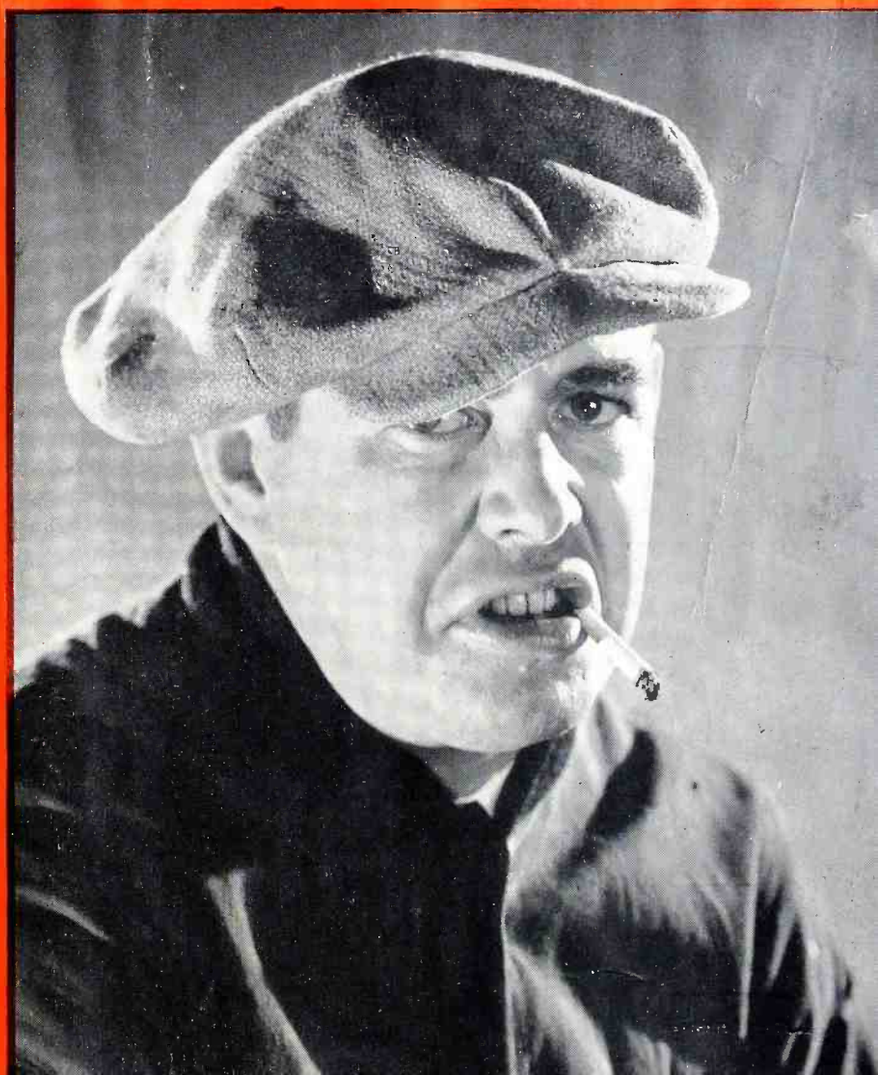
Radio SERVICE DEALER

JANUARY 1942



This Month

SERVICE ENGINEER

DISTRIBUTOR

MALLORY

We Three...

No use kidding ourselves. We three—you, your Mallory Distributor and the Mallory Company—face a real problem.

It is the problem thrust upon us by the conscription of raw materials, vital for wartime production. Shortages of materials have interrupted, slowed down, sometimes cut off the production of many radio repair parts. Yes, it is a problem, sometimes a tough problem, to repair broken down radio receivers and "keep 'em listening."

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Let us work together, we three—and we will always find a way to lick the problem.

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Approved Precision Products

Radio
SERVICE-DEALER
SOUNDMAN AND JOBBER
Reg. U. S. Pat. Off.

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Ad Index

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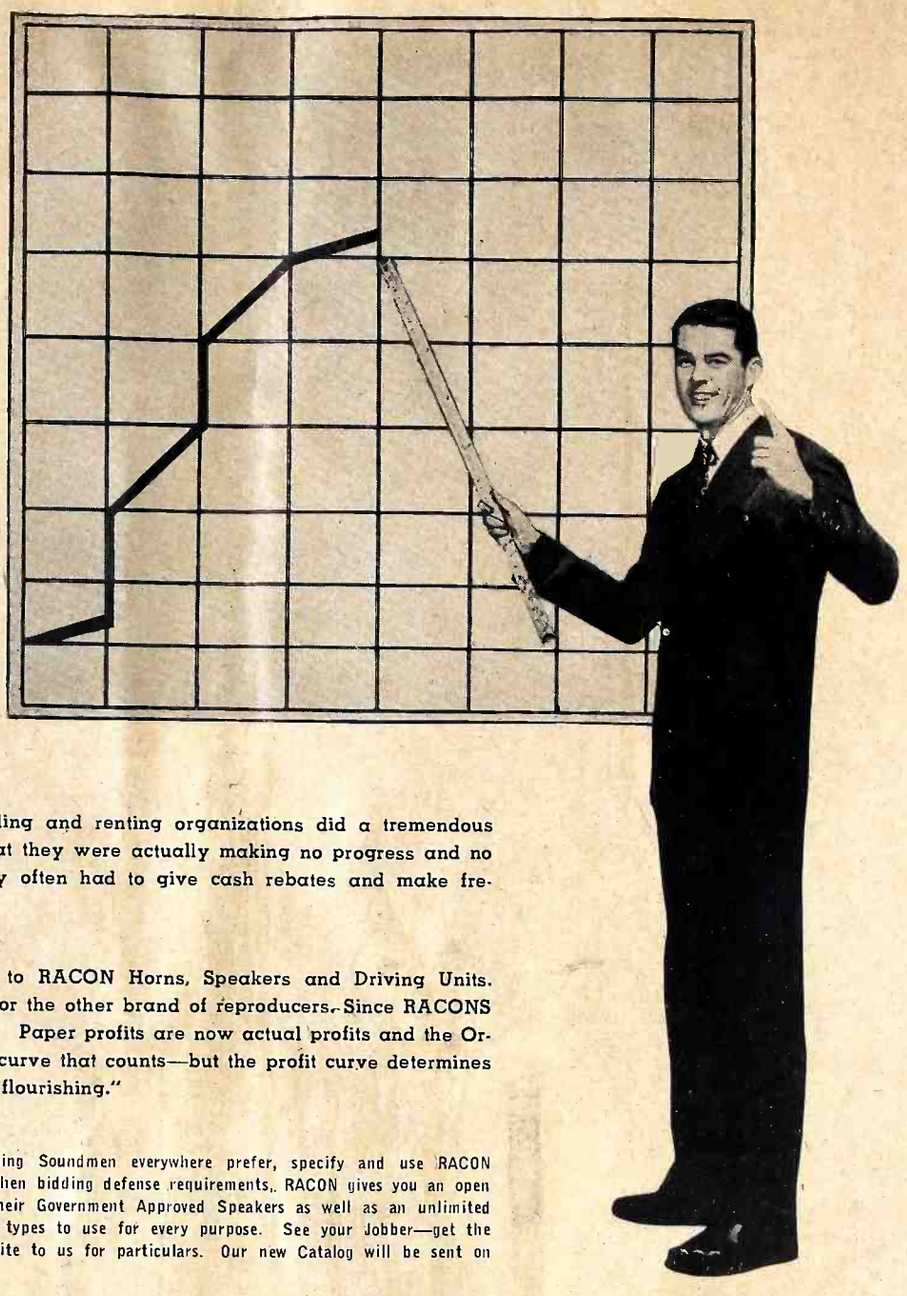
RACONS make this profit-curve possible . . .



★ One of the country's leading sound selling and renting organizations did a tremendous amount of business, yet their books disclosed that they were actually making no progress and no profit because, to keep many sales "sold," they often had to give cash rebates and make frequent free service calls to dissatisfied customers.

★ This Sound Organization now switches to RACON Horns, Speakers and Driving Units. They pay no more for RACONS than they paid for the other brand of reproducers. Since RACONS went in, rebates and free service calls are "out." Paper profits are now actual profits and the Organization is thriving. Moral: "It's not the sales curve that counts—but the profit curve determines whether or not the Sound-Selling Organization is flourishing."

★ Leading Soundmen everywhere prefer, specify and use RACON Products. When bidding defense requirements, RACON gives you an open door with their Government Approved Speakers as well as an unlimited selection of types to use for every purpose. See your Jobber—get the facts—or write to us for particulars. Our new Catalog will be sent on request.

There is a RACON for every purpose . . . here are just a few:

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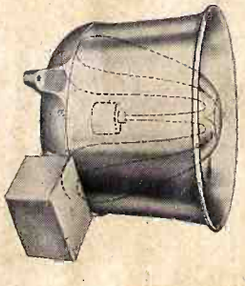

Re-entrant type speakers using horn type units for marine and general P-A applications — may be used as loudspeaker or as a microphone. Miniature and regular sizes approved by the Bureau of Marine Inspection and Navigation, Department of Commerce, for marine work. In all sizes, miniature, midget, regular and bull, handling from 5 to 50 watts.

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Operating capacity 12-15 watts, peak 25 watts. Other P.M. units available from "baby unit" of 5 watts to "bull unit" with an operating capacity of 50 watts. Efficiencies of the highest order obtainable with the finest magnetic material and steel utilized.

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For SUPER-POWER highly efficient sound projection. Developed for installations where space is limited and weight factor small. STORMPROOF—guaranteed weatherproof even if completely immersed in water. Indoor and outdoor types 42" and 54" long are demountable, have heavy cast aluminum throat sections and suspension rings. Indoor types take 2 or 4 units, outdoor types 4 or 9 heavy units. Up to 3 mile ground projection capacity.

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Compact trumpet of the double, re-entrant type. Occupies but a small space, nevertheless has a long air column enabling it to deliver highly concentrated sound of the greatest efficiency over long distances. Base and inside cone arm made of aluminum castings, outside bell of heavy gauge aluminum spinning, centre section of RACON ACOUSTIC material to prevent resonant effects. Available in 6', 4½', 3½', and 3' air column units.

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

GUARDIANS OF THE FREE VOICE

FROM THIS TIME ONWARD, until the bright day of world peace, what are to be our responsibilities? And what is to be our conduct? Are we to carry on business as usual, and assume that through our increased earnings we are doing our whole part by investing an ever-increasing amount in Defense Bonds? Will we be holding up our end merely by *investing* our money in the United States Government? Is that to be our *total* contribution to the cause?

OUR RESPONSIBILITIES

Most certainly no, but we hardly need tell you that. Our responsibilities measure higher than an investment, although investment is one of them. For one thing—and there is no question about it—we are the guardians of the Free Voice of Radio, both in the sense that we all share it and keep it free by our wills to have it so, and in the sense that, as radio servicemen, it is given to us to see that it is not silenced, by technical defect, in *any* home, be that home lowly or great. *No* family should be deprived of the Voice that brings the solace of music, the assurance of truth, the lessons of conduct under the stress of war, the uplift of comedy and, should the bombs drop, the warning of danger.

We have seen this effectively dramatized by the National Broadcasting Company, in an institutional advertisement, picturing a family seated before their radio, with the faces of the father, mother and child highlighted by the glow from the radio dial. It says, simply, that this is "The Light That *Must* Not Fail."

PROTECT ALL

If we consider the worst that can happen—and we would be fools to ignore the possibility—then all of us, without having to question the matter, know that there are doctors, nurses, air-raid wardens, firemen, policemen, light and telephone service squads, and others, to come immediately to our aid, no matter what the personal dangers may be. Because this is not simply a soldier's war, as all previous wars have been, but a *people's* war as well. And the best in people arises, and may be counted on, when there is common danger. We have seen it in England.

We say, then, that your responsibility extends beyond any that you have heretofore assumed, or even considered. It should be—and we know it will be—the same degree of responsibility assumed by a multitude of people in your own community, and assumed by them for community protection *and not their own*. Therefore, let it be your *extra* duty, should trouble come, to keep the light from failing. And let it be said of you, whether trouble comes or not, that you never let a light go out in a lowly home because of an inability to pay for keeping the light going.

BE PREPARED

Time is dangerously short, but not too short. Too many of us have waited too long to get things in order without, now, a necessary haste. There is no longer the time to wait for the duties and special responsibilities to come to us; it is long past time that we go out to meet them.

We ask you, as a technician, to fit yourself into Civilian Defense, where there are many services you can offer. You may not know just what those services may be, for only an emergency will reveal what is needed. Possibly a quick test on an out-of-service radio transmitter, a temporary repair on an open communications line, restoration of broadcast reception at an important point, or the rapid set-up of p-a equipment for emergency work. Who knows?

Be prepared for any contingency, and remember that you may be of importance in the absence of other technicians, when time may count heavily.

TYPICAL WORNER PHOTOELECTRIC ANTI-SABOTAGE INSTALLATION.

VIGILANCE FOR VICTORY

With Photoelectric Equipment*

SINCE this war is to be won in factories as well as in the air—and on land and sea, an important "war front" is in the factories themselves.

During the days when the Axis Powers appeared to be an undefined threat we began arming our Allies and ourselves and that caused a greatly increased demand for photoelectric equipment. This equipment was used to speed up production by its application to problems of counting, sorting, inspecting, weighing, product control through color, illumination control, smoke control, combustion control, and the protection of the flood of new workers against industrial accidents.

ANTI-SABOTAGE

Photoelectric equipment is still being installed for these manifold services. But to these uses has now been added that of protecting products, plants and personnel against sabotage and espionage agents. In fact, the demand for photoelectric equipment for anti-sabotage and anti-espionage has, within the past two months, grown to such proportions that a leading manufacturer is now supplying more units for such installations than for any other purpose.

Briefly, a photoelectric installation consists of a light source unit which directs a beam of invisible light at another unit containing a photoelectric cell. Light striking the photoelectric cell causes a current to flow in the circuit of which the cell is a part. Variation of the amount of light striking the cell varies the current flowing through it. Total interruption of the light beam causes the photocell current to cease flowing. Through a system of amplifiers and relays the variations in the small current of the photocell can be built up into currents to control operating circuits of any desired electrical equipment.

In this will be seen the central idea for anti-sabotage and anti-espionage equipment. For these purposes special equipment has been designed which operates at long range (500 lineal feet) and which employs a beam of invisible light, that is, black light rays (7200 Anstroms).

Where anti-sabotage equipment is installed the would-be trespasser unwittingly announces his presence by breaking through a "fence" which he can neither see nor feel—a fence of invisible light. His trespass may be announced without his knowing it by a visible or audible alarm, or both, at a station remote from the point of trespass. The signal system not only announces the trespasser but also tells where he is within a distance of 500 feet in the case of outdoor installations. When the installations are made indoors the signal system will show the exact room in which the trespasser is to be found.

SURPRISE FLOODLIGHTING

In some cases it is desirable that the trespasser should be shown up and "put on the spot" even if he does know he has been detected. In such cases the invisible "fence" is connected with a floodlighting system in such a way that at the instant of trespass the saboteur is not only detected and located but also illuminated to make a target for armed guards. This type of anti-sabotage defense is known as "surprise floodlighting" and is an outgrowth of modern warfare. During World War 1, continuous floodlighting was used. Nowadays when enemy airplanes scout the skys to plot the location of factories, power companies, refineries, etc., any continuous floodlighting is worse than useless—it is a positive menace to safety. One of the fortunate things about the change from continuous floodlighting to "surprise floodlighting" is that the transformation from the old type to the new type can be made

** Article specially prepared for Radio Service-Dealer by the Worner Products Corp., 1019 West Lake St., Chicago, Ill.*

without discarding the old illumination, by merely attaching it to a properly installed photoelectric anti-sabotage installation.

It is natural that the reader will wonder what the specific details are for an anti-sabotage installation. Upon reflection he will realize that such data cannot be published without giving information to our enemies. In fact, each installation is made to suit the circumstances.

For example, outdoor installations may be over various types of terrain. They may be made in connection with a property patrol system of armed guards or in a system where they must be operated without a patrol system. They may operate with or without a floodlighting system. Some cases may require the invisible "fence" to be higher or lower than others.

In the case of inside installations the photoelectric system may operate as a supplement to some other alarm system or do all the protecting itself.

SYSTEM PLANNING

Variations in the layout of the system do not introduce any difficulties in making sales or installations. All that is required is a sketch of the area to be protected, with dimensions, description of terrain, and the direction of sunlight or strong artificial light. Worner engineers will plan the layout and recommend the proper equipment for the job. Actual installation and maintenance can then be made by an average electrical layman. This is true in spite of the fact that these units are very sensitive and must be "aimed" very accurately. By "aimed" is meant that the beam sent out by the light source must be directed to hit a spot in the photocell unit which is no larger than the eraser on a lead pencil. Units are installed so that horizontal and vertical adjustments are easily made and the change in adjusting the "aiming" of the light beam easily observed. This adjustment is made with the "light filter" removed so that white light shows what changes are to be made. This accurate "aiming" makes it impossible for a saboteur to make the system inoperative by using a flashlight. In order to flash onto the right spot the saboteur would have to put his flashlight directly in the light beam which would, of course, interrupt the beam and operate the alarm.

INSTALLATIONS

A few general directions about installations may be mentioned without aiding the enemy.

Units for outdoor installations are mounted on stanchions made of 1½" pipe. One end of the pipe is threaded to fit a flange in the bottoms of the unit housings. The other end is embedded in a block of cement. This makes a firm support so that ground vibration due to traffic parallel to the invisible "fence" will not shake the beam off the photocell, for that would turn in a false alarm. Another general principle of the installation is that the units are so placed that the corner of the invisible "fence" is not at the point where a unit is located but at a point where two beams intersect to form an invisible "fence" corner. The actual units are small and may be easily camouflaged so the trespasser will not be aware that the invisible "fence" exists.

Some general information about laying out an indoor installation may also be given. In such installations it is not necessary to have a separate set of units for each beam which crosses the room to be protected. The beam from a light source unit is cast upon a mirror or system of mirrors which ends by reflecting the beam to the photocell unit. By this means the whole room is criss-crossed with invisible light beams.

Many indoor areas are protected by what is known among burglar alarm companies as a "closed circuit" alarm system. This is a good means of protection against forced entry, but to obtain complete protection it should be supplemented by photoelectric equipment. Burglar alarm companies realize this is true and not a mere criticism of their systems, and many of them recommend the photoelectric system to supplement their own, whereas in the beginning they regarded the photoelectric system as a rival.

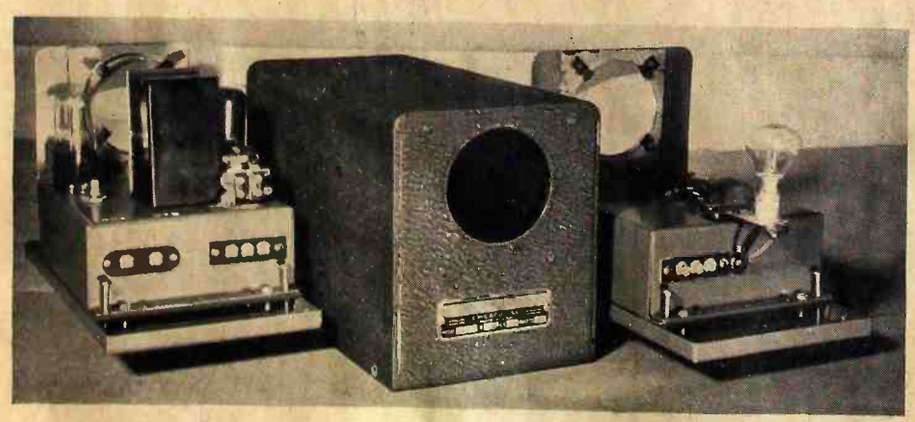
The "closed circuit" system consists of a circuit of fragile foil tape pasted across all windows and connecting into the circuit by means of contacts when the windows are closed. A section of the same circuit across each door makes the circuit complete when all doors and windows are closed. Any forced entry through doors or windows will break the circuit and sound the alarm.

However, this system may be circumvented in two ways.

One is to break through a floor, ceiling, or wall. These methods have been used many times. Breaking through a wall was the method used by a criminal whose story was recently enacted over the radio program "Gang Busters."

The other method of circumvention does not require any forced entry. The saboteur conceals himself in the room before the doors and windows are closed. He then goes about his work. When he is through he puts a shunt across the circuit of the door or window through which he plans his escape. Breaking the original circuit will still leave the circuit closed because of the shunt. This is a commonly-known means of circumvention.

When the photoelectric anti-sabotage system is used the saboteur is detected regardless of whether he makes a forced entry or an entry by concealment.



Robot is shown at left and light source at right; weather proof case, as used for both units, in center.

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BOOK REVIEW

"AUTOMATIC RECORD CHANGERS AND RECORDERS," by John F. Rider. Published by John F. Rider Publisher, Inc., 404 Fourth Ave., New York, N. Y. 8½" x 11", stiff cloth cover, 744 pages. Price $6.00.

Within the past ten years the popularity of automatic record changers has grown by leaps and bounds. From a very modest beginning in the more elaborate radio-phonograph combinations, record changers by the tens of thousands are now found in all sorts of jobs, with and without a radio receiver.

Some of these devices are surprisingly simple in their make-up and functioning, while others have the most complicated of mechanisms to perform the same tasks. However, they all have one thing in com-

(Continued on page 21)

RIDER on Tube Phase

KP AND G—PART III

John F. Rider

IT might appear from the way the last installment was concluded that phase inversion is limited to a single triode tube. Such is not the case. True that in effect only a single tube is involved in the actual process of amplifying a phase-inverted signal or that only a single tube need be involved in the production of the same signal in two different phases—as, for example, out of the plate and across the cathode circuits—but by no means are these arrangements limited to triodes.

The phase relationship which has been described in connection with a triode applies equally to the tetrode, pentode, or any other tube which is normally used for amplification. With the cathode as the reference point, any other element to which is applied a positive operating voltage, such as the screen or the plate, will maintain the phase relationship which has already been described. We make this statement in order that you do not form the erroneous idea that just because we spoke in terms of the triode, that all which has been said applies solely to the triode.

DIODE INVERTER

To give you an illustration of just this point, examine *Fig. 1*. This is a simple diode second detector and differs from so-called conventional circuits in that a dual potentiometer is used as a load with the mid-point grounded. It should be understood that each section of this dual potentiometer has the same value of resistance and further that the two arms are tied to a single control; or, for that matter, it may be a dual control upon a single shaft; at any rate, when the control is varied like values of resistance are embraced in each section.

Since the rectified current is the same through all portions of this dual potentiometer and with the ground as the reference point, like values of resistance present between the grounded point and the location of the moving arm upon each potentiometer, will result in the presence of like values of alternating voltage across that portion of each section which is between the grounded point and the location of the moving arm. The two bypass capacities shunting the two potentiometers have a number of functions, paramount of which at the moment, is to minimize the development of r-f or i-f voltages, depending upon the nature of the input signal, across the respective loads.

Now, if we imagine a voltage applied to the diode plate which is positive with respect to the cathode, a flow of current will take place from the cathode to the plate and from the plate around the transformer and the two loads, back to the cathode, thus completing the circuit. The fact that the junction of the two "load" potentiometers is connected to ground does not in any way interfere with the movement of electrons around the complete circuit. What this ground point does is to establish two unlike phase conditions. Let us see how.

POLARITY RELATIONS

Considering the polarity of current flow as being the same as electron flow, the movement of electrons from the diode plate to the cathode through the external circuit makes the extreme left end of *R1* negative with respect to any other end of that diode load. Therefore, the grounded point of *R1* is positive with respect to the furthermost negative point of *R1*. At the same time, the right end of *R2*, that is, the end terminating at the cathode, is the most positive end of the entire diode load. Accordingly, all points to the left of the extreme right-hand end of *R2* are negative with respect to the right-hand limit of *R2*. This means that the grounded end of *R2* is negative with respect to the extreme right-hand point on *R2* and at the same time the same grounded end is positive with respect to the extreme left end of *R1*.

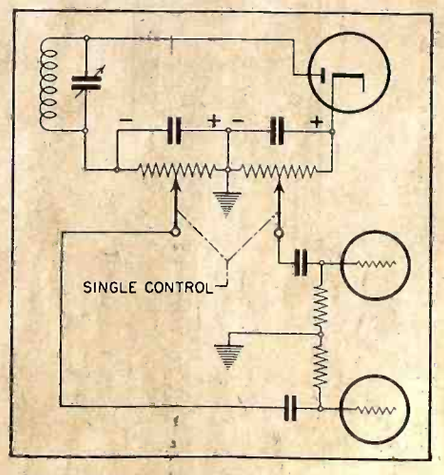


Fig. 1. Phase inversion can be obtained in a diode load circuit by the use of a dual potentiometer. Left-hand potentiometer is R1 in text; right-hand one is R2.

This condition is not very strange, for we know that all polarities always are relative and that any one point has a dual polarity depending upon what point is selected for reference. Now the polarity conditions which we outlined, apply for current flow in one direction and being a diode, we know that there is no reverse current, yet we develop across this load the equivalent of an alternating voltage. This comes about as the result of the fact that the two condensers which shunt the diode load are charged in accordance with the audio component of the modulated carrier. Such charging is due to the fact that the peak value of the modulated carrier does not remain constant, hence instantaneous variation of voltage occurs across the terminals of the diode load. Since the rise and fall of this voltage makes necessary a redistribution of electrons in the load circuit, it is the equivalent of the presence of an alternating voltage across the load resistance, that alternating voltage which represents the modulation component.

Thus, if at one instant the left end of *R1* is negative, any point along *R1*

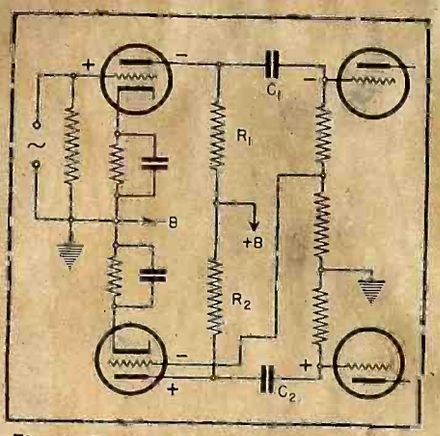


Fig. 2. Typical two-tube phase inverter, with phase-inverted voltage secured from grid circuit of upper power tube. The resistors in this grid circuit are referred to as R3 and R4 in text.

to the left of the grounded point will be negative and a negative voltage with respect to ground, which also is ground for the input circuit of the two amplifying tubes, will be applied to the lower amplifier tube grid. At the same time an equal value of voltage is being developed across *R2*, but ground now is more negative than any point along *R2* moving towards the cathode. Thus the upper tube will receive a voltage which at any instant is equal to the voltage received by the lower amplifier tube grid, but is in opposite phase.

You can, if you wish, call this diode load an ordinary voltage divider with a mid-point ground, which is similar to what happens in power-supply circuits wherein one end of the divider provides a plus voltage for the plate of the tube and some other end, located below ground, supplies a negative voltage to the control grid. The ground in such a divider is both positive and negative as in the case shown.

TYPICAL TRIODE INVERTER

Let us now return to triodes, now that we have shown that not only triodes can be used to create phase inversion. (see *Fig. 2.*) Here we employ two tubes, one of which is the conventional amplifier and the other is the phase inverter. Both combined supply the required 180-degree out-of-phase signals to a pair of succeeding tubes. Here again we make use of a divider network to supply the required out-of-phase voltage and utilize the 180-degree change in phase obtained in a vacuum tube to provide the required conditions when the two tubes are used.

The polarity signs indicate the instantaneous polarities. Let's start with the upper input amplifier tube. At one instant the grid is positive. As is evident, the input voltage is applied to one tube only, the upper left-hand tube. While the cathode resistor of the lower input tube joins that of the upper tube, the input signal to the entire system is linked solely with the upper tube. Continuing, we note that the corresponding polarity for the signal at the plate of the upper input tube is negative and the output tube grid joined to the blocking condenser which links the upper input tube to the upper output tube, also bears the same instantaneous signal voltage polarity.

Now, since the upper end of the grid resistor combination of *R3* and *R4* is negative with respect to ground, which ground at this point is also common to the cathode bias resistor, any point along *R3* and *R4* above ground will be negative with respect to ground. Therefore, if we join the control grid of the lower input tube to a point along *R3-R4*, we are applying a signal voltage which has the same polarity as that of the signal existing across ground and any point along *R3* and *R4*.

This means that the polarity of the voltage at the plate of the upper input amplifier tube and the polarity of the signal voltage fed into the grid of the lower input amplifier tube are the same, both negative at this instant. With the signal at the lower input tube grid negative when the signal at the plate of the upper tube is also negative, the signal in the lower tube between the grid and plate, goes through a 180-degree shift, so that the signal at the plate is now positive. The net result is that the signal at the upper plate is negative and the corresponding signal at the plate of the lower tube is positive. Thus the signals at the grids of the two output tubes are 180 degrees out of phase.

By proper selection of the components and full recognition of the amount of amplification obtainable within the tubes, proper tapping of the input circuit of the lower tube along *R3* and *R4*, and by the proper selection of the values for *R1* and *R2*,

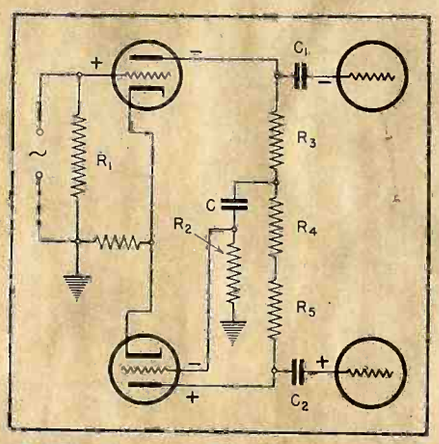


Fig. 2-A. Two-tube phase inversion, with signal for phase inverter secured from voltage divider in plate circuit of upper voltage-amplifier tube.

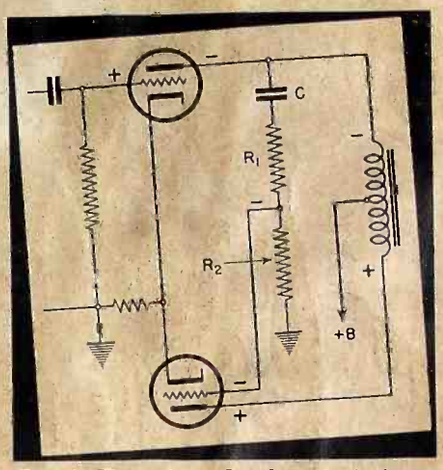


Fig. 3. Phase inversion in output stage, with signal for phase inverter secured from divider in power tube plate circuit.

the voltages applied to the grids of the two output tubes are not only of unlike polarity, but they are also of like magnitude.

Frankly, there are times when we cannot see the justification for identifying the lower input tube as being a phase-inverter tube. To us it seems to be acting simply as an amplifier. The fact that the input signal voltage is secured from an unusual source, does not seem to justify such special classification. However, it has become identified with the special classification of being a phase inverter, and we shall fall in line and call it by that name, although something else that strikes us very peculiar is that such a system is often identified as a two-tube phase-inversion arrangement. If that is so, then every amplifying tube should be identified essentially as a phase-inversion system for that action takes place automatically as an inherent action of the tubes. As it is, certain conventions have been accepted and times are momentous enough without seeking fur-

(Continued on page 29)

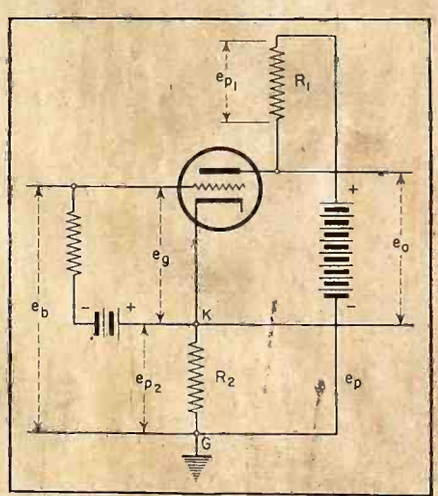


Fig. 4. A single-tube phase inverter, with half of voltage developed across R1 and the other, reversed-phase half, developed across R2. This circuit is degenerative and has no gain.

Set of the Month—

PILOT A-FM RECEIVER

THE engineering design of a standard broadcast receiver to fall in the lower price brackets offers no special problems; nor are there stiff problems involved in the design of a low-cost f-m receiver. But to combine the two into an a-fm set without sacrificing the essential features of both broadcast services and still hold the price within range of the average buyer, is somewhat of an engineering feat.

Yet it has been done in the new *Pilot Model T-301* Table-Type A-FM Receiver illustrated on this page. Its simplicity of design is sure to be of interest.

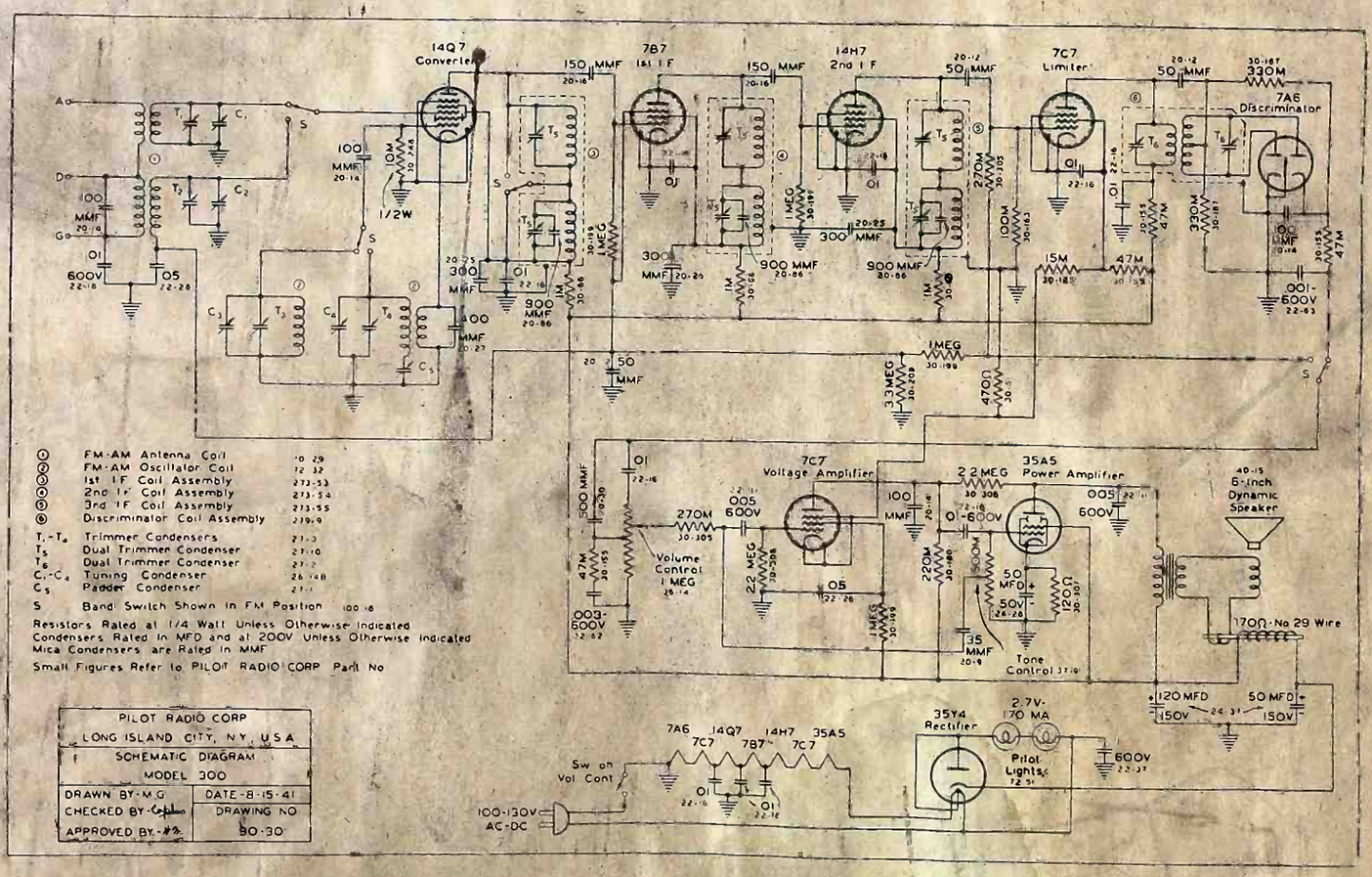
FEATURES

It is an 8-tube superheterodyne of the ac-dc type with a tuning range in the broadcast band from 535 to 1720 kc, and in the f-m band from 41.4 to 50.4 mc. One dial and one set of controls are used for all services. Low-level bass and treble compensation are features of the volume control, and very sharp cut-off of the higher audio frequencies a feature of the tone control. This permits an attenuation of the higher frequencies when receiving a standard broadcast station or when receiving other than a high-quality live studio program in the f-m band.

THE CIRCUIT

The schematic diagram of the receiver is shown at the bottom of the page. It will be noted that a simple four-gang single pole double throw switch takes care of all the band-switching operations—but more of this later. It will also be noted that mechanical and electrical simplicity has been gained through the use of impedance-resistance coupling in the i-f stages, with the result that, for any given stage, the 455-kc a-m broadcast coil and the 5.4-mc f-m coil, with associated trimmers, are housed in the same shield can of standard dimensions. How this works out mechanically (and from the viewpoint of alignment and servicing) is effectively illustrated in the chassis layout of *Fig. 1*. It will be seen that each of the three i-f "transformers" has two trimmers at the top—one for a-m alignment and

(Continued on page 33)



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Not long ago the world was astounded by news that a plane had flown the Atlantic. But almost over night, so it seems, the sensation of yesterday is child's play today.

That one-way hazardous trip has grown to frequent weekly round trips.....to Europe, South America, Alaska, Australasia and the Antipodes! That frail little craft has now become a giant Clipper Ship of the air carrying not just one, but up to 85 persons including the crew.

This triumph of airplane engineering and highly perfected equipment extends, of course, to the communication system which must keep constant contact with planes thousands of miles away. And we are proud that Pan American Airways System is a big user of RAYTHEON tubes.

These are not special RAYTHEONS! They're exactly the same kind of RAYTHEONS that thousands of far-sighted dealers and servicemen are selling today for the home radio. They know that a sound and permanent replacement business must be built on quality tubes and parts . . . the kind, for example, that have qualified for use with million dollar Pan American Clippers . . . RAYTHEON TUBES!

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INSTRUMENTS *for the Long Pull!*

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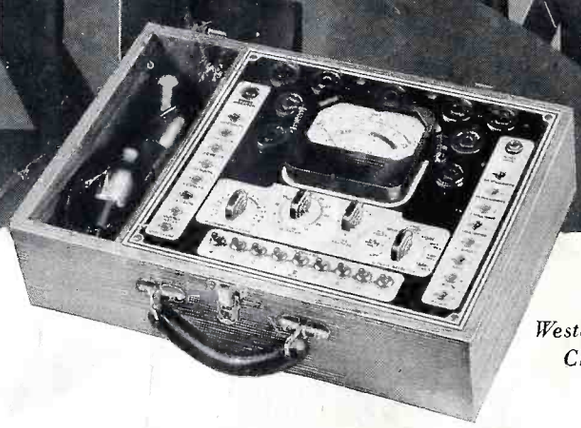

Weston Model 774 Checkmaster

Weston Model 669 Vacuum Tube Voltmeter

Weston Pocket-Size Test Instruments

Weston Model 772 Super-Sensitive Analyzer

To the serviceman who owns WESTON test equipment, *that* name on each instrument panel has *real meaning* these days. Normally, it means long, uninterrupted service and substantial savings in instrument replacement costs. It means *all this and more* today. It means that he has tools that will give him dependable service . . . *work and earn for him without interruption* . . . all during the uncertain period ahead. Weston Electrical Instrument Corporation, 605 Frelinghuysen Ave., Newark, New Jersey.

Laboratory Standards . . . Precision DC and AC Portables . . . Instrument Transformers . . . Sensitive Relays . . . DC, AC, and Thermo Switchboard and Panel Instruments.

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Specialized Test Equipment . . . Light Measurement and Control Devices . . . Exposure Meters . . . Aircraft Instruments . . . Electric Tachometers . . . Dial Thermometers.

FOR OVER 53 YEARS LEADERS IN ELECTRICAL MEASURING INSTRUMENTS

SILVERTONE AUTOMATIC RECORD CHANGER

THERE are four versions of this *Silvertone* Automatic Record Changer Unit. The two types carrying Factory Identification Nos. 101.205 or 101.208 are designed for 60-cycle operation. The two types carrying Factory Identification Nos. 101.207 or 101.210 are designed for 25-cycle operation.

Alphabetically arranged index letters are used in the three accompanying illustrations and in the following description to facilitate locating of parts. Parts with the prefix letter "A", in *Fig. 1,* refer to the *top view* of the record changer. Parts with the prefix letters "B" and "C", in *Fig. 2,* refer to the *bottom view* of the changer. Parts with the prefix letter "D", in *Fig. 3,* refer to the pickup arm control mechanism.

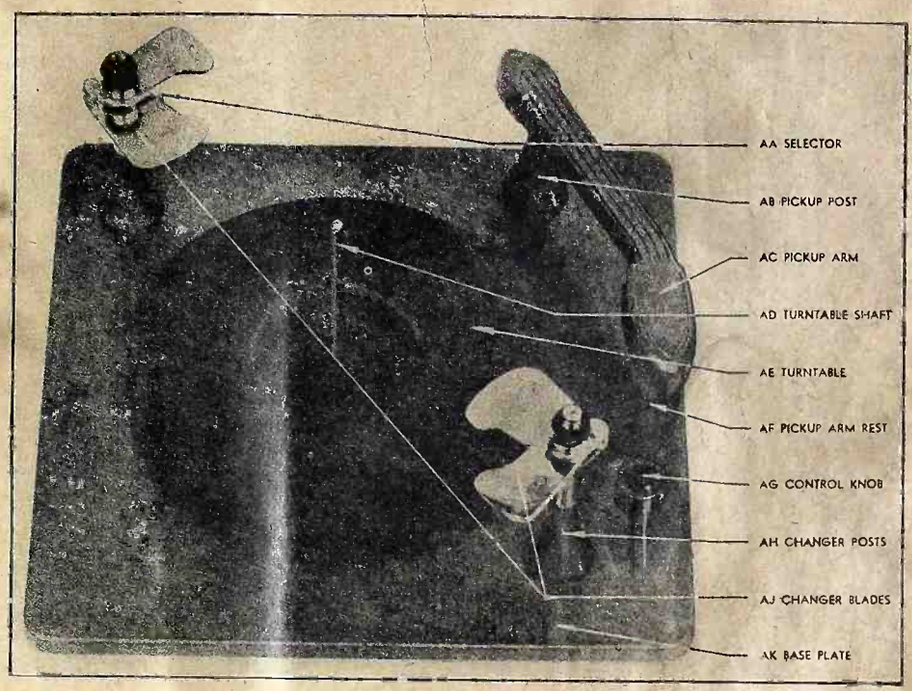


Fig. 1. Top view of Silvertone Automatic Record Changer.

DESCRIPTION OF OPERATION

To load the instrument with records, turn the changer blades AJ to the position as shown in the top view (counter-clockwise) and place a stack of ten 12″ or twelve 10″ records on the center spindle, allowing them to rest upon the lower changer blades.

The operation of the changer mechanism is controlled by means of the single button AG on the base plate AK. Turn the button to point to Automatic. Then press down to start cycle. The changer will then automatically play all records in the order stacked.

To remove records, after all have been played and the turntable switched off, lift each set of changer blades AJ slightly and turn them clockwise approximately one-half a turn. Records can then be removed.

To change records any time when the needle is on the record, merely press the control button down momentarily.

To play records singly, turn changer blades AJ away from center of table, and turn the control button to Manual.

DESCRIPTION OF CHANGE CYCLE

There are three conditions which cause the mechanism of the instrument to trip and proceed through the change cycle. (i.e., automatically to remove the pickup arm from last played record, release the next record, and replace the pickup arm in its playing position.)

1. Pressing down control button AG rotates the reject rod BD. The bent end of BD (which is same as DC) strikes the ratchet casting DF, which is fastened to trip rod DE (BE in bottom view), rotating rod BE. This pivots the bent end of BE away from the end of follower CL, allowing the heavy end of follower CL to drop, pivoting about its axis (which extends through follower arm BJ and drive arm CJ) and engaging it in the worm CN. The worm CN has a left and right thread which carries the follower CL to the opposite end of CN and returns it. This action through the axis pin of follower CL causes the pivoting of drive arm CJ and clutch arm CK about their common axis.

The construction of drive arm CJ and clutch arm CK together with the clutch spring CG, provides protection against breakage of the instrument or records in case of jamming.

The clutch arm CK thrusts the drive link BL, actuating the blade bell crank BM, and in turn the blade crank CE through tie bar CF which is riveted to the blade bell crank BM. This action operates the changer blades AJ.

2. When a record has been played and the pickup arm has reached a definite distance from the center spindle following the spiral groove towards the center of the record, the stop adjusting screw DV in the pickup crank strikes the ratchet casting DF, which in turn rotates the trip rod DE, causing the engagement of the follower CL, etc.

3. Records that have an eccentric groove inside of the playing or modulated grooves will give the pickup arm AC an oscillatory movement. This oscillation is transmitted to the pickup crank DT, which, when in the playing position, drags the pawl DU across the ratchet DF, with the pawl spring DS tending to hold the pawl. DU straight out, and any back movement of the arm DA and crank DT causes the pawl DU to catch on the ratchet DF, pushing it away against the tension of ratchet spring DG and rotating trip rod DE. DE in turn releases follower CL, engaging it in worm CN, etc.

The operation of the pickup arm DA (AC in top view) is controlled by the cam DW which is synchronized with the changer blades AJ. The rack link BH transmits action from the blade bell crank BM, through the rack DD, (BC in bottom view) to cam pinion DH.

The determination of the set down position of the pickup arm AC originates at the selector AA. As the changer blades AJ pivot in operation, the selector AA is intercepted by the edge of a record. This stops the rotation of the selector crank CC fastened to the selector, (CD in bottom view) and in turn the axial movement of selector rod CB (same as DP), said axial movement being caused by selector spring DM.

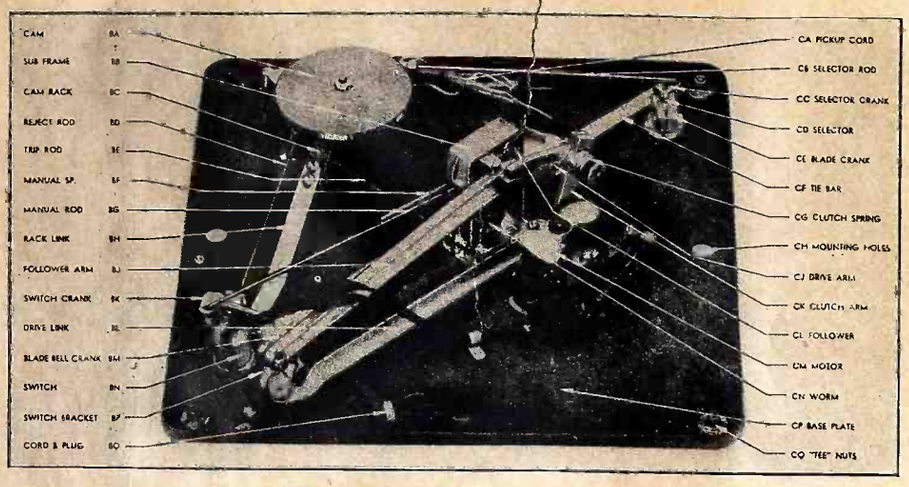


Fig. 2. Bottom view of Changer.

The rod CB interferes with the arcial movement of the pickup crank DT, in accordance with the size of the record passing through the blades AJ, causing the cam follower DR to follow the outer groove or to be allowed to ride into the inner groove in the face of cam DW. The outer groove controls the setdown position for 12" records, and the inner controls the 10" records.

ADJUSTMENTS

Should the changer blades AJ be forceably turned out of proper adjustment, loosen the clamping screws in the blade crank CE and/or the blade bell crank BM, and with the machine in neutral at the end of a cycle or in the playing position, turn the blades so that the upper blades are equi-distant and within 1/8" of the edge of a 12" record. Then clamp screws securely.

To adjust the setdown position of tone arm, turn off the machine during cycle just before the pickup arm descends to a record, loosen the set screw in crank DT, and while holding the crank DT in place, turn the pickup arm AC until it is straight above the outside groove of the record. Then retighten the set screw.

The adjustment of the ratchet DF on rod DE (BE in bottom view); the selector crank CC on the switch button shaft; the small casting on the straight end of DC (BD in bottom view); and the selector crank CC on the selector CD are limited and are obvious from the description of cycle.

REPLACING MOTOR

Remove idler wheel and the three motor mounting screws. Be sure to save metal bushing spacers, which slip inside of rubber grommets. These prevent rubber from being squeezed out of shape which would prevent proper cushioning of motor. Place motor of proper rating in same position as present motor and replace spacers, washers, and screws as before.

LUBRICATION

No lubrication should be necessary. However, in case of squeaks or stiffness of operation a drop of any good light machine oil on each of the bearings on the spindle worm, motor, and at other pivot points should be applied. Also, a light application of grease to the worm itself might help.

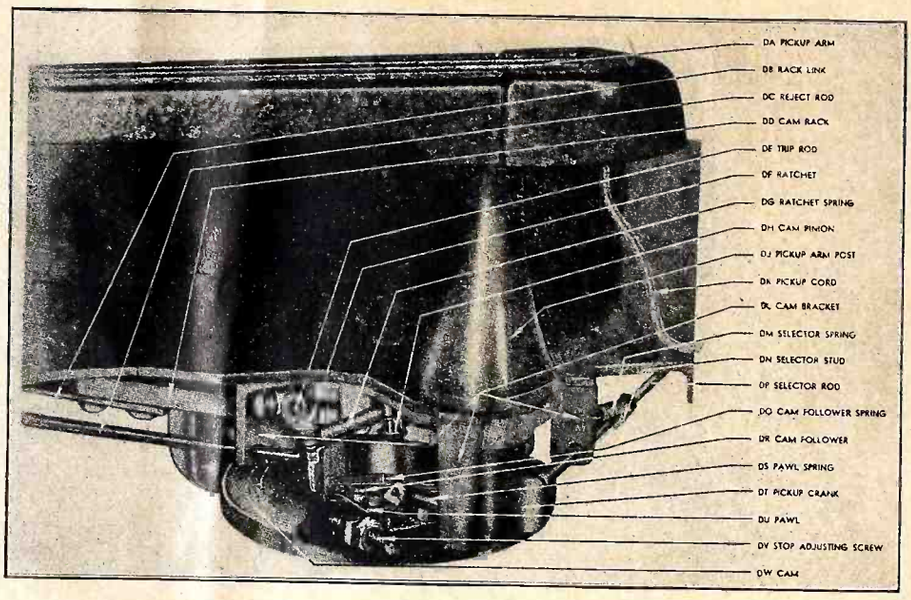


Fig. 3. Pickup arm control mechanism.

NEWS

Important Announcement — An official of Recoton Corporation was interviewed to determine how war conditions were going to effect deliveries of Recoton's needles. We take pleasure in printing his reply:

"First of all, the Recoton Corporation anticipated requirements of the trade for many, many months. Sensitive to the existing emergency, we warehoused extra large quantities of Recoton Phoneedles so as to insure uninterrupted deliveries. At this moment we are still receiving regular shipments, so I feel that we shall be able to continue to serve and deliver to our trade, as heretofore."

★

Move— Effective January 5, 1942, the office of The Turner Co. New England representatives, the Henry P. Segel Company, will be located at 221 Columbus Avenue, Boston, Massachusetts. The telephone there is KENMORE 3012.

★

Auster to OPA—Milton Auster, pioneer in the radio industry and member of the sales staff of the New York Sylvania Radio Tube distributor, The Dale Radio Company, was appointed recently and is now functioning as business specialist on radio parts in the Emergency Management Office of the Office of Price Administration, Washington. He is devoting his full time to his new government position.

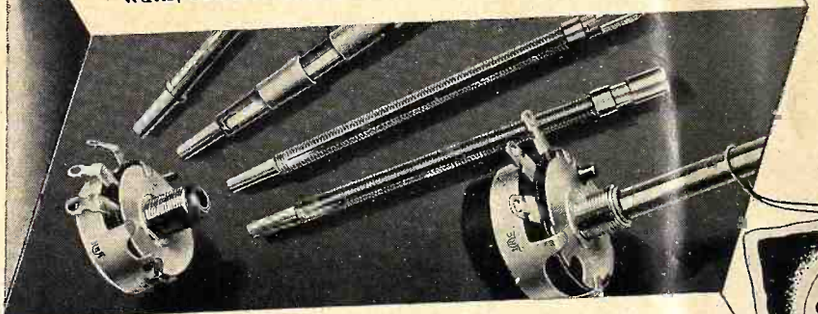
Mr. Auster has been associated with the radio business for twenty years and is particularly well known in the eastern territory.

Anniversary—A dinner tendered to the management by Aerovox employees on Armistice Day, marked the third anniversary of that organization in its giant New Bedford plant. Held in Lincoln Park just outside the city, the dinner was attended by over a thousand employees, by the mayor and other city officials, by the press and invited guests. Mayor Glynn presented S. I. Cole, president of Aerovox Corporation, with a soft-ball trophy, while the company presented the members of its soft-ball team with jackets. Wrist watches were presented to the first male and the first two female employees in the New Bedford plant. A huge two-tier birthday cake elaborately decorated, with "Aerovox" flanked by two real condensers, dominated the head table.

EXTRA QUALITY COUNTS MORE THAN EVER THESE DAYS...

INSULATED METALLIZED—The only resistors with the famous Metallized-type element (except IRC "F" type and high-power and high-voltage types produced for industrial use). Completely sealed and insulated from end to end. Moisture-proof and vibration-proof. ½-, 1- and 2-watt sizes.

POWER WIRE WOUNDS—They dissipate heat faster—stand overloads better—are protected against moisture by an exclusive Climate-Proofed Cement Coating. 53 standard sizes and shapes, also many special types, from 5- to 200-watts, fixed or adjustable, inductive or non-inductive.



CONTROLS—POTENTIOMETERS—Quiet—and built to stay quiet. The only Controls with the noise-eliminating features of Metallized-type element bonded to a moisture-proof base; 5-finger "knee-action" contactor; and spiral connector which eliminates metal-to-metal wiping contact.

PRECISION WIRE WOUNDS—Designed to combine a high degree of accuracy with real dependability and modest cost. Made in 14 types. Inductive or non-inductive windings. Standard accuracy is 1%, or to as low as 1/10 of 1% on special order. Impregnated against atmospheric conditions.

IRC Resistors and Controls represent the greatest values for your money — not that they cost less, but because they are built to perform better and last longer.

Quality and dependability are now more important than ever in keeping the nation's radios in good working order when almost every day brings War news and other broadcasts of utmost significance, no radio owner will want to miss.

BUILDING BUSINESS—FOR YOU!

This little tag, packed with all IRC Volume Controls sold through the jobbing trade, is designed to hang on the control knob whenever you make a replacement. No customer will fail to see it. None will fail to be impressed with the fact that you have used a replacement of the highest quality. The reverse side has space for your name, address and 'phone number and suggests that satisfied customers recommend your services to friends.

IRC
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INTERNATIONAL RESISTANCE CO.

401 N. BROAD ST., PHILA., PENNA.

Serviceman's Diary

John H. Potts

WEDNESDAY: When it's down around zero, as it was this morning, I usually knock off a few shop jobs and then, around eleven or twelve when it gets warmer, I start out on the calls. But with eighteen jobs on the hook, I had to shove off early this a.m., or be stuck until late tonight.

The first four calls went fast—averaged only fifteen minutes including traveling time—but they were only tube replacement jobs plus, of course, a few lead-in strip replacements. Then, all of a sudden, I heard the air-raid siren sound off with its long and short blasts. I looked up but the sky was dull and I couldn't see anything, so I kept on driving. Then a traffic cop yelled to me to pull up to the curb and get to a shelter. No use giving him an argument—they had just passed a law calling for a five-hundred-buck fine for disobeying an air-raid instruction, so there wasn't anything else to do.

I found myself in front of a big apartment house, but no air-raid shelter anywhere around. I remembered that the safest place was supposed to be about the third or fourth floor of a tall apartment building, so I entered and walked up to the third floor. I punched the first bell-button I came to and a moment later the door opened slightly and a charming blonde head made its appearance. It looked as if I'd picked a good spot, though perhaps not too safe in some respects.

"Air raid, miss," I said authoritatively, "and I'm obliged to take refuge here."

"But why," she protested, "can't you go to a regular shelter? There's one about a block north. I'm really not prepared to receive visitors."

"Sorry," I snapped. "I was sent here by an officer of the law and there's a five-hundred-dollar fine for disobeying orders. So I'll have to come in." I wasn't taking any chances on being thrown out of this place.

"I'm sorry I'm not more familiar with air-raids and such things," she said, as she opened the door wide for me to come in. "But, you see, mother and I just moved here recently from the West. Won't you sit down and make yourself at home, and may I offer you a drink?" I had made no mistake about this place, all right. No better shelter in the entire town, air raid or no air raid. She sure looked a lot like Betty Grable, too.

"No, thank you, miss," I answered automatically. Might as well be polite about it. Then, on second thought, I added, "That is, not at the moment." She might forget to offer drinks again.

"Now," I continued, "We've got to get busy and protect ourselves. The regulations say to crawl under a table placed near a hall wall. So if you'll give me a hand with this kitchen table we'll move it out in the hall. Then I'll need a mattress to place under the table, or at least cushions, so we can sit down and be comfortable until after the raid."

"But isn't the kitchen table a little small?" she inquired. "After all, there may be others coming in and we'll be a little crowded. Why not take the big dining-room table?"

"The kitchen table will be plenty big enough," I insisted. "It's too late now for others to attempt to get here." Besides, I thought to myself, it'll be far more congenial with a small table, and I swore that no one else would get in.

She gave me a hand in getting the table and mattress in place, and then made herself comfortable under the table.

"Now," I told her, "I can bring you a book from the library, or this morning's newspaper," (which I saw in the living room) "or we can sit together and I'll discuss some of the latest methods of detecting spurious ionization."

"If you don't mind," she replied, "I'd prefer the newspaper."

I brought it and was about to sit down beside her when the door-bell rang. She started to get up, but I motioned her back and answered the ring myself. There a big, fine-looking fellow, who resembled Gary Cooper, was standing.

"I've come to help Gloria get ready for the air-raid," he announced.

"Thank you so much," I told him,

(Continued on page 25)

"Air raid, miss," I said authoritatively, "and I'm obliged to take refuge here."

TECHNICAL SERVICE PORTFOLIO

SECTION XV

TECHNICAL PROGRESS IN 1941

WITH the advent of a new year that, paradoxically, will accelerate progress in one direction and freeze it in another, there is special value attached to a summary of receiver design over the past twelve months. Though it is too early to say definitely that all efforts toward the improvement of receivers for the consumer market will cease altogether until the termination of the war, present decisions with regard to war efforts point in that direction. If that is the case, and present receiver design is the dead end, then the design trends in 1941 are worth reviewing.

In scanning these months, it must naturally be understood that the beginning of one phase or design, or the end of another, may have first taken place in 1940 or earlier, but with the full influence of the change reflected in 1941. There are no definite points of cleavage, and in many cases the transition from one phase or design to another has been slow in taking in the whole field.

TUBES

As an instance of this, RCA's Preferred Type Tube Program, which was instituted in the latter part of 1939, has probably shown its greatest influence on receiver design in present models. Revised from time to time, the Preferred Type Tube List has done more to rationalize receiver design than any other factor, and in this respect its value has been immeasurable.

Included in the program were the then comparatively new single-ended tubes, now universally employed. But of more importance were the tubes excluded from the list. Thus, the 6L6, extensively used in console sets has, in 1941 designs, given way to the 6V6, and the 6K6 and 6F6 pentodes; all three capable of providing ample power output for home use. In the very latest designs the 6V6 and 6F6 predominate. Also holding the stage are the 6SK7, 6SA7, 6SQ7, 6J5, the 6SC7 and their 12-volt counterparts. In a-m broadcast receivers, other types are distinctly in the minority.

In the field of ac-dc receiver design, where series heaters are used, there are now a sufficient number of tube types with different heater or filament voltages to make it possible in the majority of cases to dispense with ballast tubes, or the earlier resistors and power cords with voltage-dropping resistors built in. Receivers with no r-f stage add up to the approximate line voltage with either a 35L6GT or a 50L6GT; or with a 35L6GT when the receiver includes an r-f stage. Since the majority of late ac-dc sets include an r-f stage; the 35L6GT is the type most often used.

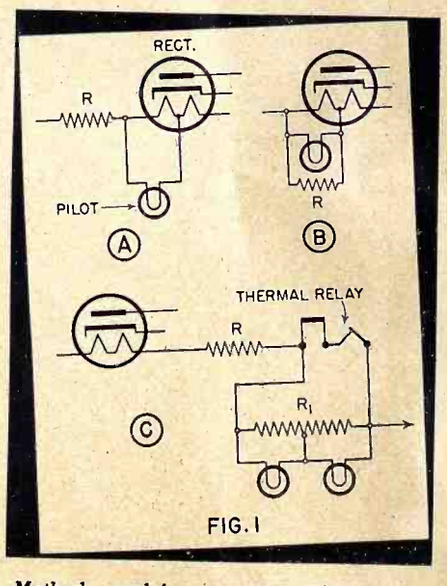


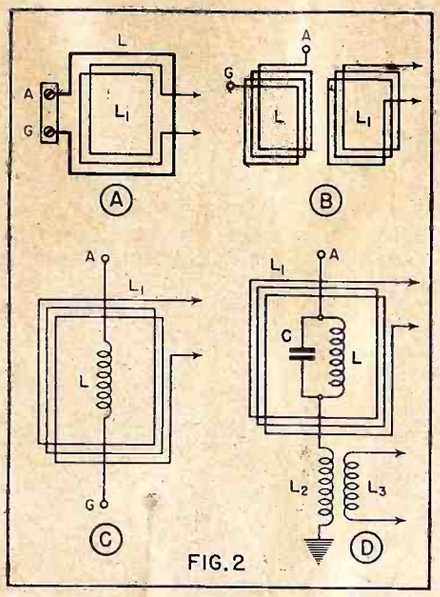
FIG. 1

Methods used for protecting tube heaters and pilot lamps.

While on the subject of ac-dc sets, it is well to note that consideration has been given to the protection of tube heaters and pilot lights. One method has been the use of a voltage-dropping (or surge prevention) resistor *R* in series with the heater line, as shown at *A* in *Fig. 1*. Since the heaters have low resistance when cold, they tend to draw excessive current when the set is first turned on. The heavy current through resistor *R* reduces the voltage across the heater string with the result that excessive voltage does not appear across the heaters and pilot. The effect of *R* is small once the heaters warm up and increase in resistance value.

A resistor *R* has also been used to protect the rectifier heater in the event of pilot-lamp failure, as shown at *B* in *Fig. 1*. The use of this resistor, shunted across the pilot and one-half the rectifier heater, prevents excessive voltage across one-half the rectifier heater in the event of pilot lamp failure.

More recently, a thermal relay has been employed in some ac-dc sets. An RCA version is shown at *C* in *Fig. 1*. The relay is normally closed, thus



The various forms of loop coupling employed in 1941-42 receivers.

shunting out the pilots. Resistor *R* is a heater element which causes the thermal relay to open about one minute after the set is turned on. By that time the tube heaters have reached maximum resistance, the relay opens and the pilots are placed in the series circuit *after* the initial voltage surge.

LOOP CIRCUITS

Loop circuits have shown considerable improvement. The arrangement shown at *A* in *Fig. 2* was used at the outset. External antenna coupling was principally capacative, through a single turn *L* wound around the loop *L1*. The arrangement shown at *B* was also used, the winding *L* around the loop being more in the order of a primary or coupling coil. This was further improved upon by using a comparatively high-impedance coupling coil, similar to the average antenna transformer primary, loosely coupled to the loop, as shown at *C* in *Fig. 2*. The same idea has been carried through in two-band sets, with the primary *L2* of the short-wave coil connected in series with the broadcast primary *L1*, as shown at *D* in *Fig. 2*. The coil *L1* is bypassed for short waves by the inclusion of the shunt condenser *C*.

Another interesting innovation has been the addition in some receivers of one or more separate short-wave loops which, on the whole, work out quite satisfactorily. Loop tracking has also been improved by the addition of "inductance trimmers" in the form of small series coils with adjustable iron cores or slugs.

SENSITIVITY

The year 1941 also brought on an increase in the sensitivity (and superior avc action) of the average table model ac-dc job. This was managed without too much of a boost in cost, by the addition of a resistance-coupled r-f or i-f stage, as shown at *A* in *Fig. 3*, with the final preference seeming to veer toward the former. The untuned r-f stage was later improved upon by the addition of a booster circuit favoring the higher broadcast frequencies, making the overall gain more uniform. A number of arrangements are used, with the one shown at *B* in *Fig. 3* being the most common. The booster consists of the coil *L* shunted by the resistor *R* to flatten its peak.

Where the addition of a stage has been prohibitive for mechanical or economic reasons, a regenerative i-f stage is often used, as shown at *C* in *Fig. 3*. The regeneration takes place in the screen circuit of the tube.

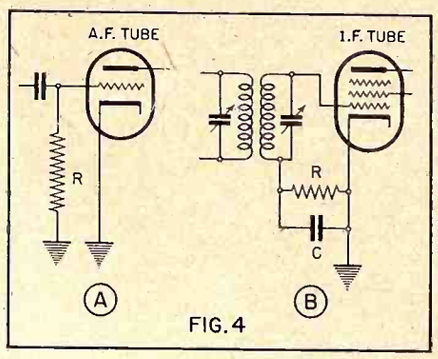
BIASING

One scheme that has become quite common in the past year is the biasing of certain voltage amplifier tubes by means of "contact potential." This form of biasing as applied to an a-f voltage amplifier is shown at *A* in *Fig. 4*. The grid resistor *R* has a value from 2 megs to as high as 10 or 15 megs. One advantage of this arrangement is that the cathode can be directly grounded, thus eliminating one source of hum voltage.

More recently the same scheme has been applied to i-f stages, as shown at *B* in *Fig. 4*. Here, again, the resistor *R* has a comparatively high value. Condenser *C* bypasses the r.f.

POWER AND DEGENERATION

Though Class B amplification is practically extinct, with the exception of some auto jobs, sincere efforts have been made to increase the undistorted power output of all classes of receivers. In the console jobs, some engineers have resorted to parallel push-pull output stages; others to Class AB1 amplifiers. But on the whole, Class A remains in control, and has been made more serviceable in both single-ended and push-pull output stages by the addition of inverse feedback in one of its many forms.

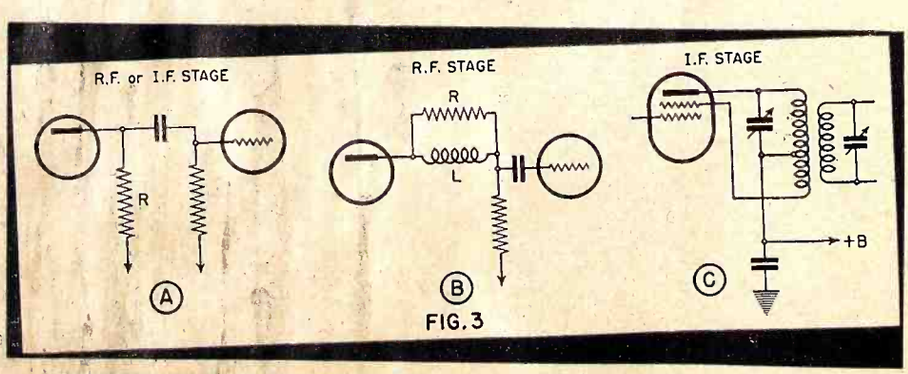


Both a-f and i-f contact-potential biasing has come into general use.

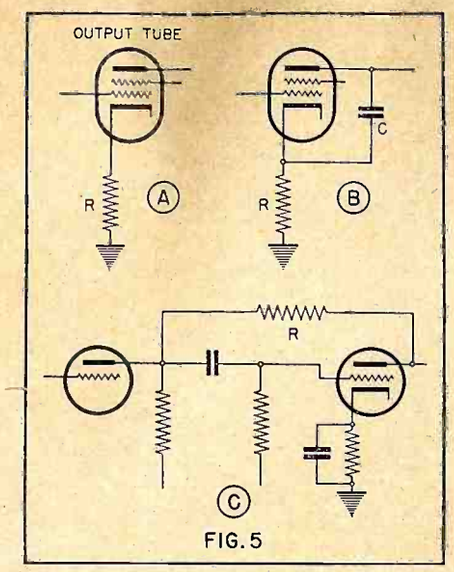
Oddly enough, degeneration has been more evident recently in ac-dc receivers, many engineers having dispensed with it in the larger console jobs. Certainly it is less evident than formerly, but it remains a very useful method.

In the smaller receivers it was first introduced by omitting the bypass condenser usually shunted across the cathode resistor of the power tube, as shown at *A* in *Fig. 5*. Later it was advanced by the method shown at *B* in *Fig. 5*, where out-of-phase voltage is fed back from plate to cathode (and developed across *R*) by means of a condenser, *C*. More recently the arrangement shown at *C* in *Fig. 5* has come into use (even in some of the console sets). Feedback is by means of the resistor *R* which usually has a fairly high value—1 to 2 megs or so.

Aside from other considerations, it is worth pointing out that the addition



Sensitivity has been increased by the use of resistance-coupled r-f or i-f stages, and i-f regeneration in some cases.



Three forms of degeneration now commonly employed.

of degeneration in a power stage actually provides a larger *undistorted* output than would otherwise be available. Hence, its use in small receivers provides more *usable* power than in previous designs.

"QUALITY"

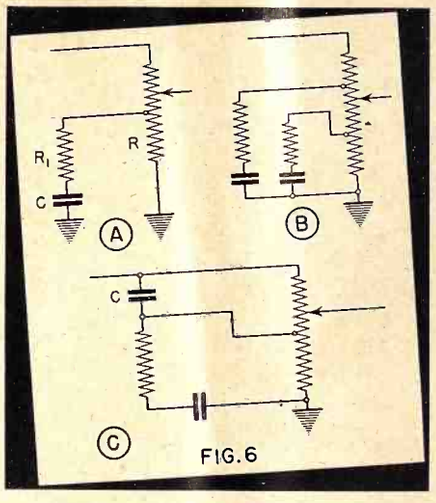
Engineers, if not the public, became quite tone conscious during the past twelve months. Improved speakers have given the designer a much wider latitude than he previously had, and this has paid dividends in the form of more higher- and medium-priced receivers with band-pass circuits or broadened i-f stages for quality reception.

And if this much has not been done, at least 1941 saw immense strides in the design of tone-control circuits "to suit every ear." That these circuits are definitely worth while is made evident by the fact that people of differing age do not hear the same. For instance, a man of 29 has a loss in hearing of 6 db at 8000 cycles; a man of 50 a 32-db loss at the same frequency.

Tone controls have wandered around in receiver circuits for years, but 1941 has placed most of them right in the volume control circuit. We started out with a bass-compensated volume control such as shown at *A* in *Fig. 6*, which provided an apparent increase in bass response at low volume levels. Later, additional compensation was added at another point, to make the response still more uniform over the volume range, as shown at *B* in *Fig. 6*. This was followed by the addition of treble compensation, through condenser *C*, as shown at *C* in *Fig. 6*. From this modest beginning has sprung the present-day multiple-switch tone-shading circuits providing bass boost, treble boost, and intermediate shadings, by the switching of condensers and resistors in the volume-control circuit.

At the same time designers woke up to the fact that compensation was required in the circuits of crystal pickups if the phonograph response was to approach that of the radio channel. Last year found practically all phono-radio combinations equipped with some type of pickup equalizer, which could not be said of the year before.

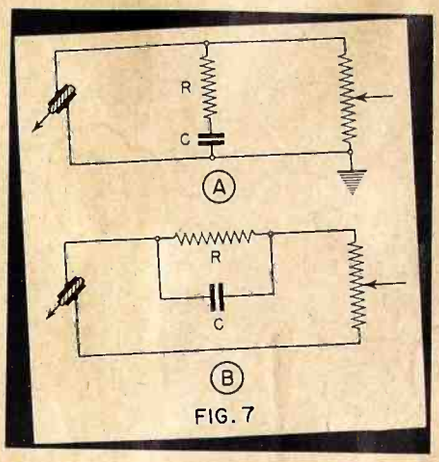
In its simplest form, this compensation has amounted to a condenser or resistor in series or shunt with the pickup. But most manufacturers have turned to the shunt-type equalizer, as shown at *A* in *Fig. 7*, or the series type, as shown at *B*.



Compensated volume controls.

PHASE INVERTERS

Presumably no one has ever developed a phase inverter that would rest well on a designer's stomach. We got along pretty well with the type shown at *A* in *Fig. 8* for quite some time.

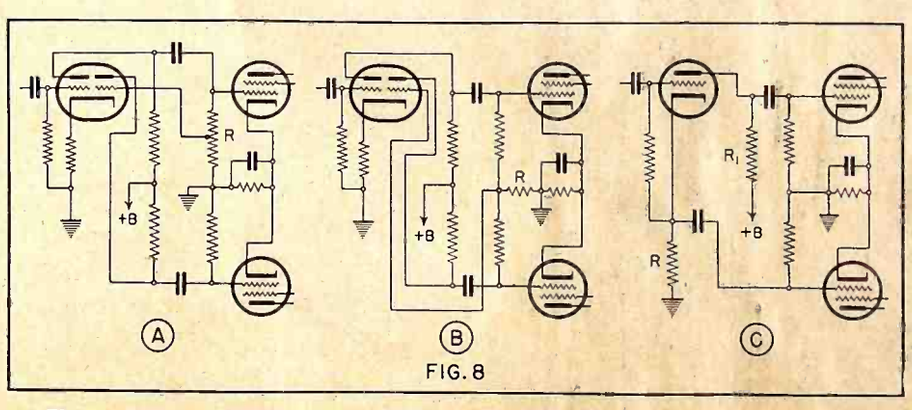


Shunt and series phono pickup equalizers.

This arrangement, using two tubes or a dual tube at the input, picks off a portion of the voltage output of the upper tube or tube section by means of a tap on resistance *R*, and feeding this voltage to the grid of the lower tube or tube section. Theoretically, the signal voltages fed to the output-tube grids are equal and opposite in phase; actually, equality is not obtained in practice due to resistor tolerances and other factors.

This circuit was thrown out the window upon the introduction of the self-balanced phase inverter circuit shown at *B* in *Fig. 8*. In this arrangement the voltage developed across *R* is fed to the inverter-tube grid, and since the circuit is degenerative, a rather close balance (within 10 percent) may be obtained.

This circuit has been with us for some time now, and in some recent receivers a closer balance has been obtained by using dissimilar values of plate or grid resistors. But some manufacturers, after having used the self-balanced version for some time, have suddenly returned to the original method shown at *A*. In some instances this has been done because



The most commonly-used forms of phase inversion, with (C) gaining prominence.

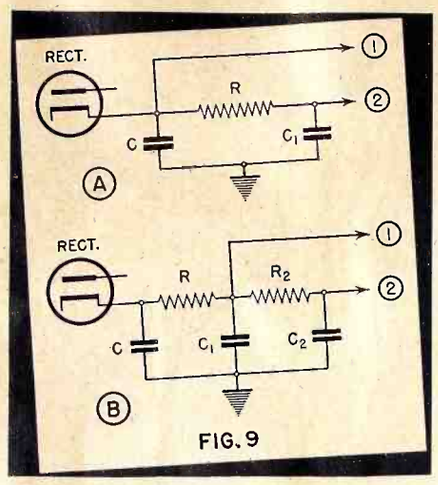


FIG. 9

Two-section filters are on the increase.

the old arrangement was more suited to the type of inverse feedback employed in the output stage.

But more recently there has been a trend toward the cathode-follower type of phase inverter, as shown at *C* in *Fig. 8*. This arrangement uses but a single tube in a voltage-divider circuit, half of the signal voltage appearing across the plate resistor, and the other, out-of-phase half, appearing across the cathode resistor *R*. In the circuit shown, there is no gain in the inverter tube. In a similar circuit, with the grid return to the lower end of a bypassed cathode bias resistor of the usual value and in series with *R*, some gain is derived from the inverter tube.

FILTERING

Better and more extensive filtering has shown up in the 1941 receivers. Tube circuits are decoupled by means of resistance-capacity filters, or isolating resistors of high value where there is no current flow. More filtering has also shown up in power-supply circuits—even unto the midget.

Earlier ac-dc sets relied on a single section resistance-capacity filter, as shown at *A* in *Fig. 9*. The plate of the beam-power tube was fed from terminal (1), the remainder of the tubes and the beam-power tube screen from terminal (2). Even though the capacity of the electrolytics were upped considerably, as compared to previous practice, the arrangement was not ideal.

There is now a definite trend toward a two-section filter, with the first section feeding the plate of the power tube, as shown at *B* in *Fig. 9*. The additional cost is not prohibitive; the reduction in speaker hum well worth the while.

Where priorities have caused a return to the electro-dynamic speaker, a single-section filter suffices, as the filtering action of the speaker field used as a choke is far better than that of a resistance-capacity combination.

TUNING

The past year also revealed an increase in the number of sets employing permeability tuning for complete coverage and for push-button station selection. Permeability tuning has also been noted in a few f-m receivers.

There have also been more receivers with bandspread tuning in the short-wave ranges, some using variables tapped down on the coils, and others using series tuning, separate coils, coils in parallel, and similar arrangements.

BATTERY SETS

Battery-operated receivers and three-way jobs have also benefited by the addition of untuned r-f or i-f stages to increase their effectiveness in poor locations. Some have been further enhanced by the addition of external booster loops and wire antennas that may be used where satisfactory reception is not to be had with the built-in loop.

Also worth comment is the General Electric portable equipped with a compact, light-weight storage battery; and the Stewart-Warner jobs equipped with an additional rectifier for the charging of the dry cells.

The year also saw improvement in three-way receiver filament circuits, where precautions have been taken to prevent premature burnout of tubes. For instance, to keep the full plate current of the power tube from flowing through the filament string, the shunt or bleeder resistor *R1* is employed, as shown at *A* in *Fig. 10*. This same resistor prevents the A filter condenser *C2* from building up and holding a charge which might otherwise discharge through the filament string and burn out one or more tubes.

Similar precautions have been taken in receivers employing the miniature-type tubes, as shown at *B* in *Fig. 10*. Here, again, bleeder resistors are employed to drain plate current to A minus instead of permitting the total plate currents to flow back to A minus through the filament string.

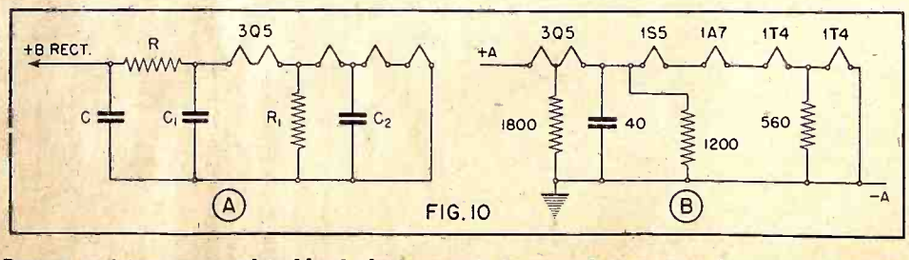


FIG. 10

Bypass resistors are used to bleed plate currents to ground, to protect the series filaments.

F-M RECEIVERS

Definite improvement and simplification has been shown in the design of

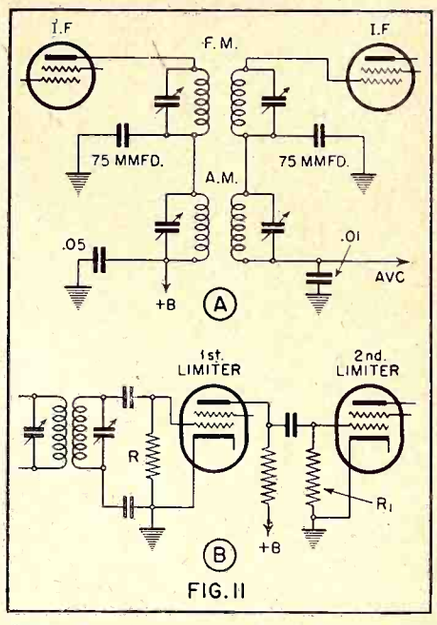


FIG. 11

Series transformers and dual limiters are features of new a-fm sets.

the 1941 f-m receivers. Station interference has been obviated by the use of higher i-f frequencies. Earlier sets had peaks in the vicinity of 2.1 mc, the present models from 4 to 8 mc. The resistors formerly shunting the r-f and i-f transformers have been dispensed with and the signal left to flatten its nose in the limiter circuit. Besides, transients are less of a problem in the newer designs, and the shunt resistors are not required for the purpose of damping them out.

We have also seen the introduction of self-contained f-m antennas, some of them taking the form of actual loops and others the form of folded doublets or Marconi's. They're all effective in

(Continued on page 34)

CIRCUIT COURT

Bias Control Tube

SOME OF THE NEW *Silvertone* receivers employ a bias control tube, which is usually a 6J5. In the *Silvertone* Model 7039, one of the diodes in the 6SQ7GT inverter tube is employed for this purpose, as shown in the accompanying diagram.

The arrangement is employed to maintain an initial bias in the avc circuit. It is obtained by tapping off r-f voltage from the oscillator tube, through condenser *C22,* and applying it to the 6SQ7GT diode where it is rectified and appears as a d-c voltage across the load resistor *R17.* This voltage is then applied to the dual avc line through the isolating resistors *R15* and *R16.*

The bias voltage so developed is variable, and is dependent upon two factors; first, the r-f voltage developed in the oscillator, which varies somewhat with frequency, and is lower in the short-wave bands; and, second, the actual value of the signal-developed avc voltage across the detector diode load resistance. Under no-signal conditions, the oscillator-developed bias voltage takes over. With a signal present, the negative voltage developed across the detector diode load resistor tends to counteract the positive oscillator voltage in the bias-control diode, thus reducing the bias developed at this source. At higher signal voltages, the oscillator voltage is, in effect, cancelled out, and the signal-developed bias voltage takes over. This transpires because the signal-developed avc voltage is also impressed on the bias-control diode.

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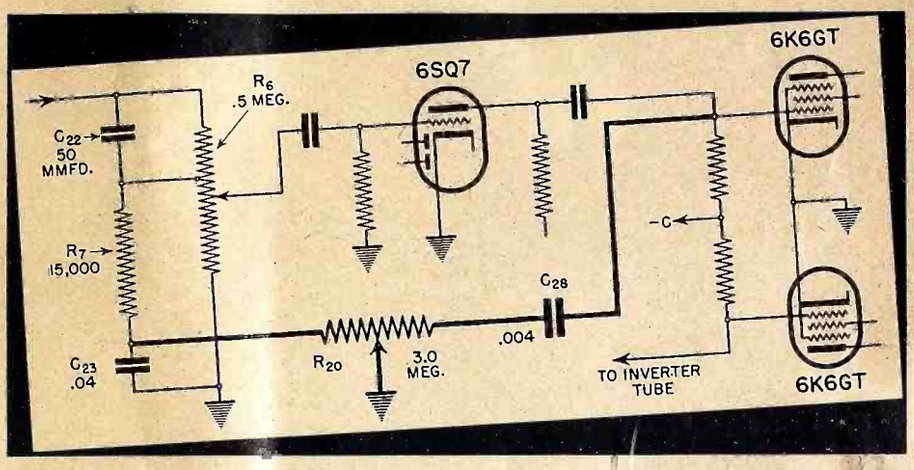


Composite Tone Control

AN INTERESTING variation in tone-control systems is employed in *Wards Airline* Model 14WG-807A receiver. By means of a single knob, either bass or treble emphasis may be obtained. When the knob is turned to the right, a brilliant tone is obtained and when turned to the left a bass effect is produced.

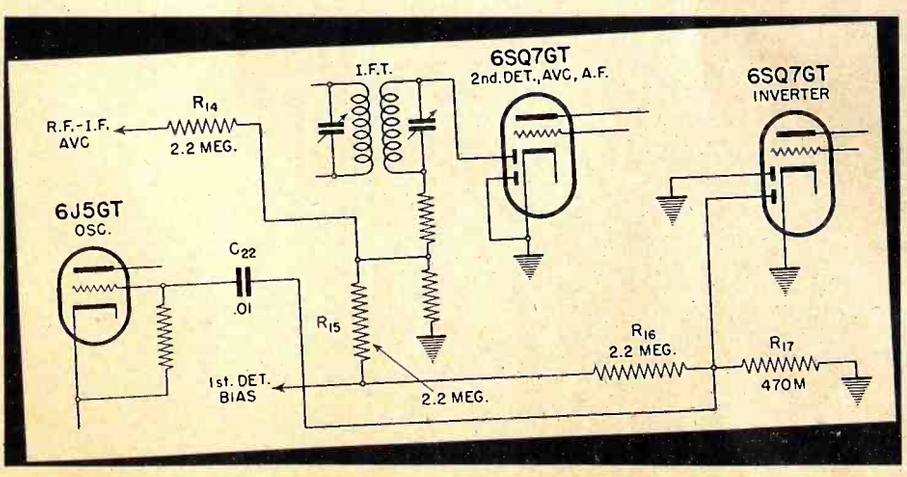
The arrangement is shown in the accompanying diagram. Of first consideration is the compensated volume control consisting of the potentiometer *R6,* the resistor *R7* and the condensers *C22* and *C23.* Condenser *C22* provides treble compensation at the higher volume levels and condenser *C23* provides bass compensation at the lower volume levels.

Connected between the signal grid of the upper 6K6GT and the bass compensation circuit of the volume control is the two-way tone-control potentiometer *R20* with its arm grounded. With the arm in mid-position, 1.5 megs appears in series with condenser *C28* and ground and 1.5 megs in shunt with *R23.* This is the "normal tone" position.

Moving the arm to the right (as per diagram) decreases the resistance in series with *C28* and increases the resistance in shunt with *C23.* This has the effect of increasing the bass response in two ways: first by increasing the bypassing of highs to ground through *C28,* and second by decreasing the bypassing of lows around condenser *C23.*

Conversely, moving the tone-control arm to the left increases the treble response by adding series resistance in the circuit of *C28,* thus decreasing the bypassing of highs, and lowering the shunt resistance around *C23,* thus bypassing the lows.

Hence, maximum bass response is obtained when the tone-control arm is full to the right (as per diagram) in which case *C28* is connected directly to ground, and maximum treble response is obtained when the arm is full to the left, in which case *C23* is shorted out and 3 megs is placed in series with *C28.*



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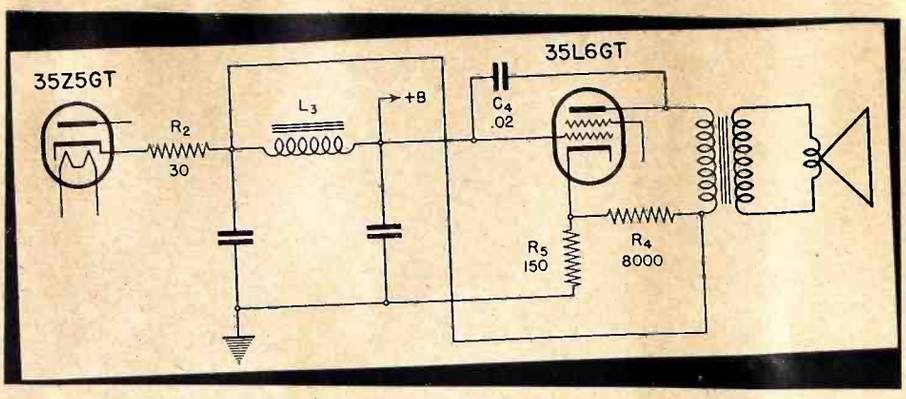
Bleeder Bias

IN POWER AMPLIFIERS employing self (cathode) bias, power output is somewhat restricted on signal peaks due to an increase in plate current which automatically increases the bias voltage developed across the cathode resistor.

In the *Silvertone* Model 7004, and similar models, this tendency toward a reduction of power output on signal



peaks is counteracted to some extent by the use of a combination of fixed and self bias, as shown in the accompanying diagram.

The normal, self bias, due to plate current, is developed across the cathode resistor *R5*. A substantially constant, subsidiary bias is developed across the same resistor by means of the bleeder resistor *R4*, connected from the power supply to the cathode of the 35L6GT.

The result of this arrangement, where both self- and semi-fixed bias voltages appear across the cathode resistor *R5*, is to make the voltage drop across the cathode resistor more nearly constant, so that signal peaks cannot produce as great a change in the bias voltage. With this proportionately smaller increase in bias voltage on signal peaks, a greater power output is obtained.

Note the anti-surge resistor *R2* in the power-supply circuit.

★

Bass Reactor

THERE IS SHOWN in the accompanying diagram the tone-control circuits employed in the *Stromberg-Carlson* No. 925 series of a-fm receivers.

The treble control circuit consists of the condenser *C71* in series with the 1-meg potentiometer *R57*, and the equalizer *C78-R36*. The bass control circuit consists of the resistor *R17* in series with the condenser *C76* which is shunted by the 1-meg potentiometer *R58*.

These receivers are equipped with a jack to accommodate the bass reactor *L43* which will provide a greater degree of bass boost. When used, it shunts the condenser *C76*, forming a resonant circuit. The degree of bass boost is then dependent upon the value of shunt resistance *(R58)* in circuit. With all of the resistance out, both the condenser and reactor are short-circuited to ground through the potentiometer arm, and bass response is at a minimum.

Condenser *C75* is normally shorted by a section of the waveband switch, but is in circuit when the switch is set for shortwave reception. This tends to reduce high-frequency noise.

The equalizer *C78-R36* provides treble boost and its effectiveness is controlled by the treble control *R57*.

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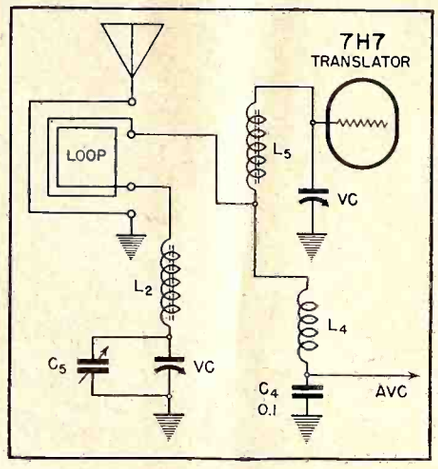
Loop Preselector

AS A MEANS OF obtaining adequate selectivity and band-pass characteristics without the addition of a tuned r-f



stage, a preselector circuit is employed between the antenna and translator tube in the *Silvertone* Model 7038. Hence a three-gang condenser is used.

Referring to the accompanying diagram, the two variables marked *VC*, and used for tuning the preselector circuit, are ganged with the oscillator variable condenser, not shown.

The preselector operates in the broadcast band only, but functions with either straight loop reception or external antenna.

Coil *L2* is the loop loading coil. Coil *L5* is the translator or first detector coil. Coil *L4* is the preselector coupling coil and is of the air-core type.

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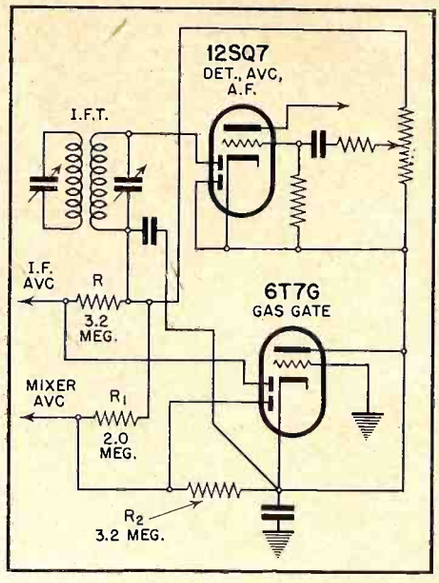
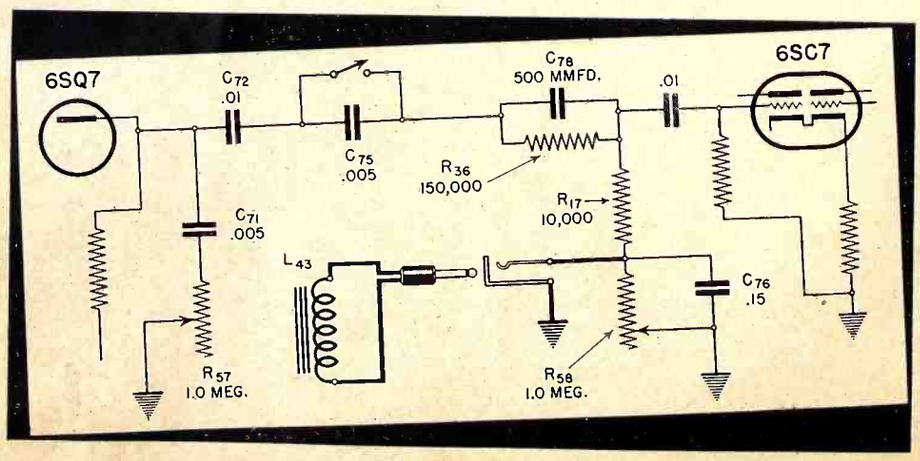
Gas Gate

AS A MEANS OF overcoming the development of a positive bias in the avc



circuit due to gassy tubes, *Belmont* employs what they term a Gas Gate in their Model 7D22 receiver. The connections are shown in the accompanying diagram.

The diodes of a 6T7G are connected to the separate mixer and i-f avc lines, to the left of resistors *R* and *R1*. Any positive voltage developed in either avc line will cause current to flow in one or the other of the diodes in the 6T7G Gas Gate tube, which in turn developes a negative voltage to counteract the positive voltage.



BOOK REVIEW

(Continued from page 5)

mon: an electric motor to drive the turntable and the record-changing mechanism. Since this prime mover is of such importance, the subject of small electric motors has been dealt with quite extensively in the text section of John F. Rider's *Automatic Record Changers and Recorders.*

In line with the subject of motors is the control of their speed in connection with phonographs and recorders. Many different methods are employed to insure this constancy of rotation of turntables, the more widely used being discussed, as well as the devices used for changing the turntable speed from 33⅓ to 78 rpm.

Lately a great many recorders have appeared on the market and as these devices are so closely allied with automatic record changers, a description of their mechanisms, their functioning and operation have been included in this book, together with the data concerning methods of recording, types of records, cutting needles, etc. The same is true of the electric phonograph. A description will be found in the text of the several types of pickups and needles, as well as their proper use and operation.

Even though there are but four distinct types of automatic record changers—the drop, the throw-off or ejector, the turnover, and the two-side non-turnover—the variations of these four are manifold. This is true to such an extent that a complete description of the functioning of each would fill a volume many times the size of the 744-page *Automatic Record Changers and Recorders.* Therefore, it was deemed advisable to outline a plan of analysis that would apply to any type of changer so that its functioning could be more quickly understood. To illustrate this idea, a step-by-step analysis of a simple drop-type record changer was made in the author's laboratory, each step being photographed and explained.

The latter portion of the book is devoted to the manufacturers' service data, which covers practically all the automatic record changers and recorders on the market at the time of writing. These data are more comprehensive than those pertaining to radio receivers, as notes on the functioning of the devices, their adjustments and care, have been supplied in most cases by the manufacturer.

Not only is the text section indexed, but an extensive cross-reference index indicates with a minimum of effort just which record changer or recorder is used with any particular radio-phonograph combination and where the data covering the changer or recorder can be found in the book. Also the record changers and recorders are listed under their own maker's name, as well as being indexed as mentioned above. The data have been arranged in the same way that has proved successful in Rider's Manuals.

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THE RADIO HANDBOOK, Eighth (1942) Edition, by the Editors of Radio. Published by Editors and Engineers, Ltd., 1300 Kenwood Road, Santa Barbara, California. 140 pages 6½" by 9½", profusely illustrated with 577 line drawings and half tones, and 41 tables. Price of cloth-bound edition, $1.75 in continental U.S.A., elsewhere $2.00.

The *Radio Handbook* is a general compilation of information on the practical aspects of radio. Its content can be divided into three classifications: (1) basic theory of electricity, radio, vacuum tubes, and antennas, written from the standpoint of practice rather than from the engineering viewpoint; (2) constructional information on the building of a wide variety of types of high frequency and u.h.f. transmitters and receivers for phone and c.w. use, coupled with information on the construction of many useful pieces of test equipment; (3) tube characteristic tables, reference charts and graphs, and a collection of formulas useful to the practicing radioman.

Investigation to determine the principal sale of previous editions indicates that there were two main classes of buyers: those who were using the *Handbook* as a reference work and hence had greatest need for the comprhensive tube tables, charts, tabular material, and formulas; and those schools who were using the *Radio Handbook* as a radio instruction textbook.

(Continued on page 23)

The RADIOFRONT

KARL A. KOPETZKY

Hindsight

WE have been writing for publications a little over eleven years. Every so often we go back and take a score. Sometimes we have batted very badly, and at other times our average has been high. Let's look over the back issues of *RSD* and see how we fared these last six months.

We stated in July that the Government would shortly do something about the aluminum shortage which was then causing the manufacturers to make electro-dynamic speakers in preference to the permanent magnetic types. We were partly right. Uncle Sam eased the permanent magnet situation slightly, tightened up on copper till it hurt, and then relaxed the copper wire conditions until the industry was able to finish the season with flying colors. Today, with the *OPM* order *M9c*, the copper situation is under complete priority control, and aluminum is not the problem for speakers; it's the nickel that's bothersome. It will become even more difficult to obtain for civilian use as we approach President Roosevelt's goal of increased production.

In July we also said that receiver prices would be higher by the time a price ceiling was established. We hit 100% on that one (how could we lose?), and ceilings will be established at the November, 1941 levels.

Paper work, which was a gripe in July, has been "streamlined." Witness the new amendment easing up on the PD-3 forms, of which the greatest number were being presented on purchase orders of less than $500 value. A Government counter-signature is now done away with, but still there is some griping about the mountains of paper work necessary to complete a file on any one priority job.

We renew our contention that the *OPM* procedure will be further streamlined to remove at least 50% of the present paper work. Uncle Sam is out after production, and not after a peak of paper! To that effect was the recent curb placed against so-called "surveys" being made by every unit of the Government. It has been said that if each and every survey were to be integrated and the information to be co-related, it would take ten years longer than the war will last!

As early as July we said that there would be set production curtailment. Word reaches us that a shut-down of from 35 to 60% in production of new receivers for the year 1942 can happen; it might go as high as 85%. *FLASH!* All civilian receiver production in Canada was stopped on January 15, 1942.

In August we reported, "No blanket rating will be given replacement parts supply in radio, etc." No rating has been given. Nor will one be.

Our prophesy that "out-of-season" purchases of radio by Uncle Sam would result in a spread of all-year-round business was a poor guess. There will be *no* out-of-season in radio. To meet the goal set by the Government requires 24-hours a day, 7 days-a-week plant operation for 365 days a year.

Our statement in September that there would be a crack-down on the abusers of priority certificates was 100% right. The picture will be tightened still more. Soon priority blanks will be treated with the same respect as income tax forms, and the filling out of these important priority documents will not be left to happenstance.

Best Bet: The *OPM* will defeat the Military as the sole arbiter of the Priority Certificate! The Military dislikes taking orders from the *OPM*, and ducks the issue of who is right whenever and wherever they can. *Nothing, however, will be permitted to interfere with production,* and the manufacturer, stuck in the middle, as usual, will be grateful when he knows what is what.

In September we said that the story of the spreading of sub-contracts was strictly "for home consumption" and would not come about for a long time. It hasn't happened yet!

The investigation by the Senate of the *OPM*, reported as stymied in the September issue, was. We see no investigation of the *OPM*. None is needed, nor indicated.

The pitiful recital of the go-by given the "smallie" trying to get sub-contracts from the "biggie," as set down in October, is more true now than ever. Prime and sub-contracts are still being given to the few. The "biggie" has the inside track, and it is safe to say that he will retain it, to the exclusion of every small manufacturer for the next 4 to 5 years. Should the war last longer than that, and the smallie be still in business then, (a doubtful condition at best), then the smallie may get a smell. Put that one down for sure.

The *repair-rather-than-buy-new* scheme for the radio industry was described in October and is gathering tremendous momentum.

The sub-rosa fight between the *Defense Communications Board* and the *Signal Corps* reported in the October issue, and the prophesy that the hams would lose out came to pass. All hams are now off the air, and the manufacturers of their equipment have no priority. In the new Civilian Defense Ham Set-up, the *Signal Corps* wants no part of the picture, and is observing a strict hands-off attitude.

We pulled a boner in the October issue when we said the radio would win the war. It won't. *But Defense Bonds, and the Will To Win, will.*

And that about winds up the review of the last half of 1941. For the most part, we have been guided by what we heard, and what we could reasonably deduce. What about the future?

Foresight

Copper will become scarcer; and the margin of safety in current-carrying capacity of wires will become a determining factor. There will be no more of this using a size wire which will take 1 ampere for 100-milliampere use. The smaller size will be the only type okayed.

Nickel will be withdrawn from the civilian market almost to the vanishing point, and hence either a new type of permanent magnet will make its appearance, or the present type will also vanish.

Stainless steel has practically disappeared.

Brass is to be scarcer than the proverbial hen's tooth. Even brass for electrical connections will be cut down, and a substitute used.

Rubber for every civilian purpose is taboo.

Tin in any form is already going, and will, in eight months be out.

Chlorine compounds, vital to all plating work for civilian use, will be entirely replaced by the petroleum by-products. Later even these will disappear.

Gasoline will be rationed; and ethyl, as such, will dwindle. So will the anti-freeze solutions, which are by-products for alcohol and glycerine manufacture.

Against this, steel will remain easier, as will wood. Paper will become tight, and that means trouble for the transformer industry. Parafine, varnish and shellac will be hard to obtain in any quantity. Tar products will be difficult to get. More trouble for transformermen.

In short, gentlemen, *we are in a war.* It will be no picnic. Each and every one of us must: (1) *Realize the Fact,* and (2) *Lend a Hand!*

We feel utmost confidence that the radio industry will acquit itself admirably, even to the doubling of its production to $1,000,000,000 worth of units scheduled for 1942.

What About The Serviceman?

The man behind the gun, the man on whom the radio industry is depending to keep the home fires burning, is the serviceman. He is coming into his own . . . will be an extremely valuable adjunct of the Government's program of Home Morale.

Servicemen should get set for a long, long haul. They will be heavily taxed, will be beset with difficulties in getting materials. But when the smoke of the battle clears away, there they will stand, firmly rooted in their community. This war will shake out the gyps, the dopes,

(Continued on page 23)

(Continued from page 21)

As a consequence of this investigation the tube tables have been expanded as well as being bought up to date, and the reference material has been considerably increased. To assist those using the *Handbook* as a text the theory chapters have been rewritten and expanded with an eye to increasing their suitability to this application. Due to a more compact type style and an increased number of pages these increases in text and reference material have been made with no sacrifice in the amount of space devoted to constructional information.

Investigation also showed that one reason this *Handbook* is so widely used as a textbook is that no other comparable book contains so much up-to-date information suitable for instruction in the subjects of F.M. and U.H.F. Communication, in addition to the usual radio and electrical theory.

The *Radio Handbook* contains the most comprehensive information available in any one book on all types of transmitting, receiving, and special-purpose tubes. A total of 54 pages is devoted to this extensive listing. Both transmitting and receiving tubes are listed in the order of their assigned number to make it possible to find the characteristics of the desired tube in the least amount of time.

The list of the 27 chapter headings gives an excellent indication of the subject material treated. These are, in order: Introduction to Amateur Radio, Fundamental Electrical and Radio Theory, Vacuum Tube Theory, Radio Receiver Theory, Radio Receiving Tube Characteristics, Radio Receiver Construction, Transmitter Theory, Radiotelephony Theory, Frequency Modulation, Transmitting Tubes, Transmitter Design, Exciters and Low Powered Transmitters, Medium and High Power R. F. Amplifiers, Speech and Modulation Equipment, Power Supplies, Transmitter Construction, U.H.F. Communication, U.H.F. Receivers and Transceivers, U.H.F. Transmitters, Antenna Theory and Operation, Directive Antenna Arrays, U.H.F. Antennas, Transmitter Adjustment, Test and Measuring Equipment, Workshop Practice, Broadcast Interference, and Radio Mathematics and Calculations. There are the three additional sections in the back of the book devoted to Appendix, Buyer's Guide, and Index.

This year the price of the *Radio Handbook* has been increased 10 per cent to offset the increase in the price of paper and printing, and to cover the fact that the Eighth Edition contains 32 pages more text than the previous edition. This increase in the size of the book represents a much more than proportionate increase in the editorial content since a type face somewhat more compact than that in the previous edition has been used.

✦

Beginners Guide— Written especially for the amateur radio beginner, this guidebook contains all the information necessary to become a full-fledged amateur and includes plans, photos, diagrams, etc., for the actual construction of a complete rig to go on the air.

The reader is first introduced to amateur radio. Fundamental theory is then presented, and actual construction is begun on the first necessary piece of apparatus, the code oscillator. This leads to and includes the building of a receiver, crystal oscillator transmitter, two-stage transmitter and other amateur equipment. The book is clearly written and the reader without any previous radio experience should have no difficulty in passing his examination and building his own equipment.

This is an excellent reference book for both the beginner and experienced operator, for it contains information on the various parts and purposes of amateur equipment, symbols, list of Q signals, helpful hints, etc. Advanced amateurs will welcome the book for its wealth of information on amateur radio theory.

Cloth bound, gold stamped, 156 pages, and over 100 illustrations. 75c Net, postpaid.

★

THE RADIOFRONT

(Continued from page 22)

and the get-rich-quick boys. It will leave the real guy, the man who knows his business, and builds it on a firm foundation, stronger, and on a par with every other

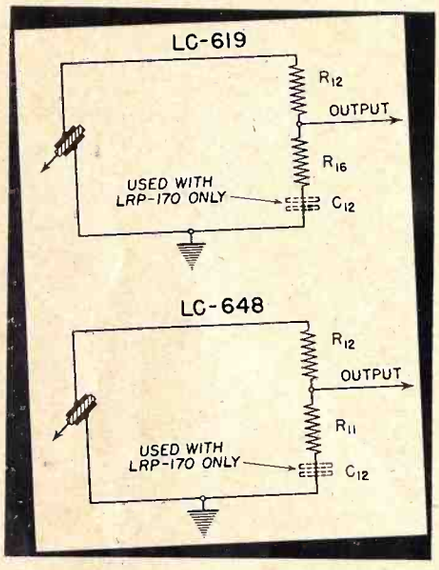
(Continued on page 25)

Shop Notes

G.E. MODELS LC-619, LC-648
Different Record Changers

Two different types of record changers were used during the production of Models LC-619 and LC-648 phonograph combinations.

The Model LRP-170 record changer is identified by the single record post and the eccentric turntable spindle, whereas the LRP-162 changers make use of a two-post record holder.



Different pickup compensation is used for the two changers. In receiver Model LC-619 using the Model LRP-162 record changer, the pickup output is shunted by two resistors (voltage divider) connected in series, the first (*R12* in original diagram) having a value of 220,000 ohms, and the second (*R16* in original diagram) with a value of 180,000 ohms. In Model LC-619 sets using the LRP-170 changer, the values of these resistors are 47,000 ohms each, and are connected in series with a .002-mfd condenser (*C12* in original diagram).

In Model LC-648 sets the differences in compensation for the two types of record changers are the same as given above, but the two resistors are labeled *R11* and *R12* in the original diagram.

✦

G.E. MODEL L-915
Wavetrap

The wavetrap consisting of the capacitor *C15* and the coil *L11* was not included in the early production receivers.

This wavetrap is series-tuned and connected from the grid of the 6SA7 converter to ground.

Should occasion call for the installation of this wavetrap in an early production model, the G.E. Catalog Number is RM-409.

LOCATING INTERFERENCE
With RCA Model BP-10

The Model BP-10 "Personal" loop receiver has been used successfully in tracking down the source of electrical interference, and the location of local rectification in stubborn cases of local cross-modulation and hum-modulation.

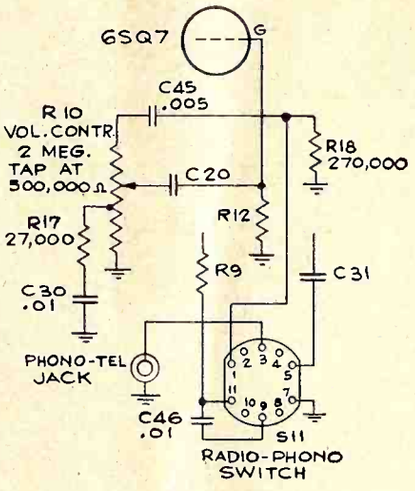
The directional pattern of the BP-10 is essentially a figure "8," with a sharp minimum at right angles to the plane of the loop.

The small size, light weight, and high sensitivity of this battery-operated receiver makes it ideally suited for this work.

✦

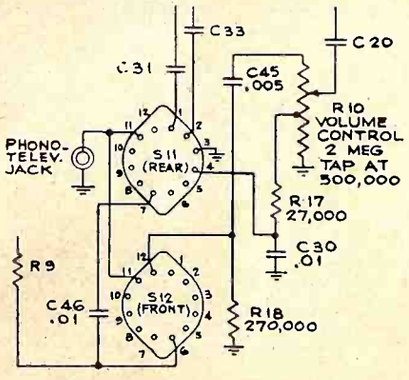
RCA 16T2, 16T3, 16T4
Noisy Volume Control

In the second production of these models the volume control is changed from 0.25 meg to 2 megs and the circuit is



revised to isolate the control from the diode d-c current. This isolation reduces the possibility of the controls becoming noisy.

The revised circuit for Models 16T2 and 16T3 is shown above; the revised circuit for Model 16T4 is shown below.



These changes should be made on any first production receivers when this trouble is encountered.

SILVERTONE MODELS 7004,-6,-8, 7024, 7026
Oscillator Coil

In later production the oscillator coil No. N17233 was supplanted by No. N17320. The new coil may be identified by the fact that Lug No. 1 is blank whereas the start of the white winding of coil No. N17233 was connected to Lug No. 1 (see accompanying sketch).

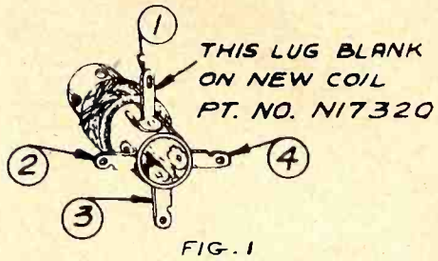


FIG. 1

The hookup of the coil in the circuit remains unchanged and is as follows: Lug 1 to chassis, lug 2 to variable condenser, lug 3 to floating ground, lug 4 to cathode of 12SA7GT.

✦

SUSTAINED OSCILLATION
Precaution for Oscillators Employing Filament-Type Tubes

According to *RCA Application Note No. 117,* experience with filament-type acorn tubes as oscillators in transmitting equipment has shown that, under some conditions of operation, oscillation may continue after the filament voltage has been removed unless the plate voltage is also removed. When the filament voltage is removed from an oscillator tube having particularly low filament power consumption, continued oscillation frequently takes place because of continued heating of the filament by the plate current.

Continued oscillation has been found most likely to occur (1) with a tube having high emission capability, (2) with an exceptionally well-designed circuit, and (3) with a high value of oscillator plate current; it has been observed with oscillator tubes operated at moderate values of plate voltage and current.

Because of these results in the laboratory and in the field, it is recommended that both the filament voltage and the plate voltage of filament-type miniature, GT, and acorn oscillator tubes used for transmitter purposes be removed when equipment employing these types is "shut down." Usually, a convenient method is to break the minus filament and the minus plate supplies with a single, double-pole switch.

The recommended procedure insures that the oscillator will always stop functioning in the "off" position, saves B power, and avoids interference with reception in combined transmit-receive equipment.

(Continued from page 23)

decent businessman of his locality.

Servicemen! This is your great chance. Don't muff it. You won't see another like it in this lifetime!

Odds n' Ends

Uncle Sam is considering raising the ante so as to obtain the services of the better class of radio engineers, most of whom are older men with commitments deserving of higher salaries . . . —

When the complete story of the Fifth Column of Hawaii is told, it will raise hair on a bald man's head. We have heard some details, but they are much too hush-hush to repeat at this time . . . —

Here's one for the book. Uncle Sam's Military engineers complain that there do not seem to be enough frequencies for his operations. Contact some hams, Uncle; they'll tell you how to put 'steen stations on the same band, and have them all work out fine. Haw!

The Navy and the Army are still looking for radiomen. Contact George Bailey, 2101 Constitution Avenue, Washington, D. C.

How to make Saps outa Japs: buy a Defense Bond, and Stamp out treachery!

SERVICEMAN'S DIARY

(Continued from page 14)

"but it won't be necessary. She's asleep now under a table and is perfectly safe. I wouldn't have her disturbed for worlds."

He gave me a funny look. "Well, I'm glad she's being looked after," he said. "Just tell her that Bill called, will you? I'll drop in as soon as the all-clear sounds."

I closed the door and went back to Gloria.

"Who was there?" she asked.

"Just a Fuller Brush man," I answered. "He has a special offer on brooms today, designed especially for cleaning up dust and dirt caused by bomb explosions. He'll be back right after the bomb hits this building."

"Right on the job, isn't he?" Gloria said. "But somehow his voice seemed to sound a little like my boy friend's. How does it happen he didn't leave a free gift brush of some sort?"

"Said he'd bring it when he came back," I told her. She was getting me in a corner.

"You know," she continued, drawing her knees up and putting her arms around them, "I do hope you can call some time when Bill is here. You'd like him. I do. He's big and tall and looks like Gary Cooper. He sells hair tonic. Now you're a little bald and I'm sure, if I ask him, he'll be able to get just the right kind of tonic to make your hair grow over that bald spot on top. Also, he's a boxer and——"

"Yes," I said, "he's a swell fellow, I'm sure. I used to use hair tonic myself. During prohibition. You see, it contains alcohol—of a sort—but it does have a kick and we had nothing better to drink then. I wouldn't want more hair now, you know. Not patriotic. Keeps the barbers busy so they can't go out and carry a gun. Have to take those things into consideration too, you know." It began to look as if I were getting nowhere fast.

"You interrupted me," she said sternly. "I was telling you that Bill is also a boxer, and he can fix radios too. You know our big set started to get weak and noisy a few days ago and we were going to call a repair man. But Bill's been coming in every morning—he only goes out in the afternoons and evenings to his customers—and is giving our radio a thorough going over. Already he has put in new tubes and a filter for the electric light and this week, he thinks, he may have it playing again. But if I had gone to an ordinary serviceman it might take months to get it fixed. You know how dumb they are."

"Yeah," I answered. "Let me see that radio." She started to get up.

(Continued on page 29)

THE STRANGE CASE OF SERVICEMAN WALDO MUDD

Dear Miss Barefacts:

I know that your column is entitled "Advice to the Loveless" and I am not loveless. As a matter of fact, I have more love than I know what to do with. That's why I am writing to you.

You see, Miss Barefacts, I am a radio service man. I make good money and I'm very happy. I mean I was happy until I met Arabella Blotts. She is one of my customers. In fact, she is my very best customer. That's the trouble.

Arabella has a very nice apartment with about eight radios in it. The first time she called me, I went over and fixed two of the radios in about half an hour. Then Arabella asked me to sit down and have a drink with her.

The correspondence course I took in radio servicing didn't say anything about what to do in a case like this. Besides, I don't drink anything but ginger ale. However, Arabella insisted, so I asked for ginger ale. It was very funny tasting ginger ale and I even felt funny after I drank it.

Then Arabella sat down beside me. She is a very big girl. Also, she is very determined. Every time I moved away from her, she shoved over closer to me. Finally, I was at the end of the davenport and couldn't move any farther. Also, I was at the end of my wits.

When I got back to my shop, I remembered she hadn't paid me for fixing the radio. Also, I was dizzy and didn't feel like working any more that day.

The next day, Arabella called and said both of the radios I had fixed were broken again and would I please come right over. Well, there wasn't anything to do but go over and fix them. So I did.

Then the same thing happened again, the very next day.

However, Miss Barefacts, I will not bore you by telling you any more of this sort of thing. Suffice to say, it was six months ago that Arabella first called me. Since then, she has called me almost every day. I have fixed all of her radios at least a half dozen times each and she still hasn't paid me for a single job. What's more, I am afraid to send her a bill. Arabella is funny that way. She might get mad and not call me any more. After all, she is the best customer I have.

What shall I do?

Very truly yours,
WALDO MUDD,
Radio Service Man.

★ ★ ★

Dear Mr. Mudd:

Don't worry. Your problem should be an easy one to solve. My first suggestion is that you marry Arabella Blotts. Evidently that would please her. Then you can repair her radios in your spare time and spend the rest of your time at work for which you will be paid. My second suggestion is that, in the future, you use Sprague Condensers and Koolohm Resistors for every replacement. Once you install them you can forget them—and so can your customer. Then, the next time you meet a girl like Arabella, she will have to be more original in finding an excuse to invite you back again.

Sincerely yours,
GERTRUDE BAREFACTS,
Editor, "Advice to the Loveless Column."

NEW PRODUCTS OF THE MONTH

SHURE

Super-Cardioid "556"— A new Series "556" introduces a "Super Cardioid" polar pattern that is twice as unidirectional as the

Cardioid, from the standpoint of receiving front sounds and rejecting rear sounds, yet has wide-angle front pick-up. Decreases pick-up of reverberation energy and random noise 73%. The axial polar pattern is symmetrical at all frequencies.

Improved wide-range frequency response from 40 to 10,000 cycles assures full reproduction of music, crisp reproduction of speech.

New moving-coil unit is highly immune to mechanical vibration and wind noises.

The Super-Cardioid is available for immediate delivery in three models: Model 556A for 35-50 ohm circuits, Model 556B for 200-250 ohm circuits; Model 556C, high impedance. By Shure Brothers, 225 W. Huron Street, Chicago, Illinois.

★

A. A & K

A-FM Multicoupler—New type multicoupler antenna system for apartment houses, etc., employs for its aerial a doublet of

two wires, one 45 ft long and the other 15. Where space is limited, vertical rod aerials are used.

The transmission line from the aerial connects with the outlet couplers, of which there may be 20 on one line. No switching or other changes are required in making each outlet instantly available for broadcast, short-wave or f-m reception. By Amy, Aceves & King, Inc., 11 West 42nd St., New York, N. Y.

✦

BURGESS

Theft Proof Vendor— Pilferage of small articles, like flashlight batteries, presents an ever-present problem to dealers the country over. With this dealer problem in mind, the Burgess Battery Company is offering a Theft-Proof Vendor, designed to cut down hidden losses in flashlight battery departments.

Cells are well displayed under glass in this all metal, attractively styled vendor. Arranged in three rows, the cells are released by push-buttons at the base of the glass, which automatically release one cell and rings a bell, which is audible over the entire store.

A bulb rack, sufficient to carry a normal stock, is also provided so as to be "out of reach." An assortment of bulbs can be displayed to promote sales. Storage space for an extra carton of cells is

also provided inside and at the back, with a protecting snap-fastened door.

A handy bulb and battery tester on top completely equips this vendor, making it an ideal, entirely theft-proof, battery merchandiser.

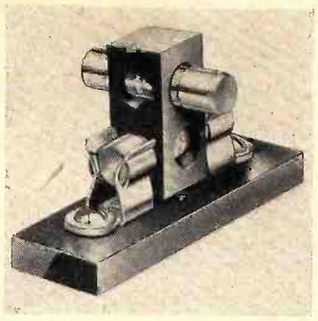
For further information on this new and modern vendor, write the Burgess Battery Company, Freeport, Illinois.

★

LITTELFUSE

Spare Fuse Holder—An entirely new convenience for changing fuses in close quarters—replacing a blown fuse in a twinkling—and giving notice on inspection that another spare is required, are features compactly embodied in a Spare Fuse Holder & Puller combined.

These new devices are applicable to all 4 A G and 5 A G fuses. The fuse in circuit goes through one end of the soft rubber rectangular Littlefuse Holder, between the clips. Above, and at right angle, is an opening in the Holder for the spare fuse. When inserted, the caps of



the spare fuse project beyond the Holder affording an easy grip for two fingers.

When the fuse in circuit blows, all the operator has to do is to pull and reverse the Littelfuse Holder. This puts the spare fuse in circuit and brings the blown fuse on top in the same position that the spare was in before.

The device is made in two sizes—No. 1422 (½" x ½" x 1-5/16" long) for 4 A G fuses, and No. 1378 (⅝" x ⅝" x 1⅜" long) for 5 A G fuses. By Littelfuse, Inc., 4797 Ravenswood Ave., Chicago.

★

ELECTRO PRODUCTS

Synchro-Power—A vibrator type power supply which furnishes 6 volts filament and 300 volts, 100 ma d-c power from a 6-volt storage battery. Complete radio-audio filter system, input and output battery cable, plug, clips and fuse are provided. Weighs 8 lbs. By Electro Products Laboratories, 547 W. Randolph St., Chicago.

✦

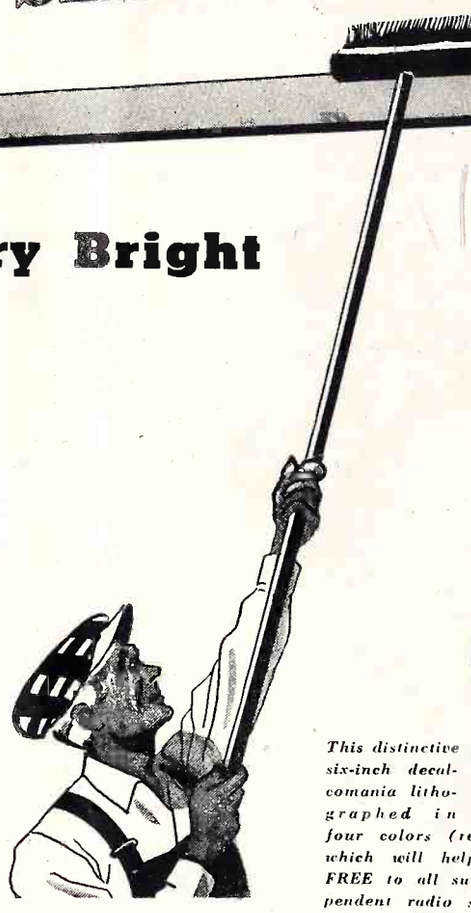
WALSCO

Wall Rack—Made to hold an assortment of Walsco Unibelts, dial cords and cables, and bottles of cements and solvents.

Mounts on wall over or near the service bench. By Walter L. Schott Co., 5266 W. Pico Blvd., Los Angeles, Calif.

NOTICE

INDEPENDENT SERVICEMEN



The Future Looks Very Bright

You now have less competition than ever before. Thousands of part-time radio servicemen have been drafted or have gone back to their regular jobs. Your income will increase. There are more old sets to service because they are getting harder usage and but few new ones are being produced. Speedier, more efficient servicing is the Order of the Day . . . "Time Wasted means Profits Lost".

The editors of RADIO SERVICE-DEALER will publish, during the coming months, hundreds of pages of important, exclusive and timely data to help you save time, energy and materials so that you, your customers and our Country will benefit. During the emergency Knowledge will be important because you'll have to solve complex problems should no exact-duplicates be available. Yes—every radio serviceman will obtain much usable data from our regular feature departments—"The Technical Service Portfolio"—"Circuit Court"—"Shop Notes"—"New Products", etc.

RADIO SERVICE-DEALER has a larger paid circulation amongst and is read by more leading independent radio service-dealers, sound-men and jobbers than any other radio magazine...and we publish more pages of valuable, exclusive technical data relative to radio servicing. Subscribers pay but 12½c per copy when they order one year subscriptions. Subscribe to RSD today. Get your associates to do likewise. Use the coupon below.

This distinctive six-inch decalcomania lithographed in four colors (red, white, blue and gold) which will help your business, available FREE to all subscribers classified as independent radio service dealers on request.

TEAR OUT AND MAIL TODAY

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Sirs: Here is my ☐ check (or ☐ money order) for $.... Enter my subscription order to RSD for the next ..... issues. (12 issues cost $2.—24 issues cost $3.) Canadian and Foreign subscriptions are $3 annually. The information given below is accurate. If my subscription is rejected I expect an immediate refund in full.

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CITY ..... STATE .....My Position Is, ☐ Owner ☐ Service Mgr. ☐ Serviceman

Please check whether firm is (If any other, state what it is) .....

☐ An independent servicing organization, we do not sell sets.
☐ An independent service-dealer (engaged primarily in service work)
☐ A service-dealer (does servicing, but is primarily interested in retailing)
☐ Selling, renting or servicing Sound Equipment
☐ Jobber ☐ Any other classification
☐ Manufacturer (State it) .....
I belong to a serviceman's organization ..... Yes ☐ .....No. ☐

We stock the following checked items:

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☐ RECEIVERS
☐ BATTERIES, etc.
☐ SOUND EQUIP.
☐ ELEC. APP'L'S.

We own the following instruments:

☐ V-T Voltmeter
☐ Tube Checker
☐ Analyzer
☐ Oscillator
☐ Signal Generator
☐ Volt-Ohm Meter
☐ Others
☐ MANUALS

Defense Savings Pay-Roll Allotment Plan

How company heads can help their country, their employees, and themselves

voluntary pay-roll allotment plan **helps** workers provide for the future

voluntary pay-roll allotment plan **helps** build future buying power

voluntary pay-roll allotment plan **helps** defend America today

This is no charity plea. It is a sound business proposition that vitally concerns the present and future welfare of your company, your employees, and yourself.

During the post-war period of readjustment, you may be faced with the unpleasant necessity of turning employees out into a confused and cheerless world. But you, as an employer, can do something *now* to help shape the destinies of your people. Scores of business heads have adopted the Voluntary Pay-roll Allotment Plan as a simple and easy way for every worker in the land to start a *systematic* and *continuous* Defense Bond savings program.

Many benefits . . . present and future. It is more than a sensible step toward reducing the ranks of the post-war needy. It will help spread financial participation in National Defense among all of America's wage earners.

The widespread use of this plan will materially retard inflation. It will "store" part of our pyramiding national income that would otherwise be spent as fast as it's earned, increasing the demand for our diminishing supply of consumer goods.

And don't overlook the immediate benefit . . . money for defense materials, quickly, continuously, *willingly.*

Let's do it the American way! America's talent for working out emergency problems, democratically, is being tested today. As always, we will work it out, without pressure or coercion . . . in that old American way; each businessman strengthening his *own* house; not waiting for his neighbor to do it. That custom has, throughout history, enabled America to get things done *of its own free will.*

In emergencies, America doesn't do things "hit-or-miss." We would get there *eventually* if we just left it to everybody's whim to buy Defense Bonds when they thought of it. But we're a nation of businessmen who understand that the way to get a thing done is to *systematize* the operation. That is why so many employers are getting back of this Voluntary Savings Plan.

Like most efficient systems, it is amazingly simple. All you have to do is offer your employees the convenience of having a fixed sum allotted, from each pay envelope, to the purchase of Defense Bonds. The employer holds these funds in a separate bank account, and delivers a Bond to the employee each time his allotments accumulate to a sufficient amount.

Each employee who chooses to start this savings plan decides for himself the denomination of the Bonds to be purchased and the amount to be allotted from his wages each pay day.

How big does a company have to be? From three employees on up. Size has nothing to do with it. It works equally well in stores, schools, publishing houses, factories, or banks. This whole idea of pay-roll allotment has been evolved by businessmen in cooperation with the Treasury Department. Each organization adopts its own simple, efficient application of the idea in accordance with the needs of its own set-up

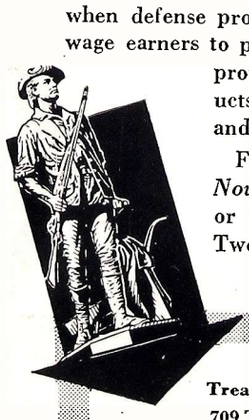
No chore at all. The system is so simple that A. T. & T. uses exactly the same easy card system that is being used by hundreds of companies having fewer than 25 employees! It is simple enough to be handled by a check-mark on a card each pay day.

Plenty of help available. Although this is *your* plan when you put it into effect, the Treasury Department is ready and willing to give you all kinds of help. Local civilian committees in 48 States are set up to have experienced men work with you just as much as you want them to, and no more.

Truly, about all *you* have to do is to indicate your willingness to get your organization started. We will supply most of the necessary material, and no end of help.

The first step is to take a closer look. Sending in the coupon in no way obligates you to install the Plan. It will simply give you a chance to scrutinize the available material and see what other companies are already doing. It will bring you samples of literature explaining the benefits to employees and describing the various denominations of Defense Savings Bonds that can be purchased through the Plan.

Sending the coupon does nothing more than signify that you are anxious to do *something* to help keep your people off relief when defense production sloughs off; *something* to enable *all* wage earners to participate in financing Defense; *something* to provide tomorrow's buying power for your products; *something* to get money *right now* for guns and tanks and planes and ships.



France left it to "hit-or-miss" . . . and *missed. Now* is the time for *you* to act! Mail the coupon or write Treasury Department, Section A, 709 Twelfth St. NW., Washington, D. C.

FREE - NO OBLIGATION

Treasury Department, Section A,
709 Twelfth St. NW., Washington, D. C.

Please send me the free kit of material being used by companies that have installed the Voluntary Defense Savings Pay-Roll Allotment Plan.

Name _____

Position _____

Company _____

Address _____

DSS-BP-1

GPO 16—24977-1

(Continued from page 25)

"No," I said, "you stay where you are. I'll find it."

I went into the parlor and found a big Philco. I switched it on and listened. Nothing but a lot of noise. Pulled it out from the wall and checked the antenna connection. The wire was hooked to the antenna post alright, but seemed to be a little too limber. I pulled out my knife and scraped the insulation off. As I thought, the lead was broken under the insulation. I fixed it and reconnected it to the set. The set responded in glorious volume, a voice announcing that the all-clear had just sounded. Gloria came running in.

"How did you do it?" she gasped. "It plays wonderfully now. I think you're marvelous!"

"Oh, it wasn't anything," I said modestly. "I'm sure Bill could have done it better!"

"Never mind Bill," she replied. "He just tinkered around and got nowhere."

"Well, you see," I answered, "I'm just one of those dumb servicemen. And I haven't got much hair——."

"I wouldn't worry too much about it if I were you," she answered. "Because——" and she pinched my arm a little—— "you see, I don't!"

KP and G

(Continued from page 7)

ther places where there may be room for argument—at least not until we win the war.

PLATE-FEED INVERTERS

Continuing further with such two-tube systems, *Fig. 2-A* illustrates a different method. In this arrangement the signal voltage for the phase-inverter tube is secured from a divider located in the plate circuit of the amplifier tube. Starting with an instantaneous positive voltage upon the grid of the upper amplifier tube, the grid of the phase inverter receives a signal which is negative with respect to ground.

Still another arrangement somewhat similar to *Fig. 2-A,* is shown in *Fig. 3,* but in this system the phase inversion takes place in the output stage by tapping off a portion of a signal-voltage divider connected across the plate to ground system of one of the output tubes. The relative instantaneous polarities of the signal are as indicated.

In *Fig. 4* is shown a phase-inversion system employing a single tube, and based on the fact that the signal voltage developed across the plate resistor *R1* is 180° out of phase with the signal voltage developed across the cathode resistor *R2.* Hence the output voltages *eo* are out of phase, and equal providing the resistors *R1* and *R2* are of the proper value.

It is possible to give many more illustrations of phase-inversion systems but they should be unnecessary, considering the number already shown in these pages. There are several differences between these systems other than the location of the point from which the signal is secured for the phase-inverter tube. But that is another story for some time in the future. In the meantime, we want to reiterate that such phase inversion is not limited to triodes when considering multi-element tubes. For example, in *Fig. 3,* the tubes could just as readily be pentodes and the load resistances, *R3* and *R4,* could have been located in the screen circuit instead of the plate circuit.

The plate system would contain the conventional load resistance, whereas the screen circuit of the upper tube would not be bypassed to ground so that a signal voltage would be built up across the screen resistor. The phase of this voltage is inverted in the same way as the phase of the signal voltage

(Continued on page 32)

RSA NEWS

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At times like these the public mind is in an uncertain state. One class of people is going to spend freely, fearing for the future of money conditions. Another, and larger class, is going to be conservative and save wherever possible. In all probability, radio set sales are going to be hurt, but the public is going to *demand* that the already overworked servicemen keep their radios in first class repair.

We all know the trouble we have had in the past getting material and we realize that with our country actually at war, this condition is not going to improve. So the task ahead of us is a difficult one indeed, and our future depends upon how we handle it. We must play square with our customers, explain the conditions to them, make no promises that we cannot fulfill. We must value our time and sell it for enough to insure our continued existence in business and the maintenance of that business and of our equipment. We must receive enough compensation from our work to live the American way, but we must not take advantage of a war-minded public and charge unreasonably for our work. We're really not worried about many of our members being guilty of the latter.

More than ever, radio servicemen need organization. Organization to see that the servicing industry gets the rights due it as an essential industry in war-time. Organization to safeguard the serviceman's interests in the necessities of war. Without effective organization, any group will be at a serious disadvantage during the years to come.

Above all else, let's all keep our heads, think carefully before making any important decisions and not be one of the many affected by war hysteria. We are all behind America and we believe we're not taking too much for granted in saying that we all stand ready to serve our country in whatever way we may be called to serve.

—From the Danville Chapter RSA publication, "The Servicemen's Dirt."

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Secretary of the Treasury Morgenthau has asked that the following message be conveyed to members of RSA:

"Overnight we have become a united people, an awakened people—wide awake to the stark truth that the very existence of the Nation and the lives, liberties, and fortunes of all of us are being put to a supreme test. In this hour of crisis Americans are working together, as never before in our history, toward a victory that will make certain that international treachery and attack without warning shall never endanger us again. It goes without saying that materials and money will be produced and expended in vast quantities before that victory is assured.

"The present machinery for raising a substantial portion of the money to be expended — i.e., the Defense Savings Program — already has enabled the American people to contribute over two billion dollars to the production of war materials and at the same time to add to their own personal security. The immediate need is to extend that machinery, so that everyone may purchase Defense Savings Bonds and Stamps, regularly and conveniently, to the best of their abilities.

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"The Treasury Department now asks that every American business concern institute similar machinery, where practicable, as one of its principal contributions to the war effort.

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"Although this is your and your employees' plan when it is put into effect, the Treasury Department is ready to give every assistance. There are local Defense Savings Committees in the forty-eight states. Experienced men on those committees are ready to help you in instituting and encouraging participation in the plan. You are not only invited, but urged to call on them for help.

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"Now our story *must* get across to the public — and we intend to do it. These are times when new and important problems confront our business and yours. This National Emergency has placed the radio serviceman in a bewildering predicament as concerns his planning for the future.

"To discuss these problems — to find solutions — the Chicago Chapter of the Radio Servicemen of America invites you to be their guest at the Stevens Hotel on Wednesday, November 26th, at 8:00 P. M. This meeting is packed with importance to every radio serviceman in the Chicago area, be he an independent operator or in the employ of a retail store . . . "

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(Continued from page 29)

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INVERSE FEEDBACK

This subject, like phase inversion, is a long one, but its basis is the fact that the phase of the signal voltage is changed in the vacuum tube. Whereas in the normal phase-inversion system, the requirement is that two signals 180 degrees out of phase be available for distribution to two other points in the system, inverse feedback utilizes a single phase-inverted signal which is fed *back* to some point in the circuit ahead of that point where it had been secured. This is shown in graphic form in *Fig. 5,* wherein the oblong can represent a single stage of amplification or a complete system. In either case, the phase-inverted signal, which we have identified as E_{inv}, is returned from the output to the input as indicated in *Figs 6* and *7.*

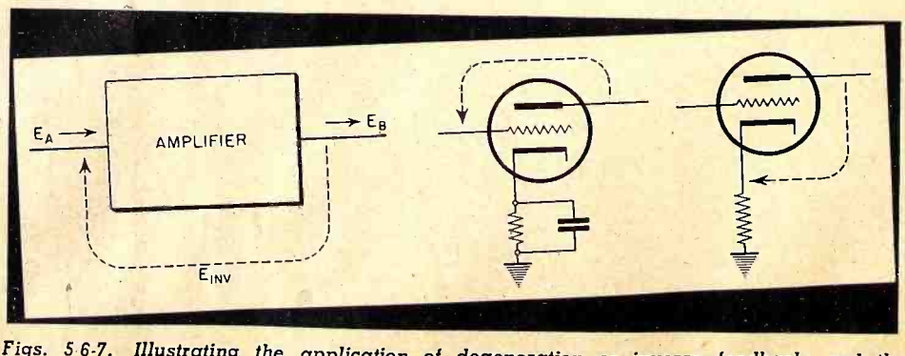
The last two illustrations show in general where the feekback signal can be returned to the system. The fact that E_{inv} in each case is associated with a dotted line does not signify that this return path consists of nothing more than just a solid conductor. Obviously the return circuit must contain such components that will permit the passage of alternating currents, yet not interfere with the distribution or arrangement of the d-c operating potentials.

As you can readily understand there are two forms of such feedback systems which can be called "positive" and "negative." It is the latter which is recognized as inverse feedback and signifies that the signal voltage fed back upon itself to some point ahead of that where it is secured, is out of phase with the original signal and therefore would tend to buck the signal. It is this type of feedback, of which there are numerous arrangements or means of accomplishing it, that is extremely popular in connection with audio-frequency amplifier operation. Inverse feedback has contributed tremendously to the construction of audio amplifiers possessed of very wide frequency ranges and substantially flat operating characteristics, with minimum distortion. For example the writer has been working with an audio amplifier which is substantially uniform in final output over a range of frequencies from about 14 cycles to about 200,000 cycles. In this system the inverse feedback is connected from the plate of the output tube back to the cathode of the input tube.

DIRECTION OF VOLTAGE

The direction of this feedback voltage from the output plate to the input cathode is such as to increase the signal voltage developed across the cathode, which incidentally, is not bypassed. Because of the phase relationship existing between the control grid and the cathode in the same tube, as has already been described in a preceding issue, the greater the signal voltage permitted to develop across the cathode, the greater is the bucking effect upon the signal voltage applied to the control grid, hence the greater the degeneration.

Unlike the arrangements usually used with positive feedback, which is the kind of feedback employed in oscillator systems, inverse feedback is accomplished by apportioning a certain part of the total output voltage as being that which is returned to the input circuit 180 degrees out of phase with the signal in the input circuit. Since this kind of feedback has the tendency to reduce the overall amplification, it means that if a definite overall output is desired, an increased signal input must be provided. To say this differently, an amplifier which is connected in such a manner as to use inverse feedback must be of a higher inherent gain than another which does not use like feedback and both provide like output. Or, the signal voltage fed into the amplifier with negative feedback must be greater.



Figs. 5-6-7. Illustrating the application of degeneration or inverse feedback, and the methods by which it can be applied to a single tube.

This comes about as the consequence of the fact that the actual output from an amplifier employing inverse feedback, is the difference between two signal voltages which are out of phase with each other. An approximation of what is the output of such a controlled amplifier can be said to be the difference in signal voltage fed into the amplifier and the amount fed back to the input through the inverse-feedback system after it has been amplified in the system.

This is a very meagre discussion of inverse feedback, but it is the best that we can do in the space allotted to us and we hope that some time in the future we shall have the opportunity of considering the subject, which is very interesting, in greater detail.

(Conclusion)

PILOT A-FM SET

(Continued from page 8)

the other for f-m alignment. *Fig. 1* also shows the handy location of the trimmers for both a.m. and f.m. on the dual-gang variable condenser.

Returning to the schematic, the ganged switch *S* is shown in the f-m position. Thus, in the antenna circuit, the upper r-f transformer is for f.m., the lower for a.m. The use of but one single pole double throw switch in this circuit is made possible by the arrangement of the transformer primaries, which are connected in series. In the f-m position, as shown, the impedance of the a-m primary presented to an f-m signal is offset by the 100 mmfd condenser shunted across this winding, which provides a low-reactance path to ground for an f-m signal. Conversely, with the first section of switch *S* in the a-m position, the primary of the f-m transformer presents a low impedance to the flow of an a-m signal current, whereas the 100 mmfd condenser across the a-m primary presents a high-reactance. path. Hence the a-m signal follows the path through the a-m primary.

The second section of the switch *S* connects the oscillator grid of the 14Q7 converter to one or the other of the oscillator coils, the left one being the f-m coil.

The third section of the switch *S* shorts out one or the other of the 1st i-f coils. In the position shown, the lower, a-m coil, is shorted. This arrangement prevents any interference from riding through the i-f amplifier.

No switch sections are required for the 2nd and 3rd i-f coils as the resonant frequencies (455 kc and 5.4 mc) are too remote for one of the series coils to have any effect on the other.

The fourth section of switch *S* connects either the f-m or the a-m output to the input circuit of the 7C7 voltage amplifier. It is shown connected to the output of the discriminator, since the remaining switch sections are in the f-m position.

It is the a-m position of this switch section, however, that is of the most interest. In this position it connects the high end of the volume control to the grid circuit of the 7C7 limiter tube —the connection being to a point on a voltage divider composed of the 270M, 1 meg and 3.3 meg resistors series connected from the limiter grid to ground. During a-m reception, the control grid and cathode of the 7C7 limiter function as a straightforward diode rectifier, and the three resistors previously mentioned form the load. That plate current still flows in the limiter tube is of no consequence since the output of this tube, through the discriminator, is no longer connected to the audio input.

It is also interesting to observe that this very same limiter grid circuit provides avc voltage to the converter and 1st i-f tubes irrespective of whether

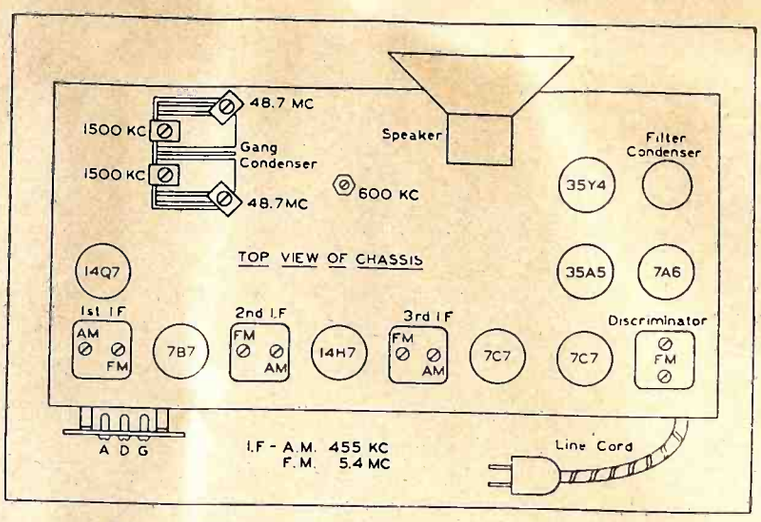


Fig. 1. Location of trimmers on chassis of Pilot T-301.

the receiver is set for a-m or f-m reception, for the grid of the limiter tube draws current in either case.

AUDIO AMPLIFIER

Getting around to the audio circuit, low-level bass compensation is provided by the 47M resistor and .003 condenser connected from a tap on the volume control to ground. Treble compensation is provided by the 500 mmfd condenser connected from the high side of the volume control to the tap.

Parallel-feed, constant-voltage inverse feedback is introduced in the power stage by means of the 2.2-meg resistor connected from the plate of the 35A5 power tube to the plate of the 7C7 voltage amplifier. This arrangement provides a greater degree of undistorted power output than would otherwise be possible.

The sharp cut-off tone control takes the form of a 500M potentiometer which functions as the power-tube grid resistor. The arm is connected to the input of the 7C7 voltage amplifier through a 35-mmfd condenser which passes only the higher frequencies. Since the voltage so fed back is out of phase with the input voltage, the high-frequency response is reduced —the degree of attenuation being dependent upon the position of the tone-control arm on the grid resistor.

All the tube heaters, of course, are series-connected, as shown. The heaters of the 14Q7 converter, 7B7 1st i.f. and 14H7 2nd i.f. are bypassed to ground by means of .01 condensers, to keep r.f. out of the other circuits.

The speaker is a dynamic, with the field used as the filter choke. Note that 50 mfd is used across the input and *120 mfd* across the output.

ALIGNMENT

The location of all adjustments used in re-aligning this receiver, and the frequencies at which these adjustments should be made, are shown in *Fig. 1.*

When aligning the i-f amplifier, the signal generator must be connected to the grid of the 14Q7 tube through a .1 mfd condenser. When aligning the receiver on the broadcast band, connect the signal generator to the antenna wire through a .0002-mfd condenser, and on the f-m band use a 72-ohm carbon resistor.

No attempt should be made to align the f-m band without the use of an f-m signal generator.

SERVICE PORTFOLIO

(Continued from page 18)

good localities, providing the receiver has an r-f stage, which is usually the case.

The year also brought improved design in a-fm sets, the preferred arrangement being similar to that shown at *A* in *Fig. 11.* The f-m and a-m i-f transformers are series connected, and since the peak frequencies are so far apart, one or the other transformer offers no effective impedance to the i-f signal to which it is not tuned.

Dual limiters also scored heavily in 1941, with practically all the late model console sets employing them. Since the preceding i-f stages provide sufficient selectivity (and gain) the preference has been toward the use of resistance coupling for the second limiter, as shown at *B* in *Fig. 11,* although transformer or impedance coupling is used in some cases.

The use of a second limiter further reduces noise interference. It might even be said that the use of two limiters guards against *any* noise interference.

The usual scheme is to apportion the work of noise reduction by the proper selection of tube voltages, the first lim-

iter having the job of clipping noise peaks of large amplitude and the second limiter of clipping the remaining noise peaks of lower amplitude.

PHONOGRAPHS

The rim-drive type of phonograph turntable is now extensively used in both record players and automatic record changers, the gear-driven type having taken a back seat except in commercial applications. The rim type is superior to the gear type where cost is a factor.

Automatic record changers have shown great improvement. Features of the latest drop mechanisms are: reduction in time interval between playings, automatic clutches to prevent jamming and damage to records or mechanism, gentler handling of records and simplification of operating mechanism.

The highlight of the year was the RCA dual-pickup changer that plays both sides of the record, or one side at a time where the record sides are arranged for drop-mechanism sequence.

Although crystal pickups having low needle pressure (usually 1 ounce) and small vibrating mass, with permanent sapphire styli were first introduced some time ago, it was not until 1941 that they came into general use in both record players and automatic record changers. Today they are standard equipment, and will remain so until something better is devised.

Where at one time it appeared that volume expansion would eventually become a standard feature of the higher-priced phono-radio combinations, it now seems that its use has been rejected altogether. It is not a feature that is easily understood by the consumer, and past experience has indicated that the average owner of such a combination has misused the volume-expansion control.

On the other hand, volume expansion came into its own in 1941 in many p-a amplifiers, and more than likely will be retained. For one thing, it is more effective and advantageous when used in large halls or out of doors; and for another thing, the chances are good that the operator will have a better understanding of its use and control than the layman.

In general, 1941 saw a simplification in p-a equipment, more power per dollar, compactness, a greater number of input channels, a more general use of mixers, and also remote volume controls of various types. The most generally used remote control has been the type based on the variation of screen voltage on one or more of the voltage amplifiers. Cathode followers have been used in some instances, and so have variable bias systems.

NEW LITERATURE

Solar Catalogs—Solar Manufacturing Corp., Bayonne, N. J., have issued two new catalogs covering the company's line of "Elim-O-Stat" Radio Noise Suppressors (Catalog 12-F), and Solar Capacitor Analyzers (Catalog 12-G). Either or both are available on request to the manufacturer at the above address.

★

Pickup Cartridge Manual— The Astatic Corporation, Youngstown, Ohio; has published a Phonograph Pickup Cartridge Replacement Manual for the convenience of Astatic jobbers, dealers and servicemen, made possible by the fine cooperation of the various radio set and phonograph equipment manufacturers.

The use of this Manual will enable Astatic distributors and their customers to intelligently select the proper pickup cartridge when required to make replacements for phonograph equipment.

Ohmite Stock Items—A new, up-to-date, 16-page Catalog listing over a thousand stock items in Rheostats, Resistors, Tap Switches, Chokes and Attenuators has been issued by the Ohmite Manufacturing Company, Chicago.

This new Catalog 18 is especially useful today for quick reference by engineers, maintenance men, purchasing agents, servicemen, jobbers, and amateurs. It gives illustrations, descriptions, ratings, prices and other helpful information on the wide range of Ohmite stock types and sizes—simplifies selection. There are close control vitreous enameled Rheostats ranging from 25 watts to 1000 watts—Dividohm Adjustable Resistors from 10 watts to 200 watts, and Fixed Resistors from 1 watt to 200 watts—all in many resistance values. Two types of Tap Switches and a wide variety of Power Line and R. F. Plate Chokes are listed. There are also many other items of general interest.

A free copy of the new Catalog 18 may be obtained by writing to the Ohmite Manufacturing Company, Dept. 8M, 4835 Fluornoy Street, Chicago, Illinois.

★

Handbook Circular—Ghirardi's newly revised and expanded "Radio Troubleshooter's Handbook" is described and a detailed listing of its 66 chapter titles given in an attractive circular in color just issued by the Radio & Technical Publishing Co., 45 Astor Place, New York City. This circular also points out the specific advantages which this 710-page book offers the busy serviceman—not as a "study book" but as a reference volume which contains the mass of data needed in his everyday servicing problems.

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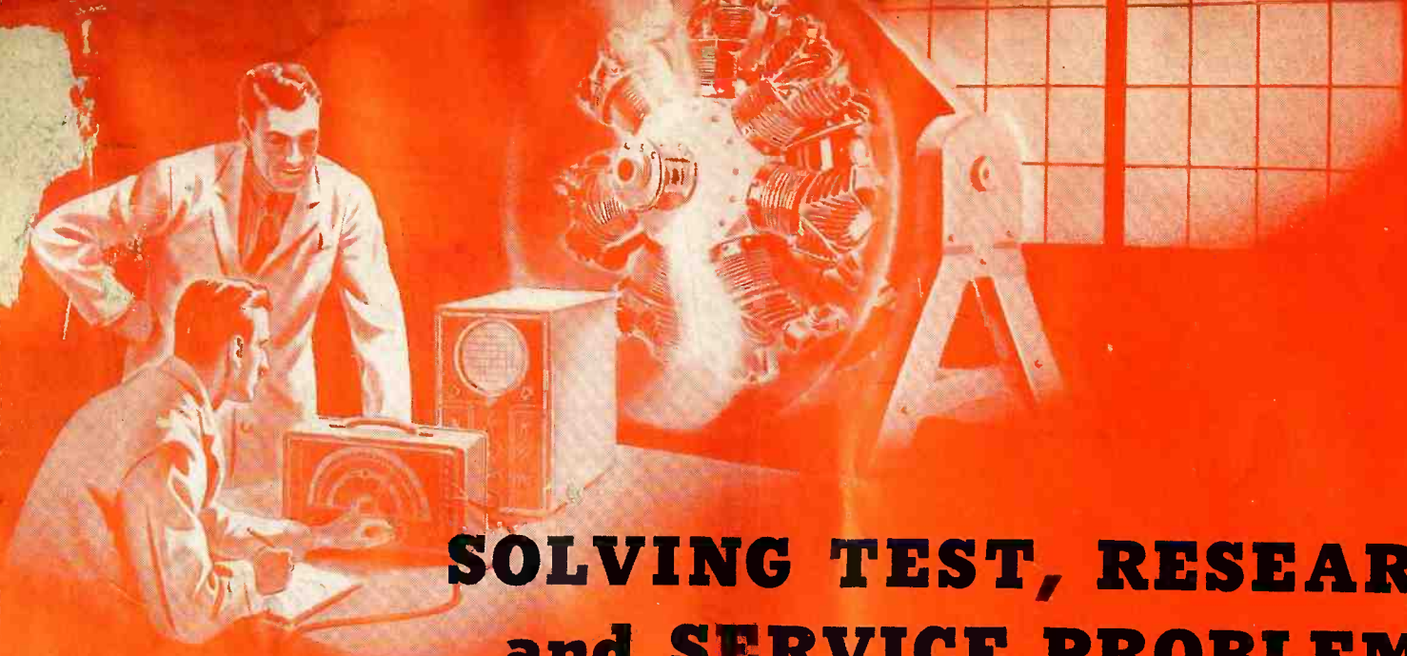

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