections and the resulting images secured in the process of aligning an f-m discriminator-detector circuit are illustrated. The same results would likewise have been secured from the discriminator in an afc circuit. Note that the scope is connected across the discriminator load. When a wide-band, frequency-modulated signal is fed to the i-f amplifier, the resulting output of the discriminator should conform to that shown in Fig. 5-A. The lines should be straight near the crossover point and the crossover should be approximately in the center. The central position is secured by adjustment of the secondary trimmer, which is quite critical, and the straightness—and to a certain extent the height—is dependent upon correct adjustment of the primary trimmer, which is not at all critical. Improper adjustment of the secondary and primary trimmers is shown in Fig. 5-B; of the secondary alone, in Fig. 5-C.

In some sets distortion of the types noted in Figs. 6-B and 6-C is commonly experienced. These result from an audio signal, as shown. When 6-A is normal, 6-B indicates the result when overload causes grid current over one-half cycle; while 6-C shows the result when the other half cycle is affected. In either case, overload is occurring and, if the signal is not too strong, a defect in the stage under test is indicated.

FARNSWORTH P-2

(Continued from page 7)

drop. To adjust, set the record shelves for 12" records and have record changer in playing position. Loosen Lock Nut 99-11-6 (these are part of 56-153) and adjust Screw 99-18-15 until the needle drops 5-7/8" from the center of the Record Spindle. Be sure nut 99-11-6 is tightened after adjustment is made.

Adjustment of Tone Arm 71-12 (Fig. 1)

With records on the shelves, the top of the pickup arm at the highest point in its return should be 3/16" below the bottom of the bottom record on the shelves.

Adjustment—Loosen Lock Nut 99-13-5. Adjust Screw 99-26-17 parts of 66346 (Fig. 2) to secure proper clearance. Be sure Lock Nut is retightened.

With the tone arm 71-12 off the record and off the rest, the needle should clear the top of the base plate from 3/16" to 5/16". Adjustment is made by bending the front lip of 64219 (Fig. 4).

The Pickup Brush 6725 (Fig. 4) should be adjusted so the needle pressure is from 2 oz. to 2-1/4 oz.

Trip Mechanism—(Fig. 5)

The proper adjustment of the Trip Mechanism is, when the needle is 1-7/8" from the center of the record spindle, the Trip Finger 46287 (Fig. 5) trips the Starting Lever Release Trip 07-31 (Fig. 6).

To adjust tension, loosen Bristol Set Screw 99-28-30 in Upper Collar 43185 (Fig. 5). Turn collar counterclockwise to increase friction (if changer does not trip at end of record) and clockwise to decrease friction (if changer trips before the end of the record). There should never be any more friction than is necessary to move Starting Lever Release Trip 64215 (Fig. 6) off the end of the Starting Lever 13-38 (Fig. 6).

Excessive friction will cause a loud click each revolution of the turntable after a part of the record has been played.

Starting Pin 34309 and Starting Lever 13-38 (Fig. 6)

The Starting Pin 34309 (Fig. 6) is normally driven into the Spindle Gear 57-8 (Fig. 6) until the square end projects about 1/8", and should engage the end of the Starting

Lever 13-38 to allow the teeth of the Main Cam to mesh with the Spindle Gear without topping. Two adjustments are possible if the teeth do not engage properly, either drive the Starting Pin in further or bend the end of the Starting Lever.

Motor Speed

Due to commercial tolerances it is impossible to secure motors which will run at exactly 78.26 rpm. The Farnsworth limits are from 76.59 rpm to 80.00 rpm.

Oiling Instructions

The following simple oiling instructions will result in a minimum of service calls:—

Every six months or once each year, two or three drops of oil should be put on the two felt washers in the Spindle Gear Bracket. One washer is located at the bottom of the Spindle Gear, the other is at the top of the bracket and is accessible by removing the Turntable. Two or three drops of oil on the felts in the Motor. One drop of oil on the Pin for the

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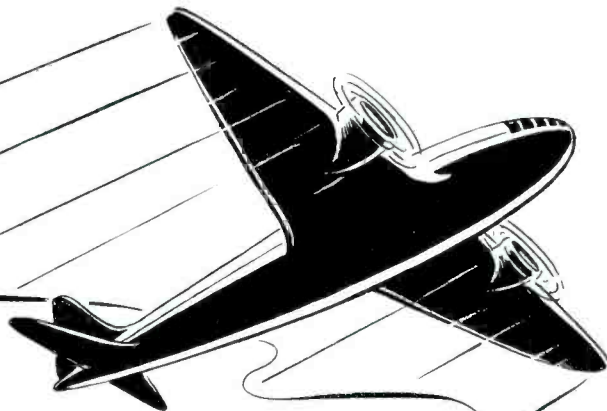
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roller of the Tone Arm Lift Lever. A very light application of White Vaseline on the teeth of the Main Cam, also some on the face of this Cam where the Tone Arm Swing Lever rides. A single drop of oil on the 10" and 12" plungers. Care should be exercised to prevent an excess of oil being used on any part.

No further lubrication of the tone arm bearing will be necessary unless a replacement is made. In this case a thin film of vaseline may be used.

Care should be taken to see that no oil gets on the motor pulley, idler pulley or rim of the turntable. No oil should be used on the Friction Trip Assembly.

Use only a good grade of machine oil with a viscosity of SAE 10.

G.E. LB-530

(Continued from page 18)

rent is much less than this value at the rated line of 117 volts, one or more of the copper-oxide discs may be defective.

To check individual discs, the following tests are suggested. In the conducting direction, the rectifier disc should pass 0.5 ampere or more when 0.5 volt is impressed across the disc. **Note:** The copper-oxide rectifier disc conducts when the positive potential is applied to the copper oxide surface. The copper oxide is a dark blue coating and is plated with nickel to afford good surface contact.

If a d-c ammeter is not available for measuring currents as high as 0.5 ampere, the circuit shown in Fig. 2 can be used for this check. This method requires that the resistance of 2.75 ohms be made fairly accurate. It is placed in series with the rectifier disc and the two placed across the 2-volt storage battery. The voltage should always read 0.5 volt or less; if the voltage exceeds 0.5 volt across the disc in this circuit, it indicates a defective disc.

The reverse current flow is as important as the above test and is made as follows: Reverse the battery polarity in the test circuit of Fig. 2 and place a 0-10 milliammeter in series with a lead to one of the battery terminals. This reverse current should not exceed 2.5 ma at the applied 2 volts. If the current is considerably above this value the disc should be discarded. **Precaution**—A suitable meter fuse should be used in series with the milliammeter to prevent

possible damage in case the disc under test is shorted.

A rough check, if a milliammeter is not available, is to measure the resistance of the disc in the non-conducting direction on the low-resistance tap (1.5 v.) of an ohmmeter. The resistance should measure at least 750 ohms.

Before the receiver chassis can be removed from the cabinet, it is necessary to first remove the battery-vibrator case. The battery case is held in place by four screws reached from the bottom of the cabinet. The chassis is held

by two Phillips screws located on the control panel. See Fig. 3 for interconnections.

ALIGNMENT

Turn volume control to maximum, set test oscillator to 455 kc and keep output low. Apply signal to 1A7GT converter grid through a .05-mfd condenser and align progressively the trimmers on the 2nd and 1st i-f transformers, as shown in Fig. 4.

For r-f alignment, set test oscillator to 1750 kc and loosely couple



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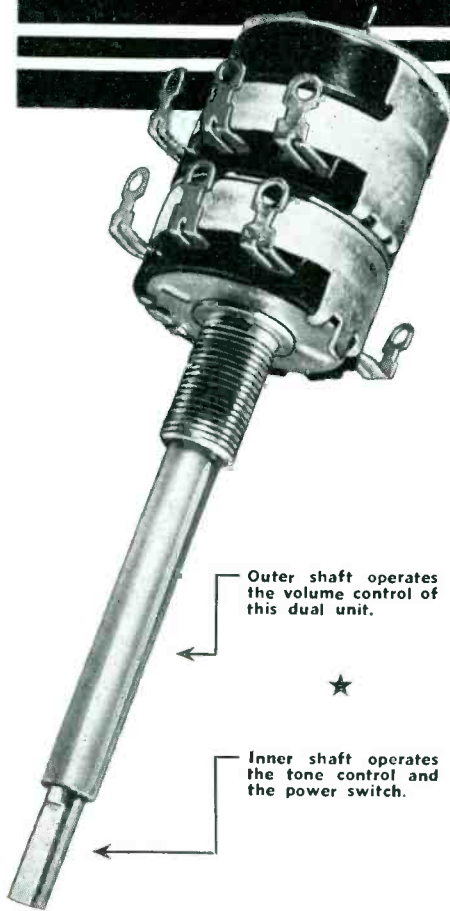
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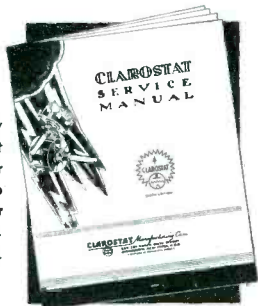
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a wire from the output terminal of the test oscillator so that the receiver loop will pick up the signal. Set the gang condenser to minimum capacity and adjust the oscillator trimmer C2A (See Fig. 4) to receive the signal. After that has been done, set the test oscillator to 1500 kc and tune it in on the receiver. Then adjust the r-f trimmer C1A for maximum output. In case of bent plates in the gang condenser, set the test oscillator and receiver to 600 kc and bend plates into the position for maximum output.

CIRCUIT COURT

(Continued from page 17)

bing-fading arrangement is shown in Fig. 4. The volume-control potentiometer R controls the microphone gain. The mixer volume control R1-R2 permits the mixing of voice or music from the mike with the output from radio or phonograph. Since R1 and R2 are separate controls, fading from one input to the other can also be accomplished. The 500,000-ohm resistors

changer is used for phonograph reproduction—or the manual turntable used for playing single records—the pickup output is fed to the 6Q7GT grid through switch SW. When the record changer is used for recording, switch SW is used to select radio or phonograph input to the audio amplifier, the volume being controlled by potentiometer R2. Then, if desired, mike input can be interjected through control R1.

Delayed Control Bias

To obtain maximum sensitivity for DX reception and its resultant aid in locating weak stations, a delayed automatic control bias arrangement is employed in the Truetone Model D1042 receiver.

The portion of the circuit involved is shown in Fig. 5. Since a small degree of control bias is developed by the diode due to contact potential, a small positive voltage is introduced into the avc bus to counteract it, by virtue of the 40-meg resistor R10 connected

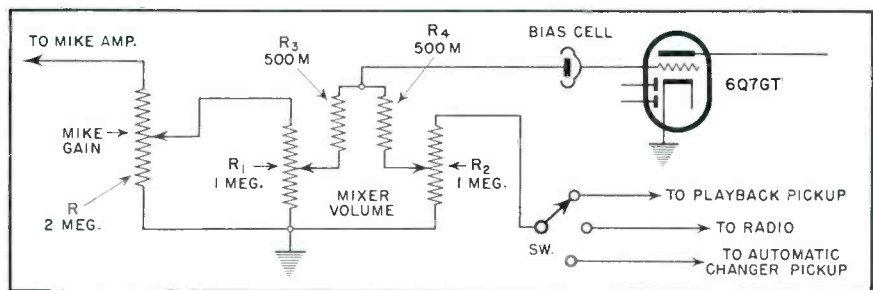


Fig. 4. Mixer-dubber-fader circuit.

R3 and R4 serve to isolate the mixer controls R1 and R2 and to prevent the grounding of the 6Q7GT grid through one or the other of the controls, which would otherwise be the case were one of the controls set at minimum volume.

When the automatic record

from B plus to the avc line.

The delayed action affects the r-f, converter and 1st i-f tubes; its influence on the 2nd i-f tube is negligible as this tube carries a negative voltage of 1.3 obtained from the drop across a 13-ohm resistor in the negative leg of the power supply circuit.

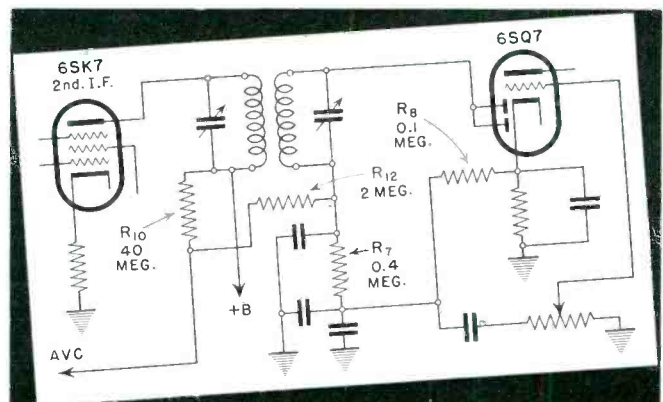


Fig. 5. Delay bias is fed from the plate supply to the avc line through the 40-meg resistor.

NEWS

Tie-Up—Working toward a closer tie-up with servicemen for mutual benefit, **J. B. Conley**, general manager of **WOWO-WGL**, Fort Wayne, Ind., has made the studios available to a local servicemen's group for its monthly meeting. An entire year's program of meetings is being worked out, featuring movies, lectures and discussions. The group held its first meeting April 25th, with about 140 servicemen and Hams in attendance. The tie-up can be attributed directly to the cooperation between servicemen and WOWO-WGL during the Radio Moving Day promotion.

Merger—**E. N. Rauland**, head of the **Rauland Corporation**, announces the purchase of the Sound Division of the **Webster-Chicago Corp.** The new trade name will be **Webster-Rauland**.

C. P. Cushway, previously General Sales Manager of Webster-Chicago, joins Webster-Rauland as Vice President and Sales Manager. **R. M. Gray** becomes Assistant Sales Manager and **J. R. Fredrickson** Advertising Manager.

Expansion—Adjoining their already extensive quarters in Bayonne, N. J., the **Solar Mfg. Corp.** has recently erected a warehouse for raw materials, thus releasing substantial additional factory space which will be devoted to increased production of oil condensers.

The largest backlog of orders in Solar's history, including substantial defense contracts receiving preferential treatment, has also made it necessary for the Corporation to lease additional space in nearby Jersey City. This new plant will produce mica transmitting condensers exclusively.

APPOINTMENTS

Edward M. Bieber has been appointed Sales Promotion Manager of the **Recoton Corporation**, New York City. He is planning a tour throughout the states in the interests of Recoton.

Roy S. Laird has been appointed Sales Manager for the **Ohmite Mfg. Co.**, Chicago. Mr. Laird has been with the Company five years as Sales Engineer.

Audio Development Co., Minneapolis, recently appointed **Norman B. Neely Enterprises** exclusive agents for several Western States.

Frank B. Koessler is the newest member of the sales staff of **Norman B. Neely Enterprises**. Mr. Koessler will handle radio parts and equipment sales.

The **Turner Co.**, Cedar Rapids, Iowa, has appointed **W. D. Lyon** as head of their Advertising Department. **Miss Garnet L. Ramsey** is named as Manager of the Vibrator Export Dept.

FISHING'S GOOD AT NORTH ADAMS

... but we're not doing much of it this year

Sure, we like to fish—but these are times when fishing must take a back seat. With one big Sprague plant working exclusively on national defense orders and with the other turning out more Sprague Condensers, Koolohm Resistors and Test Equipment for the radio trade than ever before, we've got a man's size job to do—and we're doing it. Meanwhile, we take this means of assuring our radio friends that, while putting national defense wholeheartedly first, we are neither forgetting nor neglecting them.

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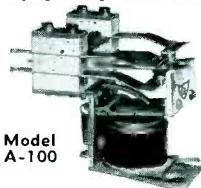
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A-100

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GUARDIAN  **ELECTRIC**

1633 W. Walnut St.

Chicago, Ill.

The appointment of **Wm. W. Montgomery** as Sales Manager of the Audiograph Sound Systems Division has just been announced by **John Meck Industries**, Chicago.

Solar Mfg. Corp. announces the return to their organization of **Sylvan A. Wolin** as Sales Promotion Manager.

NEW LITERATURE

Test Equipment—Radio City Products Co., 88 Park Place, New York, N. Y., have in preparation their new Catalog No. 125 detailing some fifty models of test equipment, including special units for electrical service-testing.



Outstanding in the new line to be presented is the Model 661 Electronic Multi-tester which combines in one instrument the functions of a vacuum-tube voltmeter for ac and dc, vacuum-tube ohmmeter and vacuum-tube capacity meter. This instrument provides a total of 26 ranges for measurements of voltages, both ac and

dc, to 6000; resistance from 1/10 ohm to 1000 megohms; capacity from 30 mmfd to 1000 mfd. Input resistance is 160 megohms on the higher ranges and 16 megohms on the lower ranges.

Catalog available through RCP distributors or direct from manufacturer.

Antenna Manual—Premax Products Division, Chisholm-Ryder Co., Niagara Falls, N. Y., announces the 1941 Edition of the Premax Antenna Manual, edited by Arthur H. Lynch. There are 32 pages of data on rotary beams, vertical radiators, f-m antennas, marine antennas, vertical beams, extended double Zepp, commercial antennas, and police antennas. Also the story of the antennas at W2USA, the New York World's Fair Ham Station. Price 25 cents.

Electrical Products—The Ideal Commutator Dresser Co., 1270 Park Ave., Sycamore, Ill., have issued their 25th Anniversary catalog of 24 pages. Copy from manufacturer on request.

P-A Catalog—A new 48-page catalog devoted exclusively to sound equipment and including the new Lafayette line for 1941-2 has been issued by the Lafayette Radio Corp., 100 Sixth Ave., New York, N. Y. Covers 25 amplifier models and approximately 75 completely coordinated sound systems. All salient facts are presented in tabular form for quick reference. Technical specifications of all amplifiers are also presented in this form. Copy on request to Lafayette.

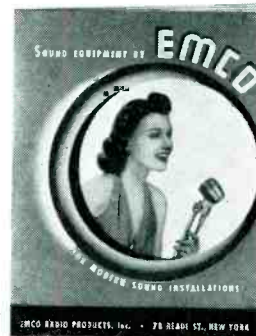
Cinaudagraph Speakers—New 8-page catalog covering the complete line of speakers and speaker systems produced by

Cinaudagraph Speakers, Inc., 2 Selleck St., Stamford, Conn. Copy on request.

P-A Guide—Allied Radio Corp., 833 W. Jackson Blvd., Chicago, through the medium of their new Spring and Summer Catalog, has provided an easy-to-understand chart covering all p-a applications, including Churches, Schools, Auditoriums, etc., for computing the area to be covered in square feet, wattage required in amplifier, size of speakers needed, etc.

A catalog including the complete chart and instructions is available from the Company at no charge.

Sound Equipment—Emco Radio Products, Inc., 78 Reade St., New York, N. Y.,



have issued an 8-page catalog covering their line of sound equipment. Copy on request.

Audiograph Catalog—A new catalog, showing the complete line of 1941 model Audiograph Sound Systems, has just been issued by John Meck Industries, 1313 W. Randolph St., Chicago. Fully illustrated to show all models available, this catalog contains list prices and is designed to serve as an aid to the dealer in selling to the consumer. Copy on request.

Service Notes—Volume IV of Emerson Service Notes is now available at 50 cents a copy from Emerson Radio & Phonograph Corp., 111 Eighth Ave., New York, N. Y. The 84 pages cover Chassis Models CA to CZ inclusive.

Tube Complement Book—A new Sylvania Radio Tube Complement Book, 1941 Edition, containing tube and panel lamp data for 16,730 radio models with 100,380 sockets is now being released by the Sylvania Radio Tube Division of the Hygrade Sylvania Corporation, Emporium, Pa. The price is 35 cents.

The book has two-tone blue cover, contains 272 pages of tube replacement data, 586 trade names of receivers, including all current makes as well as those no longer being manufactured.

Amplifier Manual—Amplifier Company of America, 19 West 20th St., New York, N. Y., has published a 32-page Direct-



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Coupled FM-AM Amplifier Manual, by A. C. Shaney, which describes a number of new and interesting circuits such as Variable Speed Non-Overloading Push-Pull Expansion, Non-Frequency Discriminating Scratch Suppression, Push-Pull Balanced Direct-Coupled Amplification, etc. It is priced at 20 cents and is available from the Company.

NATIONAL DEFENSE FRONT

Defense Market—A huge new market for virtually all radio test equipment and other merchandise handled by RCA Tube and Equipment Distributors has been opened up by the tremendous expansion of industry under the National Defense Program, according to **Bill Bohlke**, RCA's Director of Test Equipment Merchandising.

Mr. Bohlke has just returned from a four-week trip through seven far Western states, during which he met with more than 300 Tube and Equipment Distributors and their representatives in popular "Know Your Stuff" meetings, and in other informal gatherings. **W. H. "Win" Allen**, of the RCA Field Organization Headquarters staff, accompanied him.

I have discovered on this and other extensive trips into the field that the Tube and Equipment Distributors who have not neglected to maintain the proper local contacts are uncovering almost undreamed of business in industries of all types," Mr. Bohlke said. "This, of course, in addition to the expanding activity in normal radio business.

"The tremendous increase in the use of electronic devices in industry has opened up a new field for local sales and service for the distributor. Factories are calling for oscillographs, oscillators, receiving and special purpose tubes, radio equipment and parts, etc., in an unprecedented volume."

Mr. Bohlke characterized as "very successful" the series of "Know Your Stuff" meetings held for tube and equipment personnel during his trip. Such gatherings were held in California, Oregon, Washington, Texas, and Colorado.

NEW PRODUCTS

(Continued from page 22)

HOWARD

Recording Disc—New economy disc in the 6½" size. Has same Type C black coating as used on this firm's metal-base discs. Lists at 10 cents.

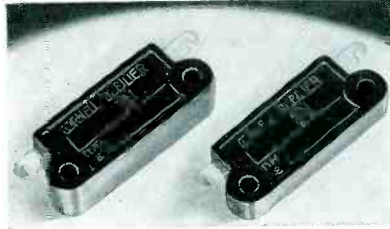
A new counter display is available, with easel for easy placement. Measures 11 x 14¾". By Howard Radio Co., 1735 Belmont Ave., Chicago.

IDEAL

Electric Etcher—The "Thin Line," a small, inexpensive etcher for permanently marking small tools and parts. Complete unit includes 9-ft. primary lead and plug, 2-oz. heat-resisting hand piece with 3-ft. lead, 4 x 6" work plate, for 115-v., 50-60 cycle line. Etching heat, 125 watts. By Ideal Commutator Dresser Co., 5104 Park Ave., Sycamore, Ill.

CORNELL-DUBILIER

Molded Midgets—Mica condensers molded in brown bakelite, measuring 1⅝ x ⅝", with thickness varying from .25 to .4 inch. Insulated mounting holes molded in



bakelite. Available in a wide range of capacities. By Cornell-Dubilier Electric Corp., South Plainfield, N. J.

SHOP NOTES

(Continued from page 20)

RCA RECEIVER ALIGNMENT

To Reduce I-F Regeneration

RCA Service Notes generally specify "stage-by-stage" i-f alignment. This procedure must be followed (when using an output meter) in order to prevent i-f regeneration or oscillation. The procedure is as follows:

Connect the signal generator through .01 mfd to the grid of the i-f tube. Adjust the primary and the secondary of the 2nd i-f transformer for maximum peak output.

Connect the signal generator through .01 mfd to the grid of the 1st detector tube. Adjust the primary and secondary of the 1st i-f transformer for maximum peak output.

Do not re-adjust the 2nd i-f transformer. When using a cathode-ray oscilloscope for alignment, the i-f trimmers should be adjusted for coincidence rather than peak output. Regeneration shows up as tapering peaks at the bottom of one side of the resonance curve.

RCA EXTENDED-FREQUENCY SETS

Alignment at 1720 kc

On models that cover the frequency range of 540 to 1720 kc, the Service Data specifies a definite alignment procedure to obtain (1) Frequency coverage up to 1720 kc, (2) Maximum sensitivity at 1500 kc. This procedure is as follows:

Feed a 1720-kc signal into the receiver. Turn the gang condenser to minimum capacity (rotor all out). Adjust the oscillator shunt trimmer in the receiver for peak output on the 1720-kc signal.

Feed a 1500-kc signal into the receiver, and tune the receiver to pick up the signal, even though it may not come in at exactly 1500 kc on the dial. Then adjust the antenna circuit trimmer for maximum output.

RCA 6L6

INSTANTANEOUS PLATE-VOLTAGE

According to RCA Application Note No. 110, during the past eighteen months, the RCA-6L6 has been manufactured with a "barrier" wafer base, which, together with the "glass button" seal employed in present-day metal tubes, enables this tube to withstand instantaneous voltages between its plate and cathode as high as 5000 volts, provided the tube is operated in typical circuits where its rated d-c potentials and dissipations are not exceeded.

It should be emphasized that the ability of the 6L6 to withstand a surge voltage of 5000 volts applies only for surges of extremely short duration. When a sustained 60-cycle voltage is applied to the plate circuit of a 6L6, breakdown usually occurs at a peak voltage of 3000 to 4000 volts.

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These features, denoting a *different* and superior type construction, insure a thoroughly satisfactory prong-base electrolytic for replacement or initial-equipment use. Don't be satisfied with anything less!

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Ask—yes, insist—on Aerovox Type F when you need prong-base electrolytics. Ask for latest catalog—write us direct.



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Notify RSD's circulation department at 11 West 42nd Street, New York City of your new address 2 or 3 weeks before you move. The Post Office Department does not forward magazines sent to a wrong address unless you pay additional postage. We cannot duplicate copies mailed to your old address. Thank You!

While the 6L6 as initially manufactured met the contemporary requirements for a "heavy-duty" receiving tube, later demands involved the ability of this tube to withstand momentarily high voltages in its plate circuit. Such voltages may be caused by transients occurring in a high-power audio amplifier which lacks the plate-load compensating network usually desirable for high-impedance output tubes. The resistance-capacitance method of compensation is effective not only in correcting the fidelity characteristic but also in preventing transients from producing excessive swings of plate voltage.

A second example of a circuit which subjects a tube to high instantaneous plate voltages is the horizontal scanning circuit of television receivers using magnetic deflection. In general, in these circuits, the 6L6 has been used to supply sawtooth current to the deflection coils. The sudden change of current in these coils induces a high voltage in the plate circuit of the 6L6 during the return time of the sawtooth wave. Often, this voltage is as high as 3000 volts. The improved 6L6 meets this condition with a large factor of safety, a statement confirmed by the satisfactory results obtained in practical operating tests.

The large factor of safety of the improved 6L6 is provided by a button-stem seal in which the length of insulation between leads has been greatly increased over that of the original bead seals, and by a barrier type of base in which the insulating paths between the staked ends of the base pins have been augmented by radial barriers molded in the insulating wafer.

RCA QU2-C, QU2-M Correction in Schematic

In the Service Data for Models QU2-C, QU2-M, the 2.2 meg avc resistor should be connected to "B" on the 2nd i-f transformer.

In some production runs the audio coupling capacitor is changed from .0025 mfd to .01 mfd. Also, in the QU2-M magnetic pickup connection, the .035 mfd capacitor is changed to .05 mfd.

RCA V-301, V-302 Mechanical Motor Noise

Mechanical motor noise due to armature end play sometimes develops with wear in the above instruments which use type RP-153 record changers. This can be eliminated by tightening the armature thrust bearings. Care should be taken to avoid making them too tight which will cause binding.

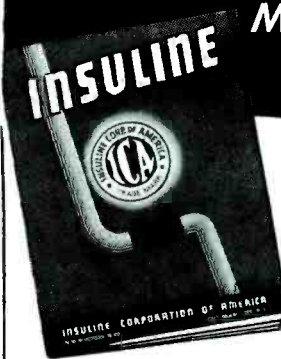
RCA REPLACEMENT STUDS For Main Lever, Cam-and-Gear, or Trip Pawl

In automatic record changers of the RP-139A, 145, 152, 153, 155, and similar types, loosening of the mounting studs on which the main lever, cam-and-gear, or trip pawl are pivoted may be caused by jamming of the main lever against the pawl pin at the end of the change cycle due to one or more of the following reasons:

(a) The long arm of the main lever slides over the thin pawl pin instead of pushing against it during first half of cycle. Check for bent arm on main lever.

(b) After being cleared out of the way, the trip pawl bounces back due to vibration (dancing near mechanism, etc.) Check the trip-pawl phosphor-bronze spring for sufficient "drag" or pressure against the pawl.

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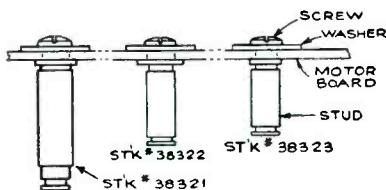
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(c) The index lever is put into "Reject" position while the mechanism is still in its change cycle. Caution customer against this.



Loose studs may be quickly and easily replaced by using special replacement studs that are fastened to the motorboard by means of a screw and washer. Three different studs are available, as shown.

RCA COLOR CODE
For Power Transformers

Changes have recently been made in the color code of RCA power transformer leads to conform to R.M.A. standards.

	Old Color Code	New Color Code
Rectifier filament . . .	yellow	yellow
Amplifier filament . . .	blue	brown
Hi-voltage secondary	brown	red
Hi-voltage center tap	brown & black	red & yellow

There are three different types of primaries as follows:

Single 110-volt primary	red	black
Double primary—110-220 volts:		
No. 1 Primary—Start	red	black
No. 1 Primary—Finish	red & black	black & yel.
No. 2 Primary—Start	red & yel.	black & green
No. 2 Primary—Finish	black & red tr.	black & red
Tapped primary—110-125- 150-210-240 V.:		
Start	red	black
110 volt tap	red & black	black & yel.
Finish	black & red tr.	black & red

These transformers are interchangeable since no change has been made in their electrical characteristics. Transformers supplied for replacement purposes using the new color code leads are shipped less end shields (covers). The end shield from the original transformer should be used. If the lower shield is of the bent lug type, it need not be removed from the chassis.

RCA SPEAKERS
Replacing Cones

In some types of speakers, the fabric voice-coil support is cemented to the top-pole plate. This design provides more accurate and permanent centering, by eliminating possible strain and movement that may occur in tightening the screws on speakers that have adjustable-type voice-coil supports.

If the voice coil scrapes in the gap, it may be caused by:

(1) A bent speaker frame. This condition can usually be corrected by bend-

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\$5.00 enclosed for 1941 National Dues for 5 memberships in RSA. Names and addresses attached herewith.

\$1.00 enclosed for 1941 National RSA Dues for single membership.

Name

Address

City State

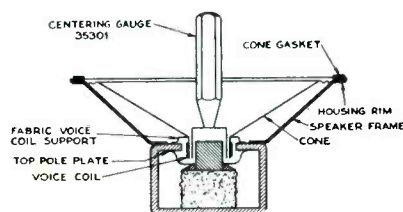
RSD—June '41

ing the frame in the required direction.

(2) A warped voice coil, or a warped voice coil support. This condition requires installation of a new cone, as follows:

Remove old cone by cutting around the cone rim and the voice coil support.

See that the air gap is uniform and clean. Cover the gap with a piece of "scotch tape" to prevent entry of dirt and metallic particles.



Remove all paper and cement from rim of cone housing and from the top-pole plate.

Apply a ring of cement ("Duco-Household") on top-pole plate and around rim of speaker frame.

Carefully insert centering gauge (RCA Stock No. 35301) into the voice coil of the replacement cone, handle first, from winding end. Remove scotch tape from the air gap and insert the cone into the speaker, with the voice coil leads in correct position with respect to the terminals. Press cone rim onto the housing rim.

Apply cement on top outer edge of cone and lay the large cardboard cone gasket in place. Set the speaker in an inverted position on a smooth flat surface that has

a 1/2 inch hole for the gauge handle to clear, until the cement is dry (about 15 minutes). See that the voice coil support is pressing against the cement on the top-pole plate.

Work additional cement around the outer edge of the fabric voice-coil support, to insure positive grip all around between the support and the top-pole plate.

Remove gauge from voice coil, using a rotary motion. Solder the voice coil leads in place, allowing sufficient slack to permit free motion of the cone. Dress the leads in the plane of motion, taking care that the leads do not strike against the cone, or cone housing. Cement dust cap on cone center.

RCA BP-10 Low Output

Low output on BP-10 Models that have elliptical speaker may be due to the 1S4 output tube lying close to the speaker magnet, causing disturbance of the space charge in the tube. To remedy this condition, install a felt pad between the speaker frame and the tube to keep the tube upright in its socket and spaced away from the magnet.

RCA Q24 Dead on Short-Wave Bands

Under certain conditions the local oscillator in Model Q24 receivers will oscillate at a parasitic frequency causing the set to be dead on one or more of the short-wave bands. If this condition exists it can be corrected by connecting a 10-ohm, 1/4-watt resistor in series with the oscil-

lator grid, mounted directly at the tube socket.

WELLS-GARDNER SERIES 9A46 Issue C Changes

Issue C chassis have a first i-f coil with optional i-f expansion. In the Sharp position, the high-frequency range is normal. In the Broad position, the high-frequency range is extended, permitting high-fidelity reception.

The selectivity control switch is located on the top of the chassis base at the rear right corner (from back).

The high end of the tone control is connected to the ungrounded end of the bass boosting condenser C39 in the tone compensating circuit. By making this connection, the bass boost is controlled by the tone control. As the tone control knob approaches the treble position, condenser C39 is short-circuited, resulting in no bass boost at this position.

WELLS-GARDNER SERIES 9A46 Issue D Changes

On the issue D chassis, the selectivity control switch is operated by the tone control knob. On the previous C issue this control was on the chassis, as mentioned above.

Also, on the D chassis the phono-radio switch, which was previously operated by the tone control knob, is now a separate control connected to the chassis by a shielded cable. On the back of the chassis base is a 6-prong socket to which the cable is connected.

Company Attention-n-n!

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For more than a decade Centralab Controls reflect the superb engineering skill . . . the meticulous care in manufacture and the precision perfection of every tiny part.

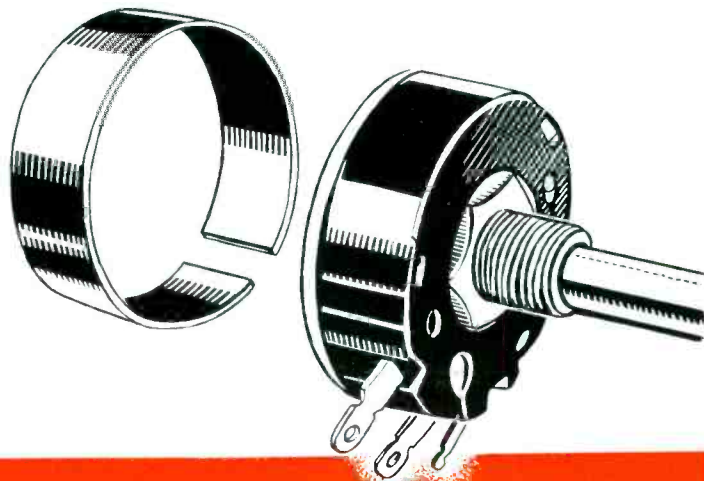
Whatever your need . . . service man or service technician . . . amateur . . . experimenter, scientist, manufacturer . . . always specify Centralab Volume Controls.

CENTRALAB: Division of Globe-Union Inc.
Milwaukee Wisconsin

The outstanding feature of the Centralab Volume Control not found in any other make is the wall-type resistor that hugs the inner circumference of the case.

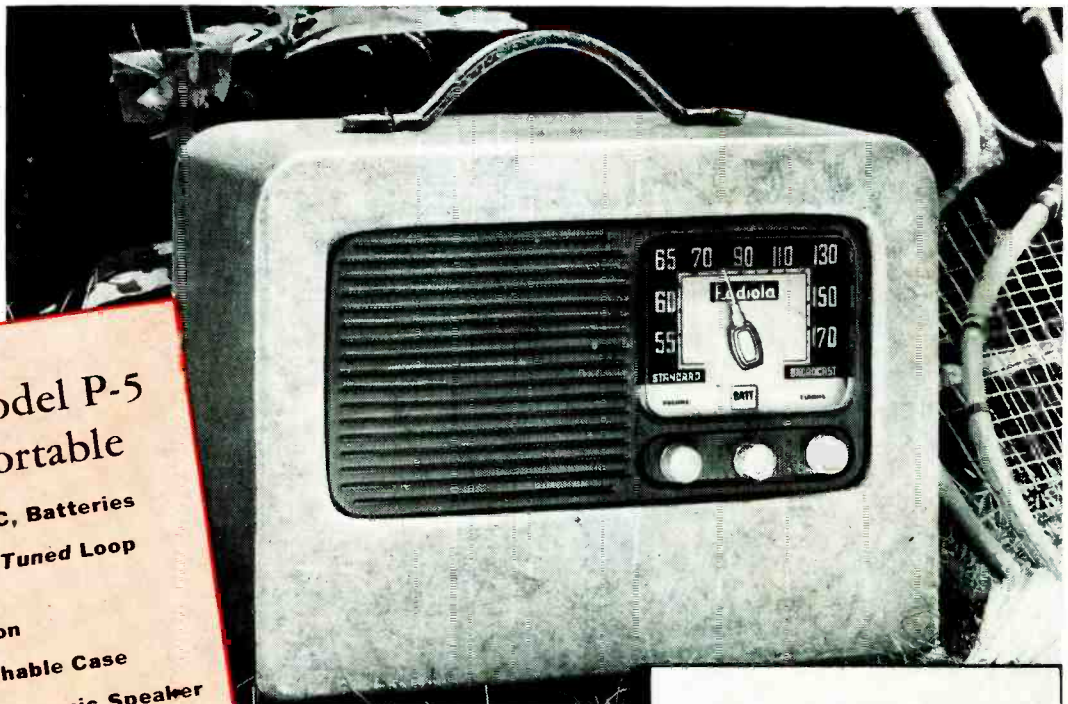
. . . giving a larger and more uniform resistance surface than the ordinary "horse shoe" type . . . of resistor form.

. . . smoother and quieter performance throughout the entire rotation. Available in STANDARD RADIOHM . . . MIDGET RADIOHM . . . ELF RADIOHM . . . and SUB MIDGET RADIOHM.



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- Durable, Washable Case
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SUMMER'S THE SEASON for sales by *servicemen!* For in summer, service customers want an extra radio more than ever—particularly if that extra radio will play *anywhere*... with the superb *performance* of this RADIOLA Model P-5 three-way portable.

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they can carry upstairs, downstairs, all around the house... and right out the front door, when they wish!

Servicemen the country over are boosting their incomes the RADIOLA way... with the only line of radio receivers specifically designed for servicemen to sell. Try it yourself. See the great new RADIOLA line at your distributor's. Combine business with *more business*: sell sets when you sell service!

All RADIOLA Models Are Equipped Exclusively with RCA Preferred Type Tubes

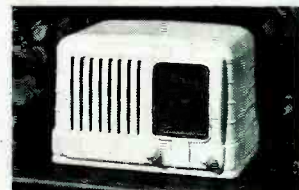


THESE
RADIOLA MODELS, TOO,
are selling like hotcakes!



Radiola Model 515

Superb *foreign* reception in an "extra" radio! Plus a continental-style cabinet... large, easy-reading dial... and RF Stage for stepped-up sensitivity! Six RCA Preferred Type Tubes. Six tuned circuits. Two built-in antennas for long and short waves. No wonder it's a *super* seller.



Radiola Model 511

A RADIOLA model you can sell nearly everywhere—a set that's packed with value! Beautiful antique-ivory plastic cabinet. Five RCA Preferred Type Tubes in a sensitive superheterodyne with full AVC action. 5" electrodynamic speaker. Large, built-in *tuned* loop antenna.

Radiola Preferred Type Radios

Made by RCA Manufacturing Co., Inc., Camden, N. J., U. S. A.
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In Canada, RCA Victor Company, Ltd., Montreal