

November

1940

*Radio*

# SERVICE DEALER

*this Month*

IMPEDANCE MATCHING

TRUE CONFESSION

TUBES AND CIRCUITS

LOW — CERTIFICATION

HIGH-FIDELITY SET

*Price*

25¢

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Financially  
Ethically

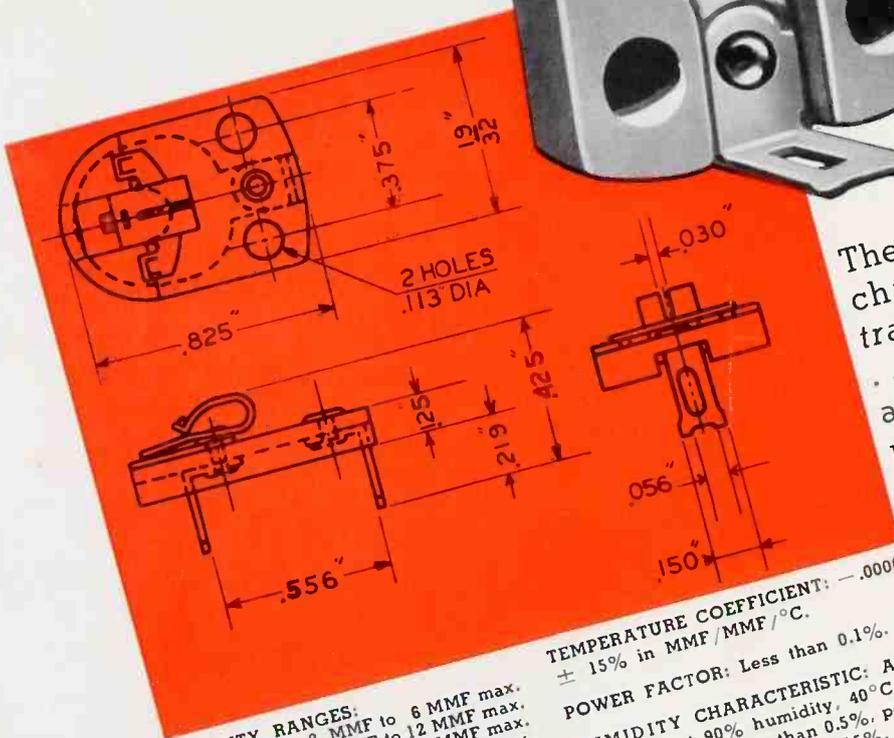
*Certified*  
**SERVICE-DEALER**

CONFERRED BY 1941 *Radio* **SERVICE-DEALER**  
THE INDUSTRY'S LEADING TECHNICAL PUBLICATION

# Centralab's New Trimmer CERAMIC CONDENSER



There are no erratic capacity changes with the new Centralab Trimmer Condensers . . . the dielectric and base are all one piece moulded under pressure with a ceramic so dense that no temperature or humidity changes can affect it. The stationary plate is silver, bonded to the ceramic with no air film between. The movable plate is metal, rotatable on the flat ground surface of the ceramic . . . a worthy companion . . . and a new member of the famous CENTRALAB family.



**CAPACITY RANGES:**  
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 (d) Less than 60 MMF to 75 MMF max.  
 Other ranges may be manufactured if in demand.  
**RETRACKING:** After repeated cycles of heating and cooling, capacity change is less than 0.5%.

**TEMPERATURE COEFFICIENT:**  $-.0006 \pm 15\%$  in MMF/MMF/ $^{\circ}\text{C}$ .

**POWER FACTOR:** Less than 0.1%.

**HUMIDITY CHARACTERISTIC:** After 100 hours at 90% humidity, 40 $^{\circ}\text{C}$ , capacity change is less than 0.5%, power factor reading less than 0.15%.

**CENTRALAB Div. of Globe-Union Inc., Milwaukee, Wis.**

*Radio*

# SERVICE-DEALER

**SOUNDMAN AND JOBBER**

Reg. U. S. Pat. Off.

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## Cover Sketch



★ The new RADIO SERVICE-DEALER Certification Seal which will be ready for distribution on December 15th. A distinctive six-inch decalomania in red, white, blue and gold, which will help your business. Be sure to read the article on page 14 for complete details of the campaign now getting under way.

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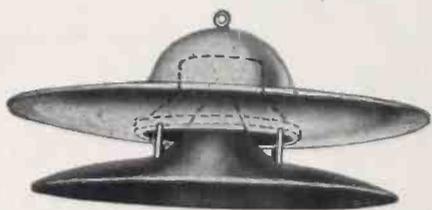
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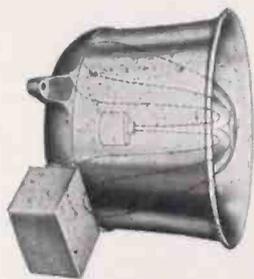
*Attention:*  
 Whether you are a Demo-  
 crat or Republican . . . .  
**RACONS** are the popular  
 choice for sound installa-  
 tions.



**RADIAL CONE SPEAKERS**

Giving even intensity sound projection over a circumference of 360° radially. Upper deflector made of heavy gauge aluminum, cone covering of steel, and lower deflector of RACON ACOUSTIC material storm-roofed for all weather conditions. Models for 5"—5"—10"—12" cone speakers.

**MARINE HORN SPEAKERS**



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

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**Super Giant P. M. Horn Unit**

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.

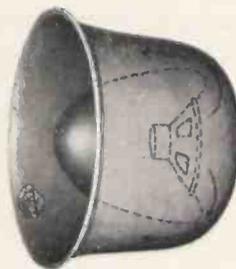


**RE-ENTRANT TRUMPETS**

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, center section of RACON ACOUSTIC material to prevent resonant effects. Available in 6', 4½', 3½', and 3' air column units.

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Re-entrant type speakers of the marine type using cone type driving units for indoor and outdoor applications. Bell made of heavy aluminum, cone mounting made of aluminum casting, and center bullet of RACON ACOUSTIC material to prevent resonant effects. Material storm-roofed for all weather conditions. Baby size for 2" or 3", miniature for 5" regular for 8" and giant for 12" speakers.



**PAGING HORN**

A small, extremely efficient 2-foot trumpet speaker, for use where highly concentrated sound is required to override high noise levels, such as in factories, outdoors, etc. Uses a small, very efficient Permanent Magnet unit. Particularly adaptable for paging systems, hotel lobbies, trucks, etc.

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**There Is A Racon Speaker For Every Purpose!**  
**See Your Jobber or Send For Free Catalog**

**RACON ELECTRIC CO.**

52 East 19th Street

New York, N. Y.

**RACON—The Oldest, Largest and Foremost Mfgr. of Air Column Speakers in the World**

# Transients

**EMERGENCY . . .** Since our announcement last month on this page that we would be pleased to declare a moratorium on subscriptions held by volunteers or those called up for military service, we have received numerous inquiries regarding a *continuance* of subscriptions in the event of conscription.

The sum and substance of these inquiries is: If we are called, cannot you arrange to send RADIO SERVICE-DEALER to the training camp; we'd like to keep up-to-date during our absence.

The answer, of course, is, sure we can—and will. When and if you go, just give us your new address, and we'll see to it that you will continue to receive RSD without interruption.

★

**SERVISALES . . .** We hope you will read the article by Mr. Jannivere in this issue. It's a good pep talk, it's based on fact, and it points a way. It is particularly appropriate at this time in view of the recognition given the serviceman by RCA in their advertisement in our last issue, announcing the return of Radiola Preferred Type Radios for servicemen to sell. What RCA has recognized, and what others will come to recognize, is that full-time servicemen are, in a sense, the Fuller Brush Men of the radio field.

It is said that a Fuller Brush Man is the only roving salesman for whom the housewife has a welcome. And it isn't because he always arrives bearing gifts—that's secondary. He is welcomed because he performs a perfectly legitimate and desirable service without making a nuisance of himself. He's a brush expert, and he'll sell you the right kind of brush if you want one. If you don't—well, that's all right, too. No argument—no offense—no sob story. No wonder he has the confidence and the good will of his customers.

Isn't that what you also have? You bet it is, if you've been at all successful, for confidence and good will are your stocks in trade. So is it a crime to use it to sell anything other than service? Not by a long shot. Selling, itself, is a service to a customer, providing the

seller has the customer's interests at heart. That means, for one thing, that any time you attempt to sell a customer a new receiver when he doesn't need or want one, you're doing the customer a dis-service. But, if his receiver has virtually gone with the wind, you can do him a real service by selling him a new one—making sure, of course, that you make a real effort to determine his wants (which may not be completely clear to him) and supply him with a set that will fill those wants.

Too many servicemen labor under the false belief that to so much as mention the word "buy" is offensive to a potential customer. This, we believe, is due to the fact that few servicemen have learned to differentiate between a "hot" customer and a "cold" one. You can bet your bottom dollar that any set owner who shows dissatisfaction in the way his set is performing, when that set is beyond reasonable repair, is, as the psychologists would say, "conditioned." He's thinking about a new set whether he can afford one or not. He'll listen with interest to what you have to say about modern receivers. And, *he will be as keen to buy as you will be to sell.*

Naturally, such opportunities do not end with receivers. There are recorder and record-player attachments to be considered, to say nothing of needles, record blanks, replacement batteries for portables, modern phonograph pickups, and so on. These items are as much a part of your business as brushes are a part of the business of Mr. Fuller's men. So make the most of the opportunity, for your own sake and the sake of your customers.

★

**H-B-T-Y . . .** Happy Birthday To You, Miss Broadcasting.

She's 20 years of age this month, and everyone in the industry will be celebrating the event from the eleventh to the thirtieth of November. All of 20 years old, but she's managed to keep her figure.

We've been nuts about her from the very first day she wet her diaper. Now she's a big girl and takes care of her own business. How time flies.

Ever stop to figure what you might be doing now, if it wasn't for her? Hell—she has us eating out of her hand.

Long live Miss Broadcasting—and may we die with the cans on!

★

**OH, WELL . . .** An instructor of a national defense program radio class was explaining the fundamentals of non-linear distortion in the operation of vacuum tubes. The blackboard was covered with characteristic curves, elaborate sketches of grid swings, plate-current waveforms and what-not.

At the completion of an hour's dissertation on the subject, which included repeated references to the significance of the knee and the bend in a typical plate-current curve, overdriving the grid, etc., he asked, "Are there any questions?"

"Yes," said one of the students. "What causes the distortion?"

★

**ARRL . . .** K. B. Warner, Managing Secretary of the American Radio Relay League, has issued a "Memorandum To The Trade" which can leave no doubt in anyone's mind, that the Hams will play a highly important part in the national defense program. They are, as a matter of fact, doing a great deal of value already.

What particularly struck us was the implication that the American Ham will do his part to the limit of his ability, and dig down into his own pocket to meet the equipment bill—the fixed, portable and mobile rigs he will use to fulfill the specific civilian radio services in which our Government has an interest.

★

**BIG SHIFT . . .** The broadcast station frequency shuffle first announced in our April issue, is now definitely set to begin the end of March, 1941. That's still some distance off, but keep it in mind. The first thing you know, you're going to see armies of push-buttons in your sleep after working on them all day—or you'll be counting buttons to bring on much-needed slumber. It's going to be hectic but profitable.

EDITOR

THE FIRST REAL MOVE TOWARD CONTROL STANDARDIZATION



Closed view of cabinet

# Save TIME... MONEY... EFFORT

## on Volume Control Replacements

- ✓ Reduce your stock and your investment.
- ✓ Have the control you need — when you need it.
- ✓ Simplify installations, speed up work, give customers faster, better, more efficient service.
- ✓ Avoid frequent need for more costly special replacements.
- ✓ Keep your controls systematically in a good-looking cabinet clean and free from injurious dust and dirt.

The 18 IRC Type D Universal ("All-Purpose") Volume Controls, 6 switches and 5 extra tap-in shafts of special design contained in this IRC Master Radiotrician's Cabinet handle from 60% to 75% of all volume control replacements as shown by actual IRC records! By supplementing them with a few additional IRC Type D Controls selected with a view to your own local requirements, you are in a position to handle the great majority of all replacements—from stock—at an investment so low it will amaze you!

You are equipped for better, faster service. You save time because it is no longer necessary to order a control every time you need one. You simplify installation because IRC Type D Controls with their Tap-in Shafts are easier to install and may be used universally for replacing "midgets" or larger "old-style" controls. You avoid frequent need for more costly special replacements because this Cabinet gives you a choice of 4 shaft types.

The handsome All-Metal Cabinet is included with your purchase. You pay only \$14.97, the standard net price of the 18 controls, 6 switches and 5 extra shafts with which it is factory-packed. See it at your IRC jobber's, or write for details and complete list of controls that are included. (Cabinets not sold empty.)

INTERNATIONAL RESISTANCE CO.

401 N. Broad St., Philadelphia, Pa.



### THE FIRST REALLY "UNIVERSAL" CONTROLS

In every respect IRC Type D Controls are exact, smaller-size reproductions of the larger IRC Type C Controls. They are unique in that, although midgets, they are fully equal in quality to the larger controls. Nothing has been left out. Only the size is different, and the only change has been the addition of Tap-in Shafts which make them much easier to install in crowded chassis and far more universal in application. Simply select the control you need, tap in the proper shaft according to easy instructions and the job is done—quicker, easier and from a small stock that will represent a tremendous saving in time, money and effort to the average serviceman whether he replaces only a couple of controls a week or a couple of dozen. Type D's are small enough to fit almost anywhere; large enough for real dependability; sturdy enough to stand up under the most severe conditions.



# Type D UNIVERSAL VOLUME CONTROLS

# IMPEDANCE MATCHING

By MAURICE APSTEIN

THE subject of impedance matching has been needlessly complicated by the use of such terms as "reflected impedance", "terminal impedance", "source impedance" and "impedance due to inductance". A backtrack to the fundamental relations governing the impedances of the windings of any transformer should be helpful to those working with sound equipment and "matched" lines.

## LOAD IMPEDANCE

To start with, the necessity for impedance matching arises because any power amplifier tube will deliver optimum performance only with a specific impedance in its plate circuit. This value of "load" impedance depends upon the characteristics of the tube and the conditions under which it operates, with which at the moment we need not be concerned. We are, however, concerned with the fact that the optimum load impedance for standard amplifier tubes usually turns out to be much higher in value than convenient for transmission for any appreciable distance. Except in the cases of transmission of sound over extreme distances (such as in telephone transmission) the sole purpose of impedance matching at the output of an amplifier is to allow the tube to operate at its optimum load impedance, even though the device it operates presents a widely different impedance. The function of the output transformer is to accomplish this impedance transformation.

There is a widely held but erroneous belief among soundmen that the primary of the output transformer, in and of itself, has an impedance equal to the desired load impedance, and a secondary

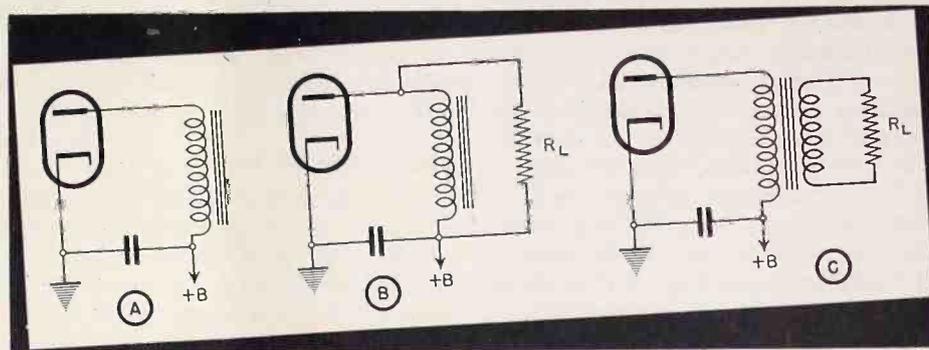


Fig. 2. The corresponding conditions shown in Fig. 1, for vacuum-tube operation.

equal in impedance to the output device. That this is not so can be readily understood from an examination of the fundamentals of transformer operation.

## FACTORS GOVERNING IMPEDANCE

Consider Fig. 1-A, which shows a simple inductance shunted across an a-c line. If the inductance has a high impedance at 60 cycles a relatively small current will flow, but what is more important, practically no power will be absorbed. The only power consumed will be that small amount required to magnetize the core, which in a well-designed inductance is negligible.

In Fig. 1-B a secondary winding has been added. Although a voltage is now induced in the secondary, no current flows because it is open-circuited. Hence, no power is consumed and therefore the primary current is unchanged as is its impedance, which remains as high as originally.

In Fig. 1-C a resistance  $R_L$  has been added across the secondary. This changes the situation completely. Due to the voltage across the secondary, current now flows through the resistor and, of course, through the secondary itself. The current flowing through the secondary tends to oppose the magnetizing current in the primary with the result that more current must flow in order to maintain magnetization. The fact that more current flows in the primary means that its effective impedance has been reduced. Thus, the resistance in the secondary has made itself felt in the primary. The impedance which the primary now assumes due to the effect of the resistor is called the reflected impedance. It is obvious that this reflected impedance may be varied by varying the resistance across the secondary and, in addition, that if the resistor absorbs appreciable power the reflected impedance will be much lower

than the impedance due to the inductance of the primary itself. Thus it can be said that the impedance which a transformer exhibits at its primary is determined by the value of the load resistance across its secondary.

## LOADING

Fig. 2 illustrates the corresponding conditions for vacuum tube operation. In Fig. 2-A the tube has in its plate circuit an inductance of high value and correspondingly high impedance. If it is desired to deliver power to a load represented by a resistor, this may be accomplished as in Fig. 2-B by shunting the inductance by the resistor  $R_L$ . If the tube requires a 10,000-ohm load for optimum output, the resistor would be 10,000 ohms because the impedance of the plate choke would be so high that its shunting effect would be negligible and the two of them in parallel would be very little less than 10,000 ohms.

Suppose, however, that the load that is to be driven has a much lower impedance than 10,000 ohms. Assume that it is the 8-ohm voice coil of a dynamic speaker. By winding a secondary over the same plate inductance, and by proportioning its turns properly, the loading effect of the 8-ohm voice coil can be made exactly equal to that of a 10,000-ohm resistor across the primary. The voice coil will reduce the effective primary impedance in exactly the same way that the resistor reduces the primary impedance of Fig. 1-C. In common parlance we would then have a "10,000-ohm to 8-ohm output transformer".

This does not mean that the primary has an impedance of 10,000 ohms and the secondary an impedance of 8 ohms. It simply means that the transformer has been so designed that when an 8-ohm load is connected across the secondary,

(Turn to page 20)

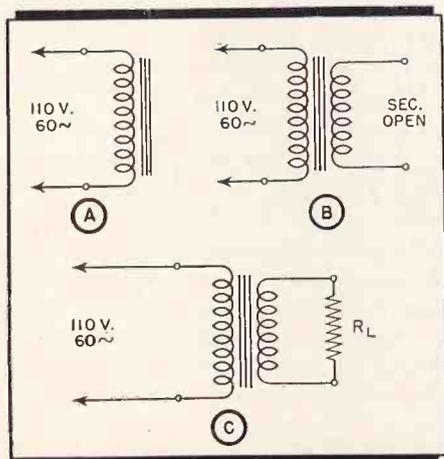


Fig. 1. Illustrating the factors governing the impedance of a transformer secondary. See text for explanation.

# TRUE CONFESSION OF

UNTIL the day that the sales manager of a wholesale radio concern took me in hand, I was firmly convinced that I did not have the ability to sell. In my mind, a salesman was a select breed of human, endowed with special God-given qualities and possessed of potent and secret formulae for breaking down sales resistance, none of which I felt I could acquire. It never occurred to me that in my daily grind of servicing radio sets, I was (1) making friends; (2) building good-will; (3) instilling confidence; and that these three factors, rather than all kinds of alibis and schemes, are the basis on which sales—and salesmen—are made.

But the day the afore-mentioned sales manager convinced me that I was passing up thousands of dollars of profit every year, was the day I decided my train of thought was expensively defeating my purpose. This gentleman, to whom I am so greatly indebted, presented such an intelligent exposé of the selling game that I finally realized I could not sell simply because I made no attempt to sell. While he agreed with the adage that salesmen are born (if they were not, they would not be here

today!) he explained that salesmen arrived on this planet minus the same equipment I considered so badly lacking in my own makeup. He further assured me that I could acquire the necessary equipment provided I made a reasonable and honest attempt.

## SUGAR COATED PILL

Now an honest attempt is not made overnight, nor is it made without due consideration of the many problems confronting the salesman. However, in this respect I was comforted by the thought that one of these difficulties had been already hurdled for me—that as a serviceman, I need not almost force myself into many homes, nor need I do a lot of cold canvassing. As a serviceman, I was actually welcomed into the home, my advice was sought, my opinion respected. Consequently an unusual sales opportunity presented itself in every home I visited, and I learned to cash in on each and every one of these plus-profit opportunities.

You can do it, too. But first you must learn to appreciate the value of your sales opportunity. You must realize that you are in a preferred position—that

your presence does not build sales resistance—that you have been invited into the home, and your recommendations sought.

The main trouble with all of us is that we do not know the true value of our service, nor do we fully realize and take advantage of the opportunities presented to us day after day. To illustrate this point, I would like to relate a true story as told by Mr. Jacob Kindleberger, president of the Kalamazoo Vegetable Parchment Company, to his salesmen on the occasion of the company's Silver Anniversary Sales Conference.

## STRING OF BEADS

Two American school teachers, bicycling through Scotland, stopped at an antique shop in a very small town to buy souvenirs to take back home. One purchased a string of beads for a nominal sum. On the way, the beads tangled in the handlebars of the bicycle, broke, and fell to the ground. Loathe to lose her purchase, the woman gathered the beads into her purse, and upon returning to London, sought out a jeweler to have the beads restrung. The jeweler looked at the beads, and much to the owner's surprise, said, "This is a very wonderful set of beads. I must send for a special string. You will have to come back tomorrow." The next day the woman returned, and the jeweler said, "Do you want to sell these beads?" The woman said, "I just picked them up at an antique store in a little town we were passing through." "Well," replied the jeweler, "I'll pay you twenty thousand dollars for these beads." When the woman, who had no idea of the value of her purchase, got her breath she agreed to the sale. After receiving her check, she was told that these beads had belonged to Mary, Queens of Scots, who—before her execution—had given them to the jailer because of the kindness he had shown her.

"The point is," said Mr. Kindleberger in conclusion, "we must learn the true value of things in this world, or we shall be in the bread line forever."

Fortunately enough for me, my string of beads broke long ago and I have had them restrung. What about you? Are you going to carry the unstrung beads around the balance of your life without attempting to learn their true value?

## TAKING STOCK

The past years of radio servicing are at last reaping their reward, and servicemen are finding themselves in an en-



*I was sitting on a gold mine and didn't know it. Friends, Good Will and Confidence were at my feet. I had failed to appreciate their true worth to me.*

# A SERVICE ENGINEER

By **EDGAR JANNIVERE**

viable position; they have earned the regard and respect of everyone in the industry, plus the gratitude and confidence of their customers. It remains for each one of us to realize his worth, to appreciate the extent of his services, and to assume his place in the radio industry.

Fully cognizant of this situation, I further realized that there was no rea-

*Mr. and Mrs. Radio Set Owner  
requests the pleasure of your  
presence at their home  
156 Rocks Avenue  
at nine thirty P.M.*

*As a serviceman, you have what amounts to an engraved invitation from your customers.*

sonable excuse for my being in the red most of the time—that it was my own fault. My responsibility to the wife and kids meant more than just doing a good service job; it meant that I must take full advantage of the serviceman's enviable position in the industry and capitalize every sales opportunity presented to me in the homes where I was called to do a service job.

So I took an inventory of myself, my operations, the hundreds of sales I had passed up to that moment, and I made a few decisions. The first, and most important, was to discontinue the practice of having my clients stamp me as a young Edison, Steinmetz, or the "town's wizard." While the reputation was flattering, its intrinsic value lay in the sales opportunities it gave me, and the confidence it instilled in my prospects.

Next, I planned to study the procedure of successful radio salesmen, and to apply their methods to my own advantage, but without losing sight of the fact that I am first and foremost a serviceman, and my first job is to sell service. I learned that successful salesmen stress the features of the merchandise they are selling, and the advantages to be gained through ownership of the product. They do *not* attempt to sell personal qualities, or make a bid for admiration of their technical knowledge. Nor do they sell complicated radio circuits, knobs and dials. They transfer their enthusiasm

for the product by describing to the prospect the world of enjoyment that can be *economically* obtained through the ownership of a radio set in the home. Radio salesmen stress the fact that millions of dollars are spent annually by sponsors to provide outstanding radio programs and that they are available to the listener at practically no cost. Radio salesmen paint a vivid picture of the entertainment possible only through radio—the world-renowned artists, the famous orchestras, the drama, the big league baseball and football games, the countless programs originating in this country and foreign lands. Radio salesmen point out to the prospect what he is missing through inadequate radio equipment. These and many other facts about the wonders of radio I found to be the "sales tools" used in selling the real value of radio in the home.

## BREAKING THE ICE

Now it remained to put my theories to work. One day I received a call from a steady customer to repair his six-year-old radio set. I was punctual and immediately got down to the business of checking the receiver—and not without forebodings. As I expected, the set was beyond repair at a reasonable figure; my ability; if not my right, to sell service on the job were questionable. So I gave my theories a tryout.

Taking advantage of the fact that his receiver was not equipped for short-wave reception, I began to relate my experiences in this connection. I told about the news flashes direct from Germany, England and France. I brought in all the highlights of the programs I had heard during the past month. Then I carefully made out my estimate and presented it to him, saying, "If you will

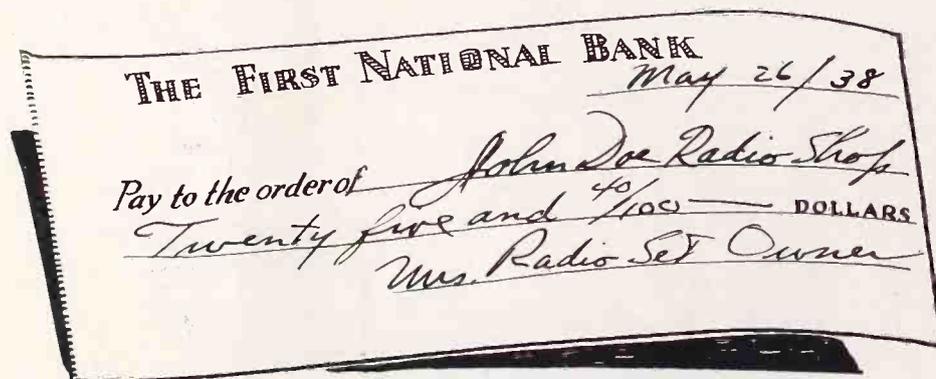
accept my recommendations, I would advise against spending that much money to recondition this old set . . . you will have trouble again before very long, as some of the other parts have outlived their usefulness. Furthermore, your set does not provide short-wave reception. Why not trade it in on one of the latest all-wave receivers? Or one with phonograph or frequency modulation?"

With this off my chest, I drew from my pocket a folder describing some of the latest jobs. I made excellent use of and placed emphasis upon the features described fully in the folder by the manufacturer.

He was surprised to learn that I offered sets for sale, or for that matter, that I had anything for sale—I had neglected this fertile field for so long. He was only too glad to handle the deal through me, for we were on friendly terms and I had his confidence. In a way he felt that he was repaying me for the excellent work I had done in the past, and he was anxious to help me make good in my new venture—*selling*. He told me that he had thought of buying a new radio for some time, but had put it off because he was unable to make up his mind just what kind to purchase. He further stated that he had confidence in my selection, inasmuch as I was a technical radio expert, and that he felt sure he would be entirely satisfied with the instrument I recommended.

So you see, your customers are not only willing to give you their business but they feel more inclined to buy equipment of your selection because of your engineering background. If you say it is good, they believe it must be good. They are glad to take advantage of your superior technical knowledge, and consider your advice valuable. All of which proves conclusively that every service-

(Turn to page 21)



Not two and a half dollars or five dollars, but twenty-five dollars. Resolve to sell as well as service and get checks like this.

# Serviceman's Diary

By J. P. HOLLISTER

MONDAY—She blew in about half-past nine this morning. Jerry and I were in the shop, but neither of us heard her come in. I was making a lot of noise, running the audio gain up and down on a Fada which was supposed to have "jumpy" action in the volume control, and Jerry was trying to put a drive cable on an old Sparton. He didn't even look up when she said good morning. I did.

She stood in the shop doorway, smiling and looking awfully cute. She had on a tiny hat, so small it looked as if it might have been swiped out of a doll's wardrobe, and it was tied around the back of her head. At first glance, you'd have thought she was only a kid, since she wasn't over five feet tall, but she had a certain self-possessed manner which showed she was probably in her twenties, at least.

"Do you handle radio nurses?" she asked.

For a moment I thought she was looking for a job. You've heard of lady

servicemen (what *do* you call 'em, anyhow—service girls?), but radio nurses were a new slant. And, as for handling them—

"Well, now, some people do call our shop a radio hospital," I told her, "and I have been referred to as a radio doctor, but I'm afraid we haven't quite advanced to the stage where radio nurses administer to the needs of suffering radios. Not that it isn't a swell idea, and there's no telling what the future may bring forth." That, I thought, ought to cover the ground fairly well; if she were looking for a job, it would let her down gently, and if she were just a dumb customer—well, you've got to humor them along.

She looked a little bewildered and started to say something, but Jerry butted in.

"I'm afraid," he said, giving me the eye, "that my partner is not altogether aware of what the past has brought forth. What would you like to know about radio nurses?"

"You see," she commenced hesitantly, "I have twins!" She looked from Jerry to me, a little helplessly.

"Really!" I exclaimed. "I, too, have twins!"

"How interesting!" she cried. "Do you have any trouble feeding them?"

"Frankly," I told her, "I'm not equipped to handle that sort of work. You see, they are very young babies, and my wife—"

"I understand," she interrupted, "I didn't realize that they were infants. Just don't worry about it any more." She turned to Jerry. "As I was saying, I have twins and I keep them in separate rooms upstairs. I have to keep them separated because when one cries it wakes the other. And downstairs, I can't tell, when I hear a cry, from which room it is coming. So often I go to the wrong room and wake the baby who was not crying. I heard there was a gadget called a radio nurse which I could use that would let me know which baby was crying. If you have one and will bring it up, I'll buy it!"

"Certainly," said Jerry. "I'll have my partner bring it up this afternoon. Your name and address, please?"

She told him. As she turned to leave, she said, loud enough so I could hear, "I think your partner is a trifle too informal with customers and I'd appreciate it if you'd bring up the radio nurse yourself."

When she had gone, Jerry came over to me.

"See, dumbbell, what you let us in for?" he squawked. "She'll be passing the word around town that I've got a would-be wise-cracker with me and where do we get—do I need to tell you?"

"Oh, yeah?" I asked him. "I made a mistake—so what? Did you know what a 'radio nurse' was, right off the bat? Do you know what 'micro-synchronous' means? Can you always remember exactly what these advertising names mean? Can you tell me right now why they call an r-f unit a 'sentry box' or a 'magic brain' instead of a magic head or a magic foot?"

"I think I could," Jerry answered. "But we needn't go into that now. Only you almost crabbed a sale. Two sales, I should say, because I'm going to sell her a radio nurse for each kid."

"You think you are," I told him.

After lunch Jerry ran over to Bill's store and picked up two radio nurses. He tried them out at Bill's and went

(Turn to page 24)



She blew in this morning, smiling and looking awfully cute.

# TECHNICAL

# SERVICE PORTFOLIO

## SECTION VI—PART II

## TUBES AND CIRCUITS

**I**N Part I of Section VI, we discussed simple methods of computing gain in r-f, i-f and a-f stages when the tube characteristics are known. Gain in converter circuits is computed similarly. We need to remember, however, that *conversion* gain represents the ratio of the i-f signal voltage developed across the plate load of a converter tube to the r-f signal voltage applied to the signal grid of the tube. For this reason, the mutual conductance of the tube is not employed in calculating the gain in such circuits. Instead, the *conversion transconductance* is used, which is usually about *one-third* the mutual conductance of the tube when used as an ordinary amplifier. Hence, since the gain of a converter tube is directly dependent upon its conversion transconductance, just as the gain of an amplifier tube is dependent upon its mutual conductance, the actual conversion gain obtained is about one-third that which would be obtained with the same tube and circuit in a straight amplifying

stage. In typical converter stages, the gain ranges from 10 to about 60.

### CONVERSION GAIN FACTORS

Since the strength of the i-f signal developed in the converter is partly dependent upon the heterodyning oscillator signal, the gain will be greatly reduced if the oscillator signal is weak. Nevertheless, set designers have found it expedient to use a rather weak oscillator signal on the short-wave bands, thus sacrificing some conversion gain, in order to secure smoother and more reliable operation of the oscillator circuit.

This is exemplified in Fig. 1, which is the basic circuit employed in the RCA Model 9Q1, 9QK all-wave receivers. Note that the oscillator voltage is taken off the cathode tap on the oscillator coil and thence is fed to the No. 1 grid of the 6SA7 converter. Higher gain could have been obtained by picking off the oscillator voltage at the oscillator grid, where the voltage is much higher, but

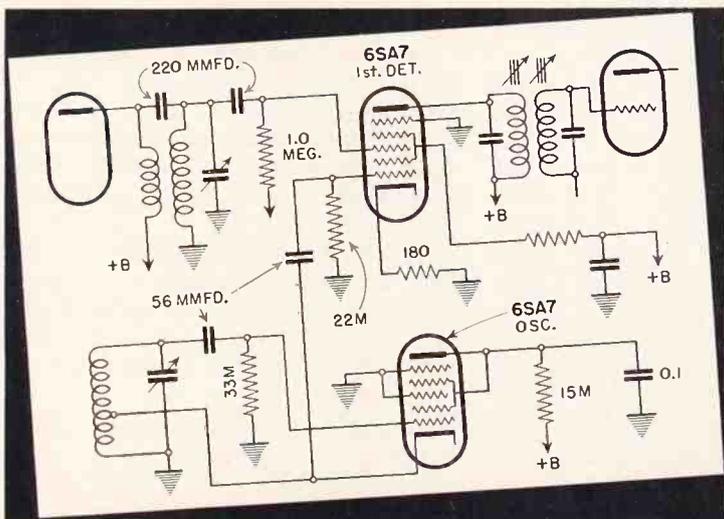


Fig. 1. Some conversion is sacrificed in this circuit in order to provide smoother operation.

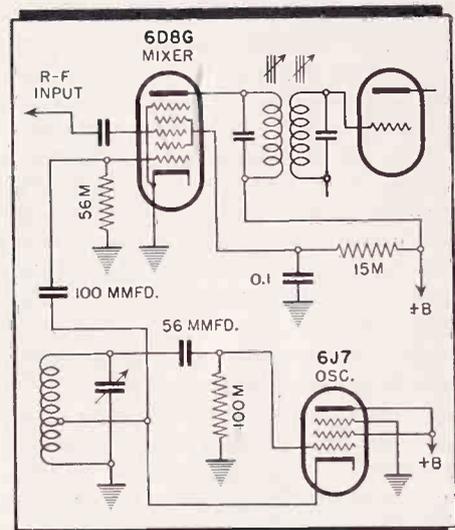


Fig. 2. Reduced oscillator voltage is applied to the mixer in this circuit.

if that were done the loading effect of the converter grid, which draws current when the oscillator voltage is applied, would serve to cause non-uniform oscillator output over the high-frequency ranges.

Note in Fig. 1 that a 6SA7 is also employed as an oscillator. The use of this tube as an oscillator is unusual, but due to the high mutual conductance of the 6SA7, its application as an oscillator seems logical. Further, there are some advantages in frequency stability in this type of tube which are not present in the more usual triode and pentode types.

The oscillator circuit of Fig. 1 may be compared with that of Fig. 2, which shows the 6J7 pentode oscillator feeding a 6D8G mixer. This circuit is employed in the RCA Model 8QB, 8QBK receivers. Again the oscillator voltage is taken off the cathode tap on the oscillator coil and is fed to the oscillator grid of

the 6D8G. The 6J7 has proved a very stable and reliable oscillator in all-wave receivers employing this type of circuit.

The application of the 6J7 as a combined oscillator-mixer is illustrated in the circuit, Fig. 3, representing that of the Western Auto Supply Company Model D745 receiver. In the input circuit, the signal voltage is taken off a tap on the r-f transformer secondary and fed to the signal grid of the 6J7 through an 0.5-megohm leak and a 35-mmfd grid condenser. This is done to avoid loading the input circuit too much, which would result if the signal for the converter were taken off the high side of the r-f transformer secondary instead of the tap, since the converter grid acts as a grid-leak detector and draws grid current in operation.

In this combination circuit, *L1* serves as the oscillator coil in a Hartley circuit, the coil *L2* providing additional feedback and coupling so that maximum conversion gain is obtained. This type of circuit is simple and functions satisfactorily on the standard broadcast band, but is not used in receivers incorporating short-wave bands, since the reaction of the oscillator voltage on the signal circuit becomes objectionable at higher frequencies, where the oscillator frequency will not differ much in percentage from that of the incoming signal. Under such conditions, the conversion action becomes very inefficient.

The manner in which grid current and grid detection is developed in this converter circuit is interesting. Note that the grid and cathode of the 6J7 return to ground, so apparently there is no bias on the control grid. In operation, though, since the circuit is oscillating, the cathode potential becomes alternately positive and negative over each oscillation cycle by an amount equal to the oscillator voltage developed from the cathode tap of *L1* to ground. On the positive half cycle, the cathode becomes positive with respect to the control grid and consequently a negative bias is imparted to the control grid. However,

on the negative half cycle, the cathode, becoming negative, renders the control grid respectively positive and therefore grid current flows over this half cycle, causing rectification and detection.

Operation of circuits of this type can be quite easily checked by means of an electronic voltmeter, measuring the d-c voltage developed from the control grid to ground. This voltage should be negative if oscillation is taking place.

**PHASE INVERSION**

In phase-inverter circuits, we are interested not only in the gain but also in the uniformity of the output voltage level. If the output voltage delivered to one power tube grid is greater than that fed to the other, proper phase inversion is not taking place, even though the gain may be normal.

A typical phase-inverter circuit is shown in Fig. 4. In operation, the plate load of the first section of the 6C8G is formed by *R1* and *R2* in series. The combined value of these two resistors is 100,000 ohms. When the grid leak of the following output tube is 0.5 megohm, the gain in this triode section is 24 for a tube of average characteristics. In other words, for a 1-volt audio signal applied to the grid of the first section of the 6C8G, the output signal voltage developed at point 2 will be 24 volts.

For proper phase inversion, the output voltage at point 3 must be the same as that at point 2, but opposite in phase. Equality in output voltage is obtained by choosing the ratio of *R1* to *R1* plus *R2* so that the signal voltage applied to the grid of the second section of the 6C8G is the same as that applied to the grid of the first section. Since the total plate load (*R1* plus *R2*) equals 100,000 ohms and the signal voltage developed across this load is 24 times that applied to the input grid, then if *R1* is made 1/24th the total plate load resistance of 100,000 ohms, or about 4200 ohms, the signal voltage developed at point 1 will be 1/24th that at point 2 and, since the gain of the circuit is 24, the signal level

at point 1 will be equal to that applied to the input grid.

Thus we see, by coupling from point 1 to the grid of the second section of the 6C8G, the same voltage is applied to the second section grid as is applied to the first section. Also, since an increase in current through *R1*, resulting over the positive half cycle of a signal applied to the input grid, causes a change in signal voltage in a negative direction at point 1, the peak of the negative half cycle of the signal applied to the second section grid coincides with the peak of the positive signal half cycle applied to the first section grid. Therefore, the signals are 180° out of phase. And, since the output section conditions are similar, this phase relationship is retained at points 2 and 3. This analysis

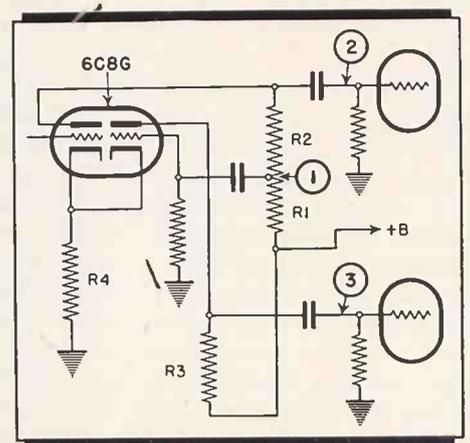


Fig. 4. Typical phase inverter. Operation described in text.

applies, of course, only at low frequencies. There may be phase shifts due to stray capacity and, at very low frequencies, to the coupling condenser reactance. But these are design, and not service, problems. Practically, they are of negligible importance.

**INVERSE FEEDBACK**

Inverse feedback circuits introduce many complexities in gain considerations; so much so that it is not practical, from a servicing standpoint, to cover all the possible factors which enter into the design of such circuits. However, unless some of the basic considerations are firmly understood, a good deal of trouble may result in servicing some of these circuits.

One circuit which is coming more and more into use is that shown in Fig. 5. This represents the inverse feedback network employed in the Sonora TX chassis and, with minor variants, in some General Electric receivers.

Note that the volume control returns to a point on a voltage divider network, across the speaker voice coil, formed by a 5000-ohm and a 200-ohm resistor in

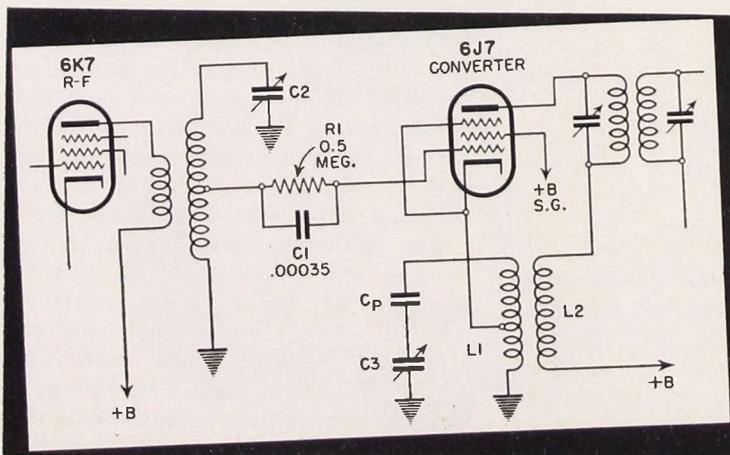


Fig. 3. Circuit employing a 6J7 as combined oscillator and converter. Specific operating conditions must be met here.

series. As a result, a portion of the output signal voltage across the speaker voice coil is fed back into the volume control circuit. The phase of the feedback is negative, so instead of increasing the signal strength, the effect is to reduce the gain. This is quite important. In servicing, if such a receiver is worked on without consulting the diagram, it might be natural to assume that the volume control should return to ground. And, in fact, if it did return to ground in this circuit, the gain and output of the receiver would be increased. But the fidelity would suffer and there would be more harmonic distortion.

The percentage of output audio voltage fed back into the volume control circuit is calculated by multiplying by 100 the ratio of the a-f voltage across the 200-ohm resistor to that across the voice coil. At moderately high audio frequencies, where the reactance of the 0.1-mfd condenser is negligible, the ratio

$$\text{is } \frac{200}{5000 + 200} \text{ or } 1/26\text{th the output}$$

voltage. Multiplying this by 100, we find that the percentage feedback is slightly less than 4%.

This seems like a small amount of feedback, yet it can cause a tremendous decrease in gain. For instance, if the gain without feedback were 100, with a negative feedback of only 4% the gain would be reduced to 20. How this is figured can be seen by considering the formula

$$\text{Gain with feedback} = \frac{G}{1 - (G \times F)}$$

where  
*G* = gain without feedback  
*F* = Feedback ratio

Thus, applying this formula, when the gain without feedback is 100 and the feedback ratio is 1/25, we find that

$$\begin{aligned} \text{Gain with feedback} &= \frac{100}{1 - (100 \times -1/25)} \\ &= \frac{100}{1 - (-4)} = \frac{100}{5} = 20 \end{aligned}$$

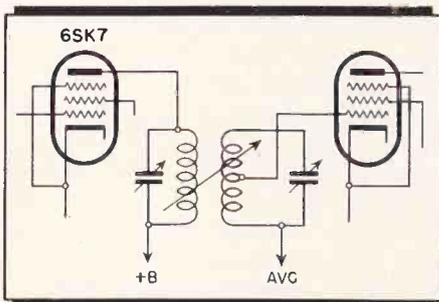


Fig. 6. Grid is tapped down on i-f transformer secondary to provide uniform frequency response.

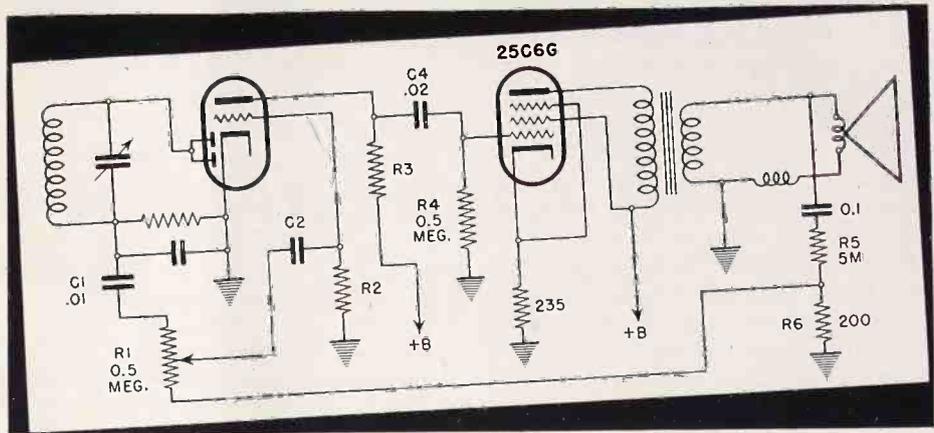


Fig. 5. Inverse feedback from speaker voice coil to low end of volume control.

Note that the fraction of feedback voltage is negative, therefore expressed as  $-1/25$ . This makes the expression in the parenthesis a negative number which, multiplied by a negative sign, results in a positive number. If the feedback were regenerative, the opposite sign would be used.

The feedback ratio in the circuit of Fig. 5 varies with frequency and also, to some extent, with the position of the volume control arm. At very low frequencies, the reactance of the 0.1-mfd condenser becomes high and, as a result, the feedback percentage becomes less. When the feedback is decreased, the gain of the amplifier increases; accordingly, bass compensation is automatically obtained.

This would be obtained anyhow if sufficient inverse feedback were used, but by using the reactance of the condenser for partial compensation, it is possible to obtain a greater degree of bass compensation with less sacrifice in gain than would be the case if uniform inverse feedback were employed.

The manner in which the percentage feedback varies with the volume control setting can be seen by considering the volume control itself as a portion of a supplementary voltage divider system for the feedback voltage. Thus, when the volume control is at minimum volume setting, the arm leading to the 200-ohm section of the inverse feedback network and the entire feedback voltage across this 200-ohm section is fed to the first a-f grid. This means that maximum feedback—up to about 4% of the total voltage across the voice coil in this case—is obtained when the volume control is at minimum setting.

When the volume control is at maximum setting, the feedback voltage must pass through the 0.5-megohm resistance of the volume control before being applied to the first a-f grid. When the arm is at this setting, the grid leak of the first a-f tube and the diode load resistance form an a-c load which re-

duces the feedback voltage to less than one-half that available, so that the actual percentage feedback at this position of the volume control is less than 2%.

#### TAPPED TRANSFORMERS

Just as inverse feedback has found application in audio systems of receivers to give more uniform frequency response and reduction of distortion, at the expense of reduced gain, so also have methods been employed in i-f systems which provide more uniform response at a sacrifice in gain. For instance, in the i-f stage shown in Fig. 6, which represents one of the stages in a Hammarlund Super-Pro of the 200 Series, note that the grid connection is made to a tap on the i-f transformer secondary. Thus only a portion of the total secondary voltage available is applied to the amplifier tube grid. The reason all the available voltage is not utilized is because in this receiver a band-pass effect is desired in the i-f amplifier. This is secured by using four low-gain stages, consisting of eight tuned circuits. Fewer tuned stages might be employed at higher gain, but then the advantages of the band pass, with sharp cutoff at the limits of the band, would be lost. Actually, in this receiver, though a gain of 100 per stage could be secured, the gain is of the order of 5 per stage. By using four stages, all the gain which would ever be necessary is secured, yet there is none of the regeneration peculiar to high-gain i-f amplifiers.

The arrow through the windings in the schematic of the i-f transformer indicates variable coupling, employed in the i-f stages of this receiver to vary the band pass from broad to extreme selectivity.

#### DYNAMIC-COUPLED AMPLIFIERS

Of late there has been a tendency toward the use of dynamic coupling in output power stages. In its simplest form, the single-ended dynamic-coupled

stage of Fig. 7 is a representative example. This circuit is that of the a-f stage of the Emerson Model CQ, CS chassis. Note that the cathode of the 6AE5GT is coupled directly to the control grid of the 25AC5GT. This form of coupling was introduced about five years ago, by Charles Stromeyer, and was called dynamic coupling. The 6B5 tube, which incorporates the driver and output tube within a single envelope, was the first tube employing this principle. More recently, the 6N6 has appeared, which utilizes the same form of coupling.

In studying the diagram, Fig. 7, you will note that there is apparently no bias for the output tube nor, for that matter, for the driver tube either. Actually, a grid bias is provided for the driver, because the control grid of the 25AC5GT operates with grid current flowing throughout the entire signal cycle. Since the plate current for the 6AE5GT driver must return to cathode through the grid circuit of the 25AC5GT, the resulting positive bias of the cathode develops a corresponding negative bias for the driver input grid. Since the cathode current varies as the signal input varies, the resulting grid bias is not constant.

The characteristics of this output circuit are, high output power with relatively low distortion. The fact that grid current flows continuously in the output power tube circuit makes for better reproduction than is secured with other output power tubes showing a similar harmonic content. Part of this is psychological, in that the ear does not notice continuous slight distortion, whereas if at some intervals there is a reduction in distortion while at other times the distortion is abruptly increased, the change becomes immediately evident.

In some circuits employing this type of coupling, a 25,000-ohm grid resistor is employed from the 25AC5GT grid to ground. This is used to stabilize the

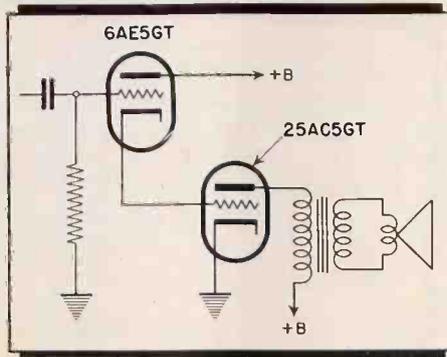


Fig. 7. A single-ended dynamic-coupled output stage.

grid current and, consequently, the cathode bias.

**PUSH-PULL VERSION**

A push-pull version of the dynamic-coupled output stage, in conjunction with a degenerative phase inverter input circuit, is shown in Fig. 8, which is a partial schematic of the Emerson Models ER-369, ER-370 receivers. The a-f voltage appears first at point 1, is amplified at point 2 and coupled to point 3, the junction of R2 and the control grid of one section of the double-triode 6AE7GT driver. This signal voltage is developed across the cathode and ground and is dynamically coupled to the 6AC5GT grid, at point 8.

The signal voltage at point 4, the grid of the phase inverter triode section of the 6SQ7GT, is derived from the voltage drop across R2 and R3 in series, the signal fed to the divider being primarily that at point 3. In addition, after the signal at point 4 has been amplified and appears at point 5, a portion of the signal voltage applied to point 6 finds its way back to R3 and into the input circuit at point 4. Since this portion of the signal voltage is out of phase with that portion which is applied via R2, it serves to buck the signal voltage at point 3 and thus reduces its level. Any increase in the signal applied directly

through R2 causes a corresponding increase in the bucking voltage applied through R1. As a result, the signal levels are maintained substantially constant at each of the driver grids.

Due to the degeneration in this phase-inverter stage, little gain is obtained. However, the advantages of increased stability in this, as in the other circuits discussed, are of greater importance.

**WIDE RANGE OVER WIRE LINES**

RECENT discussions of the use of frequency-modulation broadcasting stations have in some cases included statements that inter-city program transmission networks provided by the telephone companies are not capable of transmitting the tonal richness which will distinguish frequency-modulation from present-day broadcasting. It may be that such statements result from the fact that the principal broadcasting organizations now use inter-city networks which transmit programs from about 100 to 5000 cycles, while the frequency-modulation broadcasters, in recognition of the ability of most people to hear frequencies substantially above 5000 cycles, have been talking in terms of 50 to 15,000 cycles.

Under listening conditions normally encountered in homes and at other points where broadcasting receivers are generally operated, comparatively little is gained from the standpoint of program appreciation by the transmission of frequencies above 7000 to 8000 cycles since it is difficult for most listeners, under such conditions, to appreciate the presence of higher frequencies. Furthermore, most present-day broadcast receivers do not respond to audio frequencies above about 5000 cycles.

The telephone company has given to the principal broadcasting companies demonstrations of program transmission channels capable of handling a frequency band width some 60% greater than the 5000 cycles now ordinarily employed. These demonstrations have been made over circuits as long as 2000 miles and the broadcasters have been assured that the Bell System is prepared to provide facilities for transmitting this wider band if and when needed.

In the case of more than fifty transmitting stations, studio-transmitter channels which will transmit from about 50 up to about 8000 or 10,000 cycles are now being furnished by the telephone companies. In a number of instances, channels transmitting frequencies up to 15,000 cycles have been provided between studios and transmitters of frequency-modulation broadcasting stations.

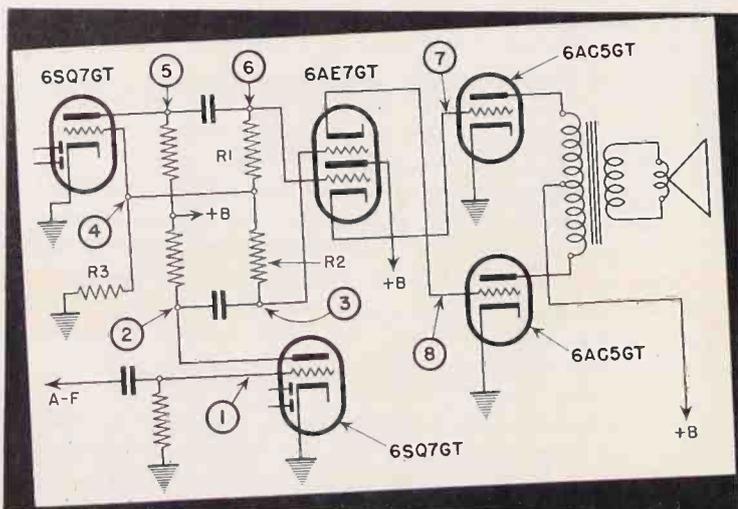
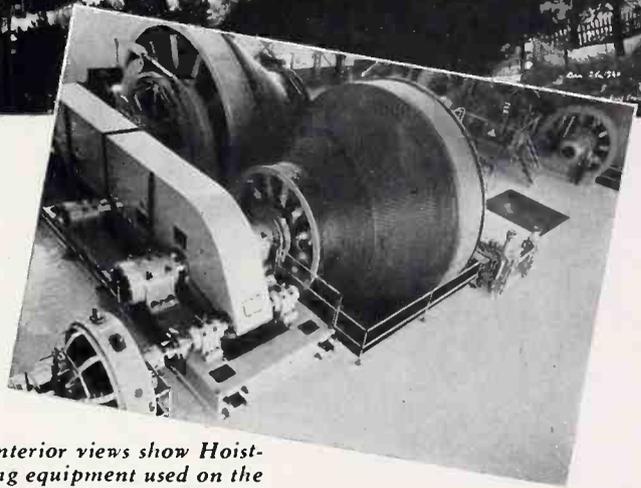


Fig. 8. Dynamic-coupled push-pull output stage employing the new 6AE7GT dual-triode driver.

# FAMOUS HOMESTAKE GOLD MINE CHOOSES

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## FOR ITS COMMUNICATIONS SYSTEM



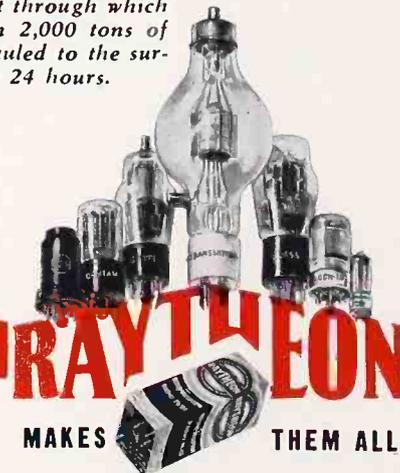
*Interior views show Hoisting equipment used on the Ross Shaft through which more than 2,000 tons of ore are hauled to the surface every 24 hours.*

FEW realize the vast scope of the operations of the Homestake Mining Company located at Lead, South Dakota. This company is one of the largest gold producers on the North American continent. For many years Homestake has successfully and scientifically mined, milled and treated lower grade ores. The operations at Homestake, where over 2,000 men are employed, embrace wide flung lumber camps, hydro-electric plants, pumping stations, sawmills and many other diversified activities necessary and vital in the production of a large tonnage of gold ore.

Included in its complete modern equipment is a communications system that is a marvel in its field. Conversations to and from cages while moving up and down the shaft! Automatic signals which show the exact location of the cages at all times! So intricate, so sensitive, is the mechanism that no chances can be taken on tubes. Safety depends upon proper equipment. The tubes must be absolutely reliable, and must function at topnotch efficiency at all times. So it was inevitable that RAYTHEONS were chosen.

This is just another example of the preference for RAYTHEONS wherever there is a tough tube job to do. And the reason is that RAYTHEONS are the development of the world's foremost tube engineers . . . specialists who devote their time exclusively to designing better tubes and to pioneering in new developments for future tube needs.

That's why RAYTHEONS deliver, wherever installed, with a service unsurpassed and that's why thousands of successful servicemen everywhere handle them. There's one for every purpose, for RAYTHEON makes them all. And they cost no more!



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**"WORLD'S LARGEST EXCLUSIVE RADIO TUBE MANUFACTURERS"**

# Now — "CERTIFIED

**F**ROM the time that radio repairing emerged as a business, servicemen and service organizations have made every effort to provide it with a specific status—a mark of approval, a qualification of some sort that would function as an implied guarantee, in much the same manner that a doctor's degree, an electrician's license, or the name of a well-established company, serves as a guarantee to the public. Unfortunately, these efforts have, on the whole, been ineffective.

## THE DRAWBACK

Yet, one of the greatest drawbacks to the servicing business lies in the fact that the financially and technically responsible, full-time serviceman has no status in his own neighborhood beyond the good will and confidence he has built up among a comparatively small group of customers. No matter how good he may be, there has been no mark or testimonial by which a new customer may judge him—no guarantor to substantiate his proficiency, as there is a guarantor supporting the doctor, the electrician, and the fellow who manages a branch service station for some large corporation. Hence, as far as the public is concerned, the radio serviceman has remained an unknown quantity.

When it is considered that few localities have static populations, the seriousness of the situation becomes apparent. In a city, for instance, it is possible for a good serviceman to lose 50 percent or more of his customers in a year's time, by virtue of their moving to new localities. The new residents have no way of differentiating between him and an inadequately trained and equipped serviceman down the block. Moreover, old residents, who may never have had occasion to call a serviceman, are equally unenlightened.

New residents or old may pick the wrong serviceman the very first time they require receiver repair or adjustment, and the unfortunate part of this has always been that the responsible, proficient servicemen suffer equally for the poor work done by the fellows who are not really qualified for one reason or another. The poor work or the sharp practices of one man invariably reacts upon all servicemen in the community, giving radio servicing in general a black eye.

The result has been that a large pro-

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portion of the public has completely lost confidence in radio servicemen—to such an extent, in numerous instances, that erstwhile customers forego receiver repair or adjustment rather than take what they consider a poor gamble. Hence, millions of dollars of servicing work are lost to the field each year.

## THE PROBLEM

This business must be regained. The building of public confidence nationally through a support of the reliable servicemen, at the expense of the unreliable, is the only manner in which this frozen business can be thawed out. How to do this has been the problem.

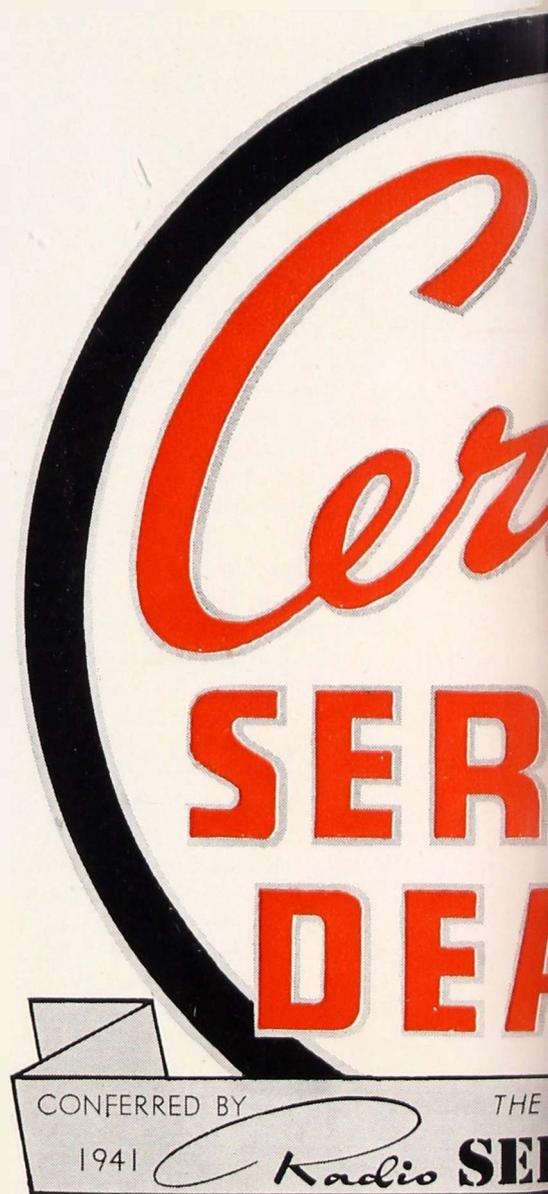
The difficulty in finding a solution to this problem has always been that radio servicemen are free lancers. Outside of the possibility of State or Federal licensing, which proposal has never met with approval, there is no means of conducting fair examinations, and no means at all of determining a man's proficiency and integrity prior to the time he can prove it through business experience. Moreover, even assuming that it were mechanically feasible to set up examining boards throughout the nation, it is obvious that the results of such examinations could serve only to determine a man's technical knowledge, but provide no clue as to the man's ability to use the knowledge effectively in practical applications, nor any hint of his integrity. Hence, examinations based on theory would prove nothing beyond the fact that the applicant had probably digested a textbook on radio. But it takes more than that to make a competent radio serviceman.

We pondered over this problem from the very time that **RADIO SERVICE-**

**DEALER** was first conceived. It was our opinion at that time that the obligation of a radio service magazine to its readers should include a sincere effort to improve and strengthen the field in all ways deemed practical. The question of public relations appeared as a "must" in our plans.

## THE SOLUTION

The more we thought of the problem, the clearer it became that the only solution hinged upon finding a common de-



A two-color reproduction of the six-inch gold. These distinctive Certification Seals are available in the November 15th. Send in

# SERVICE-DEALERS"

nominator—a single factor by which the proficiency and the integrity of any serviceman could be immediately and accurately gauged. We found the solution before the appearance of our first issue, and have impatiently awaited the day when we could commence our campaign and hope for a reasonable success. The day has now arrived.

The one unalterable gauge of a man's proficiency, honesty and responsibility is his *proven value to the community in which he lives*. The man of proven value is the man who has both *business stand-*

*ing and business integrity*. These are the marks of a successful man. With but few exceptions—and there are exceptions to every rule—the man who has made his own way *is proficient, is honest and is responsible*. The occasional gyp and the incompetent may thrive for a time by virtue of luck or a fluke, but eventually they are forced either to give way to the better men or move the scene of their operations. *They do not last for long in any one place*.

There is one sure-fire way of determining the stamp of a serviceman—he *can be reliably gauged by his jobber standing*. If he does business regularly with one or more jobbers, and is given a "clean bill" by his jobbing contacts, then there is little question but that he is proficient, honest and responsible. Hence, a serviceman on a jobber's books and recommended by that jobber as being a good business risk is, in ninety-nine cases out of a hundred, a serviceman of the better type.

## THE PLAN

With this fact in mind, the publisher of RADIO SERVICE-DEALER has never accepted a subscription from any serviceman without having first received confirmation of his status from the jobber or jobbers with whom he does business. If the confirmation has not been forthcoming, the subscription has been rejected.

By virtue of our care in accepting subscriptions from accredited servicemen only, we, as a national medium, are in a position to fairly and conscientiously act as guarantors of ability and integrity to the extent of issuing Seals of Certification ascribing to this. We are now ready to do so.

To this end, we have had prepared a large decalcomania seal of distinctive design and executed in four colors. It is available *without charge* to any serviceman—subscribers and non-subscribers alike—providing our rigid requirements are met. Subscribers whom we classify as "service-dealers" automatically qualify. Non-subscribers are required to fill in a special application form, a copy of which may be had on request.

The seals will be ready for distribution December 15th. Though subscribers are entitled to the seals, *none will be shipped except upon written request*. A postcard will do.

## FEATURES OF PLAN

A Seal of Certification prominently displayed at your place of business will be advantageous for a number of reasons.

First and foremost, the significant reading on the Seal is, in itself, convincing evidence that the sponsor or guarantor has nothing to sell and nothing to push beyond better servicing, since RADIO SERVICE-DEALER can have no occasion to influence the public on its own account. Hence, the Seal will promote public confidence in those displaying it.

Secondly, the Seal will, in time, become a familiar "signature" throughout the country. People will come to recognize it as the sign of a standard in quality and fair dealing no matter where they may be or where they may take up new residence. Moreover, should you move into a new community, the Seal will continue to serve its purpose as a chevron of reliability.

We will exercise every precaution to preserve the value of the Seal. We cannot, of course, guarantee the integrity of any serviceman beyond his jobber recommendation, nor can we function as a clearinghouse for all manner of public complaints that are, in so many instances, unjustifiable. We shall, however, reserve the right to revoke the Seal privilege in such instances where confidences are violated. As a means of keeping a check on the field, and to prevent their unwarranted use for any length of time, new Seals will be issued each year, thus automatically voiding the old ones. The year of issue will be clearly indicated on each one, as a protection to you and the public.

## COOPERATION NECESSARY

Our campaign to build up public confidence in radio servicing and increase the servicing business cannot be a real and lasting success without your cooperation. Apply for your Seal now and prepare to get behind the movement. Display the Seal where your customers can't help but see it. Explain its significance, and live up to its standards. Help to make it the symbol of reliable servicing in your community.

We do not intend to stop with the issuance of Seals. This will be an active campaign, geared to the field and constantly moving. Further announcements will appear as we get well under way. Watch for them.



lithographed in red, white, blue and black, available, without charge, on December 15th, 1940, one now.

# Set of the Month

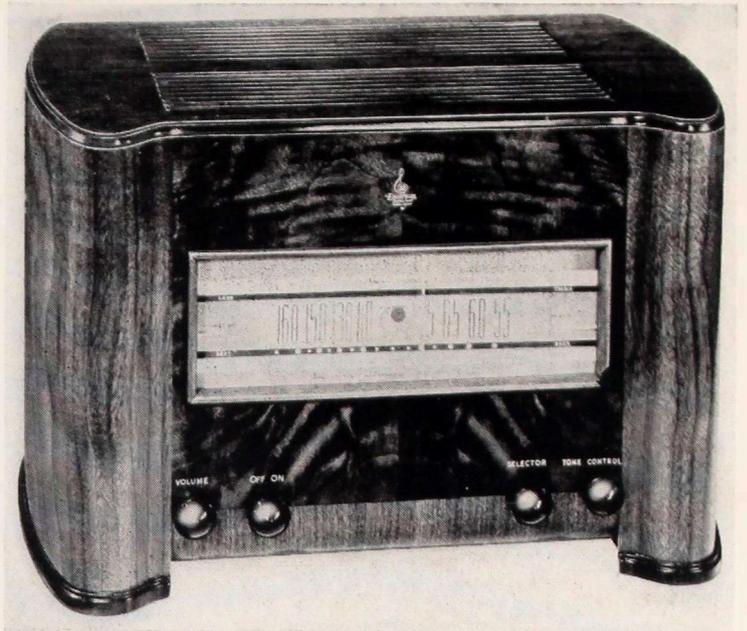
## EMERSON HI-FI RECEIVER

A FEW months back, in "Transients," we spoke of a table model high-fidelity receiver which, to our way of thinking, heralds a new trend in design-merchandising. We had reference to the Emerson Model 365 (Chassis DS)—a real quality set, with 8-inch speaker and 20 watts output; larger than a midget, of course, but sufficiently compact to have the convenience and the unobtrusiveness of a midget, as one may gain from the illustration on this page.

### FEATURES

This receiver is a single-band superheterodyne with a frequency range of 540 to 1650 kc. It incorporates a tuned r-f stage, an electron-ray tuning indicator, and push-pull 6L6s feeding a horizontally-mounted electro-dynamic

The Emerson Model 365 table-type high-fidelity receiver. Sound projection is from top of cabinet.



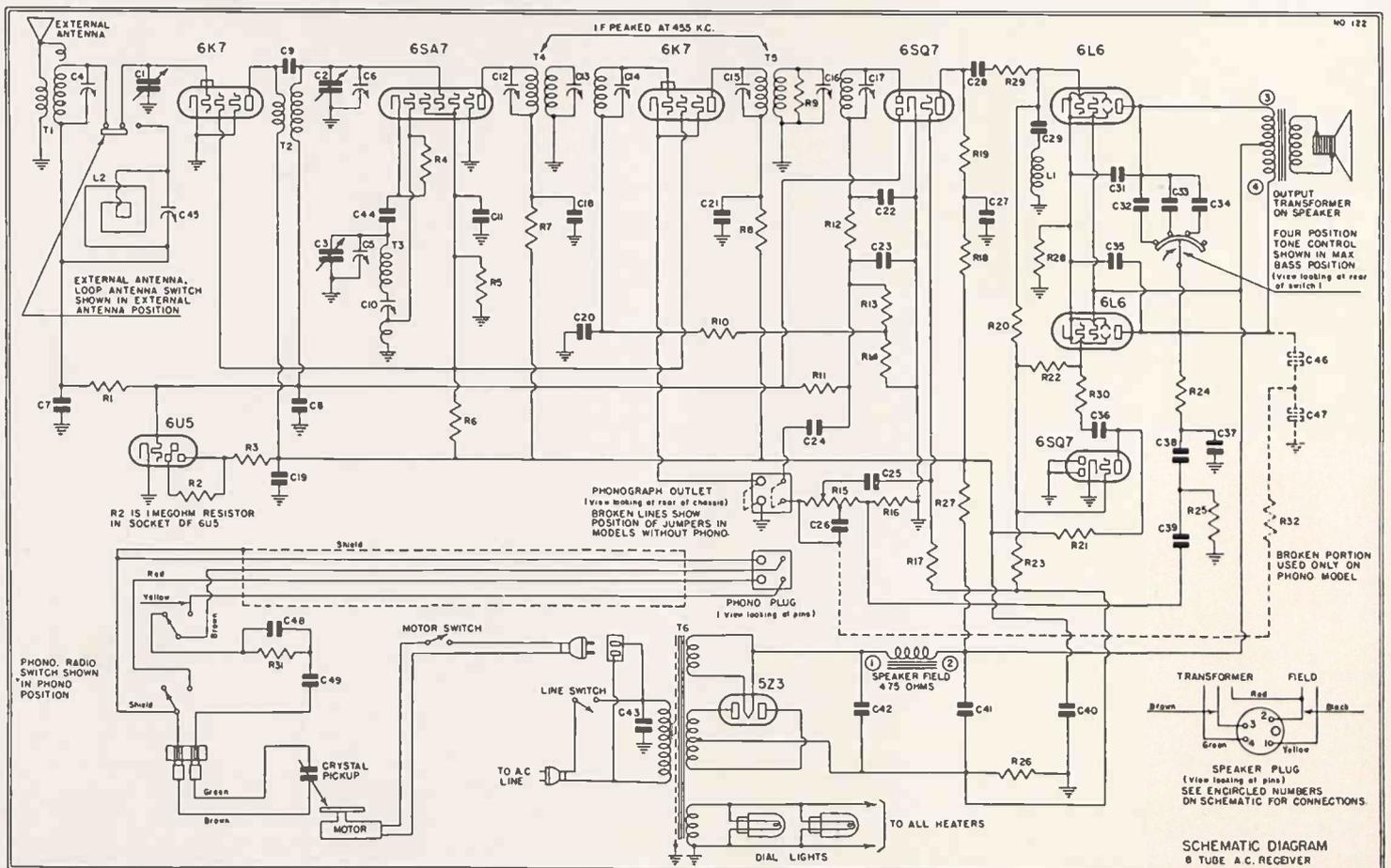
speaker facing a slotted grille in the top of the cabinet. This arrangement provides substantially uniform sound distribution, thus eliminating the "critical listening angle." Since a loop aerial is included for high signal-level reception, the cabinet may be set at the best signal pickup angle without altering the angle of sound projection from the speaker.

Both r-f and i-f tuned circuits are permanently adjusted for wide bandpass. To this end, triple-tuned circuits are used in the i-f transformers. A 10-kc filter is incorporated to eliminate band-fringe interference.

### THE CIRCUIT

The complete circuit is shown below. Of particular interest is the antenna circuit. It will be observed that, instead of a coupling loop or a loop-coupling coil, for external antenna connection, a separate antenna r-f transformer is provided. A simple two-position switch selects the loop or the coil. When the input transformer is used in conjunction with an external antenna, the loop is disconnected.

An alternative input tuning system  
(Turn to page 25)



# Circuit Court

## DOUBLE TONE CONTROL

THE NEW 1941 *Stewart-Warner Model 11-8D* Series receivers have separate tone controls for the high and low frequencies, providing a wide range of tonal shading.

Referring to Fig. 1, when the 5-meg treble control 67 is in the clockwise position, with the arm at ground potential, the 260-mmf condenser 4 acts as a bypass for the high frequencies, thus attenuating the treble notes. When this control is in the counter-clockwise position, the high frequencies are boosted through condenser 4 to the tap on the 2-meg volume control 66A.

When the 1-meg bass control 68 is in the extreme clockwise position, with the arm full to the left, the .008-mfd bass-boost condenser 53 is shorted out; hence bass is at a minimum. When the bass control is in the mid-position, condenser 53 acts to boost the bass. When the control is in the counter-clockwise position, with the arm full to the right, the .004-mfd condenser 58 acts as a bypass for the higher frequencies and condenser 53 boosts the bass.

★

## TUNED-UNTUNED R.F.

IN THE SAME *Stewart-Warner Model 11-8D* Series, both manual and push-button station selection is provided. When set for manual selection, the r-f stage is tuned; when set for push-button station selection, where maximum sensitivity is not a requirement, the r-f stage is untuned. Thus, by a simple switching system operated by the Manual Tuning button, the greater sensitivity of a tuned r-f stage is provided for distant reception, and the simplicity of the two-tuned

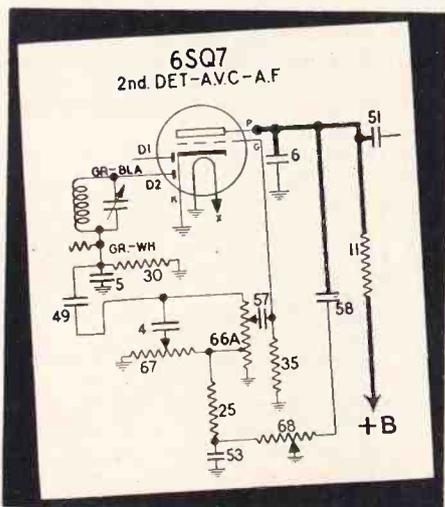


Fig. 1. Double tone control in *Stewart-Warner 11-8D*.

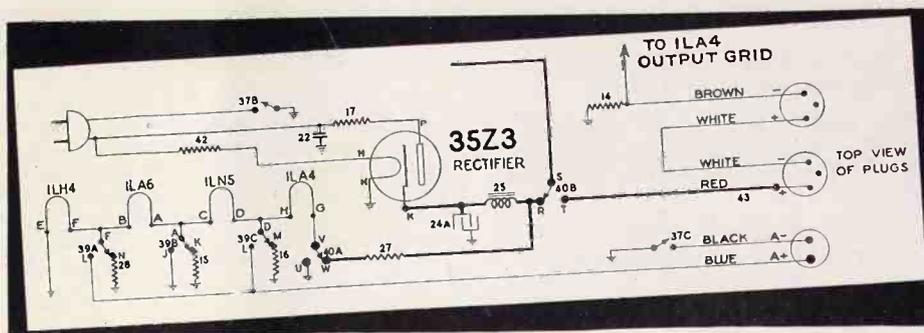


Fig. 3. Battery and line switching in *Stewart-Warner 15-5X*.

circuit push-button system retained for local automatic station selection.

The switching arrangement is shown in Fig. 2. Though the complete r-f system is not shown, there are three condensers in the gang tuning unit—one tuning the antenna circuit, one the oscillator, and the third tuning the r-f stage transformer

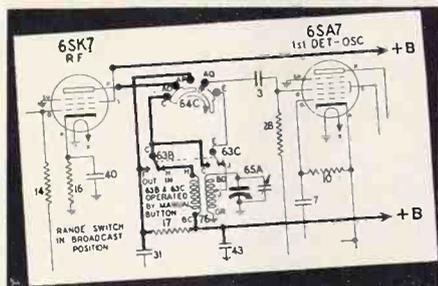


Fig. 2. Tuned-untuned r-f circuit.

76 when the receiver is manually operated. The latter variable condenser is 65A in the diagram.

The switches 63B and 63C are mechanically coupled to the Manual Tuning push button and assume the positions shown when the Manual button is pushed in (this operation also connecting the antenna and oscillator gang condensers into circuit). If you will trace the circuits through these switches, as well as through the waveband switch section 64C, you will find the r-f transformer 76 properly connected to the plate circuit of the 6SK7 r-f tube and the grid circuit of the 6SA7.

As usual, when one of the station buttons is pushed in, the Manual button is released, disconnecting the gang condensers. This operation also throws switches 63B and 63C to the left, cutting out the r-f transformer and variable condenser 65A, and connecting the plate of the 6SK7 to resistor 17 through switch 63B and to the grid condenser 3 through switch 63C, thus forming a resistance-coupled r-f stage.

The waveband switch 64C is shown in the broadcast position. When turned to the short-wave position, this switch

also changes the r-f stage to resistance coupling. Simultaneously another section of the switch connects a short-wave r-f transformer into the antenna circuit.

★

## BATTERY SWITCHING

SWITCHING FROM ac-dc to battery operation in the *Stewart-Warner 15-5X* is accomplished in a unique manner. Referring to Fig. 3, pushing the power plug into two slots in the chassis automatically actuates switches 39 and 40 and connects the set for battery operation. The filaments of the 1LA6, 1LN5, 1LH4, and 1LA4 tubes are then connected in parallel and are operated from the 1.5-volt A battery. Grid bias voltage for the 1LA4 output tube is obtained from the voltage drop across the 560-ohm resistor 14 which carries the total B current.

Operation from the line is accomplished by removing the power plug from the chassis slots and plugging it into a wall outlet. Switches 39 and 40 then connect the tube filaments in series with each other and with the 2000-ohm resistor 27, after which they are operated from the output of the 35Z3.

In this type of series circuit the filament which is connected to the grounded side carries not only the filament and plate currents of that tube, but also the additive plate and screen currents of the tubes which are operated on the positive side of the circuit. This current is far in excess of the rated filament current of that tube and would burn it out if resistors 15, 16, and 28 were not in the circuit. The purpose of these resistors is to bleed off the excessive current and keep the current through each filament at the rated value.

During ac-dc operation no plate current flows through resistor 14, so that no grid bias voltage is available from this source. The bias on the 1LA4 grid during ac-dc operation is the sum of the voltages measured across the other three filaments.

# Shop Notes

## PHILCO 39-31

### Dead

Most often caused by the insulation on the rubber covered leads breaking down. This is especially true of the transformer leads.

## PHILCO 40-115, 124 SERIES

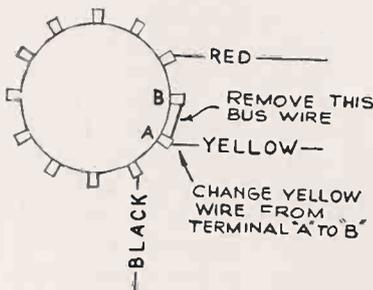
### Squeals

Replace the .05-mfd condenser bypassing the screen of the 7B7 i-f tube.

## RCA QU5

### Radio Break-Through on Phono

In localities where a strong local broadcast signal is present, it can sometimes be heard very faintly on Model QU5 when the receiver is tuned to the signal and the radio-phonograph switch turned to the phono position.



This condition can be eliminated by removing one bus wire connection and changing the yellow lead on the radio-phonograph switch as shown in the accompanying sketch.

## RCA V-300, V-301, V-302

### Increasing Phono Gain

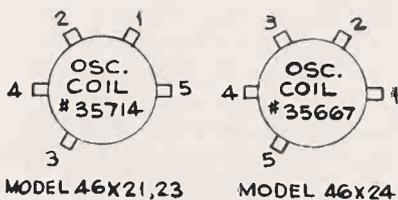
The audio output from low cut records may be increased somewhat by effecting the following changes:

Change R12 from 82,000 to 150,000 ohms. Change R13 from 2,700 to 5,600 ohms. Change C40 from .01 to .005 mmfd. The above changes have been incorporated in 2nd production.

## RCA 46X21, 46X23

### Correct Osc. Coil Connections

The oscillator coil terminations shown at the bottom of the 46X21, 46X23, and 46X24 Service Notes (1940, No. 6) apply to coil No. 35667 used in Model 46X24 only.



The terminations for coil No. 35714 used in Models 46X21 and 46X23 are shown here. The numbers refer to the oscillator coil connections in the schematic diagram.

## RCA LOOP RECEIVERS

### Store Demonstration

It is sometimes difficult, if not impossible, to obtain satisfactory radio reception on loop receivers in dealers' stores because of "shielding" caused by metal structure of



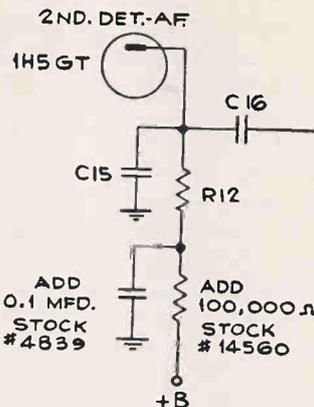
the particular building. This handicap can be conveniently and effectively overcome by installing an antenna, which will be loosely coupled to the receivers. The coupling should be in the form of a long loop, attached to, or concealed in, a wall, and connected to an external antenna and a ground as illustrated.

Any loop receiver(s) placed adjacent to this "long loop" will have ample signal strength induced by transformer action or magnetic coupling. The receiver loop should be turned in a direction parallel to the antenna loop.

## RCA 15BP

### Fidelity Change

Should accentuation of the higher audio frequency register be desired, capacitor C-15, connected across the 1st a-f output, may be decreased from 390 mmfd to 100 mmfd. Some production instruments will have this change already applied; there-



"RC" filter inserted in audio plate circuit of 15BP to reduce hum.

fore, circuit diagrams should be revised accordingly.

### Hum

Occasional cases of hum on Model 15BP instruments may often be reduced by application of the following:

Shield the 1H5GT 2nd det. a-f tube by means of a tube shield securely grounded.

Insert a filter network in the 1st audio plate circuit as shown in the accompanying diagram.

### Dial Cord Slippage

To remedy dial cord slippage, on Model 15BP add an extra turn of cord around the drive shaft, without lengthening the cord, thus securing better grip and increased spring tension.

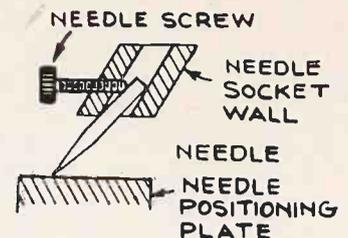
## RCA-VICTOR TOP-LOADING PICKUPS

### Inserting Phono Needle

If when inserting a new needle in the pickup, the needle screw is loosened too much the needle may take up a cocked position in the needle socket when first dropped in through the loading hole, as shown in the sketch.

Under this condition if the screw is tightened while too heavy a pressure is applied to the top of the tone arm it is possible for the screw to be tightened against the needle without actually gripping the needle in the socket. If this occurs the needle will drop out when the tone arm is raised from the positioning plate.

It will be found that if the screw is loosened only just far enough to permit



the old needle to drop out, the new needle inserted (over the positioning plate), and the screw tightened without pressing on top of the tone arm, the needle will be properly gripped in the socket and its tip will be clear of the positioning plate. If these directions are followed any RCA Victor Needle will be held tightly in the pickup socket and will not be injured on the positioning plate.

## ZENITH 1941 RECEIVERS

### Model and Chassis Numbering System

Dealers and servicemen are principally interested in receiver model numbers. However, it is necessary in production of chassis to also have a chassis numbering system. The present method used in designating Zenith chassis is quite simple, and is as follows:

The first numeral designates the number of tubes.

The letter designates the year, i.e.: A-1941, B-1942, C-1943, etc.

The last numeral designates the individual type of chassis. For instance, chassis No. 6A05 is the fifth 6-tube chassis engineered for the 1941 line.

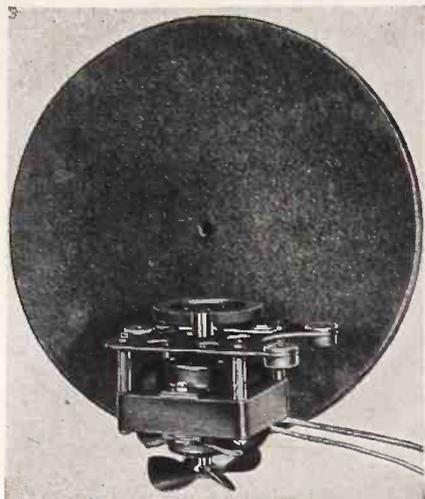
The receiver model numbering system is similar inasmuch as the first numeral designates the number of tubes, the letter designates the type of chassis as shown below, and the last numeral is the number of the cabinet. Cabinets are numbered by years, i.e.: The 300 series was used in the 1939 line, the 400 series in the 1940 line, and the 500 series in the 1941 line.

The meanings of the letters are as follows:

A—all wave, B—6-volt, D—ac/dc, F—2-volt, G—battery pack and 110 volt, J—6-volt and 110 volt, K—battery pack, L—long and standard wave, M—automotive, P—police and standard wave, R—standard wave only, S—short and standard wave, U—ultra short, short and standard wave, X—32-volt.

### ALLIANCE

**Recording Motor**—Model 90 recording motor and turntable assembly is designed for use with individual feed and cutter



designs. The motor is available with 9-inch turntable only, being designed to record up to 8-inch blanks with good speed regulation. The assembly is of the friction drive type which, in conjunction with a dynamically balanced rotor, provides smooth, quiet operation. By Alliance Mfg. Co., Alliance, Ohio. RADIO SERVICE-DEALER.

### RCA

**New Speaker**—Model MI-6237, a 15 1/4" high-fidelity pm speaker designed to handle 15 watts. Voice coil impedance is 8 ohms. Voice coil completely dust proof.

The Model MI-6222 console cabinet designed for this speaker is walnut finished and contains an acoustic phase inverter circuit to extend low-frequency response. Cabinet stands 32" high, 24" wide and 14" deep.

Also available is Model MI-6223 wall housing of heavy veneer, finished in amber grey or, for installations where it is desirable to paint it to match its surroundings, in a neutral color. Housing measures 28" high, 19" wide and 13" deep. By Commercial Sound Division, RCA Manufacturing Co., Inc., Camden, N. J. RADIO SERVICE-DEALER.

### WALSCO

**Refinishing Kit**—Contains stain, spirit lacquer, polish, French varnish, enamels and other materials required for repairing



damaged radio cabinets. Instructions included. Brushes built into bottle caps. By Walter L. Schott Co., Los Angeles, Calif. RADIO SERVICE-DEALER.

### ELECTROVOX

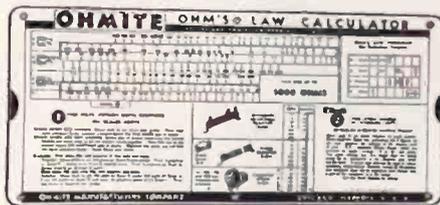
**Phono Pickup**—New, lightweight type, with permanent sapphire needle, for installation on any manually-operated record player. The point is said to be good for 15,000 records. Dropping the arm will not injure the jewel or the record. By the Electrovox Company, 424 Madison Ave., New York, N. Y. RADIO SERVICE-DEALER.

### OHMITE

**Ohm's Law Calculator**—A unique, new, convenient Ohm's Law Calculator has been specially designed by the Ohmite Manufacturing Company of Chicago. It gives the answer to any Ohm's Law problem in a jiffy, with one setting of the slide. No decimal points to worry about. All values are direct reading. It does not require any knowledge of a slide rule to operate.

The Calculator has scales on both sides so as to cover the range of currents, resistances, wattages and voltages commonly used in both radio and commercial work. It covers the low current high resistance radio, sound and electronic applications. Also the commercial higher current range for motors, generators, lamps, electrical appliances, and other applications.

The Calculator also has a convenient Stock Unit Selector, listing hundreds of



Stock Values, immediately available, in Dividohms, Fixed Resistors, (including Ohmite Brown Devils) and Rheostats. A setting of the slide shows you the stock number of the resistor or rheostat you may need. Simple instructions appear on the Calculator. The Ohmite Ohm's Law Calculator can be obtained from your Jobber or from the Ohmite Manufacturing Company, 4835 Flournoy St., Chicago, Illinois, for only 10c in coin to cover the cost of handling.

### WILCOX-GAY

**Cutting Stylus**—New type, with high clearance, particularly adaptable to recording at 33 1/3 rpm, but advantageous at 78 rpm as well.

The high clearance eliminates the tendency of the cutting stylus to chip rather than to make a smooth cut at slow recording speeds. By Wilcox-Gay Corp., Charlotte, Mich. RADIO SERVICE-DEALER.

### UNIVERSAL

**Aircraft Mike**—Designed for private planes, but can also be used for mobile transmitters and marine installations.

The unit is a single button carbon in black bakelite case with moisture-proof

cord. One model has a 3-way plug and another the 109A plug. The double pole, single throw, press-to-talk switch connects the mike and relay circuit simultaneously. Special anti-noise construction damps out motor noises.



The button impedance is 200 ohms, and the output approximately 30 volts rms across the mike transformer secondary. By Universal Microphone Co., Inglewood, Calif. RADIO SERVICE-DEALER.

### MICAMOLD

**Dry Electrolytics**—Addition of a complete line of Type MP units in capacity and voltage ranges for practically all replacement requirements. Standard lug mountings with both 3 and 4 terminals; both 1" and 1 1/8" diameters. By Micamold Radio Corp., Flushing and Porter Avenues, Brooklyn, N. Y. RADIO SERVICE-DEALER.

### ATR

**B-Battery Eliminator**—Designed for portable receivers normally operated from flashlight cells or car storage battery. Delivers 90 volts at 10 ma when operated from a 7.5-volt supply consisting of five No. 2 flashlight cells, obtainable anywhere.

Total weight of the B-Battery Eliminator, including the flashlight cell container and cells, is approximately 3 lbs—about one-third less than equivalent B batteries. By American Television & Radio Co., 300 E. Fourth St., St. Paul, Minn. RADIO SERVICE-DEALER.

### MECK

**Mobile Amplifier**—Audiograph Model AMR-15C is a 15-watt amplifier with built-in phono top, that operates from both 6-volt battery and 110-volt ac. Optional equipment includes a two-piece leatherette



carrying case, which houses two pm speakers and all accessories. By John Meck Industries, 1313 W. Randolph St., Chicago, Ill. RADIO SERVICE-DEALER.

## IMPEDANCE MATCHING

(From page 5)

then and only then, the effective impedance of the primary will be 10,000 ohms.

This relationship between primary and secondary is called the impedance ratio and like the turns ratio is constant in any given transformer. Thus, if a 4-ohm voice coil were connected across the secondary of the above transformer, the primary would acquire an effective impedance of 5000 ohms instead of 10,000. Similarly, a 16-ohm voice coil would result in a 20,000-ohm primary impedance. Over a range of about 2 to 1 variation

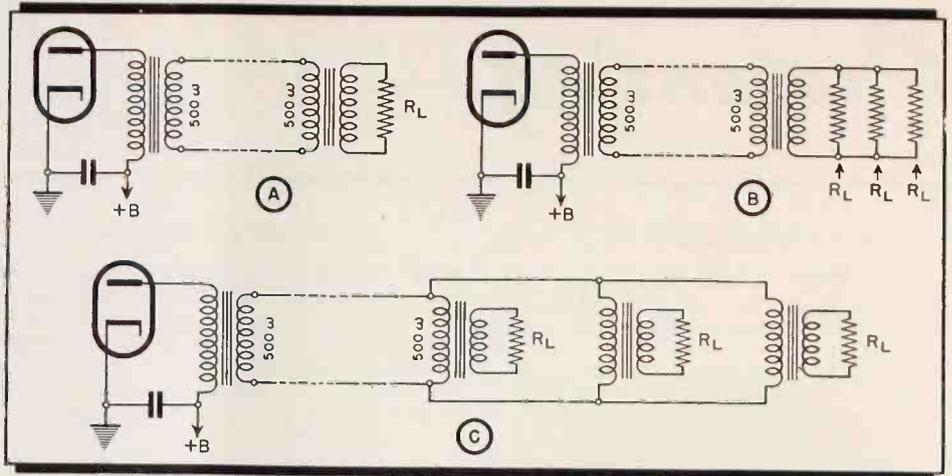


Fig. 3. Application of impedance-matching theory to actual multiple-speaker installations.

from rated impedance, most good quality output transformers will perform perfectly satisfactorily when used in this manner.

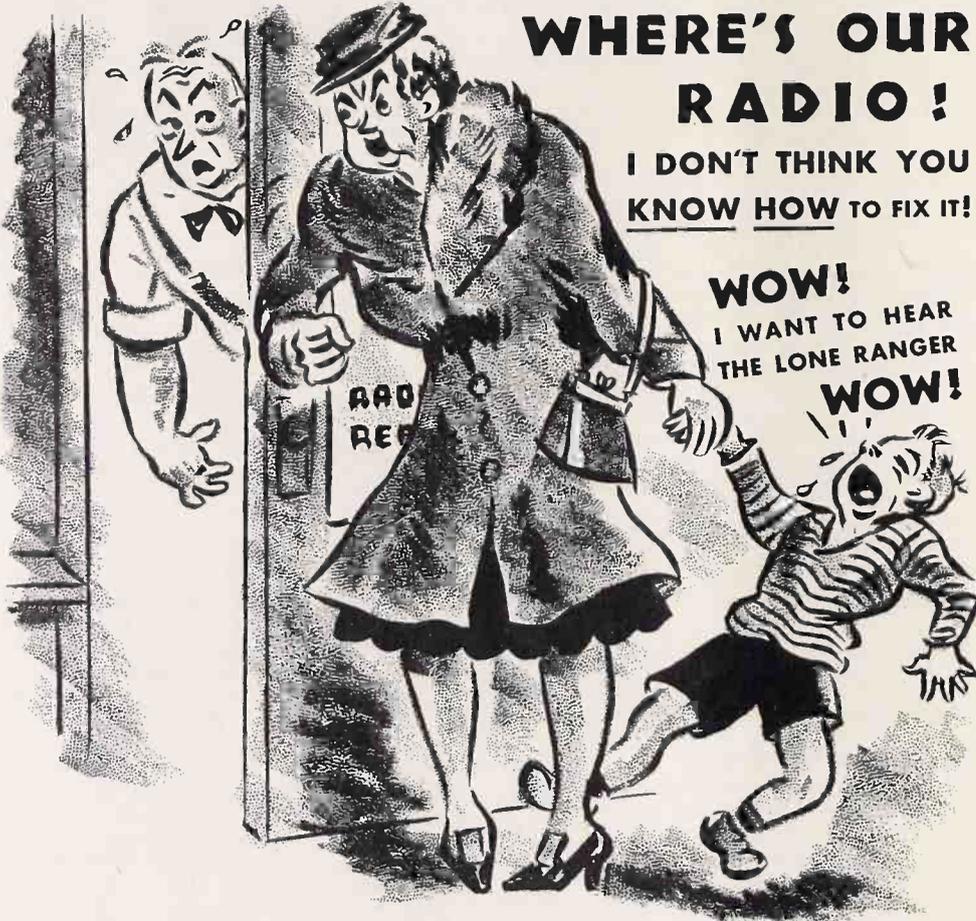
### MULTIPLE LOADING

Suppose a dual-winding output transformer is to be used to feed two loads simultaneously. Since the rated load across either secondary will reflect the rated primary impedance, it is obvious that both loads will result in a smaller primary impedance being presented to the tube. Thus, if an output transformer of 10,000-ohm primary to 8-ohm secondary is used with both an 8-ohm voice coil and a 500-ohm line connected across the separate secondary terminals the resulting primary impedance will no longer be 10,000 ohms but will become 5000 ohms.

If it is desired to operate the transformer as rated, it becomes necessary to load each secondary less so that the combined effect in the primary will not cause such a great impedance reduction. In the above case it would be necessary to use a 1000-ohm line across the 500-ohm winding and a 16-ohm voice coil across the 8-ohm winding. A more practical solution, since load impedances are usually fixed, would be to connect the 8-ohm speaker across a 4-ohm winding and the 500-ohm line across a 250-ohm winding. Thus, each would load the primary half as much as originally and the net result would be an "impedance match" in the plate circuit of the tube.

It can thus be seen that the ultimate goal in output matching is the reflection into the primary of the output transformer of an impedance which is optimum for the particular tube or tubes in use. When more than one output device is being actuated they should be so connected that their cumulative effect reduces the primary impedance by the proper amount.

Fig. 3 shows how this is done in various types of practical circuits. Fig. 3-A



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**WOW!**  
I WANT TO HEAR THE LONE RANGER  
**WOW!**

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is the condition for a single speaker located at a remote distance from the amplifier and fed by a 500-ohm line. The output transformer at the amplifier is so designed that when a 500-ohm impedance is connected across its secondary the primary will present the optimum load impedance to the tube plate circuit. If  $R_L$  represents a speaker voice coil, it becomes necessary to insert another transformer between the voice coil and the line, as shown. This transformer is so designed that when the voice-coil impedance is connected across its secondary, its primary impedance becomes 500 ohms, thus properly loading the line which in turn properly loads the output tube.

In Fig. 3-B three speaker voice coils in parallel are being fed by the single remote line transformer. If their voice coils are 8 ohms each their parallel impedance would be a little less than 3 ohms. Consequently a 3-ohm winding on the output transformer is necessary if a 500-ohm primary impedance is to result.

If this is not available another solution is possible. The 3-ohm load across the rated 8-ohm winding would reflect a primary impedance of a little less than 200 ohms. By connecting the line at the amplifier across a 200-ohm tap on the output transformer, a fairly close match would be obtained although there would be some loss in the line transformer due to the fact that it was being operated at one-third the impedance it was originally designed for.

#### INDIVIDUAL TRANSFORMERS

Fig. 3-C shows the same three speakers operated from individual line transformers. If the output transformer requires a 500-ohm load, then each of the line transformers must present 1500 ohms to the line in order that their parallel impedance will equal the line impedance. If the line transformers each present a 500-ohm impedance to the line, then the actual load on the line becomes about 166 ohms and the line must be connected across that winding on the output transformer which is nearest to that figure. When this is done the impedance reflected into the primary of the output transformer is that which is optimum for proper operation of the output tubes and good results will be procured.

If the soundman will keep in mind the above general relationships he should be able to fully utilize the inherent flexibility of impedance-matching devices.

#### TRUE CONFESSION

(From page 7)

man in this country, through sales effort, should be able to increase his earnings from five to ten times over what he is now receiving.

#### SOWING AND REAPING

Today my first customer (as introduced above) represents my best adver-

tising medium. I have given him, and many other customers, every special attention—calling back again and again to make positive that they are receiving full enjoyment, and consequently full value, through the use of the radios I sold them. It is on these occasions that I obtain the names and addresses of prospective customers for new sets, and people whose sets are not operating efficiently and require servicing—friends of the owners who have seen and heard the instruments I sold. However, my first customer is the man who actually

put me in the set business. I could have started long before, if only I had been aware of the sales possibilities connected with my service work.

Definitely make up your mind that you are going to replace every decrepit radio set now in use in your territory. Then, be sure you know the radio line from A to Z. Read and reread the sales literature. Study the schematics. Discuss each feature with the wholesale salesman or the sales manager. And the next time you are called upon to

(Turn to page 23)

**UNBEATABLE  
AND  
EASY TO OWN**



SUPREME 504

More than 3,000 SUPREME Model 504 Tube & Set Testers in constant and profitable service prove it to be the unbeatable value in the test equipment field. There are many combination tube and set testers but only SUPREME offers those necessary and desirable advantages found in the Model 504.

Take SPEED, for instance. As a multimeter, 31 ranges and functions are at your finger tips. Only two pin jacks and two rows of quick acting push buttons are necessary to give you complete control. Functional switches are on one side of the panel and range switches on the other side of the panel. All that is necessary is to press one button on the left hand row for the function desired and one button on the right hand row for the range desired.

As a tube tester, merely rotate the smooth acting roller chart to the type desired and "follow the arrows." Leakage tests are equally simple. With the same set-up just press one button after another on the right hand side of the panel. Using headphones a circuit insert is provided for checking noise, leakage, loose and bad connections.

As a complete battery tester the Model 504 provides the loads under which the battery is to operate. These loads for the most common portable radio batteries are plainly marked on the panel and the condition of the battery is indicated on an English reading "Replace—Good" scale.

Speed in testing electrolytic condensers too. All electrolytic capacitors, including high voltage filter capacitors and low voltage—high capacity by-pass condensers are checked at their CORRECT WORKING VOLTAGE on an English reading scale.

For ACCURACY the Model 504 is unsurpassed—a guaranteed over-all accuracy of 2% on D.C. and 3% on A.C. Contrast this with other instruments in which only the meter is guaranteed 2% or only the resistors to some percentage. SUPREME guarantees the OVER-ALL ACCURACY—not just one component part.

And, when we say 3% accuracy on A.C. functions we do not mean just at room temperature. The 504 incorporates an entirely new "Perma-grad" temperature compensated circuit. Each rectifier is individually matched with a specially wound spool of Hyltemco wire which nullifies the result of temperature change on the rectifier by re-acting in the opposite direction. Thus, accuracy is not guaranteed at just one temperature but is guaranteed to be within 3% over a wide range of from 40 to 95 degrees. You may be sure that your Model 504 is always accurate—summer or winter.

Protection against OBSOLESCENCE is important. The Model 504 is built to be modern today and to stay modern tomorrow. It provides for all filament voltages from 1.4 volts to the full line voltage, of course, but much more than that—it is the only instrument having the PATENTED DOUBLE FLOATING FILAMENT RETURN SELECTOR SYSTEM which automatically re-connects every tube socket to the proper arrangement while the instrument is being set up from the roller tube chart. Tube base connections on future tubes may change to any of the many hundreds of POSSIBLE arrangements and the 504 will take care of it—automatically—even unknown to the operator. That's why the 504 has only one socket for each type of tube—it is impossible to put a tube in the wrong socket.

These are just a few of the many PLUS advantages you have when you own a Model 504 Tube & Set Tester. It is beautiful in appearance, sturdily built, carries a year's free tube setting service and best of all, it is EASY TO OWN. If you can afford a telephone or if you can afford your cigarettes, you can afford the Model 504. This complete laboratory, combining a 7-way tube tester, a 31-range set tester and a complete condenser analyzer, costs you no more than 18c a day on the world's easiest installment terms.

**SUPREME**

For full information on Model 504 and complete Catalog of new, 1941 SUPREME test equipment, write

**SUPREME INSTRUMENTS CORP.**  
DEPT. 5D-11  
GREENWOOD, MISSISSIPPI

# Announcement:

On and after FEBRUARY 1st 1941  
 RADIO SERVICE-DEALER'S 1 year  
 subscription rate will be . . . . \$2.00  
 2 year subscriptions will be . . . . \$3.00

Until Feb. 1st we will accept subscriptions at our introductory half-price rates  
 \$1.00 for 12 issues — \$2.00 for 24 issues

**PAID SUBSCRIBERS MAY EXTEND THEIR PRESENT SUBSCRIPTIONS.**  
 Simply send \$1.00 for a 1 year or \$2.00 for a 2 year extension.

During the past seven months RSD has published *more and better* text material than any contemporary technical publication. This policy will be continued and expanded. As an authoritative source of accurate, exclusive, timely data RSD can be depended upon. In addition RSD now strives to bring a greater volume of profitable business to its select group of subscribers and the nation's best service-



A distinctive six-inch decalcomania lithographed in four colors (red, white, blue and gold) which will help your business, available Dec. 15th.

dealers. Study the Certified Service-Dealer plan inaugurated in this issue. It is a mark of distinction—proof of a radio service-dealer's technical ability and business integrity to be numbered amongst RSD's paid subscribers. So, hurry! Send your remittance at once. Take advantage of the money-saving subscription offer now in effect. Do it today!

(TEAR OUT AND MAIL TODAY)

## WORTH \$1.00—MAIL NOW!

Regular \$2.00 ANNUAL SUBSCRIPTION TO RSD COSTS BUT \$1.00 with this coupon. Good until Feb. 1, 1940.

RADIO SERVICE-DEALER, SOUNDMAN & JOBBER  
 11 West 42nd Street, New York, N. Y.

Sirs: Enclosed herewith is my  check (or  money order) for \$..... Please enter my annual subscription order (12 issues) at \$1.00 for 1 year or \$2.00 for 2 years, (24 issues)—1/2 the regular price. Foreign subscriptions are \$2.00 yearly. I believe the information given below is accurate. IF MY SUBSCRIPTION IS REJECTED I EXPECT TO RECEIVE IMMEDIATELY A REFUND IN FULL FOR THE AMOUNT ENCLOSED HEREWITH.

Name (print carefully) .....

ADDRESS ..... FIRM NAME ..... Est. 19....

CITY ..... STATE ..... YOUR POSITION .....

Please check whether firm is

- An independent servicing organization
- 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
- Manufacturer
- Any other classification (State it) .....

I belong to a serviceman's organization ..... Yes  ..... No

We stock the following checked items:

- TUBES
- PARTS
- 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

(From page 21)

service a hopeless receiver, *present your sales story*. Convert the technical features of the line into language your prospects can understand. By the use of analogies, you can present the features convincingly and in such a way that they will result in closing the sale—in spite of the competition offered by the non-technical salesman selling the same line. It may not work all of the time, but take my word for it, it works most of the time! And remember—the money is there for someone . . . it might as well be yours!

## APPOINTMENTS

**Southern-Ballam**—Harold Ballam, formerly associated with the Shuler Supply Company, has joined J. E. Muniot in the Southern Sellers Organization, manufacturer's representatives, in New Orleans, La.

**Solar-Merchant**—Solar Manufacturing Corp. announces the appointment as District Manager for the State of Michigan, of Mr. R. C. Merchant, 4829 Woodward Ave., Detroit.

**Kaar-Neely**—The Kaar Engineering Co., Palo Alto, Calif., has appointed Norman B. Neely, technical sales representative, as exclusive representative for Southern California and Arizona.

**RCA-Bliss-Strawn**—Appointment by RCA Manufacturing Co., Inc., of the *Bliss-Strawn Distributing Co.* as wholesale distributors of RCA Victor home entertainment products for the Detroit district has been announced. The newly-formed company operates branches in Detroit, Toledo and Grand Rapids to serve the Lower Michigan and the Northwest Ohio territories.

**RCA Promotes**—E. W. Ritter, former general manager of radio tube manufacturing, has been elected vice-president in charge of all the company's manufacturing and production engineering activities.

H. L. Sommerer, former manager of manufacturing, appointed assistant to Mr. Ritter. His responsibilities will cover all manufacturing activities in connection with national defense program activities.

E. W. Engstrom, former director of general research, appointed manager of all research activities of the company.

## NEW LITERATURE

**Birnbach Catalog**—No. 41, includes a complete line of antennas and transmission cables for f.m. and television, master antennas, etc. Also ceramic insulators, wire and cables, microphone connectors, radio hardware, etc. Birnbach Radio Co., Inc., 145 Hudson St., New York, N. Y.

**RCA Preferred-Type Tube Booklet**—A renewed drive to expand still further the already wide scope of the RCA Preferred Tube Type program, has been signaled by the issuance of a handy booklet on the subject by the RCA Manufacturing Company. Entitled "Preferred Tube Types, What They Mean To You", the booklet

is being distributed by the hundreds of thousands to dealers and servicemen.

Four important advantages that accrue to the radio dealer and distributor under the program are emphasized. These include lowered manufacturing costs and better radios, the renewal market for Preferred-type Tubes built up by the 5,000,000 1940 receivers using them, improved tube and receiver quality resulting from higher uniformity and greater skill on the part of tube assembly workers, and a constantly expanding market for Preferred-type Tubes as other receiver manufacturers standardize on the list of 36 tubes.

The booklet lists the following instrument manufacturers who use Preferred-type Tubes: Admiral, Andrea, Automatic, Detrola, DeWald, Emerson, Fada, Farnsworth, Garod, Gilfillan, Hallicrafters,

Packard-Bell, Pilot, RCA Victor, Sentinel, Sonora, Stromberg-Carlson and Wurlitzer.

**Jensen Data Sheet**—Jensen Radio Mfg. Co., 6601 S. Laramie Avenue, Chicago, have just issued a new Data Sheet (No. 199) fully describing a group of new extended-range high fidelity loudspeakers.

The new type "J" dual loudspeakers and eight-inch and twelve-inch single speakers are fully described and illustrated. The units are available separately or as complete reproducers in the Jensen Bass Reflex cabinets.

**Automotive**—The Automotive, Inc., 906 Rogers Ave., Fort Smith, Ark., distributors, have issued a new monthly Radio Service Bulletin, for serviceman and dealer.

## Now available for DIRECT MAIL—

**RADIO SERVICE-DEALER's List of 20,000 Independent Radio Servicemen and Service Organizations — Radio Dealers — Soundmen — Managers of Retailers' Service Departments — Radio Jobbers and their sales personnel.**

*These 20,000 men account for 90% of the nation's radio service and sound work each year—*

*for further information—write:* **RADIO SERVICE-DEALER**  
11 W. 42d St., New York, N. Y.

## "HAVING A SWELL TIME" WRITES ABNER BUGLE, "WISH YOU WERE HERE"

Abner Bugle is the man who used to write the advertisements for Sprague Condensers.

Nobody could juggle adjectives more gracefully than Abner and, when it came to slapping on the superlatives, even Abner admitted he was just about tops in his profession. But Abner ran into a snag one day, and here is how it happened:

"Look, boss," he wailed to the president of the advertising agency for which he worked. "I'm in a helluva fix. There's nothing more to say about Sprague Atom midget dry electrolytic condensers."

"What!" roared the president, gnashing his teeth so hard he bit the stem off his Meerschaum. "Don't be a fool, Bugle! Why, Atoms build up quicker. They stand higher surges. Their low leakage avoids overheating. They're smaller, and they've got more guts than —"

"I know all that," mourned Abner. "But every cheap condenser makes just about the same claims—whether they can live up to 'em or not. They may not be as good as Atoms in a radio set, but they look just as good in an ad. I don't know what to do."

"Jeepers Creepers, man!" the president's bellow shook the oil painting of the 50th million Sprague TC Tubular hanging on the wall. "And you say you're an advertising expert! Of course Atoms are better. They're unconditionally guaranteed. There isn't a firecracker in a carload—not in a trainload—two trainloads—three trainloads —"

"I know that, boss," wailed Abner. "But you can't PROVE those things in print. No



matter if he fills 'em with mush and wraps 'em in tissue paper, another manufacturer might CLAIM that his condensers are as good as Atoms."

The president did not reply. Grasping pad and pencil, he suddenly began to write. For two hours, Abner stood by, pale and wan and there was no other sound save the feverish scraping of the boss' gold pencil.

"Eureka!" shouted the president finally. "I've got it. Here's what we'll say in our next ad. Listen to this:

*"We're glad most condensers are bought on the basis of hard-boiled engineering tests rather than mere advertising claims. When quality is allowed to speak for itself, there can be no mistaking what it says. That's why Spragues are today specified by leading users throughout the world."*

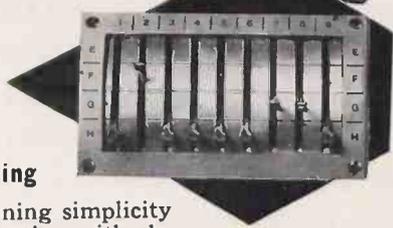
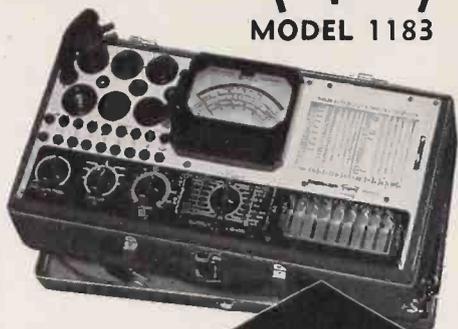
"Splendid copy, boss—and it's all true," said Abner, breathing a deep sigh of relief. "Splendid nothing!" snorted the president. "It's perfect. What's more, you're fired, Bugle. In the future, I'll write the Sprague ads myself."

### SPRAGUE PRODUCTS COMPANY North Adams, Mass.

P.S.—When last heard from, Abner Bugle had become a beachcomber in Tahiti. "Having a swell time—wish you were here," was what he wrote on the postcard, and added: "It's a great life. Beats advertising to a frazzie."

# NEW Combination Tester

**TRIPLET**  
MODEL 1183



## New Lever Switching

Combining simplicity of operation with absolute flexibility, Triplet's new lever switching permits individual control for each tube element—yet test procedure is simple and quick. The switch setting shown above will permit tests of 45 commonly used different type tubes without change of position of the levers. Many tubes require only two lever switch settings—more than half, only three settings.

Model 1183 is truly a Non-Obsolescent Tube Tester, combined with a Volt-Ohm-Milliammeter and Free Point Tester . . . three fundamental testers that you can use for many years. Volt-Ohm-Milliammeter Ranges: 0-10-50-250-500-1000 AC and DC Volts; DC at 10,000 Ohms per volt; AC at 2,000 Ohms per Volt. DC Milliampere 0-1-10-50-250; Resistance 0-500 low ohms; 0-150,000 Ohms; 0-1.5 and 0-15 Meg-ohms. Complete Free Point Tester with sockets for all tubes, including new Midgets. Tube Tester has new lever type switch. Speedex Roll Chart, removable from panel as separate unit. **Dealer Net Price \$49.84**

## MODEL 1200-F

This New Automatic Volt - Ohm - Milliammeter is Push-Button Operated — with 19 AC-DC Ranges; 25,000 Ohms per Volt DC, 1000 Ohms per Volt AC. Only one button need be pressed for any range and test setting. RED • DOT Lifetime Guaranteed Instrument . . .

Furnished in attractive metal case with rich brown suede enamel finish . . . Dealer Net Price \$27.84

For full cooperation with the National Defense Program, Triplet engineering and production facilities are being rapidly expanded to continue the service and delivery to which our trade is accustomed.

Write for Catalog—Section 4711 Harmon Drive

**THE TRIPLET ELECTRICAL INSTRUMENT CO.**  
Bluffton, Ohio



## PREFERRED TYPE TUBE ANNIVERSARY

**T**HE RCA Preferred Type Tube Program passes its first anniversary this month with the announcement that the number of receiving tube types it covers has been reduced from 36 to 31, and that two other types have been replaced to coincide with today's receiver design trends. The announcement was made to the industry at the Institute of Radio Engineers Convention at Rochester, N. Y., Nov. 11, 12, 13.

L. W. Teegarden, Manager of the RCA Tube and Equipment Division, made the announcement after pointing to the Program's first year of fulfilled promises of greater economy and higher quality, to its reception by a total of 19 radio set manufacturers, and to its direct benefit to every tube jobber and serviceman.

Three types, 1G4G, 1G6G and 6N7G, have been eliminated from the preference list as the result of a swing away from Class B audio systems by design engineers throughout the radio industry. Type 2A3 is becoming less and less popular with engineers, too, so that it has been dropped. The fifth deletion was accomplished by the program itself. It was found necessary to include both types 6J5 and 6J5GT in the original list because of a price difference. Increased volume of orders for the 6J5 has made possible manufacturing economies to bring its cost into competition with the 6J5GT, which has been deleted from the list.

Two changes of types on the list were caused by a growing tendency in the ac-dc set field for seven and eight tube receivers. The tube complement for such a receiver, if drawn from 150-milliamper tubes on the preference list, adds up to a greater heater voltage than the normal line voltage. So 6.3-volt 300-milliamper tubes must be substituted, although there have been no power output and rectifier types on the preference list useful for this purpose. Thus it is that types 25L6GT and 25Z6GT have been substituted on the list for types 12SJ7 and 12C8.

*Tabulation of the new list of preferred type receiving tubes. The number has been reduced from 36 to 31.*

"Some order has come out of the chaos in the tube industry in the past year," Mr. Teegarden declared. "Nearly a score of radio manufacturers have supported the RCA Preferred Type program by designing their receivers around the preferred type tubes. Results have been important in lowered costs all along the line, and in better and more uniform tubes.

"Now the RCA Preferred Type Program assumes more importance than ever before. The total number of tube types in the renewal market has passed 500, despite the fact that every type of radio can be designed around the comparative handful on the preference list. The RCA program moves into its second year to the betterment of the manufacturer, distributor, serviceman and public alike."

Mr. Teegarden said that currently nearly three quarters of all receiving tubes produced by RCA are concentrated in the preference list. Tube parts are now produced by mass production methods never before possible, and such parts as bases, shells, heaters, and cathodes have been standardized to affect further economies. In addition, manufacturers endorsing the program have watched their own costs go down substantially as they were able to standardize on tube sockets and other component parts, he said.

## SERVICEMAN'S DIARY

(From page 8)

on over to the customer's house. I had just put a new power transformer in a Stromberg 26 when the phone rang. It was Jerry.

"Say," he says apologetically, "I'm in trouble on this job."

"Oh," I said, "that's too bad, isn't it? But why bother calling me; why didn't you call up Bill to help you out? You know your customer hasn't any use for me."

"Skip it," he said impatiently. "I'm

## RECEIVING TUBE TYPES

PREFERENCE LIST

RECTIFIERS	INDICATOR TUBE	CONVERTERS	VOLTAGE AMPLIFIERS			DIODE DETECTOR	POWER AMPLIFIERS
			Single	Twin	with Diode(s)		
		1A7-GT	1N5-GT		1H5-GT		3Q5-GT
5U4-G 5Y3-G 6X5-GT	6U5/6G5	6SA7	6AB7 6J5 6SF5 6SJ7 6SK7	6SC7	6B8-G 6SQ7 6SR7	6H6	6F6-G 6K6-GT 6V6-GT
25Z6-GT 35Z5-GT		12SA7	12SK7	12SC7	12SQ7		25L6-GT 35L6-GT 50L6-GT

stuck. I've got a radio nurse in each room and they work perfectly. But you can't tell in the receiver which room the cries come from because they both sound alike. Now what do I do? She says I should take 'em back because she didn't need these gadgets to hear them cry. These kids have got lungs, and I don't mean maybe—"

"Okay, buddy," I told him. "Only you shouldn't have tried to work two transmitters on the same line with the same receiver. Just put *one* transmitter with *one* of the kids. If that one cries, then they'll hear it in the receiver. If they hear cries, and they don't come out of the receiver, then it's the other kid. Get me?"

"I got you." He sounded relieved. "Hold the wire a second."

A moment later I heard her voice over the phone.

"Your partner just told me that you had suggested a way of meeting the problem with just one radio nurse, and I can see that it will work. Thank you so much! I always tell my husband that a man must have brains to be the father of twins—"

"Yes," I told her, "it takes brains!"

## EMERSON RECEIVER

(From page 16)

may seem like gilding the lily, but if you will stop to reflect that a loop coupled to an external antenna remains, in itself, a signal collector, the advantages of the arrangement become obvious from the standpoint of noise interference. As an instance, the best noise-reducing antenna system may be of no practical value if coupled to an active loop positioned in a noise field, since the noise pickup in the loop cancels the effectiveness of the noise-reducing antenna system. If the receiver has a wide pass-band, the situation is that much worse. Hence, Emerson makes provisions for disconnecting the loop and the substitution of an input transformer when an external antenna is required for noise-free reception. But the convenience of loop operation is provided for locations where signal level is high and/or noise level low.

The triple-tuned i-f transformers *T4* and *T5* have a 10-kc bandwidth. Interstation interference at the band edges is eliminated by the 10-kc filter *C29-L1* in the grid circuit of the upper 6L6. The 6U5 electron-ray tube operating off the *avc* bus serves as an aid to proper tuning.

The cathodes of the 6SQ7 tubes are directly grounded. The grids are biased by the voltage drop across *R26* in the negative leg of the power supply. The lower 6SQ7 functions as a phase inverter.

The power supply employs a two-section filter, the first section consisting of the speaker field and the condensers *C41-*



## "Even-Speed" PHONO-MOTORS MODELS 80 and K

## The IDEAL REPLACEMENT UNITS at Sensational Prices

The Models 80 and K "Even-Speed" Motors are self-starting, light weight motors, ideally fitted for the rising replacement market. They are interchangeable in mounting; quickly and easily installed, and fit practically all standard phonograph and combination models.

### SPECIFICATIONS

"Even-Speed" Model 80 (illustrated above) is available for operation on 110 or 220 volt, 40, 50 or 60 cycle, source at 16 watts input in 8", 9", or 10" turntable sizes; Model K for 110 or 220 volt, 25 cycle operation in 8"

or 9" turntable sizes. Both are exceptionally quiet in operation—no gears—smooth, positive friction rim drive. Excellent regulation characteristics for uniformity of table speed. Ample proportioned bearings—large oil reserves. Forced ventilation for cool operation. Slip type fan precludes possibility of injury. Mounting plate maintains correct turntable height regardless of mounting board thickness.

### WRITE FOR PRICES

Mail a postcard today for prices and complete details on the "Even-Speed" Models 80 and K. Address Dept. R.

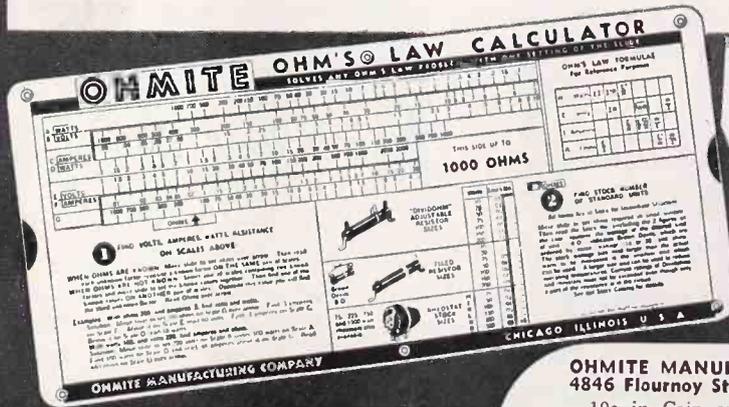
**ALLIANCE MFG. CO., ALLIANCE, OHIO**

## OHMITE Ohm's Law Calculator

### Solves any Ohm's Law problem with one setting of the slide

There's nothing else like it! It's the handiest Ohm's Law Calculator ever made—specially designed for you by Ohmite Engineers. Gives the answer to any Ohm's Law problem with one setting of the slide. Simple, easy, complete. Requires no slide rule knowledge. All values are direct reading. Covers the range of currents, resistances, wattages and

voltages commonly used in radio and commercial work. Also has convenient Stock Unit Selector—a setting of the slide tells the stock number of the resistor or rheostat you may need. Size 4 1/8" x 9". Available to you for only 10c to cover handling cost. At your Jobber, or send 10c in coin now.



It's  
NEW

It's  
Complete

OHMITE MANUFACTURING CO.  
4846 Flournoy St., Chicago, Illinois

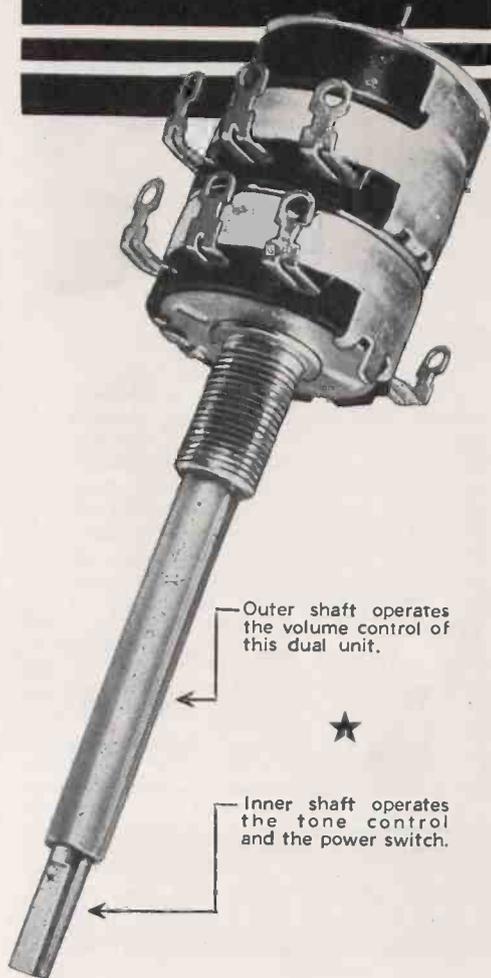
10c in Coin enclosed. Send Ohm's Law Calculator.

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Radio Serv.-Dealer—Nov.

Be Right with OHMITE  
RHEOSTATS • RESISTORS • TAP SWITCHES

## CONCENTRIC-SHAFT Dual Controls



Outer shaft operates the volume control of this dual unit.



Inner shaft operates the tone control and the power switch.

★ Yes, that really complete line of Clarostat Exact-Duplicate Replacements includes Concentric-Shaft Controls for those Philco and RCA sets.

★ You don't have to improvise when you standardize on Clarostat. You get the right data and the right replacement for the best job.

Ask for MANUAL . . .

★ Ask your jobber for copy of latest Clarostat Service Manual, with up-to-the-minute volume-control replacement listings. Or for the Plug-In Resistor Replacement Manual for 15c. Or write direct to . . .

**CLAROSTAT MFG. CO., Inc.**

Dept. 51, 285 N. 6th St. Brooklyn, N. Y.



C42. Plate and screen supply for the power tubes is taken from point 2. The second section of the filter consists of the electrolytic C40 and resistor R27. Plate and screen voltage for the remainder of the tubes is derived from this point.

The audio circuit is a riot of degeneration. It appears first in the balanced phase-inverter circuit. The power-tube grid leaks are returned to ground through R23. The voltage developed across this resistor is applied to the grid of the 6SQ7 phase inverter. Since R23 is common to both sides of the push-pull circuit, it carries out-of-phase voltages. The resulting degenerative action tends to compensate for differences in audio gain in each leg of the push-pull circuit.

Degeneration next appears in the 6L6 tube circuits. The common cathode bias resistor R28 is unbypassed. Feedback voltage from each plate is fed into the common cathode circuit through condensers C31 and C35, the resulting voltages being built up across R28. This is an interesting application, since differences in gain at any given frequency are compensated for by the self-balancing action of this dual feedback arrangement.

Thirdly, there is a compensated feedback circuit from the plate of the lower 6L6 to the volume control. The feedback voltage is developed across the resistor R16 in series with the volume control and ground. This feedback loop includes the frequency-compensating network composed of resistors R24-R25 and condensers C37-C38-C39.

The tone control is a three-position affair in the plate circuit of the power stage.

### VOLTAGE ANALYSIS

Readings should be taken with a 1000 ohms-per-volt meter. Voltages given below are from point indicated to ground (chassis) with the volume control turned on full and no signal. Readings hinge on a line voltage of 117.

#### VOLTAGE READINGS

Tube	Plate	Screen	Cathode
6K7	245	70	0
6SA7	245	70	0
6K7	235	70	0
6SQ7	125	—	0
6SQ7	150	—	0
6L6s	275	285	18.5

All heater readings should be 6.3 volts. Voltage drop across speaker field is 65 volts. Voltage at 5Z3 filament to ground is 350 volts.

### ADJUSTMENTS

An oscillator with frequencies of 455, 600 and 1600 kc should be used.

An output meter should be used across

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the voice coil or speaker output transformer for observing maximum response.

Use a standard dummy antenna or a .0002 mfd condenser for aligning the antenna coil.

Always use as weak a test signal as possible during alignment.

The last motion in adjusting trimmers should always be a tightening one, not a loosening one.

Never leave the trimmer with the outside plate so loose that there is no tension on the screw. Either bend the plate up or remove the screw entirely. Loose screws are a sure source of noise, drifting, and microphonism.

### LOCATION OF COILS AND TRIMMERS

The two triple-tuned i-f transformers are mounted in cans on the top of the chassis. The trimmers are available through holes in the tops of the cans. The copper colored screw is for the tertiary coil. The first i-f transformer is the one at the left side of the chassis.

The broadcast antenna coil is the open coil on the top of the chassis between the 6SA7G and the 6K7GT i-f tube. The trimmer for the coil is mounted on top of the coil.

The interstage coil is the larger of the two coils underneath the chassis. Its trimmer is located on the right end section of the variable condenser.

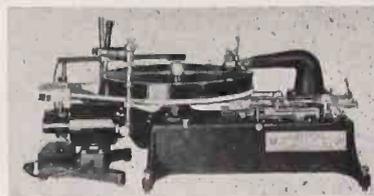
The oscillator coil is the smaller of the two coils underneath the chassis. Its trimmer is located on the center section of the variable condenser.

The trimmer for the loop is mounted on the loop board.

### I-F ALIGNMENT

Push the switch at the rear of the chassis to "external antenna" and feed 455 kc through a .01 mfd condenser to the grid of the 6K7 i-f tube. Unscrew the copper colored screw of the second i-f transformer as far as possible and then align the other trimmers of this transformer for maximum response. Shift the input to the grid of the 6SA7 (clip input to stator lug of right end section of variable condenser) and repeat the same procedure on the first i-f transformer. Do not disturb the alignment of the second i-f transformer. Feed the signal again to the 6K7GT i-f tube, shunt the primary and secondary of the second i-f transformer with 25,000 ohm resistors, and adjust the tertiary (copper color) trimmer for maximum response. Again feed the grid of the 6SA7, shunt the primary and secondary of the first i-f transformer with resistors and then, without removing the shunting resistors from the second transformer, adjust the first transformer tertiary for maximum response. Do not disturb the alignment of any of the second i-f trimmers. Remove the resistors and sweep the signal

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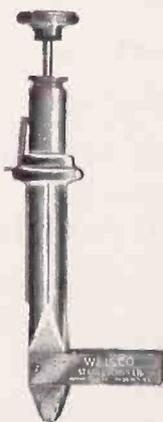
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generator through the band. The response should be quite flat with a slight peak in the middle, with a band width of about 10-12 kilocycles.

Visual alignment may be used in which case a similar procedure should be followed except that it will be unnecessary to shunt the transformers with resistors. With either method of adjustment, however, the alignment should be repeated until a satisfactory, broad response curve is obtained or the fidelity of reception will be seriously impaired.

### R-F ALIGNMENT

With the switch at the rear of the chassis in the position marked "external antenna" set the pointer at 60 and feed 600 kc to the external antenna lead through a standard dummy antenna or a 0.0002 mfd mica condenser. Adjust the series padder (located at the left of the variable condenser, on the top of the chassis) for maximum response. Move the pointer to 160, feed 1600 kc and align first the oscillator trimmer (right end condenser section) and then the interstage and antenna trimmers (see preceding for location) for maximum response. Return to 600 kc and adjust the series padder (while rocking the variable back and forth) for maximum response. Realign at 1600 kc.

To align the loop, set the dial pointer at 160. Set the signal generator at 1600 kc and feed its output into a loop of wire about 12 inches in diameter. Hold this radiating loop about 12 inches from and parallel to the receiver loop antenna. Advance the output of the signal generator until deflection is obtained on the output meter and then adjust trimmer on loop for maximum response.

★  
*RCA HAM GUIDE, 48 pages and paper cover, 8½" by 11", illustrated. Published by RCA Manufacturing Co., Inc., Harrison, N. J. Price 15 cents.*

This Guide is intended primarily for the radio amateur. In its pages are given authoritative technical data on RCA's popular amateur transmitting tubes, carefully proved circuits for utilizing them to best advantage, and helpful information on the design and operation of amateur transmitters. Detailed descriptions with illustrations for constructing two complete amateur transmitters are shown on pages 29 to 47. Included is a 5-band cathode-modulated phone & c.w. job.

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RCA goes farther even than that! From the experience and proof-of-performance of the past year, RCA now makes the still more sensational statement: “Only **31** Preferred Types will cover virtually every requirement for modern radio receivers.” Another great step!

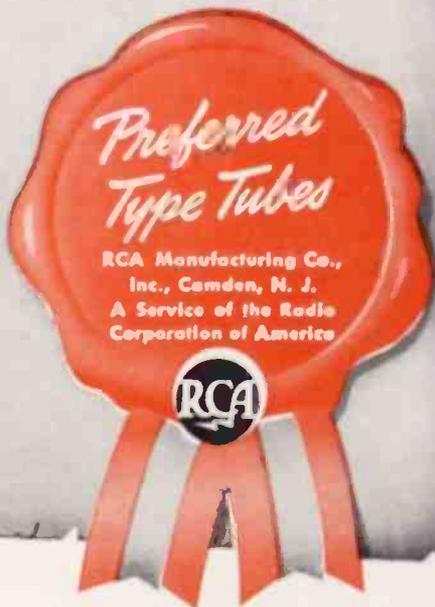
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