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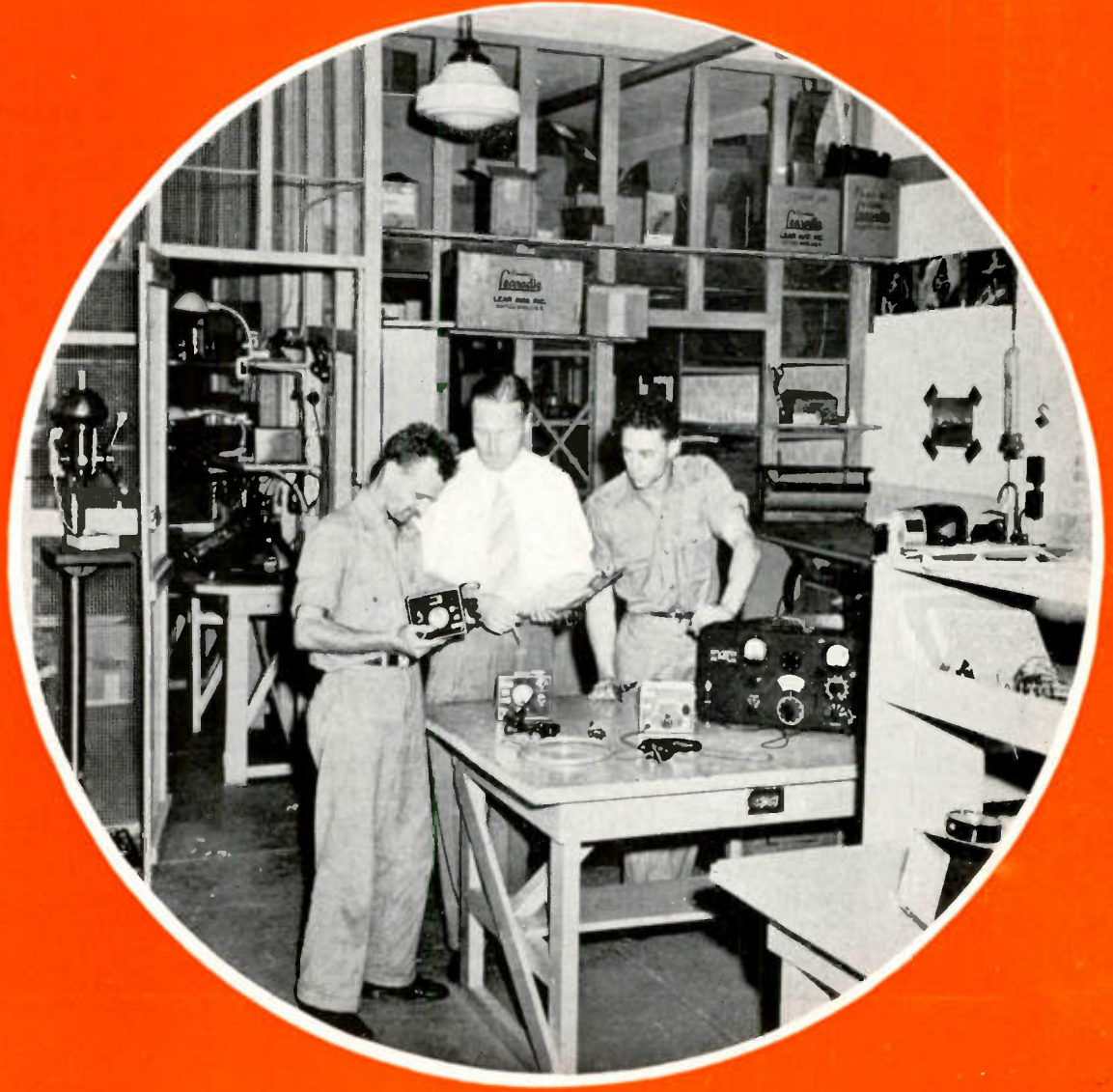
NOVEMBER  
1941

EDDIE J DONNELLY  
RADIO TESTING STA  
49 HAYES ST  
BINGHAMTON N Y

Radio  
**SERVICE  
DEALER**

*This Month*

- MORE ON TUBE PHASE**
- REPAIR CHAMPIONED**
- DRY-CELL CHARGING**
- KEEP 'EM OPERATING**
- SET OF THE MONTH**

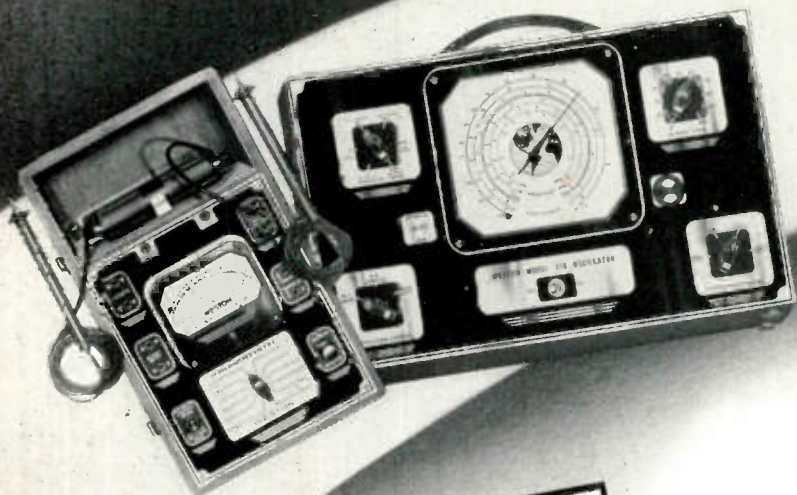


**PRICE**  
**25¢**

# *Busy days are here...*

## FOR SERVICEMEN

***Keep them profitable  
with dependable  
test equipment!***



**NOW AVAILABLE  
FOR FM AND TELEVISION**

### **WESTON**

Model 787

**UHF Oscillator**



Fundamental frequency coverage from 22 to 150 megacycles. No harmonics . . . no band switching. Used with portable antenna or standard output leads. Reads 40 kc per division at 10 mc. Self contained battery operation; compact and extremely portable.

Today, as never before, the American public *wants radio* and can afford to pay for radio. Proof is that the demand for new sets has virtually doubled. But with long deliveries prevalent in so many fields, more old sets probably will be retubed and repaired than ever before. » » » A period like this is *made to order* for the servicemen with WESTON Test Equipment. For WESTONS help produce greater profit on every job. Measurements are simpler, surer . . . trouble can be spotted quicker . . . when these basic, direct-reading instruments are used.

But the *big profit* from WESTONS is shortly to come; for FM and television are rapidly getting into stride. *These same WESTON Test Instruments fully meet the new servicing problems involved. No new and expensive equipment will be needed for the job.* Thus it *pays . . . and continues to pay . . .* to use dependable WESTONS for all servicing needs. Weston Electrical Instrument Corporation, 605 Frelinghuysen Avenue, Newark, N. J.

# WESTON

## *Test Instruments*

*Radio*

# SERVICE-DEALER

**SOUNDMAN AND JOBBER**

Reg. U. S. Pat. Off.

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## Cover Photo



★ Albert O'Donnell (center), Lear Avia's service manager, and two assistants, in the new Lear Avia service station at Roosevelt Field.

In the Air Corps it's "Keep 'Em Flying". In the Army it's "Keep 'Em Rolling". Let us remember to "Keep 'Em Operating".

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**M. L. MUHLEMAN, EDITOR**

**S. R. COWAN, ADV. MANAGER**

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# TRANSIENTS

## SERVICEMEN CHAMPIONED

RCA IS GOING to bat for the serviceman again in the second of a series of monthly advertisements currently running in *Collier's*. The first ad, which appeared in the October 11th issue, and headed "What You Should Know About Radio Service," took much of the sting out of the *Reader's Digest* display of bad taste in publishing.

"Can You Measure a Millionth of a Volt?" is being asked of the nearly three million readers in the full-page, two-color ad in the November 15th issue. The ad develops the theme that a radio performs better and lasts longer when serviced regularly.

RCA should have the thanks of every serviceman in the country for what they are doing to better his lot and protect his interests.

## REASA

AS A RESULT of John Rider's storm warning, reported on this page in the October issue, the New York area will soon hear from the "Radio & Electrical Appliance Service Association."

The association is still in the formative stage but should be going full blast in the near future. It will be watched with considerable interest, for its success in the New York area will lead to the formation of groups with similar policies in other key cities throughout the country.

## QUESTIONNAIRE

IT IS NOT often that we ask for assistance, but there are two important questions we would like to have answered. The first question is directed to servicemen only, and is this: What effect has the *Reader's Digest* article had on your business?

There have been so many diverse reports on this subject that it has been difficult to form a definite opinion. Yet little of a constructive nature can be accomplished until a definite opinion can be formed. We are sure only that the issue is far from being dead, for there has been evidence of public suspicion from all sides. But has this suspicion actually damaged your business? Let us know, won't you?

The second question is directed to servicemen, soundmen and jobbers, and is this: Are you having difficulty in obtaining replacement parts or equipment from your normal sources of supply, and if so, what parts or units are you finding it difficult to obtain?

If we can determine the situation in the supply field, there is the possibility that tight conditions in specific parts or units can be eased. All information received will be held in the strictest confidence and will be used only in its statistical form to obtain relief where that may be possible.

A line from you now and then may serve to straighten out a bad supply situation, much to your advantage.

## SAVE OLD PARTS

AND SPEAKING OF supplies, don't throw away old parts, for the day may come when you will need them. Moreover, if it is your policy to return old tubes and defective parts to your customers as proof of replacement work done, request them in turn to keep the components, for the day that will soon arrive when there will be a nationwide collection of waste materials for national defense. Better yet, *show* the customer the parts you replaced, but keep them in your own junk pile if the customer is willing.

As a nation we have been wasteful of cast-off things. It is now important, and may yet be vital, that we save everything containing materials, such as metals and paper, that can be re-processed.

# Follow the Ball AT NORTHWESTERN

## WITH RAYTHEON TUBES

End of the first quarter . . . Northwestern nothing, Notre Dame nothing! The announcer's voice is clear and life-like above the crowd noise because Dyche Stadium—like many other university athletic fields—is using dependable RAYTHEON TUBES.

Remember these RAYTHEONS are "stock" tubes, the kind that are giving such outstanding service everywhere. Backed by the years of experience of expert engineers, who are constantly pioneering in tube design and construction . . . constantly anticipating future requirements in the fast-moving radio circuit field.

When you use RAYTHEONS for replacements you know you are supplying tubes that meet the most exacting demands of important users, yet they cost you no more. RAYTHEONS build good-will . . . good-will builds good business!

No wonder the business men in service work use RAYTHEONS!

Your RAYTHEON distributor is a good man to know . . . see him without delay.

*Raytheon Production Corp.  
Newton, Mass. New York Chicago  
Los Angeles Atlanta*



WORLD'S LARGEST EXCLUSIVE RADIO TUBE MANUFACTURERS



**ON LAND** . . . at Army bases and training centers you'll find thousands of RACON's Horns, Speakers and driving units working hard, in all kinds of weather, for Uncle Sam.

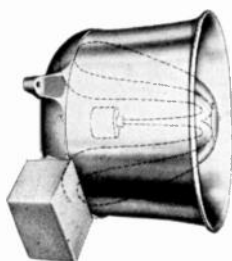
**AT SEA** . . . all leading Steamship Lines and the Navy use RACON's. Yes, where lives are at stake, and dependability important—and specifications extremely rigid—that's where you'll find RACON's.

**IN THE AIR** . . . at airports, commercial and Government owned, on planes, dirigibles and blimps—where stamina, ruggedness, and efficiency under all conditions count . . . you'll find RACON's.

Leading Soundmen everywhere have for years specified and used RACON Speakers, Horns, Driving Units and other sound reproduction equipment because there's nothing finer . . . yet RACON's cost no more. Keep this in mind when bidding defense requirements. RACON can protect you with or without priorities because RACON is the only loud speaker manufacturer that can supply non-priority restricted materials in speakers. See your jobber, — get the real low-down today, — or write to us for particulars.

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

**MARINE HORN SPEAKERS**



Re-entrant type speakers using horn type units for marine and general P.A. applications — may be used as loud-speaker or as a microphone. Manufacture 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.



**RACON P. M. HORN UNITS**

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.



**MULTI-UNIT AEROPLANE HORNS**

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.

**Re-Entrant Trumpets**



A 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.**

# RIDER on Tube Phase

## KP AND G—PART II

John F. Rider

IN order to check the relationship between the cathode and plate circuit in an amplifying stage, or for that matter in a conventional triode system, it is necessary to establish the current relations first. To do this we show a simple triode circuit containing but slight modifications of the original basic system shown in the first installment of this article. In this circuit, illustrated in *Fig. 1*, we have added a cathode resistor and a ground junction. Usually such a ground junction joins the grid return point, but not in this case, due to the division of voltages which are desired.

If you look closely at the arrangement of the cathode and plate, the load resistance  $R_1$  and the battery and the cathode resistance  $R_2$ , you will see that these elements comprise a simple series circuit. For easiest recognition we show just these elements in *Fig. 2*. In connection with *Fig. 2*, we shall assume that the grid circuit is that means whereby the magnitude of plate current flowing in the system is controlled and that while it is not shown, it exists nevertheless.

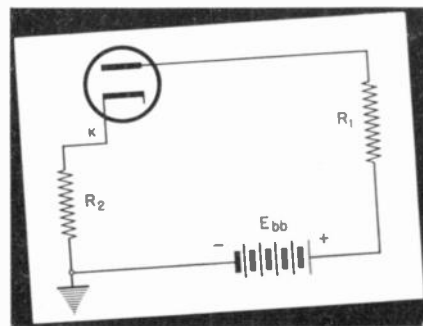
Since this circuit is a series combination whatever the value of current flowing in this circuit as the result of the grid action and the basic value of plate supply voltage  $E_{bb}$ , that value of

current flows in all parts of the circuit, through the tube, through  $R_1$ , the battery, and  $R_2$ . As to the division of voltages across the different parts of this circuit, we require a reference point and it is for this reason that the ground connection is shown at the junction between the battery and the cathode resistance. As a matter of fact the location of the ground at this point conforms with standard practice in actually operating systems. For still further simplification of things, suppose that we assume that the ohmic values of  $R_1$  and  $R_2$  are the same. This immediately sets up a condition of voltages which is easy to understand. No matter what the value of current in the circuit, the voltage drops developed across  $R_1$  and  $R_2$  will then be the same, for the same value of current flowing through two like values of resistance will result in identical voltage drops.

### PHASE RELATIONS

But this is not the most important thing we are after. What we want to establish is the phase relationships between the voltages across  $R_1$  and  $R_2$  with respect to ground. To do this, suppose we start with the condition that a steady value of plate current of 5.0 milliamperes flows in the system. If for some reason a change occurs in the value of the plate current this will cause corresponding changes in the voltage drops across  $R_1$  and  $R_2$ . If the plate current rises the voltage drops across  $R_1$  and  $R_2$  will likewise increase and if the plate current decreases, the voltage drops across  $R_1$  and  $R_2$  likewise will decrease. There we have basic conditions to which we can refer later.

Now for the polarity of these voltage drops. If we select the ground junction of the system as the most negative point, then every place else in the system is positive with respect to ground. In other words, both cathode

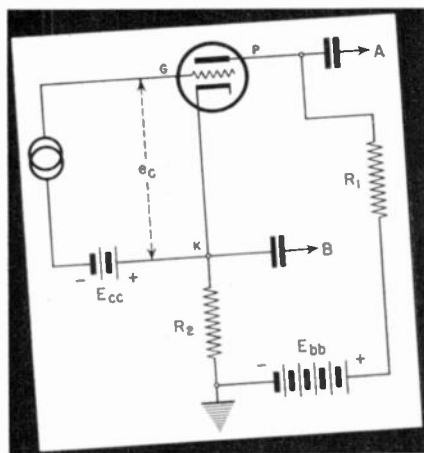


*Fig. 2. The whole works is a simple series circuit.*

and plate are positive with respect to ground. This is the normal static condition as determined by the polarity of the plate voltage supply source and the direction of current flow through the plate circuit.

But again, the determination of the fixed polarities is not the only thing we seek to set up. We have another bit of information which we want to establish and this relates to the manner in which these voltage drops vary when a signal voltage is applied to the control grid of the tube shown in *Fig. 1*. Imagine for a moment that as the result of a plus voltage applied to the control grid, the plate current is momentarily increased from 5.0 milliamperes to 5.25 milliamperes. What happens now?

To answer this, we have to refer back to the original quiescent condition: no signal input to the grid and the steady 5.0-milliamperere flow in the system. When this value of current flows in the system, it establishes the respective voltage drops across  $R_1$  and  $R_2$  and at the same time sets up the polarity and voltage of the plate with respect to ground and that of the cathode with respect to ground. We also said that when the plate current increases the voltage drops across  $R_1$  and  $R_2$  increases. Interpreting this action in the potential difference between the plate and ground and the cathode and ground, we find that when



*Fig. 1. Output voltages at A and B are equal but opposite in phase.*

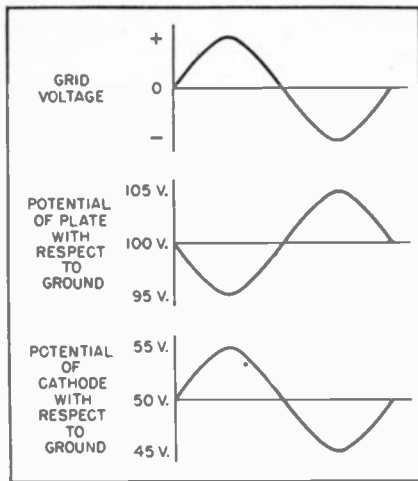


Fig. 3. Grid, plate and cathode phase relations.

the plate current increases and causes an increased voltage drop across  $R_1$ , the voltage at the plate with respect to ground decreases. This was explained in more detail in the first installment. At the same time, the potential difference between the cathode and ground increases; thus plate  $P$  becomes less positive with respect to ground and cathode  $K$  becomes more positive with respect to ground.

#### PLATE-CATHODE VOLTAGES

Let's put this into figures. Let us say that as the result of 5.0 milliamperes of quiescent current flow in the plate circuit, the plate is 100 volts plus with respect to ground and the cathode is 50 volts plus with respect to ground. The plate current now increases by 0.25 milliamperes. The drop across  $R_1$  increases, which would tend to reduce the effective voltage at the plate. The result is that the plate now is plus 95 volts above ground and the corresponding 5 volts increase in the drop across  $R_2$ , makes the cathode 55 volts plus with respect to ground.

Now, let's assume the reverse condition. The voltage applied to the grid is negative and of such magnitude as to decrease the plate current by 0.25 milliamperes. This would decrease the plate current flow, hence the drop across  $R_1$  and  $R_2$ . Imagine that this change in voltage is again 5 volts, but this time, it would increase the voltage effective at the plate—that is, between plate and ground—so that the plate would be 105 volts plus with respect to ground and the cathode now would be only 45 volts plus with respect to ground.

From the figures quoted, or rather from the manner in which the effective plate voltage (with respect to ground) and the cathode-to-ground voltage changes, we can establish a very significant fact; a fact which makes pos-

sible phase inversion. According to what has been said we see that we have available in the cathode-plate system two separate sources of the alternating component of the plate current; or to say this differently, we have two sources of an alternating voltage in the plate system. One of these is  $R_2$ , the cathode resistance, across which the change in voltage drop is the equivalent of the alternating component of the pulsating plate voltage, and the other is the plate load resistance  $R_1$ , across which the change in voltage drop is the equivalent of the alternating component of the pulsating plate voltage.

And what is of greatest significance is that these two voltages are out of phase, for you will recall that an increase in plate current makes the plate less positive with respect to ground, which is the same as saying that it makes the upper end of  $R_1$  less positive with respect to ground and at the same time, the upper end of  $R_2$ , or the cathode in this case, becomes more positive with respect to ground by a like amount. If we now show the relationship between the change in voltage across the cathode resistance and across the plate load resistance and the grid voltage, it appears as shown in Fig. 3.

#### SIGNAL INVERSION

If you now correlate Figs. 1 and 3, the grid voltage  $e_c$  in Fig. 1 is the "grid voltage" in Fig. 3. The alternating voltage existing between  $A$  and ground in Fig. 1, or that which is normally spoken of as being developed across the plate load resistance  $R_1$  in Fig. 1, is that wave of voltage which is identified as "potential of plate with respect to ground" in Fig. 3. The alternating voltage existing between  $B$  and ground in Fig. 1, or that which in a phase-inversion circuit of this type is said to be developed across the cathode resistance  $R_2$ , is that wave of voltage which is identified as "potential of cathode with respect to ground" in Fig. 3. Thus the input signal voltage in Fig. 1 is amplified and inverted in phase in the plate circuit. A corresponding amplified version is available in the cathode circuit as well, but here its phase corresponds with the input signal voltage, for like the input grid voltage, it is 180 degrees out of phase with the plate voltage.

The reason we say that the amplified version is available in the cathode circuit is that the amount of current which flows through the plate load resistor and which is the result of the amplification process existing within the tube, also flows through the cathode circuit. Since the signal voltages

at  $A$  and  $B$  or plate and cathode of the combination amplifier and phase inverter tube, are of like magnitude, they can be delivered through suitable coupling condensers as shown in Fig. 1, to the grids of a push-pull stage.

In actual practice, the grid bias battery  $E_{cc}$  would not be used. In its stead a cathode bias resistor, would be used properly bypassed by a large capacity as shown in Fig. 4. Also the plate voltage supply would not be a battery but rather a power supply unit. As to the cathode bias resistor  $R_k$ , it naturally plays a part in the distribution of voltages for the plate current flows through it, but as to any changes in voltage across this resistor, there it is of no importance due to the presence of the large value of bypass capacity.

The specific type of circuit shown in Fig. 4 has certain advantages and disadvantages as far as practical use is concerned, but these are not of importance at the moment, for all that we were interested in initially was the manner in which phase inversion is accomplished between the cathode and plate circuits of a vacuum tube.

#### CATHODE-GRID RELATIONSHIP

There is still another relationship existing within the conventional amplifying tube which is of interest to us in view of the forthcoming discussion of different kinds of feedback in an amplifying system. These are the factors associated with the grid and cathode voltages. Although we have put the cart before the horse by speaking about phase inversion before we discussed the grid-cathode relations, no harm has been done.

It is a well-known fact that there are two methods of supplying bias to an amplifying vacuum tube. One is the

(Continued on page 18)

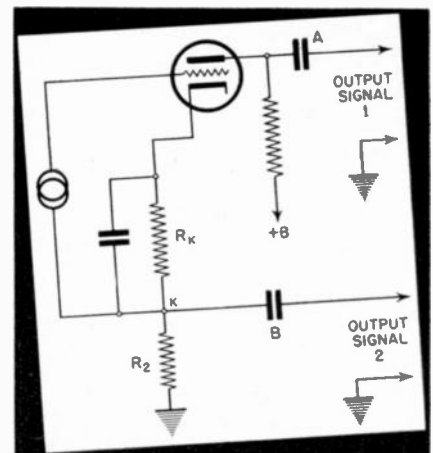


Fig. 4. A single-tube cathode-load phase inverter.



# Serviceman's Diary

J. P. Hollister

MONDAY—When you come back from a vacation, you get the idea that somehow things are going to be different, but they never are. From the shop window I could see Jerry with his feet up on the desk, hard at work on a cross-word puzzle, just as he was when I went away. When I came in he put down the paper and grinned.

"So you're back," he said. "You don't know what you've missed!"

"Been rushed?" I inquired hopefully. It would be nice to know that money had been rolling in while I was away, having a good time.

"So-so," he answered. "What I mean is that the Women's Club has swallowed all that baloney which appeared in the damned Reader's Digest article about gyps and they've had one of the noisier hams give a couple of talks on radio to them, so they can get the 'elementary knowledge of radio'

which the Digest article said they should have to protect themselves."

"Swell!" I told him. "If they get educated to the point where they don't expect me to tell them what's wrong with the set and how much it will cost to fix it before I even have a chance to take off my coat and take a look at it, I'll be happy."

"But it doesn't work out that way," Jerry told me. "They've found out that fixing radios is a very simple thing. You won't even have to shoot trouble now—they'll just tell you what's wrong and what they want you to do. You'll see!" He pushed over a ticket for a call, which I noted was from the president of the Women's Club. "See what Mrs. M— has to tell you."

Sometimes it's hard to tell whether or not Jerry is kidding. Anyhow, I took the call and started out.

I had never called on Mrs. M— before, though of course everyone

knows about her. She lives over in the most exclusive section of the town and is continually getting write-ups in the newspaper. Her husband, I think, is dead; or if he isn't, he might as well be, because nobody ever heard of him. She's got lots of dough and has a way of spending it so it will make the most noise.

I straightened my tie and made sure that my hair wasn't mussed up before I ran up the walk leading to her house, which was set back about a hundred feet from the street. When I pushed the bell button, the maid showed me in. I was careful to take off my rubbers in the vestibule, then picked up my tube checker and followed the maid. Mrs. M— was waiting in the library.

"Good morning!" I said, as cheerfully as possible, and with my most radiant smile. Gosh, what a big cow she was!

She looked me over carefully from head to foot, without replying. Then she said, "I am not inclined to trust people who grin too much—they usually do so to conceal their true thoughts."

I hastily eliminated the smile. I was going to say something about the radio, but thought better of it. Let her do the talking, I said to myself, and play safe. After a moment's pause, she started in.

"This radio," she waved a hand toward a "Concerto Grand" midget in a corner of the room, "was noisy for a few days and now it has become inoperative—"

"You mean the part which makes it play loud or soft made a noise when you turned it—" I interrupted.

"The volume control," she said severely. I should have known better. This was a customer who had been educated in radio. I apologized.

"Now," she continued, "I want you to take your voltmeter—" she pointed at my tube checker— "and diagnose the trouble in my receiver. Not that it is really necessary, because I know already what the trouble is."

I suppose she thought the tube checker was a voltmeter because the Reader's Digest article said that all that was necessary to shoot trouble on any set was a voltmeter. I couldn't let that go by.

"I'm sorry," I said as diplomatically as I could. "The case of this instrument looks like that of a voltmeter, but in reality this apparatus is designed

(Continued on page 13)



"I want you to take your voltmeter and diagnose the trouble . . ."

# Set of the Month—

## Stewart-Warner "Companion"

IN THESE days of national emergency, any method that prolongs the useful life of a component—and thereby conserves raw materials—is both worthy and interesting . . . which brings us to the Stewart-Warner 207C chassis, used in receiver models 207CA to 207CZ.

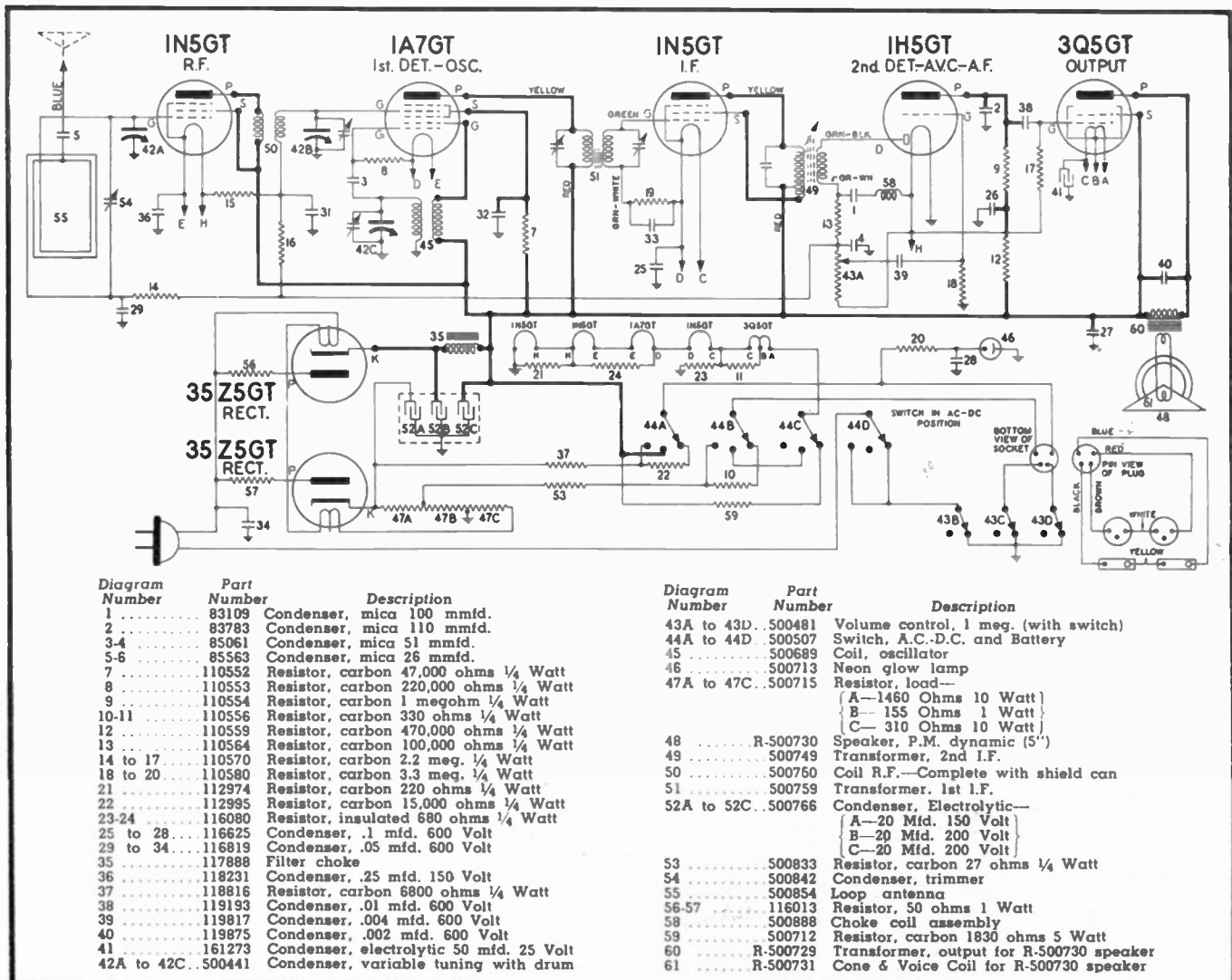
This ac-dc-battery portable is interesting in itself, but its feature is a separate dry-cell battery charging system arranged to provide a very light charging current when the receiver is operated from either ac or dc, which is just enough to maintain the batteries, and a rapid recharging rate to bring

the batteries back to normal after prolonged use. The number of times the batteries can be recharged is, of course, limited, but the method introduced extends their life over a much longer period.

### THE CIRCUIT

The complete schematic diagram of the receiver is shown at the bottom of this page. It will be noted that a tuned r-f stage is included, making a total of

(Continued on page 13)

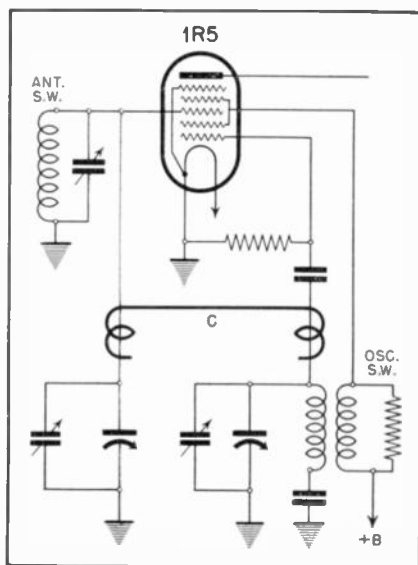


# CIRCUIT COURT

## DUAL GIMMICK

THE RECENTLY introduced Zenith Model 4K640 battery-operated receiver is a two-band job, with a tuning range of 5.6 to 18.2 mc in the s-w band.

Since a pentagrid converter, such as the 1R5 used in this receiver, ordinarily has low efficiency above 5 mc, due to lower oscillator output and other factors, capacity coupling between the oscillator and signal sections of the tube is added. In the Zenith set, this takes the form of a dual gimmick, *C*, as shown in the accompanying diagram. The capacity is quite low, as the dual gimmick is the equivalent of two condensers series-connected. It provides practically no coupling at broadcast-



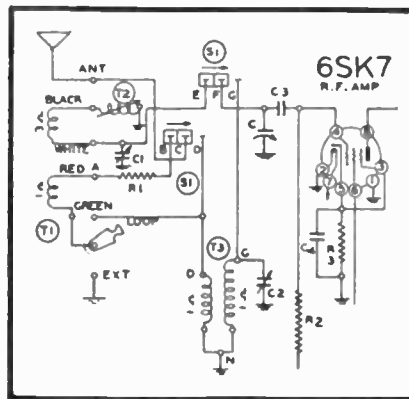
band frequencies (where additional coupling is not required) but is increasingly effective as a coupling medium from 5.6 to 18.2 mc.

## LOOP TRACKER

SINCE THE distributed capacity of a loop aerial differs from that of an antenna transformer, the two have differing LC ratios.

In Wards Airline Model 14BR-1109A two-band receiver, the trimmer condenser *C2* is included so as to provide proper tracking when the short-

wave antenna transformer *T3* is in use, as shown in the accompanying diagram.



In the broadcast band, where the loop *T1* is employed either as a straight loop or an antenna transformer in conjunction with an external antenna, proper tracking at the low-frequency end of the band is gained by the addition of the coil *T2* with an adjustable iron slug, which permits an alteration of the loop inductance.

This circuit is aligned at 1400 kc by means of trimmer *C1*, and at 600 kc by means of the adjustable inductance *T2*.

## BIASED LIMITER

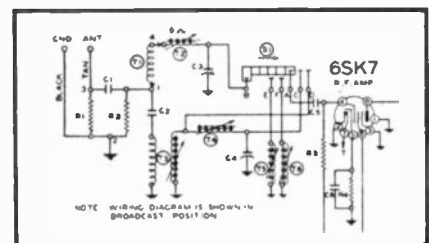
IMPEDANCE COUPLING is employed between the first and second limiters in the Zenith Model 12H678 a-fm receiver, as shown in the accompanying diagram. Unusual is the fact that a positive bias of 0.2 volt is placed on the signal grid of the 2nd limiter tube. This positive bias is obtained from the

plate circuit of the preceding tube by means of the resistor *R16*. The grid return for the 2nd limiter is through this resistor, the impedance *L21* and the voltage-divider resistors shown.

With a positive bias on the grid of the 2nd limiter, together with low values of plate and screen voltage, the tube is easily driven to plate-current saturation by the signal voltage. Hence, any noise voltages of greater amplitude than the signal that may be present at the grid of the 2nd limiter will produce no changes in plate current and therefore will not appear in the discriminator circuit.

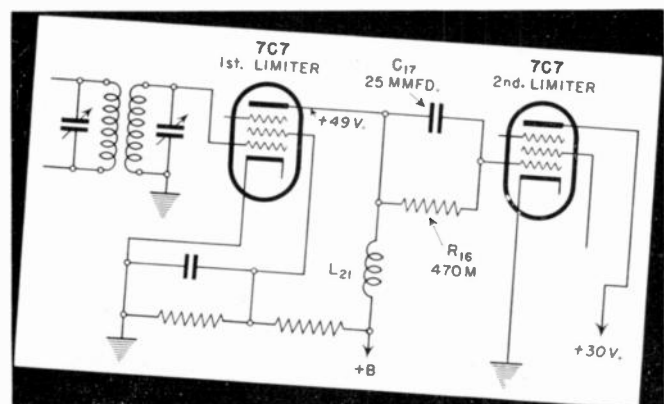
## PERMEABILITY TUNING

THE NEW MODEL 12A51 Coronado 5-band receiver is entirely permeability-tuned. The movable cores in the coils for all wave-bands are ganged and controlled by a single tuning knob. The disposition of these coils in the circuit



for each waveband is shown in the accompanying diagram which shows the switching arrangement in the antenna circuit.

Coupling from an external antenna  
(Continued on page 22)



Dual limiter with positive-biased 2nd limiter in Zenith a-fm receiver.



## HEY, FELLOWS—PRIZES!

You read about the membership contest in last month's *RSA News*. Have you entered yet? Prizes, you will remember, are Rider's Volume XII, Rider's "Aligning Philco Receivers, Vol. II," and three RSA gold lapel pins, as well as many, many RSA leather card cases, stamped with the RSA insignia and slogan, for your membership card and your personal business cards.

All you need do is invest a little time in the protection of your future by telling your fellow servicemen about RSA and sending in their memberships. Five or more new members sent in by you (just their names and addresses and a dollar bill each, together with your name, of course) will entitle you to one of the convenient RSA leather card cases. And the members who send in the most new applicants before December 31, 1941, will receive the prizes in the order listed above.

As in any organization, RSA can only grow and accomplish its aims by the efforts of its members in telling about RSA and our work. RSA is *your* organization, and accomplishes results directly in proportion to the efforts of its members. At a dollar a year, memberships are easy to get. But it takes that personal touch of *you* telling your fellow servicemen about RSA. We can only meet the present threats to independent servicing by united efforts and action of all ethical servicemen.

In six months RSA has grown more than 50%. That's results to be proud of. But that isn't nearly enough. We need *every* competent, ethical servicemen as a member to accomplish our aims.

Get going, fellows. Let's gain the rewards of a strong organization. Get those members *now* . . . and we'll send you the prize you earn.

## FLASH !!!

The National Office of RSA has obtained for RSA members, through the courtesy of the RCA Manufacturing Company, a large supply of RCA Victor service notes. We have for you more than 225 pages of detailed service data, covering over a hundred 1938, 1939, and 1940 RCA Victor models.

To get this valuable addition to your personal service library, send only 35c in stamps to cover mailing costs to: Radio Servicemen of America, Inc., 1216 W. American St., Freeport, Illinois.

## TELL 'EM WHERE YOU STAND!

The RSA emblem is the badge of "Reliable Service Assured" to your customers. Are you displaying it and using it?

Do you wear your RSA insignia pin so your customer can see it? Do you display the RSA window decal on your shop window and on your car or truck so the

public knows you are RSA: Reliable Service Assured? Do you use the RSA insignia cut and the RSA slogan on your billheads, stationery, and business cards, and in your advertising? Do you show your membership card to your customers and display your membership certificate in your shop? The leather case stamped with the RSA insignia and slogan displays your membership card to best advantage. Do you show your customers and prospects the RSA Code of Ethics to which you adhere?

You can gain and keep public confidence with the RSA emblem. Use it. Let the RSA insignia and slogan make money for you.

## CHAPTER CHATTER

### Chicago Chapter:

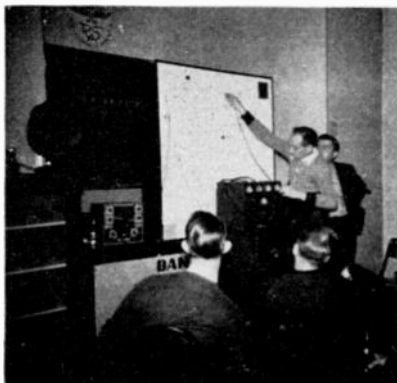
Our meeting and service clinic of October 29 was planned to further our aim, "Learn more to earn more." The meeting was held at the shop of President *Lowry Easley*. Two of our members, who are using the Chanalyst in their daily work, showed us some of the tricks they have learned, using receivers with actual (not manufactured) troubles. A number of members brought faulty sets for the clinical diagnosis.

The improved Chapter service-form was presented for final adoption. The revisions, based on several years of use in the field, will make this form even more valuable in the selling and billing of "corrective services."

—*Al Kilian, Secretary*

### Danville Chapter:

*Earl Drollinger* had charge of the program of the last meeting of the Danville Chapter, using "Servicing Radios With a Vacuum Tube Voltmeter" as his subject, and giving an interesting demonstration. While orating on the wonders of the



**A corner of the RSA Hall, Danville Chapter, during a recent meeting. Member Earl Drollinger is the lecturer. Danville Chapter maintains these club rooms for members use at any time, for meetings, reading, talk-fests, or parties.**

VTVM, Earl thought "Oscar" was struck by lightning. You can see for yourself what happened . . . it was *Evard Welch*, official Chapter photographer, "flashing" the picture herewith.

An interesting Hallowe'en party was held the thirtieth. RSA Hall was all decorated up, and a big time was enjoyed.

If you don't get out on rural service calls, you don't know all the trials of radio servicing. *Steve Goth* had quite an alarming experience the other day. While on a rural service call, he was attacked by a large turkey. Steve took to his heels with the gobbler right behind. Fortunately, he made it to the car ahead of Mr. Gobbler. Steve threatens he'll get even about Thanksgiving!

—*From the "Servicemen's Dirt,"*  
*Cal Stapp, Editor*

### North-Eastern Iowa:

While we are not yet officially a Chapter of RSA, all of us are RSA members. We have been getting started in good faith; everyone in our group are sure with us in every way. Our monthly meetings have been planned to "get organized," and are rotated among the various cities where we have members.

We have discussed and set up price charges for service work so that we will all be in the same price bracket. Programs have consisted of discussions of difficult service problems and talks by members and invited speakers.

We are conducting a membership campaign and hope soon to apply for our RSA Chapter Charter.

—*Orville Saboe, Secretary*

### Flint Chapter:

A big November "get-together" will open the fall activities of Flint Chapter. The meeting will be a pep meeting, with officers of the Chapter to be elected and new members signed up. We expect practically every full-time serviceman in Flint to attend.

—*William F. Lutes, Secretary*

### Interstate Chapter:

Our October meeting was held in the laboratory of St. Ambrose College, Davenport, Iowa. Visitors from Burlington, Iowa, were present (and incidentally, joined RSA and laid plans for a Burlington Chapter RSA). *Dr. Harvalik* was presented with an Honorary membership in RSA. In accepting, Dr. Harvalik promised his further support and help. We all know by now that we are being benefited greatly by his attendance at our meetings.

*President Gordon* again urged members to stock up on tubes and parts if possible as the shortage is getting more acute.

*Dr. Harvalik* was the speaker of the evening, his topic being meters. Every member and visitor present learned much

from the doctor's talk. He showed by actual demonstration and illustration just how all types of electrical indicating and measuring instruments work. After the meeting, an inspection of the laboratory, its instruments and books, was of great interest to those present.

My reaction to this meeting was probably indicative of the view of others: I cannot see how any serviceman can expect to get the knowledge he requires from a theoretical standpoint from books and seclusion, when by joining an organization he can have handed to him at very small cost the knowledge gained from talks and demonstrations and from meeting with his fellow servicemen.

—Oscar Olson, Secretary

♦

#### Lehigh Valley Chapter:

"Your Future" was the subject of our October 6th meeting. The present unstable conditions were discussed at length. *President Fillman* tendered his resignation because he is engaged in defense work in Philadelphia, but it was not accepted. *Vice-President Gruitt* will officiate for the balance of the term. *Stan Eisenhard* was appointed Banquet Committee chairman.

Our technical meeting of the 20th was addressed by a representative of *National Union*.

On November 17th, *John F. Rider* will address us. 'Nuf said.

—Ray E. P. Abbott, Secretary

♦

#### Metropolitan New York Chapter:

On Monday evening, September 29th, *John F. Rider* spoke to an open meeting of New York Chapter RSA. The 300 men who attended showed a keen interest in the problems facing the independent servicemen today, as outlined by Mr. Rider, and an intense desire to do something about them. It was a serious meeting with the purpose to picture conditions as they are today and to look forward to some means to combat these conditions.

Highlights of this important meeting:

"Many factors have been working against the interests not only of the independent radio servicemen, but against all those directly interested in the radio servicing industry. Servicemen no longer stand alone. Jobbers, dealers, magazines, successful servicemen and unsuccessful servicemen, the large servicing business and the small servicing business all have mutual problems.

"The recent *Reader's Digest* article concerning the radio service field was not necessarily a cause for public suspicion, but whether it was sincere or not, it is sure to cause repercussions affecting the welfare of radio servicemen in general. This is more true in a large community, which is not as neighborly as a small town. But everywhere servicemen feel the pressure of public suspicion. This attitude is not necessarily new. For 15 years the radio service industry has lacked public confidence. The results of such surveys are certainly not conclusive, but the public does believe them and the lack of confidence of the past 15 years is now intensified.

"These are important matters that

should not be overlooked. They stand as examples of things to be combated. However, they represent only one force acting against the independent serviceman.

"There is another force very close to home that we must now consider. Although such a plan has been denied, photostatic copies have been obtained of a Utilities plan to go into the radio servicing business. While we may not find objection to the Utilities going into the radio service business, we must consider what will be the result of such action.

"It is proposed that a company be formed under a name that would give its purpose, namely: the servicing and repair of all appliances on the power lines of the Utilities company. While the territory to be serviced would be only that covered by the local Utilities, this organization idea may spread out to other parts of the country if it succeeds in New York City.

"While we are concerned primarily with radio service, such an organization would embrace all forms of maintenance. The proposed company would be under the sponsorship of the Utilities and would assume responsibility for all repair and maintenance. The cooperating companies, dealers, etc., would be supply depots where appliances would be repaired, inspected, tested and certified. Servicing agreements would be prepared, a rehabilitation service for major appliances. Such appliances could be taken to central service points and the cooperating dealers receive a fixed commission on work submitted. This plan affords cooperating dealers the opportunity to sell service in association with the Utilities. Provision would be made to finance the repair of all appliances and for the collection of payments. Parts would be obtained on inventory and consignment with payment in 90 days. A competent staff of servicemen would be assembled and an educational program developed with the help of factory engineers.

"This is the general picture. This program is a threat to the independent serviceman, and every parts jobber and radio magazine. If the independent serviceman is affected, these will also suffer.

"There are many reasons why such a plan may succeed. The public does not have confidence in the independent serviceman, while the Utilities have a name that commands respect. Men trained by such a system would have entry into the home and, having fixed one appliance, will ask about others. The installment payment program may appeal to the public. The utility has money to back up its efforts with advertising.

"The curtailment of basic raw materials due to the present defense emergency has resulted in a condition where the Utilities can see a profit in the servicing business. The utilities want to take on all kinds of service to make up for the lack of raw materials and the loss of sales of new appliances. For distributors and set dealers, too, it is common sense to go into the service business for additional revenue.

"The independent serviceman resulted because the set dealer cast out service. The sets increased in number and complexity. The trend is now being reversed and the manufacturers are pushing dealers

back into the servicing business to make up for the loss of sales.

"While the independent man may be very busy right now, he is facing a three-fold attack aimed to take his business away. If these three fronts are permitted to expand, if the independent servicemen do not make an effort to fight these threats, there will be no independent service industry in America.

"Today we know what can be done in the service field. In the past, servicemen have worked for very little because they have been engrossed in their work, but this has been a major fault. We must wake up to conditions today. Not so long ago the successful service shop could see no reason for joining an association. The day is gone when the large independent service shops can stand alone. It is only when the industry works together, large and small, that this three-fold attack can be withstood. The fate of parts jobbers and radio magazines is directly tied up with the welfare of the independent servicemen. They must actively support the serviceman.

"It is essential to gain public confidence. Many ways have been proposed in the past and many of these have been sound. However, in the past the servicemen just didn't go for anything. If they had tried out the best ideas suggested, they could now have had public confidence."

Following the meeting proper, the groundwork for a stronger local organization in Metropolitan New York was laid, with *President Wardlow* as chairman of a committee to study the situation.

—From the *RSA Bulletin*,  
*Max Spitalny, Editor*

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## NEWS

**IRC Expands**—To meet expanded defense requirements with minimum interference to its regular production, the International Resistance Company has added approximately 30 per cent more manufacturing space at 401 N. Broad St., Philadelphia. The production of several types of resistors, required in quantities for national defense, has been increased materially through the addition of this space and the necessary special equipment.

This makes the third expansion since IRC's removal to its present quarters five years ago, and a total increase of 50 per cent in floor space.

♦

**Universal Expands**—Universal Microphone Co., Inglewood, Calif., has added to its production facilities by the erection of a factory annex connected with the main plant by an enclosed archway.

One story will be for storage, while the main floor will be given over entirely to production and testing facilities on national defense orders, as well as complete assembly lines for microphone orders designated by the Army Signal Corps.

Annex No. 1 will be air cooled in summer, dry heated in winter, and equipped with fluorescent lighting.

♦

**Philco Training**—Thousands of servicemen  
(Continued on page 18)

# The RADIO FRONT

KARL A. KOPETZKY

## By Way of Explanation

EVER since the publisher of this magazine tacked the title of "news analyst" on us, we have felt that to live up to that name we should take a broad outlook on the whole business situation, rather than to restrict ourselves to the radio end. And that in spite of the title to this column, "The Radiofront."

We base our assumption on the fact that radio is but one of many businesses, and as such enjoys no special privilege which places it outside the pale of the vices and vicissitudes to which the other industries fall heir. In fact, to get an accurate picture of what is going on in the radio trade, one must survey the whole situation and apply the lessons and the trends to radio. Were one to close one's eyes to what is going on in the world and say, "That concerns the automotive industry, only," or, "That particular problem will never be felt outside of the cloak and suit trade," makes the interpretation of events erroneous and of little value because of the narrowness of viewpoint. So it should be remembered that radio is only a part of the vast business world of these United States.

Considering the wider aspect of National Defense, it is important to realize that this war has not yet become overwhelmingly popular with our people. It is a war in which we have great sympathy for the oppressed and hate for Hitler, the oppressor. But the people are not imbued with an enthusiasm such as we saw in 1917. There is no "Let's-kick-the-Kaiser-in-the-pants" spirit. At present, the war is, to us, a drag, unwanted affair in which we take part reluctantly, shadow-boxing our opponents to avoid actual shooting. We little realize our great danger, or the urgency that we at once get going. Just as long as the war is not popular, even though it may not be unpopular, there will not be a really concerted All-Out effort.

To prove the point, we cite figures recently released which show that of the total sums allotted for National Defense and Lend Lease, only 13% will have been spent by the end of this year, and an additional 28% by the end of 1942. That means that of the 100 billion dollars which have been authorized, only 41% will have been spent in 18 months at a time when it was supposed to have all been spent. Further, Knudsen gave out figures last week wherein he stated that at present business was only engaged 15% to 20% in National Defense, that he hoped it would be at least 53% by December 1942 and, unless it did reach or pass the 65% figure, it would not really make itself felt in this struggle. That is not very encouraging, especially to those small houses who are finding themselves driven to closing at the 20% stage. But it definitely shows that unless the war becomes rapidly more popular with the people, and

hence with all business in general and the small businessman in particular, we are in for not a war, nor a revolution, but a general upheaval with dislocations all along the line.

It seems to us that there will be many new faces in the radio industry after the war is over, that many who are now nibbling at defense contracts and sub-contracts which necessarily take them far away from radio, will not want to return to the industry and will desire to stay in the new fields that the war has opened to them. In their places will come the now insignificant manufacturers whose plants can be kept open with orders so small that the regular manufacturers cannot accept them because they are unprofitable. These small radio manufacturers will slowly be eating their way into the business presently enjoyed by the bigger fellows, and will be in a position to carry on in the bigger fellows' shoes when the war is over.

## Brass Tacks

But to get down to brass tacks. What has happened in the radio industry during the last month? Remember that we stated that the "pot was beginning to boil," although everything seemed serene on the surface? Well, things are now showing. For instance, Leon Henderson, blithely side-tracking the RMA, sent out wires to the radio industry requesting that they go along with him until he can formulate price control in the industry; and asked it to maintain prices at the October 15, 1941, level. There seems no doubt that the trade will go along with him if—and it's a big if—the materials do not increase in price, or the labor. But selling prices are bound to increase because of the new 10% excise tax placed on radio anyway, since most manufacturers are "absorbing" the tax and raising their prices accordingly. This, in turn, will make the jobber, and then the retailer, raise his prices.

Then, seemingly as if in answer to the *Reader's Digest* article, comes word that the *Office of Price Administration (OPA)* is contemplating price ceilings on not only the retail sales of new radios, and on trade-ins, but also on repair and replacement prices. Here again we have no definite statement to go by (beyond the wires above mentioned), but we did see in print the statement of one of the chiefs of the OPA that such procedure was being worked out for the automotive industry. The record of that industry can well be used as a barometer for the radio trade.

## I-Told-You-So Department

As foretold here, the OPM cracked down on an aluminum firm. That's old news to readers of this column. Now a further crack-down on six other firms is said to be contemplated.

## Flash!

Apparently following our suggestion as contained in last month's column, Rep. J. Voorhis, (D), of California, on November 7th introduced a bill making compulsory the subcontracting by prime contractors. Rep. Voorhis said that this was to "prevent the present concentration of national defense business in the hands of large contractors."

Perhaps Rep. Voorhis read our statement last month, and perhaps he has come to the realization that that will be the only way by which subcontracting will be extended to the small businessman.

Now we'll watch to see if the Bill will be buried, or whether the small businessman will get himself some action.

So to all small manufacturers: Write your Congressman at once that you want action on Rep. Voorhis' bill. It won't hurt to write your Senator, either!

## Prognostications

It is rumored that the OPA will have a *Compliance Section* which will really be a *duzie*. In order to keep sellers in line, a flying squad of enforcement officials will take to the road. This smacks very much of the prohibition days. We may even see the comeback of the "speakeasy" and the "bootlegger." Only it won't be for liquor, it will be to serve those who have the cash to lay on the barrel-head, and who want materials or finished products regardless of price. Some sort of the same thing flourishes in the conquered countries, and is called the "black market." It is a sad commentary on our democratic way that here, in the United States, where we are free, we, too, may have a "black market." But, as we said before, until such a time as the war is made popular, there will be many who will want to circumvent the various devices inaugurated to help National Defense and Lend Lease.

## Allocations and Such

Allocations to the radio industry are bogged down temporarily due to the fact that Defense Requirements are not generally known. Estimates are no longer good, what with new ideas, the doubling of arms production, new products for war, and the ever increasing demands for more planes, more tanks, more guns and more ammunition. Even so, the radio trade may enjoy a bit of relaxation from the strenuous restrictions placed on copper by the recent development which may replace brass shell cases (the main cause for the dislocation in the matter of copper) with soft steel—copper plated.

Meanwhile, hunts for violators of the restrictions in copper and other critical list materials are going on, and the guilty may have been brought to term by the time that the reader sees this page. In the matter of aluminum, over 10% non-  
(Continued on page 16)

## SERVICEMAN'S DIARY

(Continued from page 7)

to determine the control-grid transconductance in micromhos of amplifier tubes and the electronic emission of full- and half-wave rectifiers."

I could see she was beginning to look a little bewildered. But she was tough. "Just what do you need such a fancy instrument for?" she demanded.

"To test the tubes," I responded. "After all, if the receiver is inoperative, we have no other means of test."

"Our lecturer on radio said nothing about that," she muttered angrily. "What I wanted to tell you," she continued, "is that the power transformer in my radio must be replaced. As you can see, some of the wax has dripped down and is running out the bottom of the set, and there was a bad odor just before the receiver became inoperative."

"I am very certain," I told her, "that your trouble is not due to a defective power transformer."

"But the symptoms are precisely those described by our lecturer," she protested. "You had better look over the set carefully before rendering an opinion."

"If you will get your lecturer on the phone," I told her, "I'll gladly explain."

She dialed a number, meanwhile telling me if I were wrong I'd get no more business from her or her friends. When she got the lecturer on the wire, she repeated her story of the symptoms and asked for his diagnosis. Then, when he told her again it was the power transformer, she told him I had said it wasn't.

"He wants to know," she told me, "just why you are so certain the trouble is not due to a defective power transformer when you haven't even tested the set."

"Please tell him," I said carefully, "that it can't be the power transformer because this set hasn't any—it's an a-c, d-c receiver!"

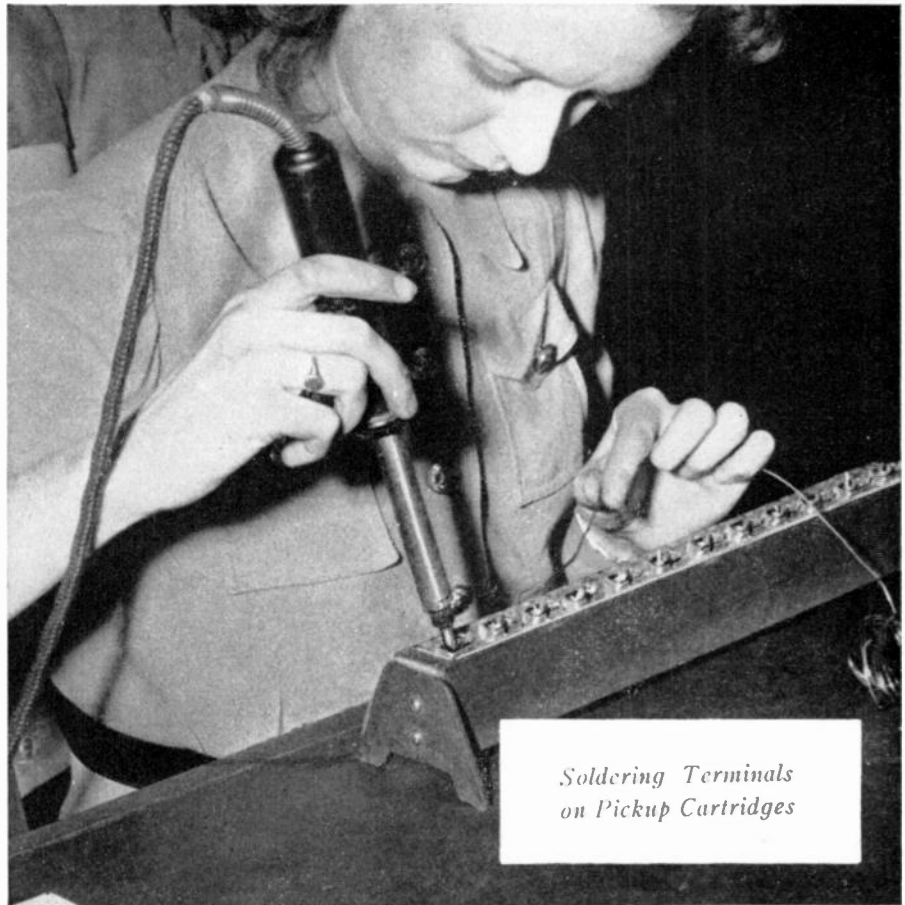
I have a hunch that the enthusiasm for an elementary knowledge of radio is going to die out very fast in our locality.

## SET OF THE MONTH

(Continued from page 8)

three manually-tuned circuits. Automatic control bias is used on the signal grids of the r-f and 1st detector tubes. Semi-automatic bias is provided for the grid of the 1N5GT i-f tube, the voltage being developed across the 3.3-meg resistor 19 in the grid-return circuit.

(Continued on page 15)



*Soldering Terminals  
on Pickup Cartridges*

# 3000 BUSY FINGERS

## *Trained in Precision Workmanship*

● Because of the many exceedingly small and fragile parts required in the manufacturing of crystal microphones, pickups, cartridges and recording heads, much of this work must be done by hand. Astatic employees, long experienced in the assembling of these products, show amazing skill and accuracy in these operations. Constant supervision and testing provide an additional guarantee of accuracy. No Astatic Crystal Microphone, Pickup or other product ever leaves Astatic's shipping rooms before it has been tested and approved to meet the exacting standards of performance for which it was intended. Careful design, engineering and assembly assure the long and satisfactory service of Astatic Crystal Microphones, Pickups, Cartridges and Recording Heads. Your Radio Parts Jobber will be pleased to demonstrate their efficiency.

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# Shop Notes

## MONTGOMERY WARD RECORDERS

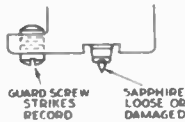
### High Pitch Playback

If the pitch when a home recording is played back appears to be too high, it may be due to excessive depth of cut. This causes too great a load on the motor, slowing it down. The remedy, of course, is to reduce cutting needle pressure.

## RCA RP-158,-160,-162 CHANGERS

### Fails to Track—Distorts

If the pickup in any one of these record changer models fails to track properly, or there is distortion, the sapphire may be



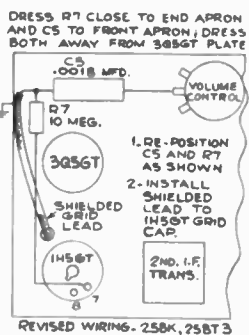
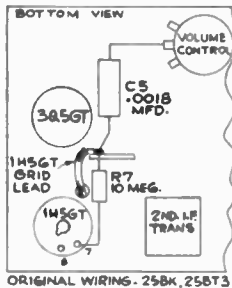
loose or damaged, or the guard screw may strike the record.

For data on replacing the sapphire, see *Shop Notes*, page 14, August issue.

## RCA 25BK, 25BT3

### Minimum Volume

When these models are used near strong local stations, the minimum volume may



be too high. This can be remedied by re-positioning the 1H5-GT 1st-audio grid capacitor C5 and grid resistor R7, and installing a shielded lead to the grid cap of the 1H5-GT tube. These changes are shown in the accompanying drawings.

## SAPPHIRE PHONO STYLI

### Tip Radius

In *Shop Notes*, page 10, September issue, it was stated that more recent sapphires have a tip radius of .0027" to overcome surface noise and a certain form of distortion.

As a matter of interest, sapphire tip radius is not standardized. RCA, for instance, have used a tip radius of .003" ever since production was first started on pickups employing sapphire needles. Crosley uses even a larger radius, the needle coupling to the top of the record groove only.

In each case the tip radius is such that the point of the needle is kept from riding the groove bottom.

## TRUETONE SERIES 5B24-2 (Model D1180)

### Issue B Change

Issue A chassis of the above model used an antenna trimmer C2 (1-12 mmfd) mounted on the loop aerial assembly.

On issue B chassis, the antenna trimmer C2 has been replaced by a gimmick, consisting of 2 wires, one wrapped around the other. The 1400-kc adjustment is made at the factory and need not be made in the field.

## WARDS AIRLINE 14WG-808W-M

### Band Spread Coils

It is not practicable to make field replacements of the individual antenna and oscillator coils in the Band Spread Assembly Unit.

Should one of these coils be damaged in any way, remove the Band Spread Assembly Unit (consisting of the 3 antenna and 4 oscillator coils, the right-angle mounting plate, and the band switch) from the chassis and return to the factory for replacement.

**Caution:** Two of the coils in the band-spread coil assembly, the 19 meter antenna and oscillator coils, have adjustable iron cores. One of the adjusting screws extends out from the front panel of the chassis base at the left of the band switch. The other adjusting screw extends up from the chassis base in front of the 1st i-f transformer.

Do not change the position of these adjusting screws as they have been properly set at the factory and cannot be satisfactorily readjusted in the field.

## WELLS-GARDNER SERIES 5D8-1

### PM to ED Speakers

When the 4" electro-dynamic speaker replaces the 4" permanent-magnet speaker in the above chassis (receiver models 14WG-518, 14WG-519) the issue letter advances to "C".

The speaker field replaces the 1500-ohm B plus filter resistor with additional changes in the B plus circuit connections to the 35L6GT output tube. A 20-mfd, 25-volt electrolytic is placed across the 170-ohm 35L6GT cathode resistor. A 60-ohm, 1.5-watt resistor is inserted in the heater circuit between the 12SK7 and 12SA7 tube heaters.

## TEMPERATURE COMPENSATING CAPACITORS

### Applications

Compensating capacitors, obtainable in any temperature coefficient from  $-0.005\%$  to  $+0.005\%$  per degree C. over a temperature range between  $-40^\circ$  C. to  $+70^\circ$  C., can be used to correct the normally positive temperature coefficient of inductances for the maintenance of constant L-C products (resonant frequency) of tuned circuits independent of temperature.

As pointed out by Aerovox engineers the normal temperature coefficient of the components in tuned circuits is usually positive. Thus the inductance of the coils and the capacitance of the capacitors both increase with an increase in temperature. When coils and capacitors are used in tuned circuits such as oscillators or amplifiers, the resonant frequency of the circuit will vary with the temperature so that the frequency of an oscillator will decrease as the temperature increases. So that the frequency of an oscillator or the constants of an amplifier circuit may remain constant, it is necessary that either the inductance or the capacitance have temperature characteristics that compensate for any change in the characteristics of the other.

An oscillator circuit, using compensating capacitors, will provide a constant frequency source independent of any changes in ambient temperature or any temperature changes in the units caused by current flow in the circuits. Zero temperature coefficient capacitors may be used wherever a capacity independent of temperature is required. One suggested application is as a shunt for the measurement of r-f currents with a vacuum-tube voltmeter as an indicating instrument. Since the compensating capacitor is available in any temperature coefficient from  $-0.005\%$  to  $+0.005\%$  per degree C., many circuits can be improved in stability, and new circuits developed to utilize the negative, zero or positive temperature coefficients of the compensating capacitor.

Another example would be in high-power oscillators for radio transmitting, especially where weight and space are of utmost importance and do not allow for use of quartz crystal oscillators and their associated apparatus. By the use of compensating capacitors it is possible to obtain oscillator frequency stability comparable to that obtained with quartz crystals.



(Continued from page 13)

Bias for the grid of the 3Q5GT output tube is obtained from the drop across the filaments of the r-f, 1st detector and i-f tubes in series. A choke, 58, keeps r.f. in the series filament string out of the diode load circuit.

The two battery-tube filament strings are connected permanently in series-parallel and operated either from the 4.5-volt A battery or from the upper 35Z5GT rectifier which also provides the B voltage during line operation.

The lower 35Z5GT is used solely for battery charging. Since this rectifier serves the function of trickle charging during line operation, its heater is connected in series with the heater of the power-supply rectifier. These are series-connected across the line through switch sections 44D and 43B, with the return circuit to ground through the voltage-dropping resistor 47C which is a part of the voltage divider 47A,-B,-C.

The neon lamp 46 on the dial scale indicates the condition of the batteries. It is included in an oscillating (R-C) circuit consisting of resistor 20 and condenser 28 which has been designed to oscillate at approximately 3 pulses per second when the batteries are fully charged. As the battery voltage decreases with use the number of pulses per second decreases.

The power switch consists of the three sections 43B, 43C, and 43D. The first section, 43B, closes the circuit for line operation, while 43C and 43D ground the negative A and B battery terminals when closed, thus completing their circuits. However, the operation of the switch section 43B controlling the line circuit is made ineffective when the Selector Switch 44 is in the "Battery" position.

When the four sections of Selector Switch 44 are in the left-hand position, and switch 43 is turned on, the batteries are placed on charge. When switch 44 is in the middle position, the receiver is connected for battery operation. When this switch is in the right-hand position, as shown in the diagram, the receiver is connected for line operation. It will be noted that in this position, the batteries remain connected across the output of the charging rectifier, with the difference that the rate of charge is reduced by the switching operation which throws in series resistors 22 and 10. The B batteries are charged from the line that connects directly to the cathode of the charging rectifier, while the A batteries are fed from the line that connects to the mid-point of the voltage divider 47A,-B.

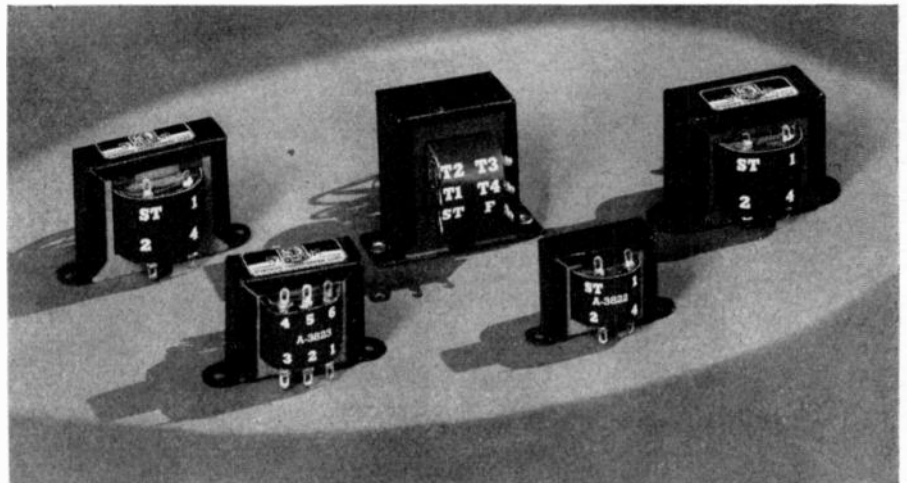
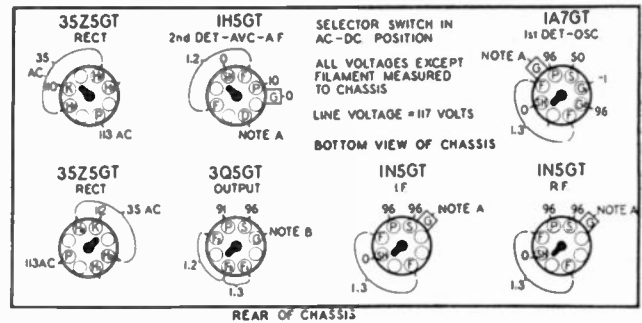
#### CHARGING NOTES

When the battery voltage is low (ap-

proximately 72 volts) the neon indicator will flicker at the rate of approximately one pulse per second rather

than 3 pulses. The set should not be operated from battery power after this point is reached. The batteries should

Fig. 1. Bottom view of "Companion" chassis, from rear, giving the socket voltages for each tube. Measurements based on a line voltage of 117.



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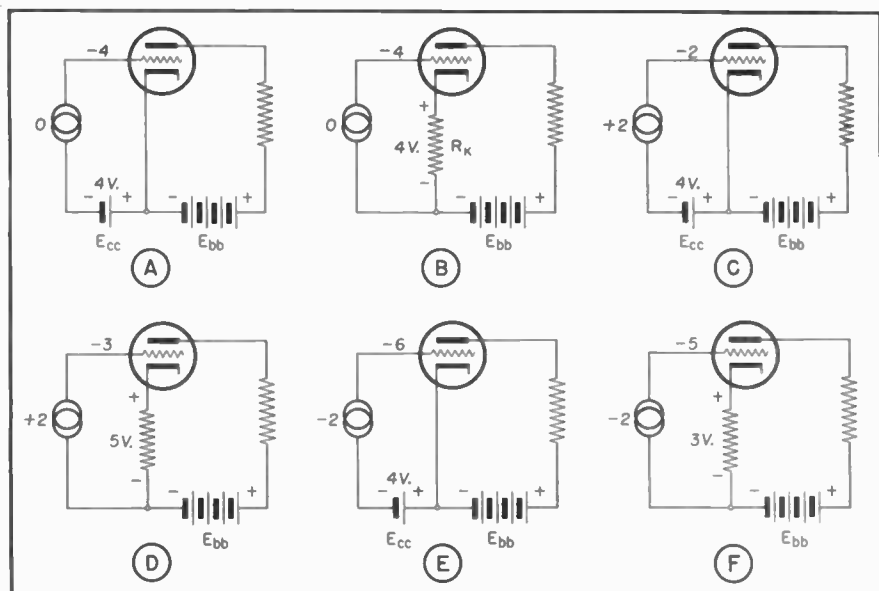


Fig. 5. Illustrating effects of fixed and self bias.

that when the normal plate current flows. Thus there occurs a fluctuation of voltage across  $R_k$ , which fluctuation follows the changes in plate current, and which condition causes the grid voltage to vary in accordance with the fluctuations across the cathode resistor.

Because of the point of connection of the grid return, the grid is negative and any fluctuation in voltage is a rise

and fall of the amount by which the grid is negative with respect to the cathode. Now, if we apply an instantaneous voltage of 2 volts plus to the grid, the effect will be different in the case of the battery biased system and the self bias system, shown in Figs. 5-C and 5-D. In the case of the former, the instantaneous effective grid voltage will be  $-2$  volts, for the plus 2

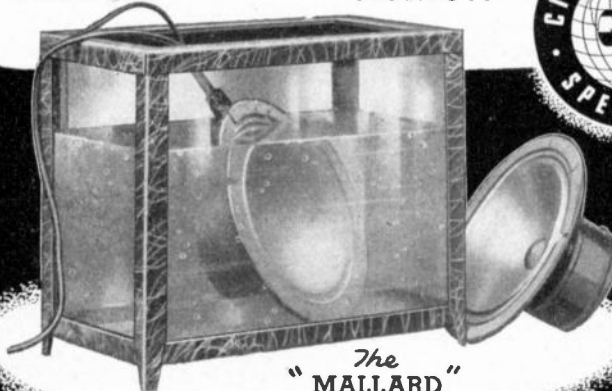
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volts input voltage will buck a part of the bias voltage. In the self-bias system, however, we find a different state.

The application of the 2 volts plus to the input will increase the plate current and the instantaneous bias developed across the cathode resistor  $R_k$  will exceed the quiescent value of 4 volts. Suppose we say that it increases to 5 volts. This means that the instantaneous grid voltage will be -3 volts, rather than -2 volts as in the case of the battery bias arrangement.

Now, we change the input voltage so that it is -2 volts. In the case of the battery-bias system, Fig. 5-E, the instantaneous grid voltage is -6 volts. But in the self-bias system, the application of a negative input voltage will cause a reduction in plate current, consequently the grid bias to a value less than the quiescent value of 4.0 volts. Suppose that we imagine it to be 3.0 volts. This means that the instantaneous grid voltage will be -5 volts. This is shown in Fig. 5-F.

The fact that we have decided upon a 1-volt increase and decrease in voltage developed across  $R_k$  in Figs. 5-D and -F is not relative to the condition. No matter what the value of change in voltage across  $R_k$ , the condition still exists: namely, that for a plus voltage applied to the grid, the effect of the self-biasing system is to make the grid more negative, and for the application of a negative voltage to the grid, the effect of the self-bias system is to make the grid less negative. In other words, the phase relation between the input voltage and the varying voltage developed across the cathode bias resistor is a 180-degree difference.

From the practical viewpoint, this is the equivalent of an opposing action by the self biasing circuit, wherein it has the effect of having reduced the input voltage. This can be stated differently, as being the same as if by some automatic means the voltage of the bias battery in Fig. 5-A is increased from 4 volts to 5 volts when the 2-volt plus signal is applied. This effect becomes more evident when we consider the total grid swing in the two systems. In the battery-bias arrangement the overall swing of 4 volts at the grid is obtained. In the self-bias circuit, however, the same 4-volt change in input voltage results in an effective swing of only 2 volts. The net result is a reduction in the amount of amplification obtained from the system, for the change in plate current is really that due to a 2-volt swing in the input circuit, rather than the 4-volt swing in the battery bias circuit. This is the equivalent of degeneration or a reduction in the amount of amplification by the feedback of a bucking volt-

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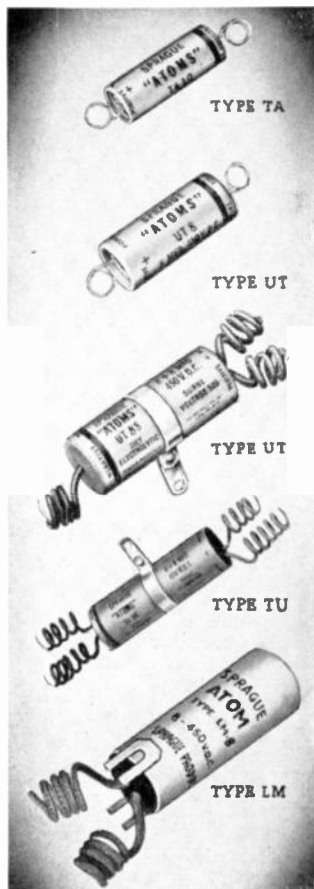
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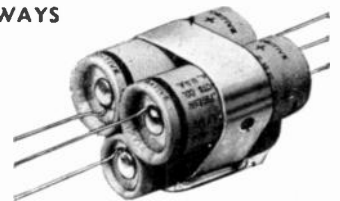
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age from the plate-cathode circuit to the grid-cathode circuit.

### ELIMINATING DEGENERATION

All of this can be eliminated by the simple use of a large value of bypass capacity across  $R_k$ , so that the fluctuations in voltage due to the changes in plate current, do not occur across the cathode bias resistor. Instead the bias voltage remains the original 4 volts which exists during the quiescent state, just as in the case of the battery system. In practice, we find that degeneration is deliberately introduced in some cases and in others great pains are taken to make certain that it does not exist. But whichever is done is something for the future. For the present we have laid the groundwork for the discussion of phase inversion and inverse feedback, by showing the various phase relations which exist in the conventional triode tube.

(To be continued)

### CIRCUIT COURT

(Continued from page 9)

to the loop  $T1$  and the coupling transformer  $T3$  is capacitive. The waveband switch  $S1$  is shown in the broadcast position.

In this position the signal grid of the 6SK7 r-f tube is connected to the loop  $T1$  through the permeability-tuned broadcast coil  $T2$ . The remaining coils are out of circuit.

In the next switch position (5.9 to 6.2 mc)  $T1$  and  $T2$  are disconnected from the grid by the opening of contact  $B$ , and the grid, through contact  $A$ , is connected to the secondary of the antenna transformer  $T3$  through the coil  $T4$ , through contact  $C$ . Since  $T3$  and  $T4$  are in series, the inductance is additive.

In the next switch position (9.1 to 10 mc) contacts  $A$ ,  $C$  and  $D$  are joined, thus shorting out the series coil  $T4$ , and reducing the total inductance in the tuned circuit.

In the fourth position (11.4 to 12.2 mc)  $T4$  remains shorted and coil  $T5$  is connected in parallel with the secondary of  $T3$ , thus decreasing the total effective value of inductance in the tuned circuit.

In the final switch position (14.9 to 15.5)  $T4$  remains shorted,  $T5$  is removed from the circuit, and coil  $T6$  with a still lower value of inductance is connected in parallel with the secondary of  $T3$ , thus permitting a still further decrease in the total effective value of inductance in the tuned circuit.

It will be seen that a single primary—that of  $T3$ —serves as the coupling medium in all of the short-wave bands.



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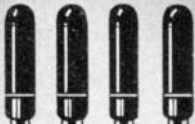
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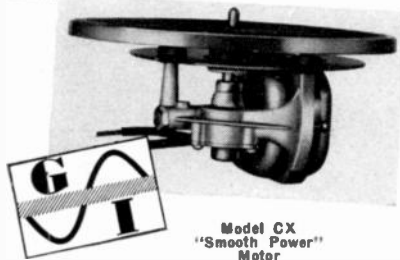
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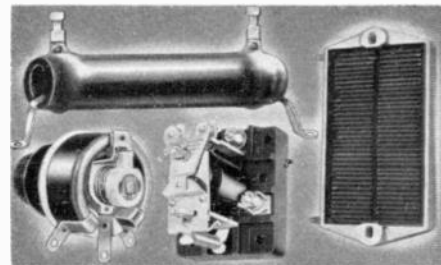


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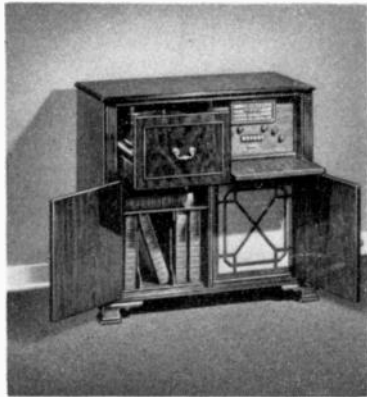
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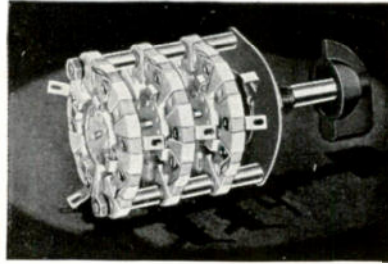
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RSD 11-41

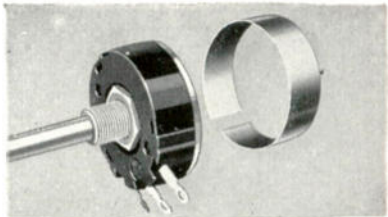
# Centralab

*The Quality Line*



### SELECTOR SWITCH

Available in an almost infinite variety of combinations . . . in bakelite or steatite . . . in single or multiple gang . . . from two to eleven positions on any one switch . . . also available for use in amateur transmitters.



### STANDARD RADIOHM

Wall type resistor. Exclusive non-rubbing contact band. 1 3/8" diameter x 9/16" deep. Available single, twin or triple, plain or tapped . . . with S.P.S.T., D.P.S.T. or S.P.D.T.



### MIDGET RADIOHM

Companion to "standard" . . . small size but large control efficiency. Available single, dual or triple . . . plain or one, two or three taps . . . with S.P.S.T., S.P.D.T., or D.P.S.T. Moulded bakelite case, 1 1/8" diameter, 1/4" metal shaft 3 3/8" long.



### ELF RADIOHM

Smaller but also features the long, straight resistor strip. Available plain or tapped with S.P.S.T. switch . . . with or without dummy lug. Bakelite case 5/8" diameter, 17/32" deep (less switch) 25/32" deep with switch.

Hams, Servicemen, Experimenters and Manufacturers appreciate the utter dependability of Centralab products. Since 1922 more than a hundred million radio parts bespeak the universal acceptance accorded Centralab products. Send for catalog if your jobber cannot supply you.

**CENTRALAB**  
Div. of Globe-Union Inc.  
MILWAUKEE

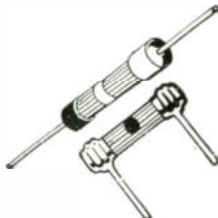
### WIRE WOUND RADIOHMS

In values from 2 to 10,000 ohms . . . insulated construction . . . 3 watts . . . universal shaft for all replacements . . . regular Radiohm switch covers may be attached . . . in linear curve only . . .



### ATTACHABLE SWITCH COVERS

For standard and wirewound resistors (Radiohms) as well as Midget and Elf Radiohms . . . S.P.S.T. . . . S.P.D.T. . . . D.P.S.T. . . . four point . . . S.P.D.T. (operates at clockwise position) and S.P.S.T. with Dummy Lug.



### AXIAL LEAD RESISTORS

Body is insulated by inert ceramic jacket . . . proof against vibration and humidity . . . will withstand five times rated load without permanent change. In two sizes . . . RMA coded . . . 1/2 watt at 1/8" x 5/16" and 1 watt at 1/4" x 1" . . . Also supplied in conventional RADIAL LEAD Style . . . 1/2 watt - 1 watt or 2 watt.



### CERAMIC TRIMMER CONDENSER

where greater stability than ordinary types is required. Supplied with neg. temp. coefficient of .006 MMF/MMF/C°. With or without mounting brackets.

### CERAMIC CAPACITOR

Small "special purpose" for h.f. circuits where temperature compensation, low power factor, or absolute permanence are important. 1000 V.D.C. leakage resistance more than 10,000 meg. Power factor less than 1%.



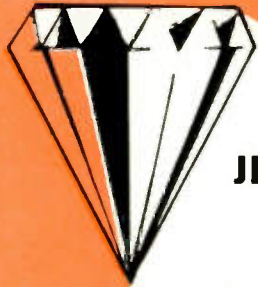
**SEND FOR CATALOG NO. 23**

# Centralab

ADD *Sales* TO *Service*

# Automatic Radiola Electrola!

Model R-566 P



**JEWEL-POINT  
PICK-UP**

**NO NEEDLES  
TO CHANGE**



## SELF-SELLING FEATURES!

- Automatic Record Changer
- Take Twelve 10" or Ten 12" Records
- Built-in Loop Antenna
- Selected-Grain Walnut Veneers
- Low in Cost—High in Value

**T**AKE a 566P with you on your next service call...leave it with your customers when you cart their old set to your shop. Ten to one, you'll find it *sold* when you return!

It's the newest RADIOLA answer to the serviceman's old problem...how to get *extra* profits from your business!

Like all RADIOLA models, the new 566P Electrola is exclusively designed for *servicemen* to sell. In a small, low-

cost package, it offers your customers superb radio performance... plus outstanding record reproduction. The automatic Record Changer is completely new—with new convenience, new features. The tone arm need never be touched—just push a button and there's your record program. Jewel-point pick-up makes records last longer... and ends the bother of needle-changing.



All Radiola Models  
are Exclusively  
Equipped with RCA  
Preferred Type Tubes

# Radiola *Preferred Type Radios*

Made by RCA Manufacturing Co., Inc., Camden, N. J., U. S. A.  
A Service of the Radio Corporation of America  
In Canada, RCA Victor Company, Ltd., Montreal