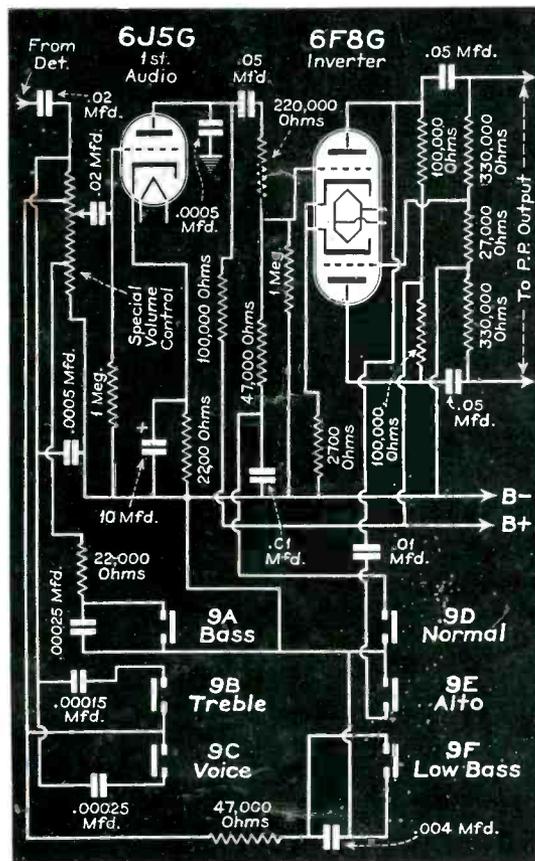


# SERVICE

A Monthly Digest of

# RADIO

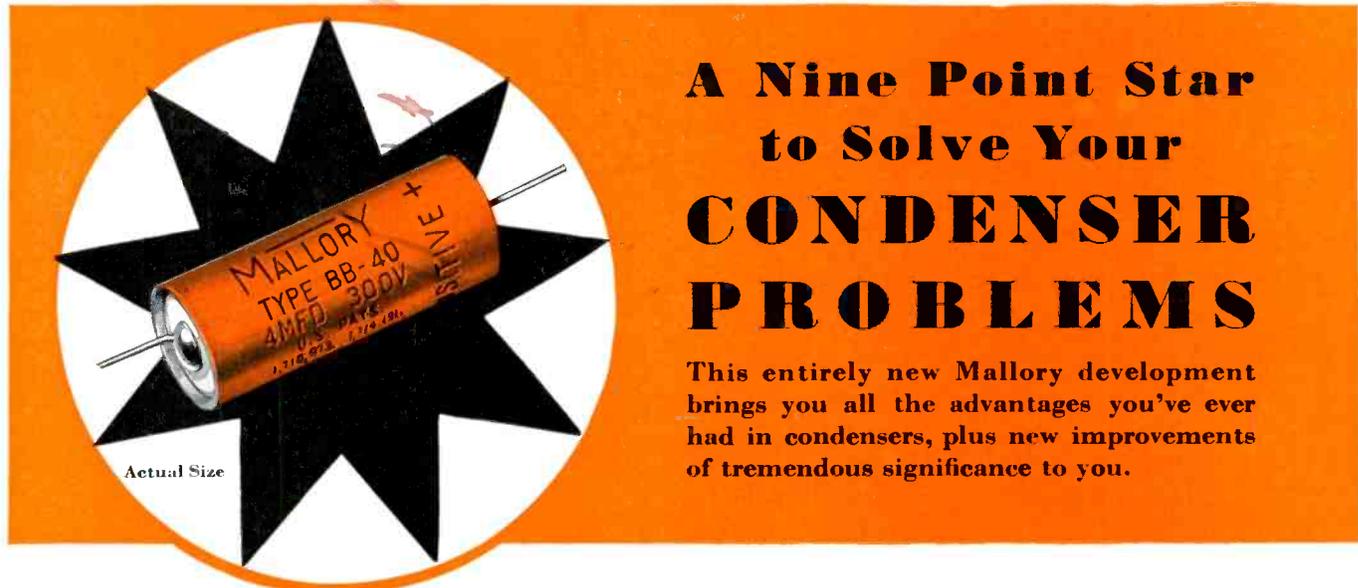
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AUGUST  
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Radiorgan  
(See page 33)



## A Nine Point Star to Solve Your **CONDENSER PROBLEMS**

This entirely new Mallory development brings you all the advantages you've ever had in condensers, plus new improvements of tremendous significance to you.

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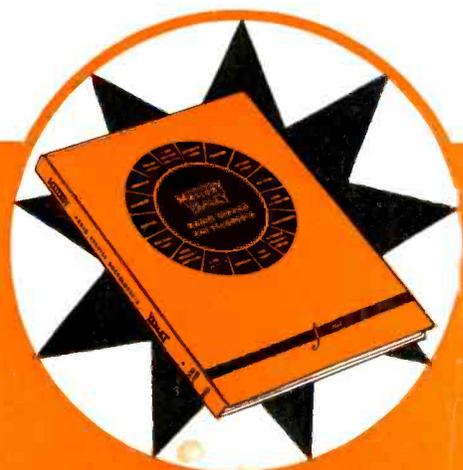
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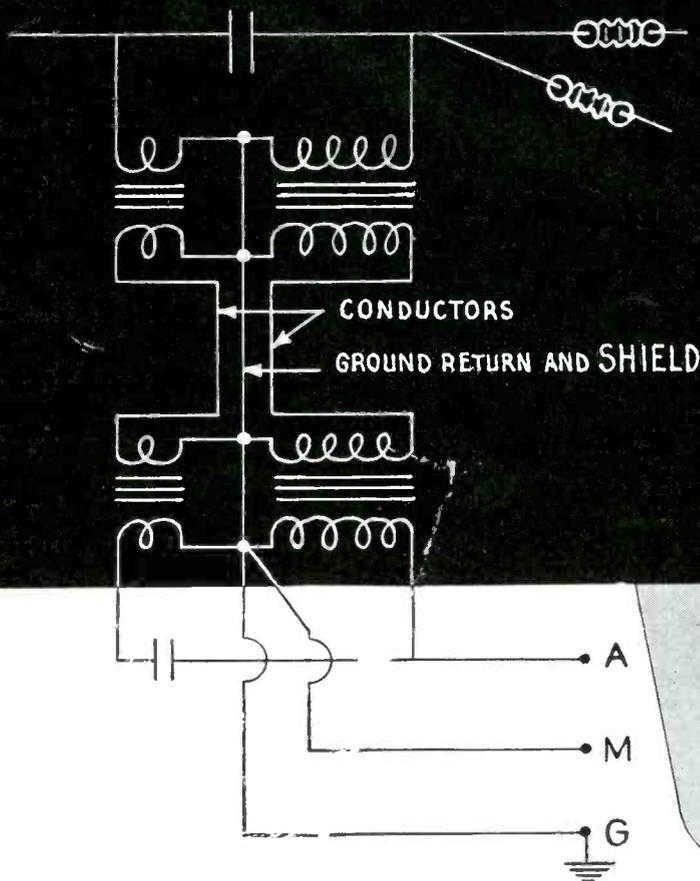
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# You Ought to Know WHAT'S IN THIS



## New Clear Channel Antenna System



**UNIQUE NEW DESIGN**—Result of long, careful research. The new Belden Clear Channel Antenna System provides ALL the following features:

- 1—A clear channel and uniform performance over the entire wave band from 400 to 22,000 kc. No dead spots.
- 2—A shielded transmission line which reduces noise and makes possible a convenient ground connection for the antenna coupler.
- 3—A shield on the transmission line which functions as a lightning arrester because it grounds any accumulated electrostatic charges.
- 4—A system that transfers greater radio power from the antenna to the receiver because of the iron core couplers and the clear channel transmission line.
- 5—An antenna that is very easy to erect and once erected, it retains a neat appearance longer with minimum risk of breakage due to wind or ice.
- 6—Elimination of man-made electrical interferences.

**BELDEN QUALITY**—has been built into this Clear Channel System. Beldenamel aerial—shielded low loss, 2-channel transmission line—special Belden Iron Core Transformers in the coupling system—these provide the finest antenna system ever produced.

**EXTRA SALES AND PROFITS**—Sell the new Belden Power Line Filter when you sell a new antenna. Eliminate the “Back Door” noises and complete your job of cutting out man-made interference.

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A big national advertising campaign in Saturday Evening Post and Collier's will boost your antenna system sales and increase your service business. Be sure to tie in.

**Watch for Your Announcement**

# Belden

**The Radio Wiring Line**

AUGUST, 1938 •

SAY YOU SAW IT IN SERVICE

1

# SERVICE

A Monthly Digest of Radio and Allied Maintenance  
Reg. U. S. Patent Office. Member, Audit Bureau of Circulations

AUGUST, 1938

EDITOR  
Robert G. Herzog

VOL. 7, NO. 8

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SANFORD R. COWAN  
*Manager*

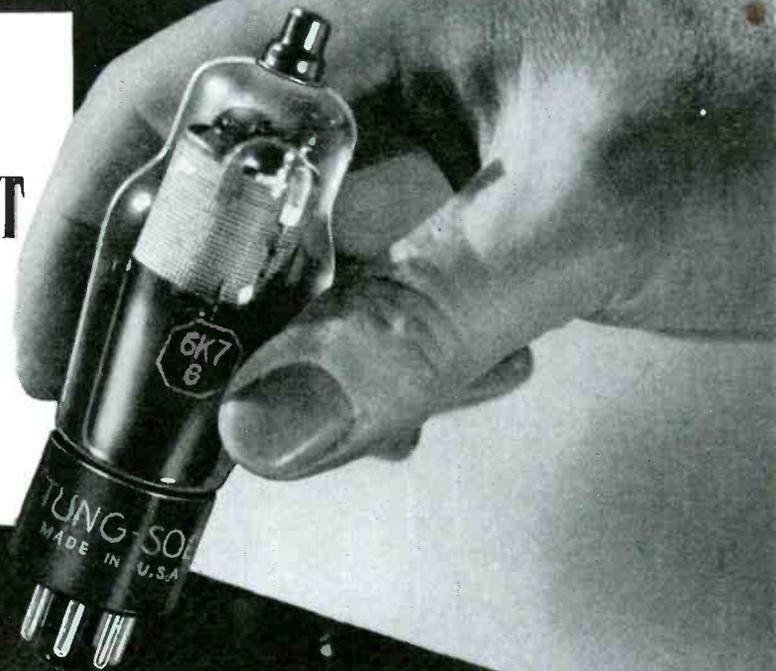
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**TOO BAD** THERE AREN'T  
**METERS TO CHECK** *profits*



**S**UPPOSE your tube checker *did* have a profit and loss dial. Which way would the needle swing?

Would it indicate that investment losses due to slow turnover, obsolete stock and cut-price competition are cutting into your profits?

Under the Tung-Sol Consignment Plan, the needle *always* reads plus. Your profits are guaranteed, because you pay only for the tubes you sell *after* you sell them.

Thousands of dealers who could qualify have found this plan the means to profitable radio tube sales. Our nearest office will be glad to furnish you with details.

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# THE ANTENNA . . .

---

## SERVICE CHARGES

THERE HAS BEEN SO much said, and on the whole so very well said, on the subject of service charges that we feel guilty in raising the subject.

In his article in this issue, Mr. Rhine advocates boosting service charges. There is much to be said in favor of his viewpoint and very little that can be said to oppose it.

With few exceptions prices, in all business enterprises, automatically stabilize at a level which provides the company with a fair profit and at the same time provides the purchaser value for his money. There are, of course, many factors that will disturb the price level in a business—factors such as the necessity for increased wages, or increased taxes.

Since production, sales distribution and advertising costs are computed in much the same way in practically all businesses, it turns out that there is a definite relation in "dollar value" between the products of one industry and those of another. Thus an automobile is no more "expensive" than say, a radio set.

The same sort of price level usually applies to businesses and professions where the individual or organization charges for a given service. But here again the price level may go up one year and down the next, depending upon outside conditions.

Men of all professions and businesses have gone through lean years. Prices and charges for services dropped off, but most of these prices and charges have been rising for the past few years. It is time that service charges followed the general increase in other fields. It is especially warranted in view of the fact that radio entertainment is more in demand today than it was a few years ago.

One thing you should try to impress upon your customers before you mention higher charges, is that the modern receiver is as delicate in adjustment as a fine watch. Most people know what poor work can do to a good watch, and it is about time they realized what poor work can do to a radio receiver.

. . .

## NATIONAL ANTENNA CHECKUP WEEK

MANUFACTURERS OF ANTENNA equipment are cooperating to make the week of October 15 to 22 "National Antenna Checkup Week."

It can be readily conceded that the antenna can be your natural entrée in a canvass for new business. This canvass can be either through the mail or from door to door. In either case you should make your approach personal, for example:

"Mrs. Brown, if you will take one look at your antenna

you will see that it is not all that it should be. Only yesterday, Mrs. Jones across the street had us put up one of the latest all-wave antennas and she was indeed pleased with the improvement both in improved foreign reception and in the reduction of noise and in the clarity of reception on all programs. There were noises that spoiled some of her favorite programs. . . . Perhaps you have had similar trouble lately. The newer types of antennas work wonders especially on modern receivers. . . ."

Take advantage of the national advertising campaign that the National Antenna Checkup Week will perpetrate. Plan to canvass for new prospects on the basis of new antenna installations.

. . .

## PREPARE FOR FALL BUSINESS

WITH THE SUMMER NEARING its end, vacation time is over and the usual fall spurt of service business will start.

Now is the time for all efficient Service Men to take inventory of their parts and tubes and make sure that they are adequately equipped for this increased business. Place your orders now for the missing items and get set for a profitable season.

. . .

## KEEP UP TO DATE

TO OPERATE EFFICIENTLY you must have an up to the minute knowledge of what is happening in the field. You must learn all about new parts—new equipment—new devices—new methods.

We know of no better place to obtain this information than from the catalogs and bulletins released by the parts and equipment manufacturers. These manufacturers spend thousands of dollars annually to present this information for your use. In most cases it is yours for the asking.

We can enumerate dozens of recent innovations which make it possible for you to accomplish your work in less time, at a lower cost, and yet with more lasting results.

Consider for example the midget electrolytic condensers recently introduced—the light weight permanent magnet dynamic speakers—the low priced home recording equipment—push-button testers—improved microphones—push-button tuners—high power mobile and portable p-a equipment—and so on almost without end.

Make it a point to write for literature regularly. The manufacturers welcome your requests.

# The RIDER Chanalyst

A Few of the Major Tests You Can Conduct with this New Instrument while the Receiver is in Operation.

**1.** Trace passage of signal through receiver from antenna to speaker in r-f, i-f or a-f stages, enabling you to establish where it exists, dies, becomes weakened—where it becomes distorted and where it takes on hum—without interfering with the operation of the receiver.

Check gain or loss or noise in r-f, i-f or a-f stages. Possible to break into any part of the signal circuits of the receiver under test in order to examine the character of the signal during operation.

**2.** Check actual operating voltages at any point in the receiver without loading the circuit.

Because of the unique and original design of the voltmeter in the Rider Chanalyst, you can measure operating voltages at tube elements or in high resistance circuits without changing the constants of the circuit and while the signal is passing through the receiver.

**3.** Accurately check actual control voltages developed by the signal and present at the tube elements—without interfering with the normal operation of the receiver.

Because of special design, the voltmeter in the Rider Chanalyst is capable of measuring the actual avc or other control voltages directly at the control grid of a detector, amplifier or oscillator tube during actual operation—that is, with the signal present in the tube circuit.

The avc channel characteristics can be established with the greatest of ease—avc control voltages can likewise be measured whenever present—despite high resistance or balanced networks.

**4.** Check bad padders, frequency and drift in the oscillator section in a superheterodyne.

Constant check of the performance of the oscillator in a superheterodyne with frequency calibrations up to 15 megacycles and check of operation of the oscillator section of the receiver—up to 70 megacycles.

**5.** Instantly check wattage consumption of the receiver during actual operation.

**6.** Quickly locates troubles in intermittent receivers.

The test channels available in the Rider Chanalyst provide a means of separating a complete receiver into five basic sections. Each of these sections has its own indicator. When an intermittent condition develops, the indicators show the presence or absence of the signal in the various sections—the change in voltage consumption and operating voltage—if any. By interpreting the indications—you can localize the fault as being in a certain part.

**Go To Your Jobber For DEMONSTRATION**

AUGUST, 1938 •

**WAIT**

THE GREATEST ADVANCE EVER MADE IN THE HISTORY OF SERVICING INSTRUMENTS

**THE RIDER CHANALYST**

**SEND FOR THIS 16-PAGE FREE BOOKLET FIRST!**

**Complete Details on The Instrument Everyone is Talking About**

Hold everything until you've read this 16-page booklet on the Rider Chanalyst! It's written by John F. Rider, and is yours for the asking. It tells the how and why of the Rider Chanalyst—What it is . . . What it does . . . How it works . . . How it enables you to speed-test your service jobs — everything you want to know about this revolutionary new instrument. As you read through its pages you will learn how the Chanalyst enables you to trace the passage of the signal from the antenna to the loudspeaker in r-f, a-f or i-f stages, and localize troubles in each stage . . . How to check operating voltages at any point in the receiver without loading the circuit, no matter how complicated the circuit . . . How to check actual control voltages developed by the signal and present at the tube elements—a.v.c. and a.f.c. characteristics . . . How to check bad padders and

coils in oscillator section in a superheterodyne . . . How to instantly check wattage consumption of the receiver during actual operation . . . How to quickly spot and localize troubles in intermittent receivers.

These are only a few of the multitude of tests which the Chanalyst makes possible. Send for your free booklet today on this remarkable, essential basic new instrument.

**"THERE'S ONLY ONE RIDER CHANALYST"**

**SERVICE INSTRUMENTS, Inc.**  
410 FOURTH AVE., NEW YORK CITY

**SEND FOR BOOKLET See Your Jobber for Demonstration**

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Please send descriptive booklet on the Rider Chanalyst.

Name.....

Address.....

SAY YOU SAW IT IN SERVICE

# Utah VIBRATORS



## Help Guide

### THE SWEDISH FISHING FLEETS

Even the little fishing villages of far off Sweden know Utah Vibrator dependability. Scouting boats with Utah-equipped radios cruise the seas hunting for the catch. Once found, word is flashed to the waiting fishing fleet in the harbor and out it goes. Gone are the days of fruitless searching—the radio equipped scout boats make every hour at sea profitable.

Weather reports flashed by radio to the busy fishing boats minimize the danger of sudden storms. The very lives and livelihood of this sturdy people are dependent on the uninterrupted operation of their radios. Utah Vibrators were selected for this important job because of their dependability, long life and precision performance under the handicap of highly unfavorable operating conditions.

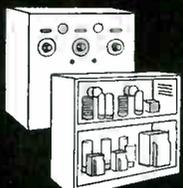
In America, too, you'll find Utah vibrators selected for the same reasons;—you can rely on Utah quality. Insist on Utah when purchasing replacement vibrators—your customers will appreciate their long life and dependable service.



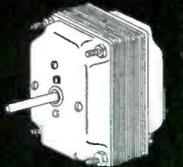
SPEAKERS



VIBRATORS



AMATEUR TRANSMITTER KITS



MIDGET MOTORS



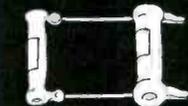
TRANSFORMERS AND CHOKES



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VITREOUS RESISTORS



SWITCHES

U T A H RADIO PRODUCTS CO.  
CHICAGO, U.S.A. CABLE: UTARADIO, CHICAGO

DEPENDABLE SINCE 1922

# SERVICE

A Monthly Digest of Radio and Allied Maintenance

FOR AUGUST, 1938

## LOCATING DISTORTION WITH A MILLIAMMETER

By R. LORENZEN

EVEN WHEN THE VERY best parts available have been used a considerable amount of distortion may originate in an amplifier due to incorrect grid and plate voltages.

In Fig. 1 a typical amplifier stage is shown with a milliammeter in the plate circuit. The range of the milliammeter is such that the current indicating pointer falls approximately in the middle of the scale for the particular tube used when no signal is impressed on the grid. In other words, the range of the meter should be approximately twice the normal plate current of the tube. For example, a 2A3 with 250 volts on the plate and -45 volts on the grid would draw 60 milliamperes, so that a milliammeter having a range of 100 milliamperes would be used. The minus post of the milliammeter is connected to the plate.

### THE GRID VOLTAGE-PLATE CURRENT CHARACTERISTIC

In Fig. 2 is shown the static characteristic curve of a triode. This is the grid voltage-plate current characteristic (the  $e_g - i_p$  characteristic) and is obtained by varying the grid voltage ( $e_g$ ) while maintaining the plate voltage ( $e_p$ ) constant. The resulting values of plate current ( $i_p$ ) are then plotted.

It will be noted that this curve differs considerably in appearance from the characteristic curves given in vacuum

FROM ANTENNA TO LOUD-SPEAKER in a receiver there is hardly a piece of apparatus in the circuit which does not aid in causing distortion to raise its ugly head, much to the annoyance of the listener. Since a large amount of distortion originates in the audio frequency amplifier, the present article will describe a simple but accurate method of locating and eliminating distortion in Class A amplifiers and which requires as its only piece of test equipment the common milliammeter.

tube handbooks. The curves given in the handbooks are the plate voltage-plate current characteristics (the  $e_p - i_p$  characteristics) and are obtained by varying the plate voltage ( $e_p$ ) while maintaining the grid voltage ( $e_g$ ) constant, and plotting the various values of plate current. For each different value of constant grid voltage a different plate voltage-plate current curve is obtained. The grid voltage-plate current characteristic of Fig. 2 can be obtained from the plate voltage-plate current curves by replotting the proper values on a graph paper with the horizontal axis as grid voltage instead of plate voltage and the vertical axis representing plate current.

The characteristic curve XYZR, in Fig. 2, has a shape somewhat like the

letter S. The portions QX and ZR are curved, whereas the XYZ section is substantially a straight line. For distortionless a-f amplification only the straight section XZ can be used. The correct value of grid bias is such, that when there is no signal impressed upon the grid, the point Y falls midway between X and Z. The grid bias is then represented by OK and the plate current by ON.

### NORMAL OPERATION

Now let there be impressed upon the grid the sine-wave voltage ABCDE. This alternating voltage makes the grid less negative or more negative as it subtracts or adds its potential to that of the fixed grid bias K. As the sine voltage varies from A to B the grid voltage varies from K to L and when the sine voltage reaches B the voltage on the grid is at L and is represented in magnitude by OL. As the grid voltage moves from K to L the point of operation on the characteristic curve moves from Y to Z. Point Z on the characteristic represents a plate current of OT. Consequently, as the sine voltage on the grid varies from A to B the plate current has increased from a to b. Similarly, as the grid voltage swings from B to C the plate current decreases from b to c.

As the impressed voltage varies from

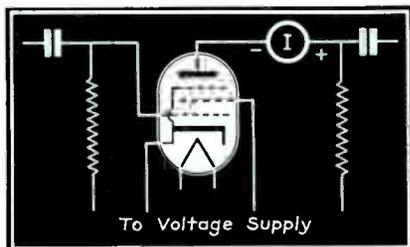


Fig. 1. A milliammeter in the plate circuit of a Class A amplifier will indicate distortion caused by incorrect grid bias or plate voltage.

MILLI-AMMETER DEFLECTION	GRID BIAS	PLATE VOLTAGE
Up	Excessive	Too Low
Down	Insufficient	Too Great



mended by the manufacturer. There are occasions, however, when it is desired that the grid bias be of some definite value. Distortion may then result due to the plate having a voltage which is either too high or too low for that particular grid bias.

#### PLATE VOLTAGE CHANGES

In Fig. 5 the effects upon the characteristic curves of a vacuum tube, when various voltages are applied to its anode, are shown. It will be noticed that as the plate voltage  $E_p$  is increased the straight portion of the characteristic becomes longer and also that the curves are shifted to the left.

When there is no incoming signal, the grid bias  $K$  will result in operation at point  $Y$  on the  $E_p = 250$  characteristic and consequently a plate current  $N$  will flow. This same grid bias  $K$ , however, will result in operation at point  $Y''$  on the  $E_p = 200$  characteristic, with a plate current  $N''$ ; and at point  $Y'$  on the  $E_p = 300$  characteristic, with a plate current  $N'$ .

If a sine-wave voltage  $ABCDE$  is now impressed upon the grid, the instantaneous grid voltage will swing between the limits  $J$  and  $L$  about the fixed point  $K$ . On the  $E_p = 250$  characteristic the grid swing from  $J$  to  $L$  will result in operation between points  $S$  and  $Y$ . Since portion  $X$  to  $Z$  on the characteristic is a straight line, the plate current output wave will be  $abcde$  which is an exact but amplified copy of the input signal. Under these circumstances there is no distortion. Since the increase in plate current from  $N$  to  $T$  is equal to the decrease from  $N$  to  $M$ , a milliammeter in the plate circuit of the tube will indicate no change in plate current when the grid is affected by a signal, that is, whether a signal is applied to the grid or not the plate current remains the same.

When the same sine-wave signal  $ABCDE$  is applied to the grid of the tube having the  $E_p = 200$  characteristic different results are obtained. The grid swing from  $K$  to  $L$  causes the tube to be operated between  $Y''$  and  $Z''$  of its characteristic, and this section is substantially straight, a normal increase  $N''T''$  in plate current ensues. The grid swing from  $K$  to  $J$  operates the tube on a curved portion of its characteristic  $X''Y''$  and this results in a smaller than normal decrease  $N''M''$  in plate current. The average value of plate current for the cycle is  $H$  which is greater than the no-signal value  $N''$ . A milliammeter in the plate circuit of the tube will, therefore, deflect upwards when a signal is applied to the grid. The remedy is to increase the plate voltage until no deflection occurs.

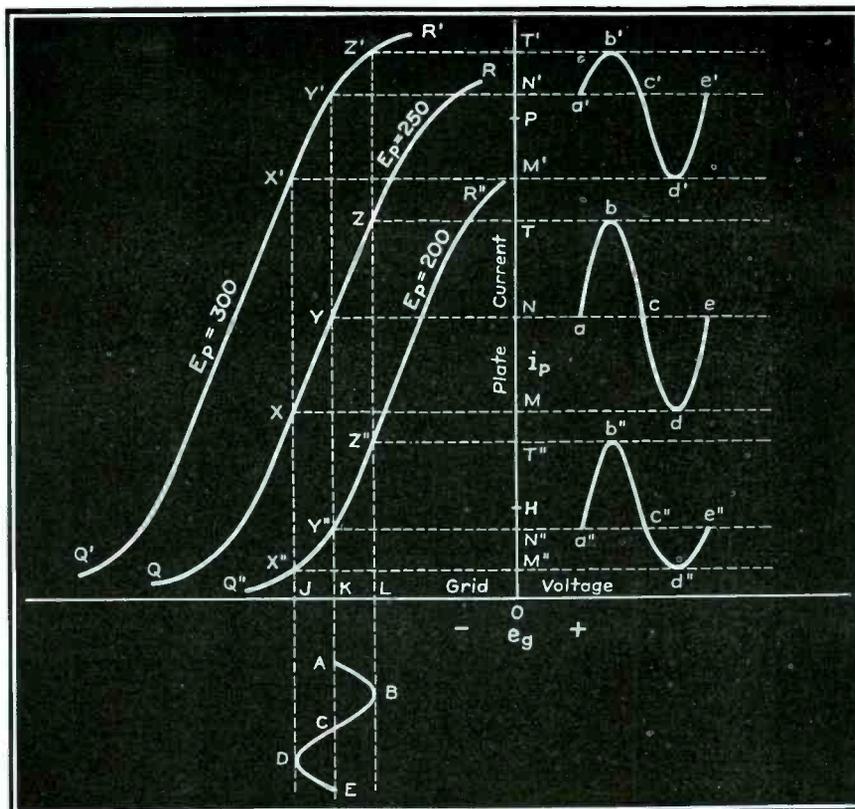


Fig. 5. The  $e_g-i_p$  characteristic curves for various plate voltages. Operation is shown for normal, too much and too little plate voltage. The milliammeter effects are listed in the chart in Fig. 1.

However, when the plate potential is raised to 300 volts the grid bias  $K$  causes the tube to be operated at point  $Y'$  of the  $E_p = 300$  characteristic. The grid in swinging from  $K$  to  $L$  results in tube operation on the curved portion  $Y'Z'$  of its characteristic and consequently there is a less than normal increase of plate current. The grid in swinging from  $K$  to  $J$  operates on section  $X'Y'$  of the characteristic, and this, being substantially straight, effects a normal decrease in plate current. The average plate current for the cycle is  $P$  and this is less than the no-signal plate current  $N'$ . Accordingly, a milliammeter in the plate circuit will deflect downwards when a signal is applied to the grid. Under such circumstances, lower the plate voltage until there is no change in plate current whether there is a signal applied to the tube or not.

#### PROCEDURE

In applying the milliammeter deflection test to determine whether the vacuum tubes in an a-f amplifier are being properly operated it is well to test each stage of amplification separately. Once a stage has been checked and, if necessary, grid bias and plate voltage corrected, this stage may be used in conjunction with the preceding or following stage in order to obtain a greater deflection on the milliammeter, if desired.

Although any source of audio frequency, such as, for example, that obtained from the radio itself, or from an a-f oscillator, may be used, it is preferable to use phonograph records in conjunction with a pickup. The high side of the pickup is connected to the grid of the tube under test and the low side to ground. No change in the circuit need be made except the insertion of the plate milliammeter.

Not all types of phonograph records are suitable, however, in making this test. The best records not only have a large dynamic range (very soft to very loud) but also a loud portion must immediately follow a soft passage throughout the record as such sections are the only ones usable. Since the dynamic range of dance music is very small such records cannot be used. Symphonies are very good for this purpose.

The first side of Gershwin's "Rhapsody in Blue," the Egon Petri rendition of "Beethoven's Piano Sonata, Opus 78" (Columbia), and the Toscanini version of Rossini's "Semiramide Overture" (RCA-Victor) are suitable.

The soft parts of the record are, for all practical purposes, equivalent to a no-signal voltage on the grid. Then, when a sudden crescendo occurs watch the milliammeter pointer.

The chart shown in Fig. 1 tabulates in convenient form the described effects.

# THUMBS DOWN ON FREE CALLS

By ARTHUR E. RHINE

MANY A WELL INTENTIONED and inherently honest Service Man makes, or has made, free service calls. No one really wants to render free service of any kind but some have felt that they were forced to adopt the practice of advertising and completing such calls because of competition. Some felt that the practice would attract customers. Others believed the customer should not be required to pay a service fee for a mere inspection.

## "FREE" SERVICE DISHONEST

The practice of advertising free, 25c and 50c service calls is, in my opinion, a thoroughly dishonest practice. The thoroughly honest Service Man has been either too dumb to realize the fallacy of the practice or, though honest as he has been with his customers, he does not hesitate to cheat himself. That is if he makes no attempt to recover the loss when he is ordered to repair the receiver. If he adds enough to his estimate to cover the loss sustained in making the free call, he is, of course, cheating the customer. He has established himself as one who had no honesty of purpose to begin with. Customers will sooner or later realize that they have been victimized. They are as smart as you. They know that nothing is free in this business world. They are skeptical from the start and will soon detect the flaw in your system. Their opinion of you could not possibly be of a high order.

I know that some of you are urged to ask why people call these free, 25c and 50c operators. No psychological explanation is required, merely common sense. When a customer calls a free operator he has decided, since he knows

You can't pay your bills with the income from free service calls.

CASH		BOOK	
DEBIT		CREDIT	
Rent	\$ \$		
Labor	\$ \$	From Free Calls	0 00
Bar Expense	\$ \$		
<b>Total</b>	<b>\$ \$</b>	<b>Total</b>	<b>0 00</b>
		<b>Deficit</b>	<b>\$ \$</b>

EXPERIENCED OPERATORS ATTEMPT no free or unprofitable 25¢ or 50¢ service calls. Since they have been bitten once they would be the first to endorse Mr. Rhine's statements in this article. It is to you Service Men who have not yet seen the light for whom these remarks are intended.

In planning the future on your good ship Radio Service, avoid the shoals or your bark will surely be wrecked . . . pounded to smithereens on the rocks of Free Service Inlet; 25¢ Cliffs; or 50¢ Rapids.

Do you have to suffer some sad experiences to determine these truths for yourself? Would you not prove yourself a better navigator if you were to believe an old Service Mariner?

nothing of his comparative efficiency, the man may be as efficient as any other. If a one dollar man were called, and no agreement reached as to price, that man will walk out of the house with his dollar without having accomplished anything other than testing the receiver. Whereas, with the free Service Man not only may any excessive estimate be discarded without payment of a fee, but some free service may actually be rendered . . . perhaps enough to restore the receiver to operation. Such a customer has been invited to feel that he has everything to gain and nothing to lose. The customer may not really believe that the free verdict will result in restoring operation without cost but he does definitely hope that it will. If he finds that he has missed his guess, he says to himself, "What have I lost." Before he calls you he says, "What can I lose."

I say that no man plans to, or intends to render free service to any customer. In my opinion, there is no such thing as a free service call. It is true that we all have call backs to homes where the jobs recently repaired by us have gone sour. Such a call is not a free call. The customer has paid your price. You have guaranteed your work. The service has been paid for and you are called upon to make good the time which you now owe such a customer. Your estimate should have taken the possible callback into consideration. If you are a proficient operator, you have covered yourself for just such an emergency. Your making

good is a definite investment in good will which is priceless.

Those who advertise and complete free service calls could make them all day long without charge to the customer. However, since the intent is not to render the time without charge or without making it up somehow, the practice may be properly labelled dishonest. If you did succeed in making a free service call and arrive back in your shop one hour after you originally left it, the fun has cost you \$1.87½ in labor, overhead and other fixed charges. If you were out only half an hour it wasn't so bad . . . it only cost \$.93¾.

## PYRAMIDING LOSSES

The practice of concentrated accumulation accomplished by multiplying results is called pyramiding. No one desires to pyramid things like poverty, woe, distress or money losses. In my opinion, there is no surer way known to succeed in pyramiding actual cash losses than by making service calls for any sum which represents an amount under the actual cost of the time involved. When 10 free calls representing a total loss of 10 times \$1.87½ shall have been made, \$18.75 will have been lost beyond recall. If the practice is continued such an operator will find himself pyramided out of the picture in a very short time unless he sells new radios and applies the profits from the sales to the losses in the service department.

The neighborhood butcher could not last very long with a sign like this in his window.

**INDEPENDENT  
FOOD  
MARKET**

~ DAILY SPECIAL ~

**FREE  
STEAKS  
TODAY**

ALL YOU WANT  
**FREE DELIVERY**



"I would rather repair 4 sets for an average charge of \$10.00 each, than to repair 10 sets for an average charge of \$4.00 each. Although the total time charge in each case is \$40.00, the time required to repair the ten sets is 2½ times that required for the four. This makes the overhead cost 2½ times as much. In addition it requires only 8 round trips to the customer's home for the four sets, whereas it takes 20 round trips with the ten sets. No one can sell me on the argument that more jobs spell profits, if a lesser number now produce no profits...."

The Service Man may go without many a lunch in order to pay his rent and stay in business but he is not even in business. He doesn't know the rudiments of running a business. He is not honest with himself, his customers or his stomach. If a spark of honor can be aroused he should arouse it and gain his self respect. He should make the simple determination to do an honest job for himself. He should begin immediately to use approved, logical and necessary methods for accomplishing this purpose.

Some men have made free calls so long as to be inured, hardened or sold, beyond all argument, to the actual belief that they are really making free calls. As I have said before, simple logic must pronounce them dishonest. I say that there is nothing to justify the free, 25c and 50c service call. In this statement I am supported by the outstanding brains of the radio service industry.

Practically all of the radios which were serviced in the year 1937 were repaired by Radio Service Men. A very small number were fixed by their owners and others. Are there too many Service Men and therefore not enough jobs for them all? The answer, in my opinion, is no! (We will except the tinkers and shoemakers.) Some fellows complain that they do not get enough work or a sufficient number of sets to repair. Don't let that worry you. There are enough jobs for all. If you are losing money now, you will lose twice as much if you have twice the number of jobs. This was clearly shown in my previous articles.<sup>1</sup> One well known and highly respected Service Man, who is 100-percent honest from the ground up, recently remarked, "If I could get by with only a bare living, I would not want to increase my business or number

of jobs, even by 50 percent. My headaches, worries and losses would also go up 50 percent. Like many others I would be satisfied to make the best of what I have and live in hope that I would profit adequately before long." I would say that this man recognizes the fact that more jobs under the circumstances would not increase his bank balance. He would be better off if he did not seek more radios to service.

#### WHICH PAYS BETTER?

Speaking for myself, I would rather repair 4 sets for an average labor charge of \$10.00 each, than to repair 10 sets for an average charge of \$4.00 each. Although the total time charge in each case is \$40.00, the time required to repair the ten sets is 2½ times that required for the four. This makes the overhead cost 2½ times as much. In addition it requires only 8 round trips (or 16 one-way trips) to the customer's home in the case of the four sets, whereas it takes 20 round trips (or 40 one-way trips) in the case of the ten sets. No one could sell me on the argument that more jobs spell profits, if a lesser number now produce no profits.

More jobs can mean less profits and usually mean multiplied losses. When, and if, you operate by the method outlined in my previous articles,<sup>1</sup> your charges or bill totals will be different by far from those of the past. Your average number of jobs may very likely decrease. Your business, however, will begin to show a profit almost immediately. Your profits will start to accrue. You will start pyramiding in the right way. Absolute refusal to bargain when you have fixed your estimates and

strict adherence to that resolve are important essentials for success. Jobs lost because of the customers' inability to pay your prices are not jobs lost after all. You may have lost the opportunity of working on such receivers just for the fun of it and perhaps breaking even in the bargain. Forget such jobs. You have not lost the customers' good-will nor his respect for you as a man. He will some day decide that your higher price is cheaper in the long run after he has chiseled several other men for poorly executed jobs. Let your competitor take all of those jobs which you know are losses. The number of jobs he obtains will be greater, but so will his woes; headaches and losses increase in proportion. Even if he be a better technician than you are, before long he shall have to retire from business entirely (unless he is smart enough to envy your success and decides to emulate you). That would be a healthy condition. A condition we all seek. If he is forced to retire from business and is no longer a competitor—good or bad—having survived, you have the field to yourself and your customers will have to pay your profit insuring prices.

#### RAISE YOUR STANDARDS

A man who repairs sets for whatever prices he can get (or for whatever the customer by ultimatum announces that he is prepared to spend), without regard to whether he is going to profit therefrom, is analogous to the butcher who would go out to sell steaks for whatever he could get, without having first looked at his bill in order to fix a sale price which would insure an adequate profit. Don't worry that your competitor will get the business when your prices go up. Rather, raise your

(Continued on page 22)

<sup>1</sup>Making a Profit in the Radio-Repair Business. By Arthur E. Rhine, Part I, SERVICE, June 1938, p. 5; Part II, SERVICE, July 1938, p. 5.

# General Data . . .

## Belden Clear-Channel Antenna System

THE BELDEN CLEAR-CHANNEL antenna system is designed to eliminate dead spots, improve efficiency on all frequencies, reduce noise and provide a simpler installation problem.

### THE ANTENNA

Investigation of doublet antennas indicate that they are excellent collectors of r-f carriers of wavelengths double the length of the antenna. When other wavelengths are desired, however, the efficiency is somewhat lower. The L or single wire flat top antenna is more efficient when considered from an all-wave standpoint. It has little or no directional characteristics, is easy to erect, and has excellent broadcast-band (400 to 1700 kc) reception qualities. Because of its simplicity and good overall performance, the L antenna was included in the design of the Belden antenna system. To straighten out the antenna characteristic, a half doublet was combined with the L antenna. This half doublet is most efficient at 30 meters and consists of a 24-foot antenna secured to the L top at the antenna coupler. It is mounted at an angle of at least 30 degrees as shown in Fig. 1.

### TRANSMISSION LINE

The transmission line is a two-channel type comprising two conductors and a shield. The ground side of the antenna coupler primaries is connected to this shield which, in turn, is grounded.

The rubber insulation on the two wires is a special compound that has a low r-f loss. To keep out moisture a wax impregnated paper wrap is used over the rubber covered conductors and over this paper wrapping the tinned copper shielding is braided. The entire

combination is further protected by an overall wax impregnated cotton braid.

The line is engineered to operate efficiently in lengths of 200 feet when coupled as indicated in Fig. 1.

The finished cable has an average power factor of 1 percent and a surge impedance of 37 ohms (one conductor to the shield) over a band from 100 to 10,000 kc.

### COUPLING SYSTEM

The two-channel transmission line and couplers are shown in detail in Fig. 1. Separate short- and long-wave couplers are used at the antenna and receiver ends of the line. At the antenna connection are two couplers in one housing, one with a few turns (short wave)

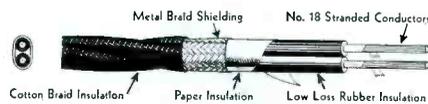


Fig. 2. Section of the shielded transmission line, showing the twisted pair, metal braid shielding, and overall weatherproofed insulation.

and the other with many turns (long wave). The long-wave coupler is connected directly to the antenna but the short-wave coupler is connected through a series condenser. This condenser is of such capacity that the short circuiting effect of the short-wave coupler is negligible on long waves.

At the receiver end of the cable, the couplers are connected in a similar manner. Both sets of couplers are wound on iron cores.

The antenna coupler steps the voltage down, and in addition, matches the impedance of the antenna to the lower impedance of the transmission line. The receiver coupler performs an opposite function. It steps the voltage up and

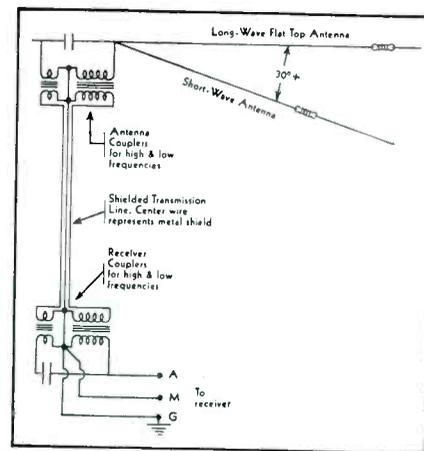


Fig. 1. The Belden Clear-Channel antenna circuit.

also matches the low impedance of the line with the higher impedance of the receiver input circuit.

### MULTIPLE RECEIVER USE

As many as four radio sets located at various parts of the house or building may use the same antenna system by the use of additional receiver couplers and transmission line. Connect an additional transmission line with the incoming transmission line at the posts of the first receiver coupler. Run the line to another coupler at the next set and repeat the process for additional sets. As many as four receiver couplers can be used with one antenna with but little decrease in signal strength.

### PERFORMANCE TESTS

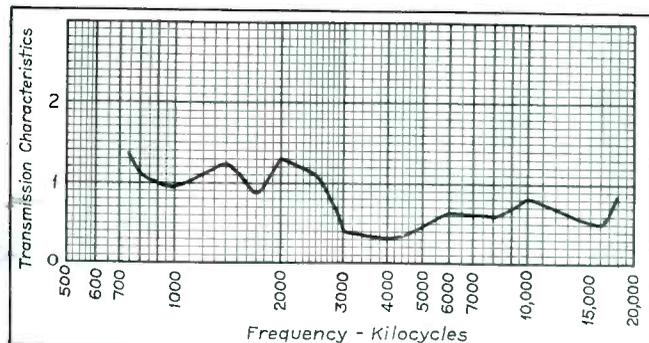
The graphs shown in Fig. 4 indicate the efficiency of the antenna system. In obtaining this data two measurements were made. The antenna system was first interposed between a 6-tube a-c receiver and a signal generator. The antenna signal was then removed and the signal generator connected directly to the receiver input posts. In both cases the required dummy antenna loads were employed for the respective frequency measurements.

The step-up in voltage observed at some points is probably due to low-loss or high Q circuits, particularly in the

Fig. 3. Belden 8300 Clear-Channel antenna system.

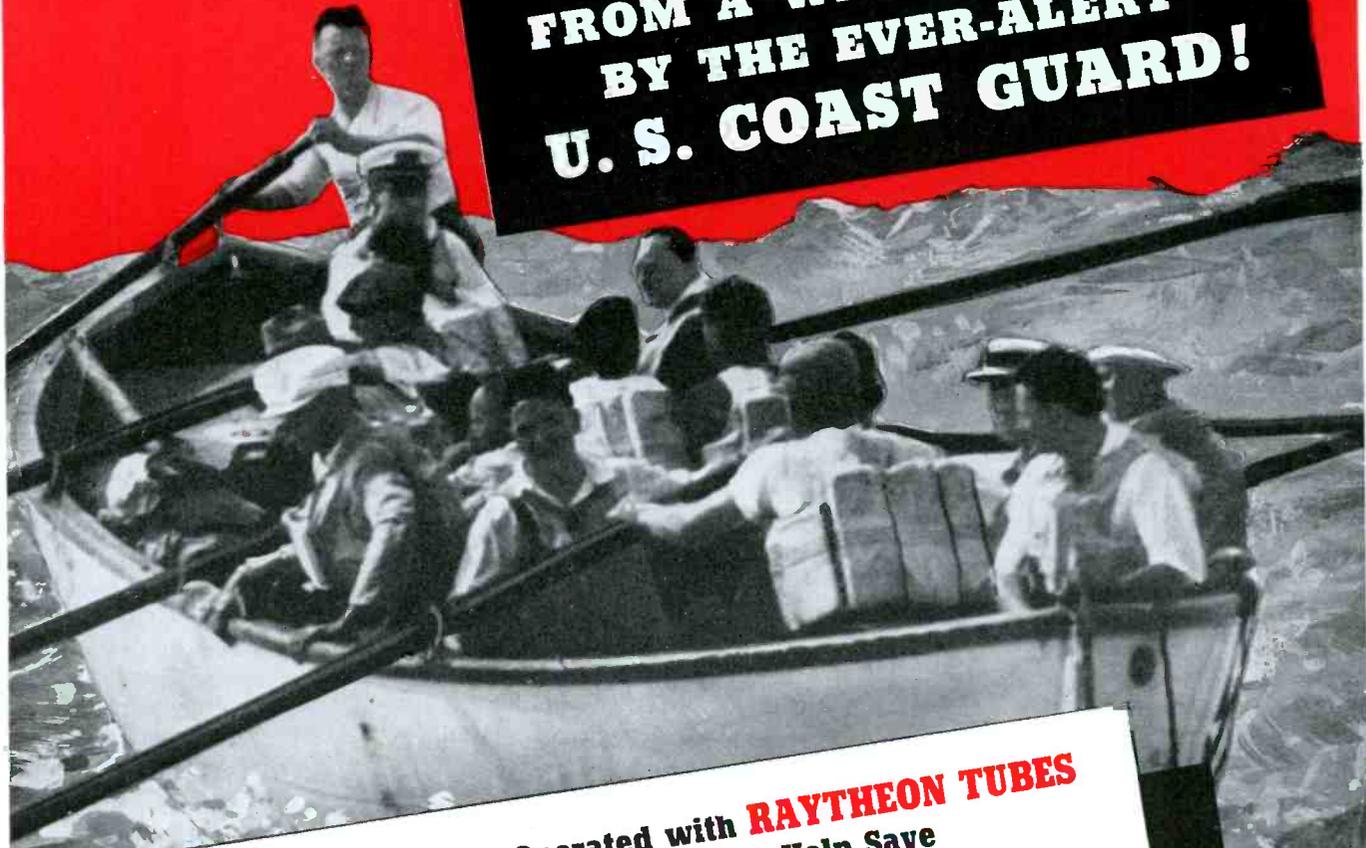


Fig. 4. Performance characteristic of the antenna system.



October 15-22, National Antenna Checkup Week

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## GENERAL DATA—continued

550- to 1700-kc band. The other readings indicate normal transmission and demonstrate the characteristics of the antenna system.

*Alfred Crossley*  
CONSULTING ENGINEER,  
BELDEN MFG. CO.

### Emerson AL-164, AL-202 (Chassis AL)

Power Supply: 105-125 volts, a-c or d-c

I-f: 456 kc

Speaker: Electrodynamic or p-m (see Production Changes)

Readings should be taken with a 1000 ohms-per-volt meter. Voltages shown on Fig. 1 are from point indicated to ground (chassis) with the volume control turned on full and no signal. Line voltage for these readings was 117.5 volts, 60 cycles, a-c. All readings except heaters and cathodes were taken on 250 volt scale.

#### ADJUSTMENTS

The set's oscillator is higher in frequency than the signal, so images should be observed on the low-frequency side of the signals.

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

Never leave a 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.

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

Use a 0.0001-mfd mica condenser as a dummy antenna during alignment.

#### LOCATION OF COILS AND TRIMMER ADJUSTMENTS

The two i-f transformers are in oblong coil cans located on top of the chassis deck. The first i-f transformer is the one behind the variable condenser. The trimmers for these transformers are accessible through holes in the tops of the cans.

The 456-kc wave-trap is mounted on the right side of the front chassis wall. Its trimmer is accessible at the bottom of the chassis.

The antenna coils for the broadcast and police bands are wound on one form and are mounted underneath the chassis deck below the variable condenser.

The oscillator coils for the broadcast and police bands are wound on one form and are mounted on the rear wall of the chassis deck near the variable condenser.

The trimmers for the broadcast antenna and oscillator coils are located on the variable condenser. The trimmer on the front section is for the antenna coil.

#### I-F AND WAVE-TRAP ALIGNMENT

Turn the switch clockwise to the broadcast position and rotate the variable condenser to the minimum capacity position. Feed 456 kc to the grid cap of the 6A7 tube and adjust the four i-f trimmers for maximum response. Feed 456 kc to the antenna and adjust the wave-trap trimmer for *minimum* response.

#### R-F ALIGNMENT

With the wave-band switch in the broadcast position, clockwise, set the dial pointer at 140. Feed 1400 kc through a 0.0001-mfd condenser to the antenna lead and adjust first the oscillator trimmer (on rear section of variable condenser), then the antenna trimmer (on front section of variable condenser) for maximum response. The police band is self-tracking and does not require any adjustment.

#### PRODUCTION CHANGES

Receivers bearing serial numbers below 1,214,000 had a phono-motor on-off switch instead of tone control with switch.

Receivers bearing serial numbers below 1,436,000 did not have the turntable insulated. These receivers also used speaker, part No. 3FS-251, pick-

up, part No. 3ZZ-564-A, and did not use the filter choke, part No. 4PT-404.

On Model AL-164: C26 has been omitted; R16 is 0.5 megohm.

On Model AL-202: C26 is 0.02 mfd; R16 has been omitted.

In AL receivers bearing serial numbers below 1,342,161 the antenna coil was part No. 3RT-318. Antenna coils, part Nos. 3RT-318 and 3RT-384, are interchangeable.

In AL receivers bearing serial numbers 1,342,161 to 1,436,458 and between 1,468,963 to 1,471,250 the antenna coil was part No. 3RT-384 and C4 was 0.001 mfd. Part No. 3RT-384A is interchangeable for 3RT-384 if C4 is made 0.0012 mfd, part No. 4DC-367.

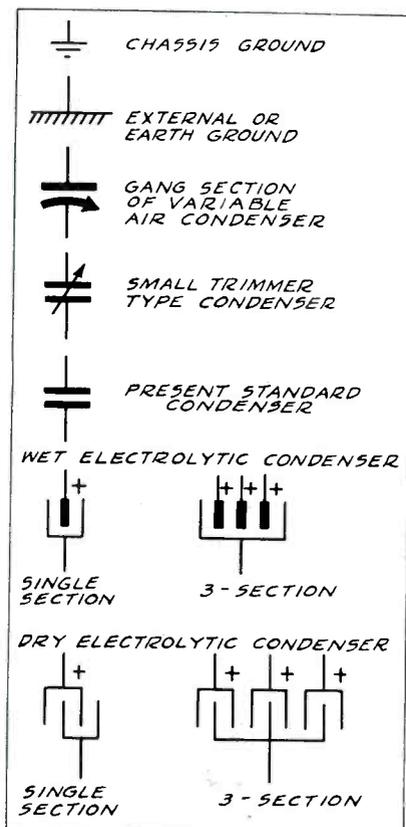
#### New RMA Radio Symbols

At the June, 1937, meeting of the Service Section of the Radio Manufacturers Association a committee was appointed to draw plans for the standardizing of symbols used in radio schematics. That such a committee should be formed was quite natural because the modern radio receiver utilizes components of various types of a single kind and it would be to the advantage of the entire radio service industry if all schematics illustrated the same type of component in the same manner. Furthermore, it would also be of advantage if the symbol used in the schematic immediately identified the type of component. Such was the reasoning of the various members of the committee.

At the recent meeting of this committee, namely during June, 1938, a number of symbols were proposed and we submit herewith the suggested form of standardization. These have not as yet been officially adopted by the radio industry, but examination of recently issued schematics produced by such manufacturers as Stewart-Warner, Galvin and Wells-Gardner shows that some of the suggested symbols are already in use. Hence this information should be of value because even if the suggested standardization is not accomplished (and we think that it will be), the individual receiver manufacturers have the right to use whichever symbols they see fit, and they no doubt will continue using the new symbols.

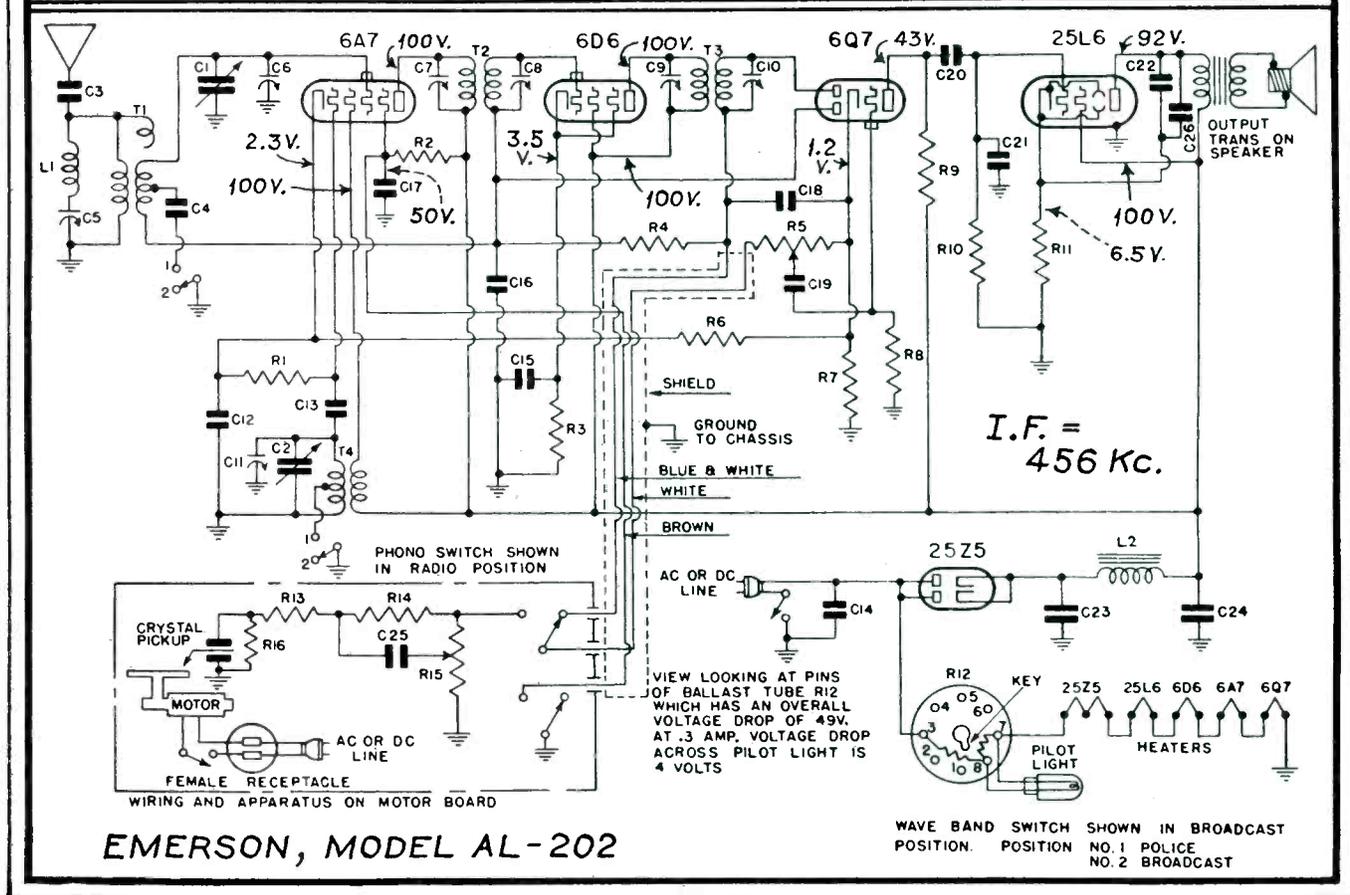
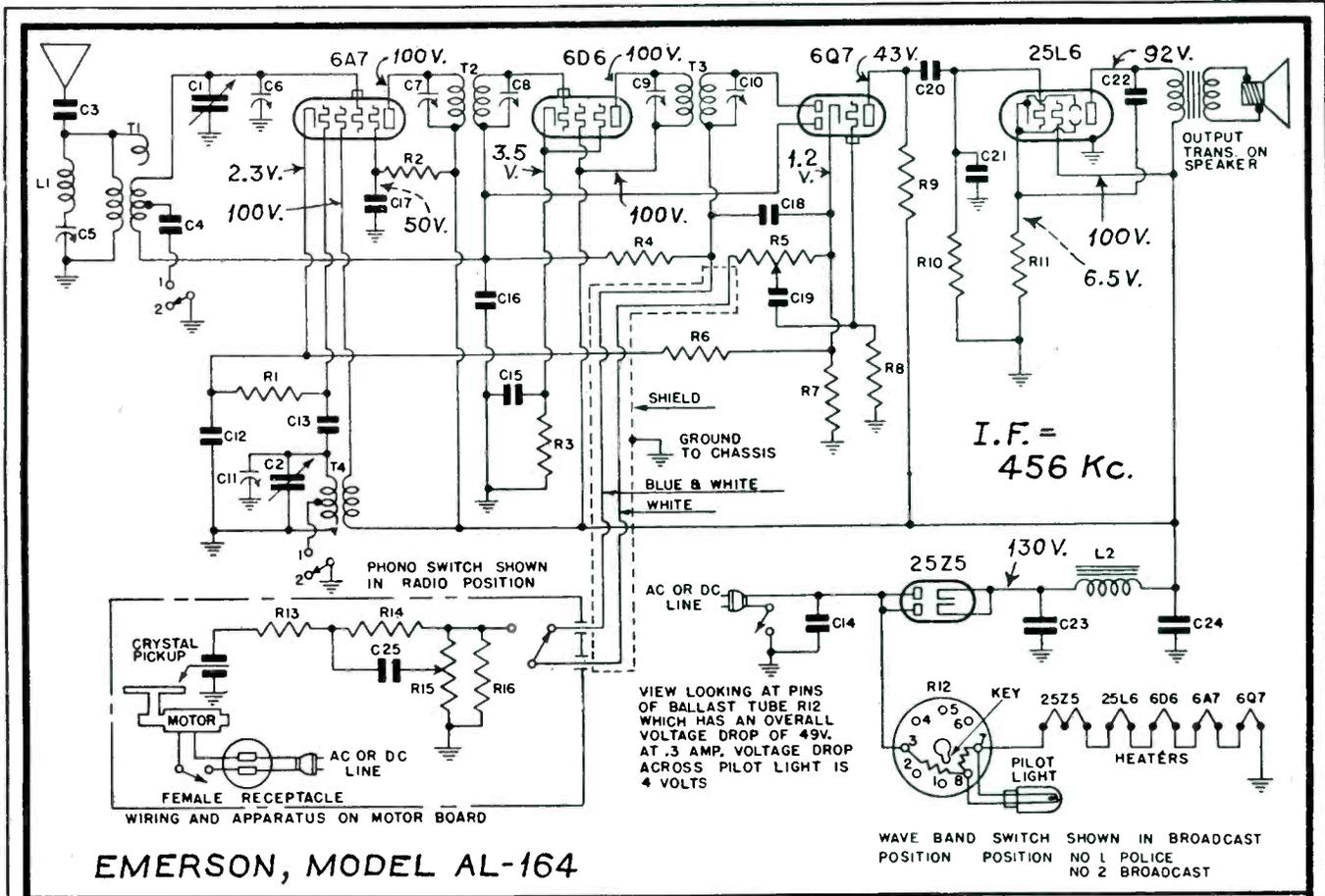
The accompanying illustrations are self-explanatory. However, a few supplementary words will not be amiss. The two types of ground connections are imperative because they appear in a-c, d-c receivers, wherein the chassis and external ground are not the same. For

(Continued on page 26)



Schematic symbols prepared by the Standardization Committee of the RMA Service Section.

GENERAL DATA—continued



# Sound Service . . .

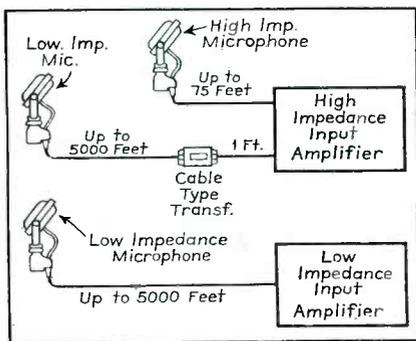
## Microphone Cables and Impedance Matching

WITH REFERENCE TO THE permissible length of microphone cables and microphone matching, a few fundamental principles properly understood will enable the Service Man to solve the various problems encountered in the field.

### LENGTH OF CABLE

The length of microphone cable that can be run on any particular installation depends largely upon the impedance of the line and not upon the output of the microphone. With low-impedance microphones (500 ohms or less) the limiting factor is the d-c resistance of the cable. With high-impedance microphones the limiting factor is the capacity between the conductor and the cable shielding.

The lower the impedance of the line



Cable lengths of 75 feet or less can be used on the high-impedance microphone, whereas lengths up to 5,000 feet are permissible with the low-impedance microphone.

the less chance of picking up extraneous noises. It is for that reason that the broadcasting stations sometimes use 50- or even 30-ohm lines. For most studios and for all long-line p-a work the 200-ohm line can be used with very little chance of extraneous noise pickup. The loss on 200-ohm lines is approximately 2 db per mile.

It is important to note, however, that a poor plug connection in low-impedance lines can cause as much loss as several thousand feet of cable. Even a fair plug connection will give a loss equivalent to several hundred feet of cable. Plug and plug connections are the first things to check when the output drops.

### HIGH-IMPEDANCE MICROPHONES

In considering the permissible length of cable in high-impedance microphone lines, these may be divided into two classes:

- (1) Capacity source microphones

which include condenser and crystal microphones.

(2) Inductive source microphones which include high-impedance velocities and dynamic microphones.

A capacity source microphone is equivalent to a condenser. The resistance of the cable is negligible, its capacity only need be considered. Adding cable to a capacity source microphone is equivalent to shunting the capacity of the cable across it. The result is a drop in output over the entire frequency range. How much the output will drop with a given cable depends upon the capacity of the microphone itself. With a better type crystal microphone where the capacity is small, the drop will be greater than with the large diaphragm type having higher capacity.

With inductive source microphones, adding a cable capacity is equivalent to putting a condenser across the inductance output of the microphone. The result is attenuation of the frequencies higher than the resonant frequency. The amount of the attenuation depends on the secondary impedance of the transformer and the capacity of the cable. The higher the impedance of the microphone the more attenuation of the highs with a given cable length. Two thousand ohms was found to be a good value. Increasing the impedance above 2,000 ohms will give higher output with a short cable, but the output and high frequencies may drop as the cable increases.

With an output impedance of approximately 2,000 ohms, cable lengths up to 75 to 100 feet can be used with ordinary microphone cable. With a space between the wire and the shield of approximately 3/32 inch. By using large-diameter low-capacity cable, such as is usually used for automobile antenna, cable lengths up to 150 to 200 feet can be used. It is usually not desirable, however, to run high-impedance lines over 75 feet. A much better practice is to use a 200-ohm microphone with a cable type matching transformer. This combination will permit any cable length up to 5,000 feet without loss of highs or output. The chance of picking up extraneous noise is reduced to a minimum.

### MATCHING IMPEDANCES

In attempting to match a microphone or pickup with the input circuits of an amplifier, it is important to note that a higher impedance source (microphone or pickup) should never be connected to a lower impedance input. However, a lower impedance source can be fed

into a higher impedance input with very little loss in output and no loss in frequency response. For example, a 50-ohm microphone can be fed into a 200-ohm line with a loss of approximately 1 db over the entire frequency range. A 2,000-ohm microphone can be fed directly into the grid of a tube.

The impedances discussed above should not be confused with the d-c resistances. The d-c resistance of transformers and sources is always much less than its impedance and is no indication of the impedance.

### PREAMPLIFIERS

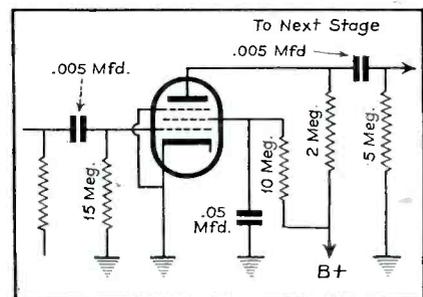
Preamplifiers are necessary only when the main amplifier hasn't enough gain to operate the particular microphone. An amplifier having a gain of 115 db or more will operate all types of high-fidelity microphones without a preamplifier. The 200-ohm velocity does not require a preamplifier near the microphone. The microphone cable can be any length up to 5,000 feet. This in turn can be fed into an amplifier with low-impedance input. If the amplifier has a high-impedance input the 5,000-foot line can be fed through a cable type transformer which is placed about one foot from the amplifier.

A 200-ohm microphone and cable type transformer is a flexible combination. It permits operating the microphone directly into 200 ohms or through the cable type transformer into a high-impedance input. In either case any cable length up to 5,000 feet can be run.

A. Barbieri,  
AMPERITE Co.

### Increasing Gain in A-F Stages

While experimenting with the low-gain stages of receivers and amplifiers we discovered that, by using the constants shown in the accompanying illustration, considerably higher gain, lower



The gain of an a-f stage may be improved through the use of the constants shown.

hum and lower distortion were evident. This was particularly true in stages operating at low input signal levels, such as the first stages of a high-gain amplifier.

The stage is operated at what has been termed "zero bias." The cathode is con-

(Continued on page 24)

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## A NEW SERVICING TECHNIQUE

By JOHN F. RIDER

### PART II

ROUGHLY SPEAKING THERE ARE five general classifications for defective receivers. These embrace virtually every defect other than purely mechanical troubles relating to dials, knobs, etc. They are: Dead receivers, which include dead spots and dead bands in multi-band receivers; low sensitivity; distortion and hum; oscillation and intermittent reception.

#### THE GENERAL SERVICE ROUTINE

The general service routine is the same in all, namely the tracing of the signal fed into the antenna from a test oscillator through the receiver to the speaker with the Chanalyst. However, there are cases, such as dead receivers and receivers with low sensitivity where in the very first test is a test of the tubes. Subsequent to the tube test is the wattage consumption test and the test of the d-c voltage between the rectifier filament or cathode and ground. By establishing that the power supply system is functioning properly, you immediately eliminate, as a source of trouble, a number of important items in the radio receiver. On the other hand, if a defect is existent in the power supply you must remedy this before any further tests can be made.

Assuming that the power supply is operating in a satisfactory manner, the next consideration is the signal fed to the receiver. A modulated signal of

about 600 or 700 kc (whose exact value is known) which will not beat with a local broadcasting station is used.

#### DEAD RECEIVERS

When working with a dead receiver, the idea is to trace the signal without considering its actual level. The matter of signal level and gain is important when working with receivers of reduced sensitivity, although of course, gain or loss is always important.

Two methods of approach are possible. One is to check, as a first step, for the presence of an a-f signal at the second detector output. The other is to proceed from the antenna and check towards the speaker. In the case of a dead receiver the latter method is our personal preference, despite the fact that it takes a little longer.

Simultaneous with the test of the r-f signal from the antenna towards the speaker (or if the a-f test at the second detector shows no signal), the operation of the receiver oscillator is established.

If the oscillator is in good order, trace the r-f signal through the r-f and mixer. As each test is made, note the presence of gain or loss. In some cases the gain between the r-f and the mixer will not be as great as between the antenna and r-f, or through the antenna transformer. This is natural because the avc circuit acts upon the gain in the r-f tube. This reference to gain or loss does not mean a quantitative measurement. It is a very simple matter to establish the pres-

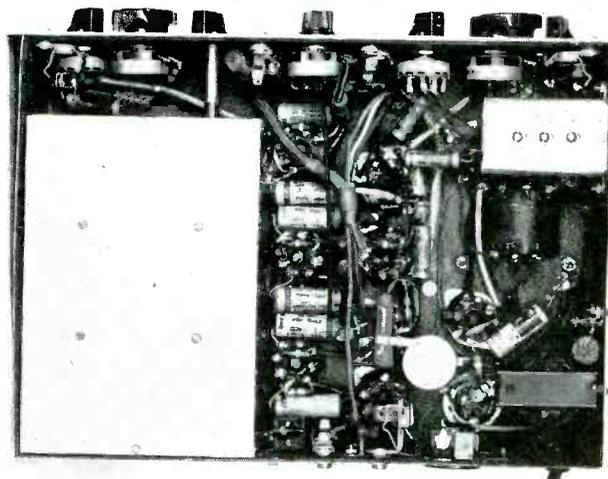
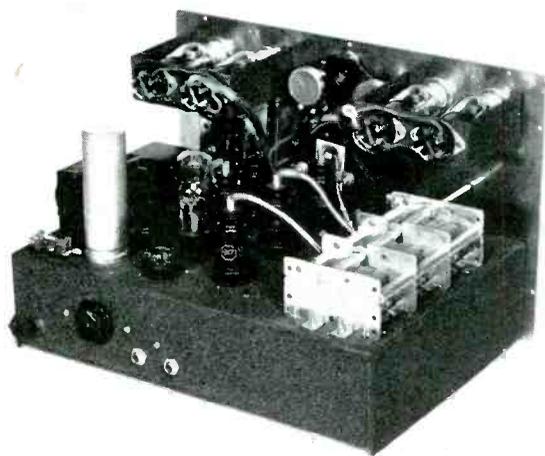
ence of gain or loss between tubes or through a coupling device, with the Chanalyst, by watching the indicator shadow and adjusting the level controls to keep the indicator shadow of constant width.

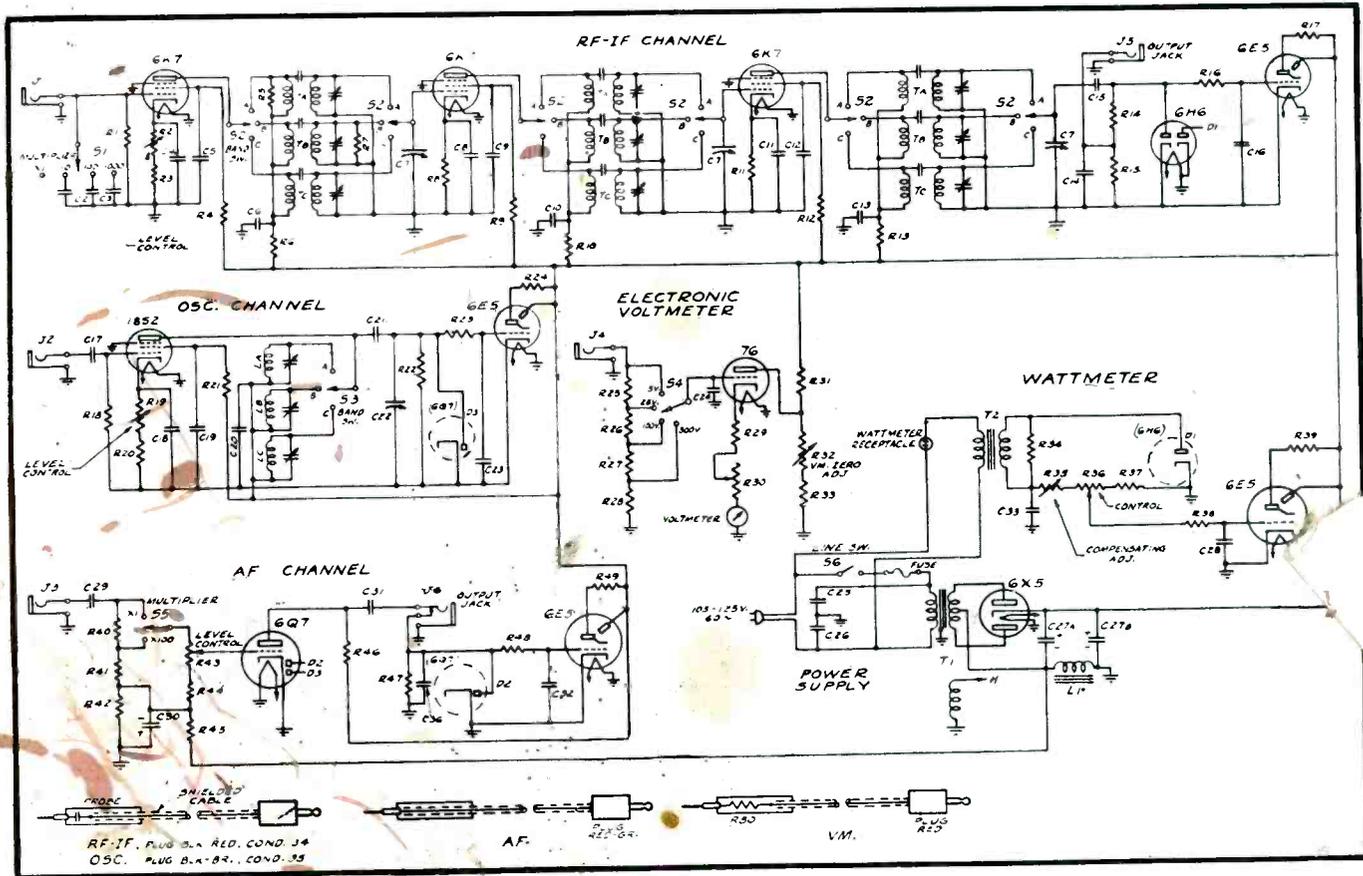
If at any point the signal does not appear to be normal, as for example at the tube elements, check the voltage.

At the plate of the mixer tube the signal has been converted to an intermediate frequency. The first i-f test is made at the mixer plate so as to establish a number of things. First the presence of the i-f signal and second the frequency of the signal. The latter is important because it establishes if the receiver oscillator is in alignment. If it is and the next test at the i-f grid shows no signal or a loss it provides a clue concerning the alignment of the i-f system, although the fault need not be this only. It is possible that something may be wrong with the i-f transformer. At any rate a poor signal at this point or an absence of the signal at this point focuses attention to that portion of the receiver. In the case of a dead receiver, the problem is to find how far the signal passes normally and where it dies. Such is the procedure through the receiver.

In one case which comes to mind, the signal would not pass through the receiver. The routine stated was followed and when the i-f signal at the plate of the mixer was checked it was found to be about 50 kc higher than the correct intermediate frequency. This was established by tuning the i-f channel across its range and noting at what point the signal was picked up. The conclusion drawn was that the receiver oscillator was not producing the correct frequency. (This was a police radio receiver operating at 1594 kc.) The receiver oscillator frequency was checked and instead of being 2050 kc, for an i-f of 456 kc, it was about 2100 kc. Realignment of the oscillator solved the problem.

Top and bottom views of the Rider Chanalyst.





Circuit diagram of the Rider Chanalyst.

**LOW SENSITIVITY**

The mode of operation is substantially the same when working upon receivers which have lost sensitivity. However, pay closer attention to gain and loss as you check the signal at the various points in the receiver. Wherever the gain does not appear to be normal or is very low or a loss exists, use the voltmeter in conjunction with the r-f, i-f and a-f channels. We assume as has been stated that the wattage consumption is correct and that you have checked the tubes.

**OSCILLATING RECEIVERS**

You can check receivers with an oscillating stage, either r-f, i-f or a-f with very little trouble. As a first step you locate the stage by progressively placing the r-f, i-f and a-f probes upon the various r-f, i-f and a-f tubes—without any signal input at the antenna. The oscillating stage develops a voltage and this voltage is checked by the resonated r-f, i-f channel. The strongest signal is available in the stage which is feeding the signal back to the preceding stage.

After the stage has been located, check the voltages, by-pass condensers, filter resistors, etc.

Another means of checking oscillating

stages ahead of the avc system is to check for an avc voltage without signal input. If some stage ahead of the avc circuit is oscillating a strong avc voltage will be available.

When you check such oscillating stages, resonate the channel to the frequency to which the r-f or i-f circuit is tuned. Tuning is not required when you check a-f stages.

In actual practice, it takes but a few moments. In a particular case, it presented the solution to a problem which had been perplexing a Service Man for almost an entire day. The oscillation was due to placement of leads. All capacities and voltages were normal and it was impossible for him to locate the defect because voltage measurement at any of the tubes in the oscillating section of the receiver stopped the oscillations.

**DISTORTION IN RECEIVERS**

You check distortion by picking the signal off at the various points in the receiver, working from antenna towards the speaker, and listening to it or feeding it to an oscillograph. The signal is the rectified modulation component present in the r-f and i-f carrier which you fed into the receiver.

In a run of the mill five tube ac, dc midget receiver, which played normally for about five to ten minutes, serious distortion gradually developed.

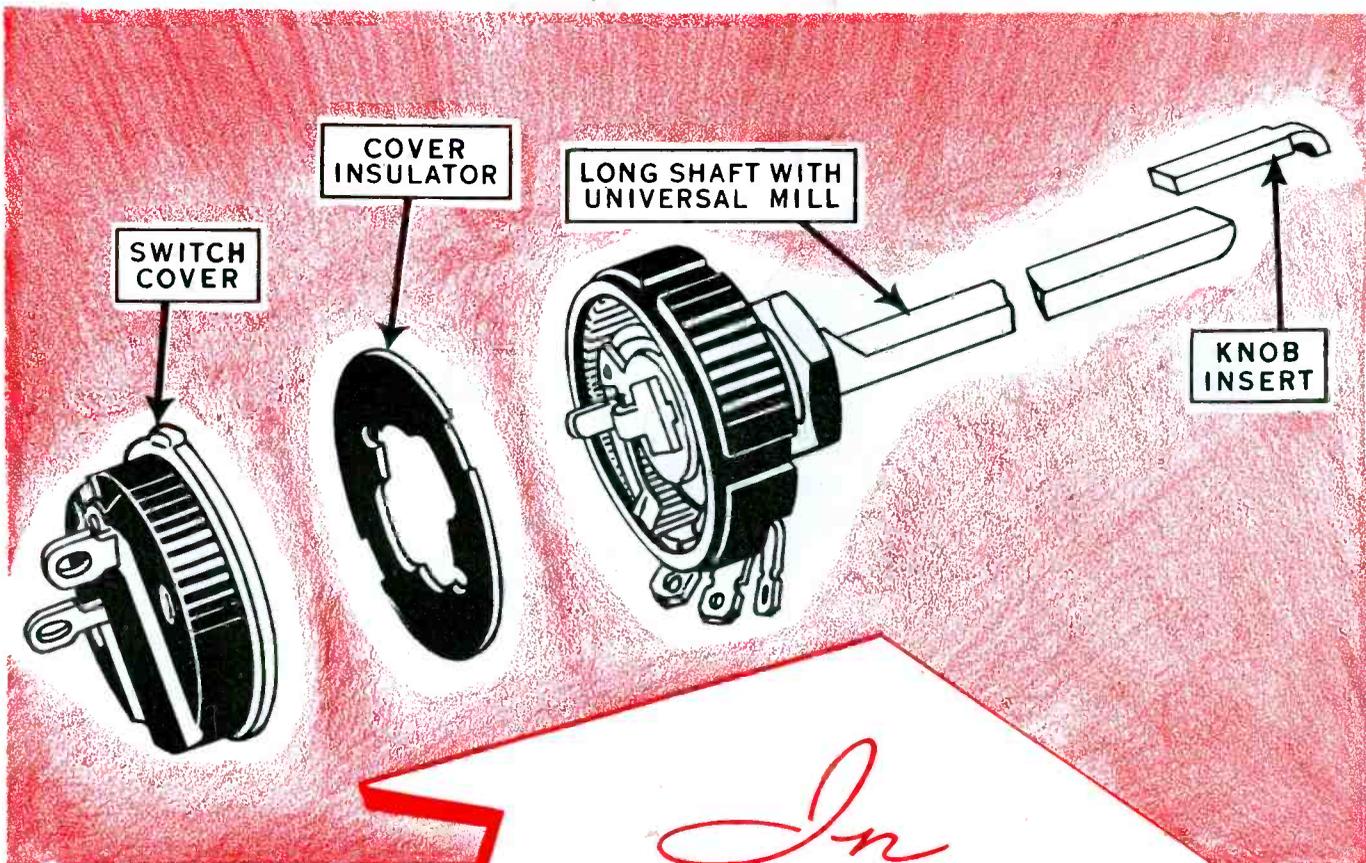
With the r-f, i-f probe on the plate of the mixer tube a clear signal was heard in the headphone connected to the Chanalyst. Next this probe was moved to the grid of the i-f stage with a resulting clear signal. This probe at the grid of the detector also produced a clean signal. However, when the a-f probe was inserted on the plate prong of this tube, slight distortion was perceptible. Using the electronic voltmeter probe voltages were checked from mixer to this point and found to be normal.

Advancing the voltmeter probe to the control grid of the output tube the distortion modulated the needle of the meter. This indicated current in the grid circuit. The set was turned off and after cooling was turned on again with the voltmeter fastened to the control grid of the output tube.

About five minutes later the needle began to fluctuate and as distortion increased the dips of the needle became greater and greater. Moving the probe

(Continued on page 31)





*In*  
**ANSWER**  
*to a*

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In radio receivers where very heavy bleeder current passes through unit in cathode and screen circuits.

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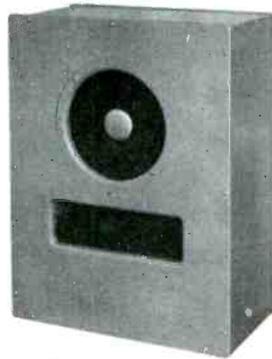
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*All are Built to the*  
**Uncompromising JENSEN**  
*Standard of Quality*

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 Peri-dynamic Reproducers with Bass Reflex.

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## ON FREE CALLS

(Continued from page 11)

standards with the fervent wish that he get the jobs you refuse. You should definitely help him to get them if you can. Call him up and give him the addresses if you want to drive him out of business quickly. Personally, I would not do such a thing. I would rather do as I am now doing—help him—like I am trying to help you—to remain in the business and to prosper. Your prosperity and his together in your neighborhood will but reflect the condition still further. Other men plus your friends and your competitor's friends, plus their recognition of the fact that you and others are suddenly blossoming out in prosperity, will but serve to whet their desire for your recipe, and you will be the boy to show them.

### WHAT OTHERS SAY

In support of much that I have said I am going to quote some statements made by those we know and respect for their sincerity of purpose. In a recent issue of a radio trade paper,<sup>2</sup> John F. Rider says; "One of the serviceman's greatest problems, and at the same time one of the most confusing, is what to charge per hour for service rendered or labor performed. This subject has been discussed by and large and it seems strange to find so few references made to the actual key to the problem . . . I refer to the number of hours available for sale, which, when sold, must produce the revenue needed to cover expenses, salaries, profits, etc."

In the April issue of the same publication the following is written editorially:

"The genuine serviceman has a job cut out for himself if he is to survive against his environment. He will have to know his business. He will have to be a better salesman; a better businessman; a better psychologist than ever before. Simply being a better technician may not help him much. You can't save a sinking boat by sending a gang of expert mechanics down to speed up the engine."

These people don't want to entirely discourage you by telling you that your boat is actually sinking—but they have a polished way of hinting—at the same time they are hoping we will all take heed of what is implied.

Leland S. Hicks in the April 1938 issue of SERVICE:

"Once the work comes into the shop the real test of a business begins . . . it is now up to the technician and business man (often, one and the same person) to produce that most essential ingredient in the transaction . . . A profit. . . . The business man must come to the front. Now—how much shall he charge



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This new development in radio means more and more AFC sets will be coming to your shop. You must be prepared if you are to cash in on this profitable work in higher priced sets. John Rider explains AFC in his easily understood style of writing.

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This servicing aid was instantly recognized by servicemen as a *necessity*. Covering every Philco receiver up to the 1937 chassis, the Alignment instructions were compiled in cooperation with the Philco Engineering Department. This *authentic* book locates every trimmer for you. The order followed is the same you use when aligning receivers on your bench.

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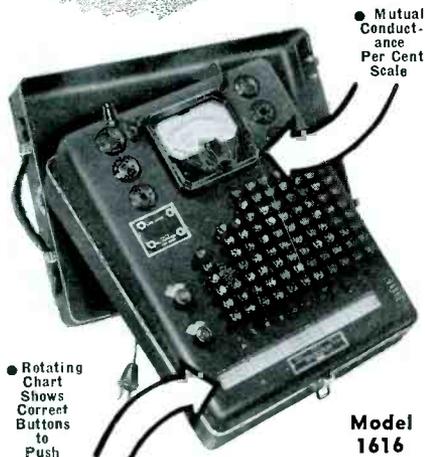


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**Tube Tester and Volt-Ohm-Milliammeter**

Many Claim Dynamic Mutual Conductance . . . Triplet Positively Has It.

The hit of the Radio Parts Trade Show was this new setting push-button tester by Triplet, with its revolutionary advancements. After rotating chart to the tube to be tested, the button to push is clearly marked under each row. What could be simpler?

And the Dynamic Mutual Conductance test for amplifiers and power tubes not only shows if the tube is GOOD or B.A.D. but the percentage of mu to the 100% Good Condition also is indicated. In critical sets this permits the dealer to pick his tubes with confidence. . . . Diodes and rectifiers are tested for emission according to the latest approved engineering standards. Gas and Ballast tube continuity test included.

Filament location switch permits application of filament voltages to any prongs of the tube. The same is true for plate location, screen location, c.g. location, etc. This selective feature, together with a spare socket, is an anti-obsolescence factor.

Rotate chart to Volt-Ohm-Milliammeter settings—push button for D.C. scales: 0-10-50-250-500-1000 Volts at 1000 Ohms per Volt; 0-10-50-250 M.A.; 2 Ohms to 500 Ohms—300,000 Ohms—1½ Megohms—3 Megohms; 0-10-50-250-500-1000 A.C. Volts at 400 Ohms per Volt; decibel chart furnished to 42 db. (Ohmmeter is line powered and provision is made for using batteries if desired). Uses two inter-changeable plug-in type rectifiers, simplifying replacement in case of unintentional damage. One is in the tube tester circuit, the other for the Volt-Ohm-Milliammeter.

Furnished in attractive, all-metal case with lustrous finish. Removable cover for portable or counter use . . . sloping panel.

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**ON FREE CALLS**

(Continued from page 22)

for the job? This is the crux of the whole question. The price charged will determine whether or not a profit will be made (after all a profit must be made or the business will soon go bankrupt). Now enters a word abhorrent to too many service organizations—"bookkeeping." Too many Service Men, in their keen fight with competition think they can be satisfied with the exact cost of materials, plus actual time spent, plus a small amount added for profit. They entirely overlook that big word 'overhead' which so often upsets their hope for a profit and which must always be considered. The computation of this overhead is one of the urgent reasons for a bookkeeping system, even an incomplete one." . . . (after listing various items of cost etc. Mr. Hicks goes on to say) . . . "The total of the items of materials cost, labor cost and overhead expense, plus a reasonable mark-up for profit gives the answer to the question 'How much shall we charge?' If all these costs have been accurately recorded and a fair mark-up added, the answer to the question will be 'A net profit,' and the balance sheet each month will show a steady growth of 'Cash on Hand and in the Bank'."

This gentleman is connected with one of the larger transformer manufacturing companies—and your success means his success. Your failure to make money means he cannot sell to you. He not only wants to see you make money but would like to help you in every way he could. Wouldn't that make things better for all of us?

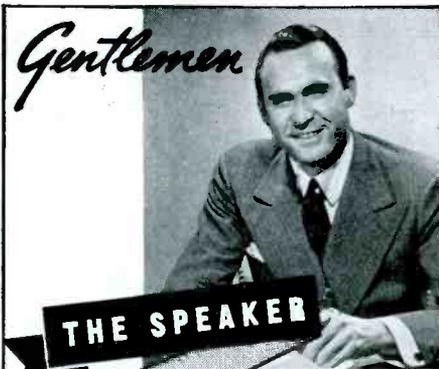
It is high time that you see the light yourself. Get busy and adjust those service charges today and we will all be proud of being Radio Service Men.

**SOUND SERVICE—continued**

nected directly to ground as is the grid return. The grid resistor has been increased to about 15 megohms.

A 2-megohm resistor is used as plate load. No additional plate filtering is necessary in a normally well designed audio system, although a 1-megohm resistor may be used in series with the 2-megohm plate load. This should then be by-passed to the ground with a 0.1-mfd. (or larger) condenser.

To prevent the grid load of the next stage from acting as a short circuit to this large plate load, it is necessary to increase this grid leak to about 5 megohms. A 0.005-mfd condenser should be used to couple the two circuits. These constants are obviously not applicable to those stages that are immediately followed by an output tube whose internal nature will not permit the use of the very large grid load. *N. Daniel*



**THE SPEAKER OF THE HOUSE**

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## PERMEABILITY-TUNED *Push-Button* CONVERTER

● It is a complete push-button tuning unit ready to be installed in any AC Superheterodyne with a 456 or 465 kc. I.F. system—regardless of the number of sections in the variable condenser! It is a simple installation job. A cable and plug (which comes with the converter) does the trick.

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ADAPTER KITS

TUNING UNITS

COMPLETE RECEIVER KITS

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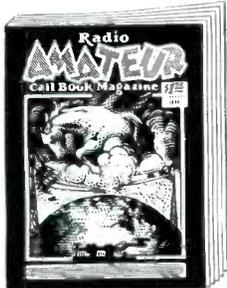


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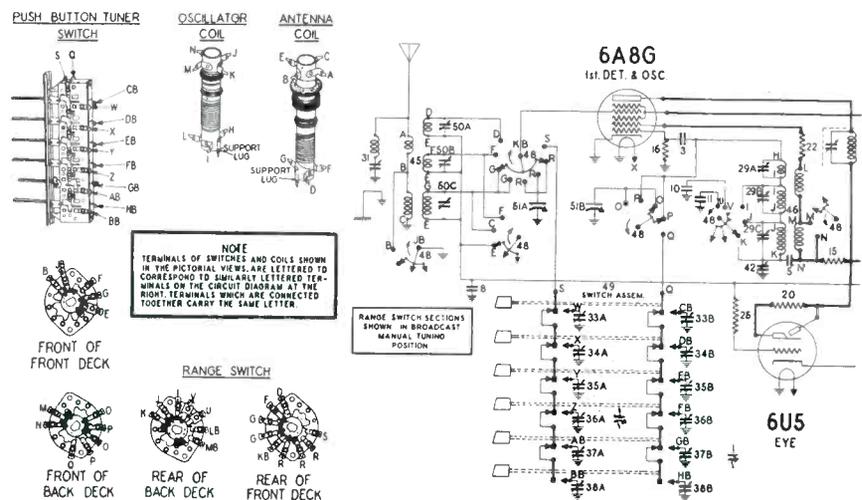
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## GENERAL DATA—continued



A portion of one of Stewart-Warner's latest schematics showing the new presentation of band-switch data.

that matter a similar arrangement may be found in some a-c receivers as well.

The variable air tuning condenser and the adjustable trimmer are distinguished both by size as well as by the fact that the tuning condenser symbol employs a curved line for the rotor, whereas the adjustable trimmer employs a straight line penetrated by the arrow. The lower line is the rotor or grounded plate, when the arrow points upward. Perhaps it is best to say that the tail of the arrow is closest to the rotor or grounded part of the trimmer. In the event that the rotor is not grounded the same illustration is used, except that the location of the arrow then identifies the rotor plate or plates.

The fixed condensed symbol is just the same as it always has been, although certain additions will be seen upon the Motorola diagrams for 1938 receivers. For that matter if you have seen any of the new Motorola diagrams and have examined the schematics critically you no doubt noted that the variety of fixed condenser was identified by either a solid line or a dash line running through the condenser, midway between the upper and lower lines. Motorola identifies their mica condensers by means of a dash line and their paper condensers by means of a solid line.

The greatest change takes place in the symbols used for the wet and dry electrolytic condensers. Heretofore, such condensers were identified simply as fixed condensers. It is quite in order to make a change because the different types of electrolytic condensers justify individual identification. The wet condenser cannot replace the dry and it is imperative that the serviceman know the variety of electrolytic being used. For that matter, it is also necessary to mention that the suggestion was made to

identify self-regulating electrolytics as against non-regulating by placing the word "regulating" or some abbreviation thereof upon the schematic, adjacent to the condenser. These wet and dry electrolytic condenser symbols are already in use by Wells-Gardner and Stewart-Warner.

Still another suggestion for standard-  
(Continued on page 28)

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**APPLICATION** →  
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.....Bill me \$2.00 National Yearly Dues

# New BEAM POWER-COMPRESSOR AMPLIFIER KITS

The new improved UTC PA amplifier and modulator kits incorporate every advanced circuit feature desirable for PA and amateur work.



The kits are provided complete with panels, covers, resistors, condensers, sockets, jacks, etc. All components are completely mounted and ready to wire; complete constructional details and diagrams are furnished.

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## COMPONENTS

The new UTC PA amplifier kits are unusually trim in appearance, employing blackchrome etched panels contrasting with the gray commercial wrinkle finish of the chassis and perforated metal cover.

All kits are furnished with four input jacks providing for dual input (high or low gain) to both channels of the mixer. The mixing system is completely cross-talk proof. The unique UTC VARITONE equalizer is incorporated to equalize high frequencies or low frequencies, as desired. VARIMATCH output transformers are employed in kits for PA, modulator and driver service.

The output impedances on PA kits are 500, 200, 15, 8, 5, 3, and 1½ ohms.

## TECHNICAL CHARACTERISTICS

### P-1A

PA kit, self bias, 30 watts output, audio and power units on separate chassis for rack or cabinet mounting. Four jack, dual channel, high impedance input, two high gain (120DB), two low gain (80DB). VARITONE equalizer and compression controls. Output impedances for line and voice coil as above.

List price .....\$87.50  
Your net cost.....\$52.50

### P-1M

Modulator amplifier kit, same as above, but for modulation purposes. VARIMATCH output has the following impedances: 200, 405, 1180, 2350, 2400, 3000, 4000, 4670, 4750, 5660, 7000, 9100, 9500.

List price .....\$87.50  
Your net cost.....\$52.50

Tubes required for PA-1A or P-1M kits are: two 6J7, one 6N7, two 6CS, two 6L6, one 83, one 6H6.

### P-2A

PA kit, fixed bias, 50 watts output, audio and power units on separate chassis for rack and cabinet mounting. Four jack, dual channel, high impedance input, two high gain (120DB), two low gain (80DB). VARITONE equalizer and compression controls. Has output for line or voice coils, as specified.

List price .....\$97.50  
Your net cost.....\$58.50

### P-2M

Modulator kit, same as above, but has VARIMATCH output having impedances of 360, 660, 2050, 3740, 4100, 7000, 7500, 8200, 12000, 12600, 15000, 16400, 21500, 29800 on the 3800 ohm plate to plate terminals. Also has 237, 1300, 1750, 2700, 3270, 5200 ohms on the 4000 ohm plate to plate input terminals.

List price .....\$97.50  
Your net cost.....\$58.50

Tubes required for the P-2A or P-2M kits: two 6J7, one 6N7, two 6CS, two 6L6, one 83, one 80, one 6H6.

### P-3A

PA kit, fixed bias, 100 watts output. Audio and power on separate chassis for rack or cabinet mounting. Four jack, dual channel, high impedance input, two high gain (120DB), two low gain (80DB). VARITONE equalizer and compression controls. Line and voice coil output.

List price .....\$142.50  
Your net cost.....\$85.50

### P-3M

Same as P-3A, but has VARIMATCH output with impedances of 270, 500, 1440, 2760, 2900, 3700, 4900, 5650, 5800, 6900, 8400, 11000, 12000.

List price .....\$142.50  
Your net cost.....\$85.50

Tubes required for the P-3A and P-3M kit: two 6J7, one 6N7, two 6CS, four 6L6, two 6F6, three 83, one 80, one 6H6.

### P-4D

10 watt compressor driver amplifier, self bias. 10 watts output, sufficient to drive any class AB, or class B amplifier of 100 watt to 250 watt rating. The ideal driver, incorporating: compression, low reflected drive impedance, multi-channel input, high gain, and VARITONE equalizer. One chassis. Four jack, dual channel, high impedance input, two high gain (117DB), two low gain (77DB). VARITONE equalizer and compression controls. VARIMATCH driver transformer incorporated as output unit.

List price .....\$65.00  
Your net cost.....\$39.00

### P-4A

Ideal 10 watt home amplifier. Same as above, but with PA VARIMATCH output transformer to 500, 15, 8, 5, 3, 1½ ohms.

List price .....\$65.00  
Your net cost.....\$39.00

Tubes required for the P-4D and P-4A kit: two 6J7, one 6N7, one 6CS, two 2A3, one 5Z3, one 6H6.

### P-5A

PA kit, self bias, 15 watts output. One chassis. Four jack, dual channel, high impedance input; two high gain (120DB), two low gain (80DB). VARITONE equalizer and compression controls. Output impedance for line and voice coils, as specified.

List price .....\$62.50  
Your net cost.....\$37.50

### P-5M

Modulator kit, same as P-5A, but with VARIMATCH output having impedances of 270, 500, 1440, 2760, 2900, 3700, 4900, 5650, 5800, 6900, 8400, 11000, 12000.

List price .....\$62.50  
Your net cost.....\$37.50

Tubes required for P-5A or P-5M kit: two 6J7, one 6N7, one 6CS, two 6V6, one 83, one 6H6.

### P-7A

AC operated pre-amplifier kit designed especially for amateurs and PA service. Very efficient filtering assuring freedom from hum. Has a gain of 70DB, and a two channel high impedance, high level mixer with jack input for each channel. Output impedances are 50, 200, and 500 ohms.

List price .....\$30.00  
Your net cost.....\$18.00

Tubes required for the P-7A: two 6J7, one 6N7, one 6X5.

## GENERAL DATA—continued

ization is identification of sections of a multi-section condenser or resistor, by the letters a, b and c, or as many as may be desired. In other words, such identification as 21a, 21b and 21c, means that the three condensers or resistors, whichever are being considered, are all parts of a multi-section unit.

Great relief is in store with respect to the comprehension of band switches. While the committee is not making a standardization suggestion for a symbol, a definite method of illustration is being recommended. This recommendation is that the switch be shown schematically on the schematic proper. The coil and other component leads are brought out directly to the proper switch terminal. Each switch terminal or lug is numbered or coded. The individual switch sections can be broken up for convenience in drawing if desired. Adjacent to the switch or nearby on the drawing is an actual picture or pictorial representation of the switch leaf. The lugs on the leaf have numbers or are coded in a manner corresponding to the schematic of the switch section mentioned above. An idea of what was suggested will be seen in the partial schematic of the Stewart-Warner models 91-68, 98-61 and 910-61 shown herewith.

The members of the committee were: J. K. Rose, Chairman, Wells-Gardner; L. E. Priscal, Sentinel Radio; J. N. Golten, Stewart-Warner; George Devine, General Electric; F. E. Smolek, Zenith Radio.

### Successful Servicing

Silvertone 6016, 6017, 6046, 6047, 6146 (Chassis 101.512)

Eliminating whistle at 930 kc: A whistle, due to a beat between the second harmonic (930 kc) of the 465-kc i-f, and a 930-kc signal may be experienced. In localities where a 930-kc station is one that is tuned frequently, it will be desirable to shift the whistle to some other point where it will not be objectionable. This can be done by shifting the i-f of the receiver.

Determine at what point between 900 kc and 960 kc the whistle will be least objectionable. Dividing this frequency by two will give the new i-f to which the receiver should be aligned. For example, if it is determined that a whistle at 915 kc would not be objectionable, the i-f should be realigned at 915/2 or 457.5 kc. Try to select the new i-f as near to 465 kc as possible.

Align the i-f at the new frequency and then realign the rest of the receiver in the usual manner.

## UNITED TRANSFORMER CORP.

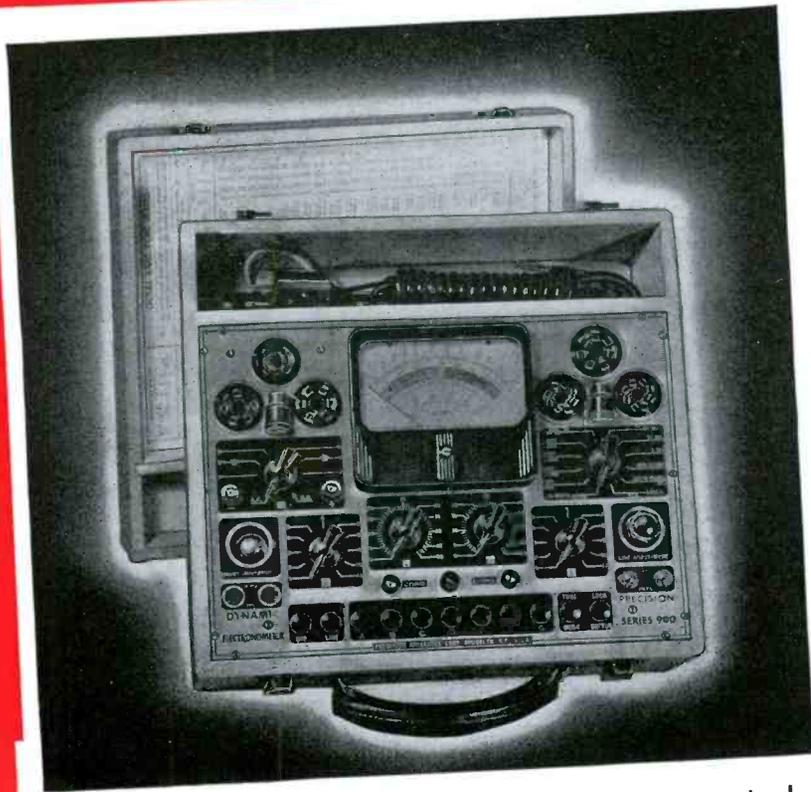
72 SPRING STREET

NEW YORK, N. Y.

EXPORT DIVISION: 100 VARICK STREET NEW YORK, N. Y. CABLES: "ARLAB"

# NEW

# "PRECISION" Dynamic Electronometer SERIES 900



A modern "push button" operated dynamic mutual conductance tube tester, combined with a twenty-five multi-range A.C. and D.C. volt-ohm-decibel-milliammeter plus a ten ampere range for complete point-to-point set analysis. Also includes ballast test facilities.

★ **PORTABLE TYPE** Encased in a very attractive hardwood carrying case with removable cover. Compact in size, only 12 $\frac{3}{4}$  x 11 $\frac{1}{2}$  x 6. Approximate carrying weight, 12 pounds.

★ **COUNTER TYPE** Attractively finished in black ripple on heavy gauge steel. Size, 18 x 11 $\frac{1}{2}$  x 6 $\frac{1}{2}$ .

★ **PANEL TYPE** Completely steel enclosed. Finished attractively in black ripple. Size, 22 $\frac{1}{2}$  x 12 x 5.

**NET PRICE** Portable, Counter or Panel type **\$49.95**

Complete with battery, test leads and instructions.

Ask for your copy of the new "PRECISION" Catalog, listing our complete line, including the latest developments in test equipment.

### TUBE ANALYZING FEATURES

A DYNAMIC TUBE TESTER employing an exclusive "PRECISION" engineered circuit which, in one operation, effectively tests all radio receiving tubes for both MUTUAL CONDUCTANCE and EMISSION. Tube merit indications are read directly on a three-colored English reading scale. ACCURACY of the tube test circuit is closely maintained by the use of individual calibrating controls, adjusted and sealed against laboratory standards. AUTOMATIC PUSH BUTTON SYSTEM: "PRECISION" designed interlocking push button selector system affords the extreme in flexibility. TESTS ALL TYPES: Glass, spray shield, MG, G and METAL TUBES. SPECIFIC INDIVIDUAL LOADS AND VOLTAGES applied to respective elements of the particular tube under test. VARYING AC SIGNAL applied to control grids. TESTS diodes, triodes, rectifiers, tetrodes, pentodes, multi-purpose tubes and gaseous types 023-024. MULTI-SECTION TUBES: Individual tests for each section of multi-section tubes, including visible tests of the fluorescent screen and winking effect on cathode ray indicator tubes. OPEN ELEMENTS: Shows up tubes with any open element. HOT CATHODE LEAKAGE TEST. HOT INTER-ELEMENT SHORT TESTS. NOISE TEST pin jacks incorporated for earphone or amplifier connection. BALLAST TESTS: The regular tube test sockets accommodate all ballast unit tests for open and loose elements and leakage between sections of multi-section ballasts.

### SET ANALYZING FEATURES

FOUR AC AND DC VOLTAGE RANGES at 1,000 ohms per volt: 0-10; 0-50; 0-250; 0-1,000 volts. FIVE DC CURRENT RANGES: 0-1; 0-10; 0-50; 0-250MA; and 0-10 AMPERES. FOUR RESISTANCE RANGES: 0-400 ohms (20 ohms center) SHUNT METHOD; 0-100,000 ohms (800 ohms center); 0-1 MEGOHM (8,000 ohms center); 0-10 MEGOHMS (80,000 ohms center). All ohmmeter ranges powered by self-contained supply. A 4 $\frac{1}{2}$ -volt battery powers the low, medium and 1-Megohm ranges. FOUR DECIBEL RANGES from -10 to 55 DB; 0DB; 14DB; 28 DB; 40DB. FOUR OUTPUT RANGES: 0-10; 0-50; 0-250; 0-1,000 volts. PAPER CONDENSER LEAKAGE TESTS. NEON METHOD. PROVISION for measuring leakages of all types of electrolytic condensers directly on the meter in terms of current.

# PRECISION

# Apparatus Corporation

821 EAST NEW YORK AVENUE

BROOKLYN, NEW YORK

# ASSOCIATION NEWS . . .

## RADIO SERVICEMEN OF AMERICA

THE RSA REPORTS THAT the following chapters have recently voted to affiliate with the RSA: Green Bay, Wisconsin; Danville, Illinois; Decatur, Illinois; Pittsburgh, Pennsylvania; Fargo, North Dakota; and Minneapolis, Minnesota.

### RSA Extension Course

The RSA announces an extension course for the practical, professional Service Man. It is not for the beginner and it does not contain any fundamentals of theory. It will contain practical working details of all new developments in the service field as soon as they are available on the market.

It is available only to RSA members at a nominal charge per year. Complete details may be had upon application to national headquarters. The course is planned to begin in September, 1938.

### RSA National Speakers Bureau

The RSA is completing plans for the National Speakers Bureau for the benefit of local chapters of the RSA. Speakers of national prominence will be scheduled to appear at regular chapter meetings of all chapters of the RSA as rapidly as the schedule can be arranged. A large number of prominent manufacturers who maintain speakers on a national speakers circuit have expressed their whole-hearted cooperation on the project.

Any interested manufacturer is urged to write the national office for complete details.

*Joe Marty, Exc. Secretary*

### Buffalo Chapter

Buffalo Chapter is planning a banquet in the very near future. In the meantime, in order to get in training, Pres. Schreiber announced a basket picnic would be held and urged that all members attend.

Clarence Redstone, Instructor at the Buffalo Technical Institute, gave an illustrated talk on the fundamentals of radio.

### Chicago

"Better Radio Reception Week" has come and gone. WGN, WMAQ, WENR and WLS cooperated with RSA Chicago in this swell effort to publicize the RSA. These stations gave some thirty spot announcements telling about the RSA men and mentioning our central phone number. Present plans call for a "follow-thru" with some other scheme in the near future providing of course, we can again secure broadcast support.

The June Trade Show saw RSA present with a booth display prepared by members of the Chicago Chapter. Its feature attraction was a geographical interpretation of the growth and strength of the RSA. Many visiting servicemen were convinced of the value of membership in RSA and as a result, negotiations were opened for the establishment of new chapters. The trick and other devices on display were real portrayals of brainbusting ideas; specimens of true and ridiculed antiquity and novelty.

### Cleveland

Open meeting June 6, 1938; this meeting was one of the first to allow any female

to enter the "secret doings," the purpose being to definitely prove that we really do things besides beer drinking. A very interesting motion picture "Wheels Across Africa," was shown.

Al Theriault, Director of the 12th District, planned the trip to the RSA Convention and the Parts Show. Cleveland was very well represented. Ed George took over from Al at Chicago and handled the delegation in fine fashion.

### Duluth

Duluth Chapter voted to have one meeting a month during the summer. A very interesting meeting was held at which H. B. Eilers gave a talk on "Facsimile." It seems that KSTP in St. Paul is on the air nightly with a facsimile program.

Three of our members attended the RSA Convention in Chicago.

### Fremont

We held a very interesting meeting on the subject of credit and collections.

All members present felt that through cooperation as a local chapter of the RSA, much good would come to each one individually.

Officers of our Chapter are: John Mutschler, Chairman; Harold Kelsey, Vice-Chairman; Don Daymon, Secretary; Frank Marx, Treasurer; and Gilbert Anderson, Sergeant-at-Arms.

### Holyoke

A regular meeting was held in our new meeting place on June 15th.

It was agreed at the meeting that each member should bring in one new member and these new members would then be voted upon at a special meeting held in July. It was voted not to have any meetings during the summer except on special occasions.

A list of slow pay customers was made up and will be distributed to our members at our first meeting held in September. A set of by-laws were drawn up—many amendments were suggested and as soon as this set of by-laws is completed it will be sent to the membership for its approval.

### Houston

Most of our last meeting was given over to a discussion of the revision of the by-laws governing the requirements of new members. Several amendments were submitted and discussion was had upon them but final consideration put over until our next meeting.

The motion to change the name of our organization from National Radio Service Association of Houston, to the Houston Chapter of the Radio Servicemen of America was put to a vote and carried.

A Committee was appointed by the Chairman to have a regular audit of Secretary-Treasurer's books immediately after meeting adjourned.

### Lansing

Lansing Chapter held its third regular meeting on June 14th. A Vice-Chairman was elected to preside in the absence of the Chairman; Clarence Kachelski was elected. Motion was made to set the terms

of the officers at one year from date of the first meeting, with the duties of the Treasurer and Secretary being combined into one office.

Motion was made to pay the expense of gasoline, oil and meals incidental to meetings of Regional Board out of the local treasury. The Chairman appointed a Committee of five members to work upon and draft a set of by-laws for the Lansing Chapter.

### PRSMA

Speaking before the Philadelphia Radio Servicemen's Association on June 7, Harry P. Bridge, president of The Harry P. Bridge Co., advertising counsellors urged that Service Men consistently spend not less than 5% of their gross receipts for some form of advertising or promotional activity.

### RADIO SERVICE ASSN. OF CALIFORNIA

Reports on our forthcoming Television Course indicate a lot of interest, which will undoubtedly increase when further details are mailed. The time and place for the picnic has been set, so, if we can get Wil and six or eight other fellows to work on it, it should be quite a success, as usual.

Last meeting Dave Atkins, of Atkins and Brown, gave a very informative talk on r-f amplifier and transmitter design. Al found still another tube to talk about. Wil wielded the gavel for a presidentless, secretaryless meeting, Morris being heavily involved in the intricacies of a folding camp bed at Pinecrest and Ye Scribe being likewise moving house.

For the August 15th meeting we will show one of the finest pictures of wild life in Africa ever filmed. The title of the picture is "Wheels Through Africa (In a Dodge)." Open house for the ladies and friends.

*H. R. Anderson, Secretary*

### THE REPRESENTATIVES

At our June 9 meeting the membership totaled 125; this membership covers the entire 48 states. During the past 12 months some 26 parts manufacturers seeking representation in various parts of the country, requested a list of our members.

The meeting was presided over by our president, Perry Saftler. Marty Camber acted as secretary in the absence of David Sonkin. There were 85 members at the meeting, representing every section of the country.

*Dan R. Bitten, Vice-President*

### NRPDA

A committee has been appointed to design an emblem for display by the members of the National Radio Parts Distributors Ass. so that they may be easily identified and it is expected that the design will be approved in the very near future.

During the past month, reports from all over the country show a continued increasing interest in the jobber's association and while not all of the dues have been paid, the financial returns show a very definite desire on the part of the jobbers to really get together.

*Arthur C. Stallman, Publicity*

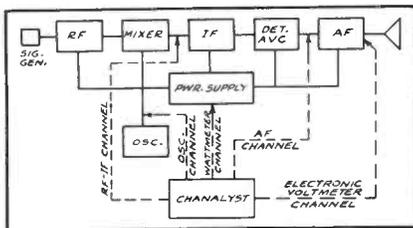
**TEST EQUIPMENT—continued**

over to the plate showed about a 25 per cent decrease in plate voltage. This definitely indicated a gassy tube, which did not show up when the tubes were tested.

**INTERMITTENT RECEIVERS**

You all know that intermittent receivers can be a problem . . . that you spend many aggravating hours in the effort to locate intermittent troubles in a receiver. The Chanalyst solves this problem by accomplishing that about which you have dreamed for years—namely, a check of how far the signal has passed through the receiver when the intermittent develops; in other words, where the intermittent exists. To list all types of intermittents is naturally impossible, but we feel that you can gather all of the facts you need for the solution of intermittents from the general and specific illustrations which follow.

The process of solving an intermittent is to divide the receiver into five major channels and to monitor these channels. The wattage indicator takes care of the power supply. The r-f, i-f channel can be used to monitor the r-f signal at the mixer or the i-f signal at the second detector or at one of the i-f tubes. The oscillator channel monitors the receiver oscillator. The a-f channel monitors the audio signal at the output of the second detector, which may be the volume control or the control grid of the first audio tube. The speaker is the second audio monitor. The electronic voltmeter can be used to monitor any one of the oper-



Monitoring an intermittent receiver with the Rider Chanalyst.

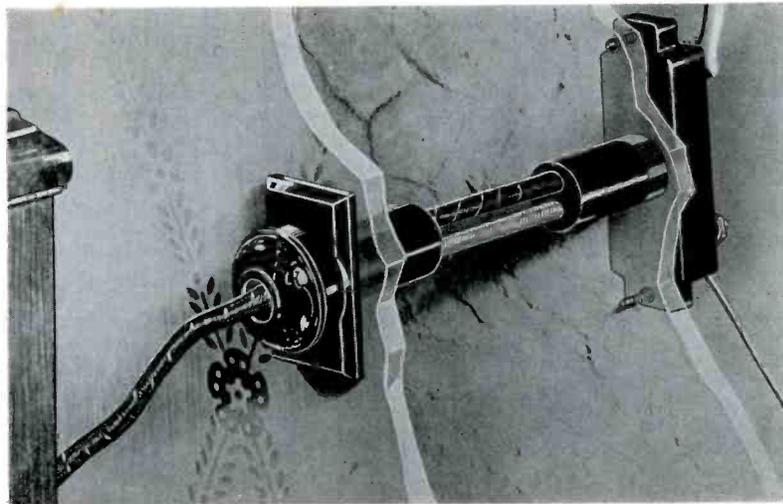
ating voltages or a control voltage, depending upon the symptoms being displayed by the receiver when it goes intermittent.

When the intermittent develops, the Chanalyst indicators will show the status of the wattage consumption, the operating or control voltage at the point monitored, the r-f, i-f, oscillator and a-f signals. Interpretation of these indications will show how far the signal gets through the receiver. It may be necessary to move the r-f, i-f or a-f probe from one stage to the next after a fade—that is, when more than one r-f, i-f or a-f stage is used.

*(Continued on page 37)*



Sloppy, dangerous connections between aerial and receiver are OUT . . . since this clean, practical NEW method came along!



**COR-NEX**  
De Luxe Aerial-Receiver  
**CONNECTOR**

A modern, scientific connection that thousands of Service men have welcomed and put to profitable use in their territories! Let COR-NEX make money for YOU!

Invented by an actual Service man to fill a long-felt need. The whole works complete, including DOUBLET lightning arrester. Does away with unsightly window strips and frayed wires. Give a neat, efficient appearance. Investigate COR-NEX . . . your jobber will supply you . . . and the waiting market is tremendous, as well as highly profitable.

**Easily Installed . . .**

- Bore 7/8" Hole through wall or moulding
- Push lead wires through wall till inside fixture is snug
- Strip insulation from exposed parts of lead wires
- Slide arrester block onto lead wires and in position against outside wall
- Secure leads on post
- Tighten 2 small screws on arrester (to perfect tension)
- Connect aerial and set leads

**COMPLETE**

with doublet lightning arrester, decorative inside plate with leads and polarized plug with cords . . .

**\$2.50 LIST**

*Distributed Through Jobbers*

**CORNISH WIRE CO., INC.**

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New York City

**MISTER!**

**YOU JUST CAN'T AFFORD TO MISS A WORD OF THIS!**



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Every service man should have his own subscription to SERVICE. A progressive service man must know more than just the fundamentals of radio circuits. He must know the Theory of Electricity . . . Acoustics . . . Salesmanship . . . Parts Merchandising! These subjects and many others of primary importance to service men will be found in every issue of SERVICE.

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To help every service man, dealer and jobber obtain his own individual yearly subscription to SERVICE for \$1.00 (or one half the regular rate of \$2.00 a year) the Group Subscription Plan was formed. When four or more men sign up at the same time, the subscription rate is only \$1.00 per year each. (The occupation of each subscriber must be given.)

Use the convenient form printed herewith. Your co-workers and service men friends will sign up with you at the half-price rate if you tell them about the "G.S.P." Sign up your group today.

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**SERVICE, 19 E. 47th St., New York, N. Y.**



When mailing a check (or money order) for a group of subscriptions, use this convenient form.

**Philco 38-116X**

*Afc does not function:* Check 6N7G tube and socket located at front of set. Also check 1,000-ke padder.

*Willard Moody*

**RCA 811-K**

*Noisy automatic tuning or motor stalling:* Check the small gear at the top of the gear assembly—the one on which is mounted a small arm that engages a pin on the extended motor shaft when the motor is turned on. This gear may be worn, or in some cases, pressing down too tightly on the next gear in the assembly.

At any point in the gear assembly where there is friction, use oil rather than grease. Many greases tend to dry out and harden from the heat developed by the tubes in the chassis. Light machine oil is best for the purpose.

*Willard Moody*

**RADIORGAN**

*(See Front Cover)*

THE RADIORGAN IS ESSENTIALLY a tone control system dividing various stages of high and low boost in the audio circuit. These boosts are controlled by keys or stops similar to those employed in an organ. The keys are merely individual switches with an on and off position.

The stops 9B and 9C (see the diagram on the front cover) introduce a high boost in the grid circuit of the first a-f amplifier by adding capacity from the high point of the volume control to a tap down about 100,000 ohms. Using the reactance formula of condensers in an audio circuit it can be shown that the highs are boosted by the addition of these capacities (0.00015 and 0.00025 mid) individually or in parallel.

The key 9A introduces capacity from the low tap on the volume control to the cathode which by-passes the high frequencies. This provides what is normally called a high cut. The key 9F has a similar action. The keys 9D provide a high cut in the grid circuit of the second audio amplifier tube. Key 9E has a similar action in the plate circuit of the same tube.

# NATIONAL UNION

## QUALITY PRODUCTS

### RADIO RECEIVING and TELEVISION TUBES

### CONDENSERS

Profitable to Use . . . Profitable to Sell because  
National Union Products are well made, trouble  
free . . . Radio Service Engineers have proven it!

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**NATIONAL UNION RADIO CORP., NEWARK, N. J.**

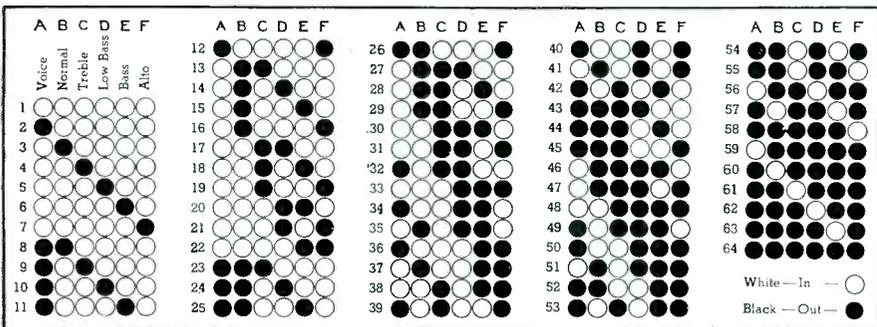


Fig. 2. The 64 tone combinations possible with the Radiorgan.

The keys are labeled on the receiver as to the response offered by each. Through the various combinations of the six stops sixty-four different tone positions are available. These are shown in Fig. 2.

In general it is suggested that the stops be left in their in positions for short-wave reception. For speech the voice normal and treble keys should be in their out positions and the others in their in positions. For dance music the normal, bass and alto keys should be out; for symphonic music all keys should be out.

# THE MANUFACTURERS . . .

## JENSEN P-M SPEAKERS

The Jensen Radio Mfg. Co. have introduced five different models of 12-in p-m speakers to cover all requirements. These models vary in sensitivity, power handling capacity and response characteristics. Additional information may be had from Jensen Radio Mfg. Co., 6601 S. Laramie Avenue, Chicago. SERVICE.

## LENZ AUTO-RADIO CABLE

Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago announces a multilead auto-radio cable. The cable was developed by Lenz engineers with the cooperation of William Dunn, chief engineer and Pat D'Orio, assistant engineer of Belmont Radio Corp.

The Lenz cable incorporates a new type insulation with high "Q" and low capacity, and a weather-proof braid. Any number of conductors may be used, including r-f and control leads.—SERVICE.

## "ROUND-THE-NECK" MICROPHONE

A suitable microphone for use by auctioneers, showmen and athletic directors etc., has always been a problem because of the fact that these men want to move around and have the use of hands and arms. The new Sunco No. 211 "Round-the Neck" microphone is said to be the answer to this problem.

Full details are available from the manufacturer, Sundt Engineering Co., 4238 Lincoln Ave., Chicago, Ill.—SERVICE

## ELECTRONIC LABS POWER SUPPLIES

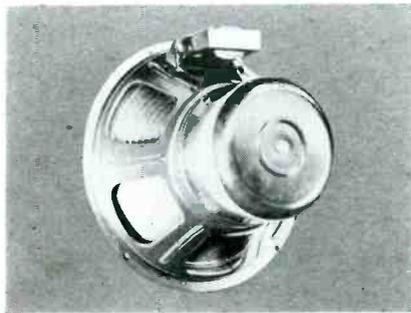
Electronic Laboratories, Inc., 122 West New York Street, Indianapolis, Ind., will concentrate, in the future, on the production and sale of heavy duty vibrators, converters, and power supplies of all types. It is expected in the near future a new vibrator type converter, rated at 2 kw output, will be available.

## STANDARD FREQUENCY CRYSTAL UNIT

The Bliley Type SMC100 standard frequency crystal unit is a dual-frequency mounted crystal for use in secondary standards of frequency. It provides a means for rapidly checking the calibration of radio receivers, test oscillators, signal generators, amateur frequency monitors and similar devices.

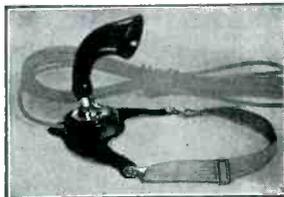
Further information may be secured from the *Bliley Electric Company*, Erie, Pennsylvania, or any Bliley distributor.—SERVICE.

Bliley standard frequency crystal unit.



Above: Jensen p-m speaker.

Below: Ohmite 225-watt rheostat.

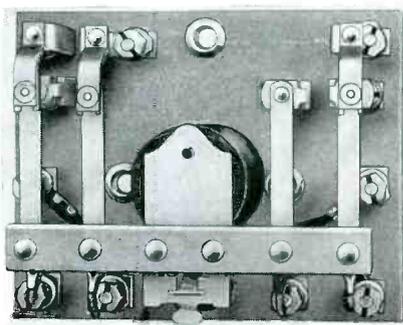


Above: Sundt "round-the-neck" microphone.

Below: Webster-Chicago school system.



Below: Ward-Leonard relay.



## OHMITE 225-WATT RHEOSTAT

The model P is a 225-watt rheostat added to the Ohmite line. The all porcelain and metal type of construction is employed. The resistance wire is wound on a solid porcelain core and is rigidly held in place, insulated and protected by Ohmite vitreous enamel. Additional information may be obtained from the Ohmite Mfg. Co., 4835 W. Flournoy St., Chicago. SERVICE.

## UNIVERSAL MODEL 5MM

Universal Microphone Company, Inglewood, California, has started to manufacture its new streamlined microphone series of which model 5MM is its new all-purpose microphone for p-a systems, schools and colleges, stage, orchestra pickup, and other uses.

## G. E. TEST EQUIPMENT

A line of service and testing equipment to be made available to General Electric radio tube dealers through distributors has been announced by the G-E radio tube sales section, Bridgeport, Conn. In the line are an oscillograph and frequency modulator, a tube and set checker, a signal generator, a tube checker, and a multimeter.

## WEBSTER-CHICAGO SCHOOL SYSTEM

Webster-Chicago, 5622 Bloomingdale Ave., Chicago, have announced their model S-40 sound system for schools and institutions. The system is designed to handle the requirements of any number of rooms up to 40.

A separate communication system allows two-way conversation simultaneously with the regular program.

Additional information can be obtained from the manufacturer.—SERVICE.

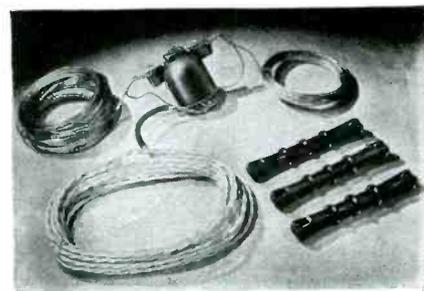
## WARD LEONARD RELAY

Ward Leonard Electric Co., Mount Vernon, N. Y., announces a break-in or push-to-talk relay. These relays are especially suitable on phone transmitters where the operator merely presses a button while transmitting and releases it while receiving. SERVICE.

## MASTER COMMUNITY ANTENNA SYSTEM

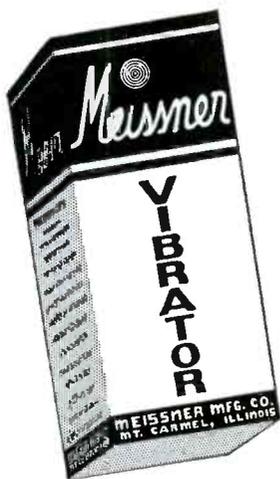
A foundation kit for a community antenna system (commonly known as a Master Antenna System) providing increased signal-noise ratio, is announced by Technical Appliance Corp., 17 E. 16th St., New York City.

Taco community antenna system.



# MEISSNER VIBRATORS

CHECKED AND DOUBLE CHECKED FOR DEPENDABILITY



They're tested, not once, but twice, and aged between tests—that's the reason why servicemen have so little trouble with Meissner Vibrators. The secret of Meissner dependability lies in the aging given every Meissner Vibrator. Where ordinary vibrators are manufactured, tested and shipped, Meissner Vibrators are aged so that the slight metallurgical changes that sometimes affect the operation of any vibrator are discovered in the second test that's given every Meissner Vibrator.

You're not gambling when you install a Meissner Vibrator—you know that it has received every possible test and will give your customer the long and dependable service that makes friends—for you and for us.

See Your Parts Jobber

*Meissner*

Mfg. Company  
Mt. Carmel, Ill.

"A FAMOUS NAME FOR TWO DECADES"

## How Do You Do It?

How do you solve the many servicing problems with which you have to contend . . . what special kinks have you worked out which help you in servicing receivers . . . have you developed shortcut schemes for testing, or built test devices that do the work better and faster?

No matter what the scheme or the device, there are many, many Service Men who would like to know the how's and why's—just as you would like to know about the schemes and devices employed by others.

## SERVICE WANTS TO KNOW!

If you have clever ideas and clever devices, we want to know about 'em as much as do our readers. Regular space rates are paid for all material accepted for publication.

All you have to do is give us the outstanding points, and a rough pencil sketch of the device if it happens to be such—and we will do the rest.

Come on, now, and kick in. Write up those ideas now and send them in to the . . .

## ON THE JOB DEPARTMENT

## MODERNIZE YOUR SHOP!



**\$100.00 worth of Prizes to winners!**

The Radio Junk Shop Era is disappearing, and to speed its passing, Sylvania designed and built a Modern Service Shop at Emporium, Pa. People were interested. People talked about it. People got excited.

To encourage Service Shop modernization, we are offering prizes valued at \$100.00 total to the three service men who best adapt the Sylvania Model Service Shop plans to their own shop. A booklet containing complete drawings, together with explanations, is available at 10c.

And you don't have to have a lot of cash on hand to do this. Financing shop modernization is provided by Title 1 of the Federal Housing Administration plan. Your local bank has complete information.

Clip the coupon below NOW and get full details on this contest. Hygrade Sylvania Corp., Emporium, Pa.

*Also makers of famous Hygrade Lamp Bulbs.*

## SYLVANIA Set-Tested Radio Tubes

HYGRADE SYLVANIA CORP.  
Emporium, Pa.

S-88

- Send me details on the Modernization Contest.  
 Send me a Sylvania Service Shop Plan Book @ 10c.

Name .....

Address .....

City..... State.....

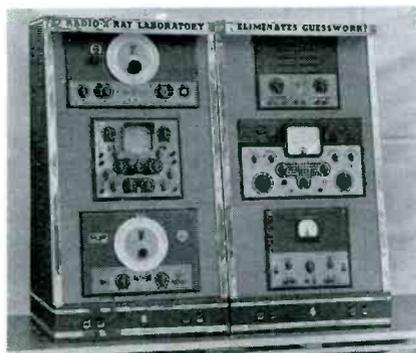
- Amateur                       Experimenter  
 Dealer                          Serviceman

Name of Jobber.....

## MANUFACTURERS—continued

### CLOUGH-BRENGLE AUTO SERVICE LAB

Said to combine all of the test equipment essential to the proper and speedy servicing of auto-radio sets, the complete laboratory just announced by The Clough-Brengle Co., 2815 W. 19th Street, Chicago, Ill., should be of interest to service men especially those concerned chiefly with auto sets. The laboratory provides for all of the necessary checks on the set operation as well as a thorough series of tests on vibrators.—SERVICE



Above: Clough-Brengle auto service lab.

### AMERICAN D9T MICROPHONE

The American Microphone Co., Inc., 1915 S. Western Ave., Los Angeles, Cal., announce their model D9T unidirectional dynamic microphone. It is recommended by the manufacturers for general p-a installations. A descriptive bulletin, No. 29, may be obtained upon request.—SERVICE.

Below: American D9T microphone.



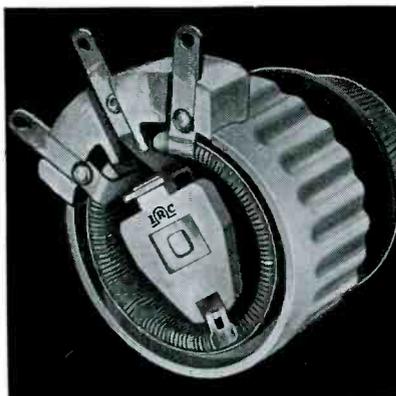
### BLUE BEAVERS

Special vents in the new Cornell-Dubilier Type BR "Blue Beaver" electrolytics is said to permit normal dissipation of the harmless, odorless electrolytic vapor and to afford a better factor of safety under operating conditions. Tubular, compact construction provides ease of wiring into circuit and a varnished protective sleeve is spun over at both ends to prevent possible short circuits of leads to the aluminum container. Catalog 156-A containing technical information on these units, is available from Cornell-Dubilier Electric Corp., South Plainfield, N. J.—SERVICE.

### IRC 25-WATT RHEOSTAT

Safe operation at full 25-watts, down to 25% of full rotation with a temperature rise of about 160° is claimed for the IRC "all metal" 25-watt rheostats introduced by the International Resistance Co., 401 N. Broad St., Philadelphia, Pa.

These IRC rheostats are fully described in an engineering bulletin which will gladly be sent upon request.—SERVICE.



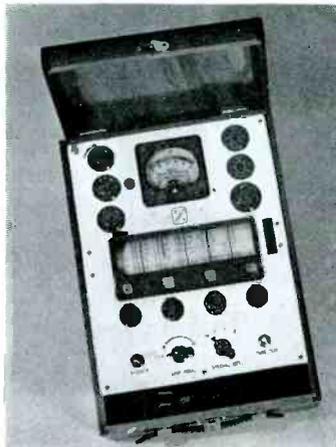
Above: IRC 25-watt rheostat.

### RCA LIGHT WEIGHT P-M SPEAKER

Introduced as a companion to the RCA 100-watt and 60-watt speakers, a 25-watt p-m speaker, the MI-6260, is announced for outdoor and indoor applications where a small, light weight unit is required. Additional information may be obtained from the RCA Mfg. Co., Camden, N. J. SERVICE.

Below: Electronic Apparatus dynamic tube tester.

RCA light-weight p-m speaker.



### NEW RAYTHEON TUBES

Raytheon Production Corporation, Newton, Mass., announces four new receiving type tubes as follows:

OA4G: A gas filled cold cathode triode, designed for use in circuits for the remote control of a-c line operated devices.

4A6G: A twin-triode power amplifier designed for Class B use in 90 volt battery receivers.

6P5G: An octal based triode which has the same characteristics as the type 76 and which may be used for the same general purposes.

6S7: A low drain r-f pentode in a metal bulb. Has the same characteristics as the 6S7G which was one of the first in the low drain group, designed for 6-volt battery and auto receivers.—SERVICE.

### PUSH-PULL VIBRATOR

Formal announcement of the James Push-Pull vibrator was made at the recent Chicago trade show. Its manufacturers, Pauley-James Corp., 4619 Ravenswood Avenue, Chicago, Ill., claim improved performance of any auto radio. Push-Pull operation is said to improve the wave-form of the output to such an extent that receiver sensitivity and power output are enhanced by its use.—SERVICE

### ELECTRONIC APPARATUS TESTER

The Electronic Apparatus Co. of 814 N. Damen Ave., Chicago is now manufacturing a new dynamic tube tester with several novel and useful features said to give a maximum of accuracy, speed and attractiveness.

Obsolescence is avoided by replacement of the roll chart sheet to incorporate new tubes. Other items adding to convenience and appearance are the line cord compartment, separate grid connector, chrome panel and walnut case.—SERVICE

### UNI-DIRECTIONAL MICROPHONE

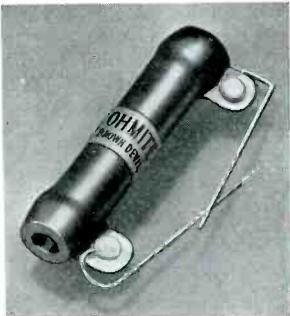
A uni-directional crystal microphone, operating on a totally new principle, is announced by Shure Brothers, 225 W. Huron Street, Chicago. The new microphone, known as the Model 730A "Uniplex," is essentially responsive only to sound approaching toward the front of the unit.

(Continued on page 38)

Shure Brothers uni-directional microphone.



SAVE SERVICE PROFITS!  
Use **OHMITE**  
**BROWN DEVILS**



Built Right—and Sealed Tight with Permanent Vitreous Enamel

The service profits stay in your pocket when you install the popular Ohmite Vitreous-Enameled "Brown Devil" Replacement Resistors. No troublesome breakdowns—No profitless call-backs. 10 and 20 watt sizes, in resistances from 1 to 100,000 ohms. Be Right with Ohmite—Ask Your Jobber for Brown Devils. Write now for New Catalog 17.

**OHMITE MANUFACTURING CO.**  
4827 FLOURNOY ST. CHICAGO, U. S. A.

**OHMITE**

RHEOSTATS RESISTORS TAP SWITCHES

**EXTRA-EXTRA**  
SEPARATE PLATE TESTS ON DIODES  
AND RECTIFIERS...  
BALLAST  
TUBE TEST



Positively Checks Radio Receiving Tubes According to Latest Recommendations of Tube Engineers

**NEW MODEL 432 ONLY \$21.60**

- Separate Plate Tests on Diodes and Rectifiers.
- Neon Short and Leakage Tests.
- Uses Triplet Direct Reading Instrument (GOOD-BAD) Scale.
- Line Voltage Adjustment.

Complete in attractive, sturdy, quartered-oak case; suitable for counter or portable use. Sloping etched panel of silver and black.

Other Readrite Tube Testers Also Are Available.

**Readrite**  
**RANGER**

**READRITE METER WORKS**  
817 College Avenue, Bluffton, Ohio

TEST EQUIPMENT—continued

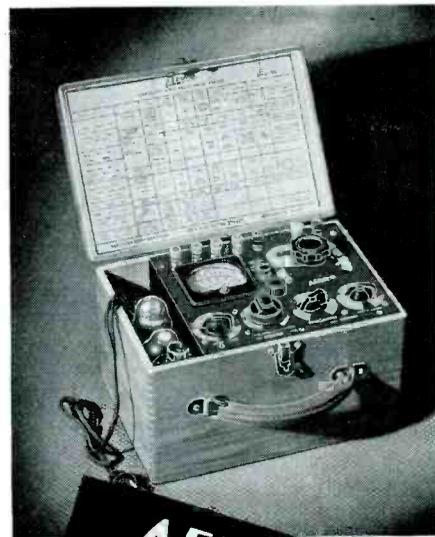
A receiver, brought to us by a local Service Man, would intermittently change the output volume level. There was no particular time interval, but it seemed to take place when loud passage of music would be heard and the receiver chassis vibrated. A broken contact was suspected—but where was the broken lead?

The Chanalyst was connected to the receiver. The r-f, i-f probe monitored the signal fed into the mixer grid. The oscillator channel monitored the receiver oscillator. The wattmeter established the power consumption. The audio channel monitored the audio voltage out of the second detector and the voltmeter circuit monitored the highest output d-c voltage. A test signal was fed into the receiver. All the electron-ray indicators were adjusted.

The bench upon which the receiver and Chanalyst were mounted was struck several times so as to cause the receiver to vibrate. After two blows the receiver output dropped. Examination of the Chanalyst indicators showed a decrease in the signal at the r-f mixer. The oscillator was normal. The wattage consumption was normal. The d-c voltage reading increased slightly and the audio indication showed decrease.

Since the receiver was still functioning but with reduced output, the r-f probe was moved from the mixer grid to the antenna to check the signal level. It was normal. Then the probe was placed in contact with the r-f tube control grid. A definite gain in signal due to the amplification in the antenna transformer was noted. Then the r-f probe was moved back to the mixer grid and a very definite loss in signal was observed. Suddenly the signal came back to normal.

Having localized the trouble it was necessary to wait for another fade. Having checked at the various grids, it was deemed advisable to provide for checking beneath the chassis. The receiver was turned top down and the signal again monitored at the mixer grid. Jarring the chassis again produced the fade. The mixer input signal again showed a reduction. Now it was possible to go to the r-f tube plate with the r-f probe tuned to the signal fed into the receiver. There was no signal at the plate of the r-f tube. The r-f probe at the r-f grid showed the correct signal. The voltmeter probe at the r-f plate showed no voltage. The same probe at the B-plus end of the coil showed a voltage. Repeating the voltage test at the r-f plate showed no voltage. The intermittent was in the broadcast band r-f transformer primary.



**AEROVOX**  
CAPACITY and  
RESISTANCE  
Bridge

● Users of condensers are now offered a more critical and conclusive yardstick of condenser quality, in the AEROVOX Capacity and Resistance Bridge. Combines, in a single, portable instrument, the following:

**CAPACITY BRIDGE**

Measures capacity 100 mmfd. (.0001)—100 mfd. in 6 ranges; leakage; power factor to 50%, etc., of condensers under actual working conditions.

**RESISTANCE BRIDGE**

Measures resistance values of resistors and electrical equipment and circuits. 10 ohms to 1 megohm in 5 ranges.

**INSULATION RESISTANCE**

Measures this important factor in condensers and other devices. Meter calibrated directly in megohms. Reads up to 10,000 megohms.

**VACUUM-TUBE VOLTMETER**

Consists of amplifier stage and grid-leak detector. Measures minute values 0-2 volts.

**PRECISION METERS.**

Voltmeter, also for external uses, provides 0-60, 0-300 and 0-600 v. meter at 1000 ohms per volt. Also a 60 mv. at 60 ohms millivoltmeter; and milliammeter 0-6 ma., 0-60 ma.

**VARIABLE POWER SUPPLY**

Available directly at terminals. 15 to 600 volts continuously variable over entire range.

**Ask to See It...**

Your local AEROVOX jobber can show you this indispensable instrument. Or write us direct for descriptive literature.

**AEROVOX**  
CORPORATION  
70 Washington St. : : Brooklyn, N. Y.  
IN CANADA: AEROVOX CANADA, Limited, Hamilton, Ont.

# HIGHLIGHTS . . .

## ADELMAN'S RECORD ENVIABLE

The advertising and sales problems of the Cornell-Dubilier Electric Corp., S. Plainfield, N. J., are managed by a genial gentle-



Leon Adelman.

man named Leon L. Adelman. At the lusty age of 9, when most moppets are falling off tricycles, Adelman was already looking into the curious working of inductance coils, condensers, crystal detectors and aerials—with a view, possibly to "taking up" radio.

This is significant because few men of his age—Adelman is 35—bring to their job so vast a fund of useful experience.

Salesman, laboratory assistant, director of publicity, editor, advertising manager, sales manager—these are satisfactory careers in themselves for most men, but to Leon it's all in a lifetime, and all in radio, at that.

## CLAROSTAT LISTINGS

A numerical listing of Clarostat exact-duplicate controls and their corresponding standard controls where the latter can be satisfactorily substituted, is now available in a four-page bulletin released by Clarostat Mfg. Co., Inc., 287 N. Sixth St., Brooklyn, N. Y.

Listings of the entire line of Clarostat products are also available in the form of jobber catalog sheets. Adequate descriptive text is included. These loose-leaf 8½ x 11 in. sheets, intended for counter and jobber salesman use, are available to anyone in the radio trade. SERVICE.

## TRANSDUCER DISTRIBUTORS

Transducer Corp., 30 Rockefeller Plaza, New York City, announces that the Tilton Electric Corp. of 15 E. 26th St., New York City, has been appointed exclusive distributors for the world for Bullet microphones. SERVICE.

## PERKINS ADVANCED

The Supreme Instruments Corp., Greenwood, Miss., test instrument manufacturers, announces that E. G. Perkins of its Engineering Dept. is now in charge of high frequency test instrument design. SERVICE.

## PRECISION CATALOG

Precision Apparatus Corp., 821 E. New York Ave., Brooklyn, N. Y., have released a catalog illustrating and describing their 1939 line of test instruments built for the Service Man. Copies of this catalog may be obtained directly from Precision.—SERVICE.

## STANCOR APPOINTS

During the Radio Parts Show in Chicago, Standard Transformer Corporation, 1500 N. Halstead Street, Chicago, made several changes in representation in various territories and is pleased to announce the following additions to its list of representatives.

W. Bert Knight, Inc., 115 W. Venice Blvd., Los Angeles, Calif.

Brown-Sherill Company, 310 E. Morehead, Charlotte, N. C.

Hollingsworth & Still, Norris Bldg., Atlanta, Ga.

J. M. Cartwright, 1288 Vinton Avenue, Memphis, Tenn.

## ARCTURUS DEALER HELPS

A list of more than fifty dealer helps, many available without cost and others at a nominal sum, has been announced by the Arcturus Radio Tube Co., Newark, N. J. A four page catalog listing and describing these helps in detail will gladly be sent upon request to any dealer or Service Man.

A revised edition of the Arcturus Tube Data Chart including complete technical and application information on 166 types of glass, "G," Midget and Coronet tubes as



well as 38 types of ballast tubes, has also been prepared by the Arcturus Radio Tube Co. and will gladly be supplied to any Service Man or dealer upon direct request to the factory.—SERVICE.

## AEROVOX BRIDGE MANUAL

The theory and functioning of the capacity and resistance bridge, together with practical instructions for miscellaneous applications are contained in the Aerovox "Capacity and Resistance Bridge Manual" issued by Aerovox Corp., 70 Washington St., Brooklyn, N. Y. Supplied as the instructions with each Aerovox capacity and resistance bridge, this manual is also available separately, at 50 cents per copy, directly from the manufacturer.—SERVICE.

## BRUNO PICKUP BULLETIN

An illustrative and descriptive bulletin on their recently introduced Symphonic phonograph pickup is available upon request from Bruno Labs, Inc., 30 W. 15 St., New York City.

## HYGRADE-SYLVANIA CONTEST

The Hygrade-Sylvania Corp., Emporium, Pa., have announced a service shop modernization contest for the progressive Service Man. Prizes worth a total of \$100.00 will be paid to the three Service Men who best adapt the Sylvania Model Shop plans to their requirements and build a modern service shop. The final closing date is Sept. 30, 1938. Complete details of the contest can be obtained directly from Hygrade-Sylvania.

## GARRARD SALES CATALOG

Garrard Sales Corp., American sales representatives for Garrard Engineering and Manufacturing Co., Ltd., of Swindon, England, announces the publication of a catalog devoted to record players and automatic record changing units.

Copies may be secured by writing to Garrard Sales Corp., 17 Warren Street, New York City. SERVICE.

## ALLIED 1939 CATALOG

The Allied Radio Corp., 833 W. Jackson Blvd., Chicago, has released its 180-page, 1939 catalog. The book features receivers, service instruments, amateur-experimenter equipment, p-a systems and parts.

Copies may be obtained by writing directly to Allied.—SERVICE.

## BELL SOUND MOVES

Bell Sound Systems, Inc., has moved to a new plant, which will serve as a factory and general offices, located at 1183 Essex Ave., Columbus, Ohio.

The Bell Sound Systems manufacture portable and permanent p-a, intercommunicating and specially built sound systems. Their equipment is built under the E.R.P.I. license arrangement.—SERVICE.

## MANUFACTURERS—continued

### HICKOK SIGNAL GENERATORS

Both of these signal generators have five output selections—frequency modulated r-f output; amplitude modulated r-f output, unmodulated r-f output, 100 to 10,000 cycle continuously variable audio-frequency output, 400-cycle fixed audio output. All ranges are controlled by output attenuator.

Model 18, illustrated, has a self-contained power level meter with three decibel ranges: -10 to +6, +6 to +22, +22 to +38. Specifications for model 17 are identical with those of model 18 with the ex-



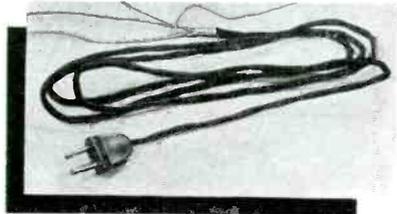
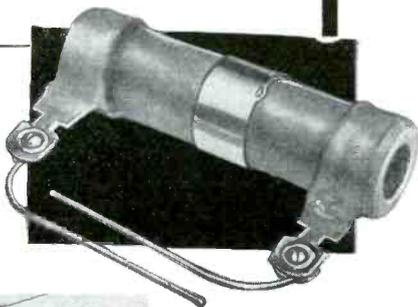
Hickok Model 18 signal generator.

ception of the omission of the power level meter.

For further information write the maker, The Hickok Electrical Instrument Co., Cleveland, Ohio.—SERVICE

## 2 New Aids to BETTER SERVICING . . .

● Provably better wire-wound power resistors. Green finish so you'll know them. Inorganic cement coated. No blistering or cracking even at red heat. Units for extreme humidity applications. 10, 20, 25, 40, 50, 80, 100, 160, 200 watts. 1 to 150,000 ohms. Variable power resistors also.



● Voltage-dropping power cords for AC-DC sets. Enclosed resistance winding provides proper plate voltage for rectifier and for tube filaments. Eight types meet all needs.

**Ask** your local jobber to show you these new servicing aids. Ask for latest CLAROSTAT catalog. Or write us direct.

**CLAROSTAT Manufacturing Co. Inc.**



285-287 NORTH SIXTH STREET  
BROOKLYN, NEW YORK, U.S.A.

• OFFICES IN PRINCIPAL CITIES •

## A GOOD NAME GOES A LONG WAY



Your customers will be better satisfied, if you install Ken - Rad Radio Tubes. You can depend on Ken - Rad Tubes.

KEN - RAD TUBE & LAMP CORPORATION  
Owensboro, Ky.

# KEN-RAD

DEPENDABLE RADIO TUBES

## SAVE \$1.00!!!

- The Group Subscription Plan for *Service* enables a group of service men, dealers or jobbers to subscribe at one-half the usual yearly rate.
- The regular individual rate is \$2.00 a year. In groups of 4 or more, the subscription rate is \$1.00 a year. (In foreign countries, \$2.00.)
- Each subscriber should print his name and address clearly and state his occupation—whether a dealer, jobber, independent service man, service organization, etc.

Remember this Group Plan when Your Subscription Expires

# Halldorson

Vacuum Sealed Transformers

## Two Models Fit 1250 Receivers

Do You Know that eight Halldorson models will take care of all replacement demands for both power and audio transformers in more than 90% of all makes of radio sets?

For better, more satisfactory results, specify Halldorson.

Ask Your Jobber

Write for New Catalog

## THE VARI-VOLT Exclusively Halldorson

0 to 256 v. in 1-volt steps; 0-128 in ½-volt steps. Simplifies radio service work.



**FREE**

to Servicemen on Halldorson Deal

THE HALLDORSON CO., 4500 Ravenswood Ave., Chicago, Ill. S-838

Please send me:

New Catalog.

Information on Free Vari-Volt Deal.

Name.....

Address.....

City.....

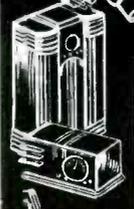
State.....

# NEW 1939

# RADOLEK

The Most Complete Radio Buying Guide

# FREE!



*Everything you need in radio.* It's all in this New 1939 RADOLEK RADIO PROFIT GUIDE. Every repair part for every receiver. Newest radio receivers. New 1939 model public address amplifiers, outputs from 5 to 100 watts. Test instruments. Technical books. Special equipment. Leading standard brands. Every item guaranteed. It must be right or we make it right.

*And everything under one roof.* You get what you want promptly, and exactly what you want. Radolek's immense stock plus Radolek's efficient organization insures you fastest service. 25,000 Servicemen depend on this service and benefit by Radolek's lowest prices. Send now for your copy of Radolek's Radio Profit Guide. It will help you make more money.

--- The **RADOLEK Co.** ---

601 W. RANDOLPH, CHICAGO, Dept. R-22.

Send me the Radolek Radio Profit Guide FREE.

Name .....

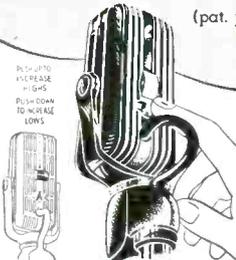
Address .....

Serviceman?  Dealer?  Experimenter?

# AMPERITE offers "ADJUSTABLE RESPONSE"\*

... made possible by  
**THE ACOUSTIC  
COMPENSATOR**

(pat. pend.)



\*Higher or lower pitch with the same microphone.

With the flip of a finger you can now (1) lower or raise the response of the microphone. . . (2) adjust the microphone for most desirable response for close talking or distant pickup. . . (3) adjust the system to any "taste", room condition, or equipment.

MODELS RBHk, RBMk, with Acoustic Compensator, frequency range 40 to 11000 cps, output, -65 db., complete with switch, cable connector and 25' of cable. . . . \$42.00 LIST

## NEW LOW-PRICED CONTACT "MIKE"

\$12.00 LIST



The new popular-priced Amperite Contact Microphone can be used on most radio sets made since 1935 and on all P.A. systems. It "makes an ordinary violin sound like a Strad" . . . gives a small piano the tone of a Grand. And yet, there is no distortion. No unnatural effects. No "fingering noises." No changes in strings or instrument. Attached without tools.

Operates with either high or low gain amplifiers. Has frequency response of 40 to 9000 cps. Output, -40 db. 20' of cable.

MODEL SKH (Hi-imp.); SKL (200 ohms). \$12.00 LIST  
Professional Model KTH (or KTL) . \$22.00 LIST

## NEW COMPACT "MIKE"



A new velocity microphone of compact size, having a head only 1 1/4" x 2 3/8" x 1 3/8". Good for speech and music. May be used as hand mike as well as for stand mounting. Complete with output transformer, cable connector and switch. Output, -70 db. into open line. Frequency response 60 to 7500 cycles.

MODEL ACH (Hi-imp.); ACL (200 ohms) . . . . . \$25.00 LIST

## MODEL RAH...\$22.00 LIST

P.A. Men, you can improve those "price" jobs by using the popular Amperite Model RAH (or RAL). You will get better results because (1) it is excellent for both speech and music; (2) has flat response without undesirable peaks; (3) reduces feedback; (4) stands up under rough handling and changes in temperature, pressure or humidity. . . . Frequency range 60 to 7500 cps. Output, -68 db.

MODEL RAH (Hi-imp.); with 12' of cable; RAL (200 ohms) with 8' of cable,  
ONLY \$22.00 LIST



Write for Complete Illustrated Bulletins and Valuable Sales Helps.

**AMPERITE** Co. 561 BROADWAY, N. Y. Cable Address: Alkem, New York

**AMPERITE** velocity **MICROPHONE**

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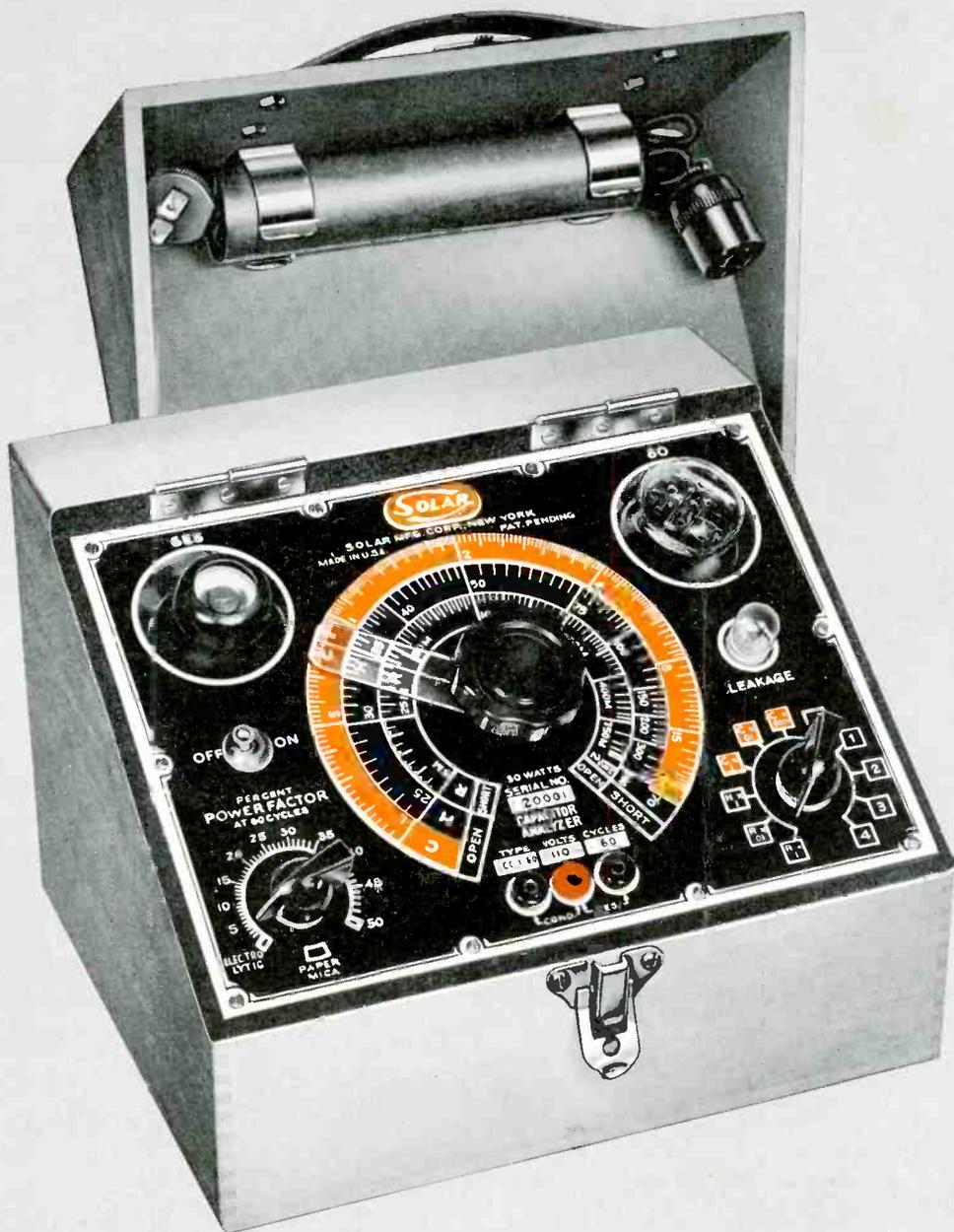
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## New RCA 2-Inch Cathode Ray Oscillograph!

Not just another Oscillograph, but a highly efficient instrument designed by RCA engineers to exacting service specifications. It's big enough for every application, yet compact and portable. The newly developed RCA-902 High Sensitivity Cathode Ray tube is specially "Tilt Mounted" to insure easy reading. Deflection sensitivity of 0.5 volts (RMS) per inch, calibration screen and all controls on the front panel are important features. Check the specifications below for other features.

### Specifications

**Radiotrons Used**—1 RCA-902 (2-inch), 1 RCA-885, 2 RCA-6C6, 1 RCA-80.

**Sensitivity**—0.5 volts (RMS) per inch.

**Amplifier Range and Gain**—Flat 20-15,000 cycles, gain 50.

**Timing Axis (Horizontal Sweep)**—30-10,000 cycles.

**Operation**—All controls on front panel—complete with calibration screen.

**Power Consumption**—30 watts.

**Dimensions**—Length 13¾", height 9¾", depth 7¾", weight 14½ lbs.—Special snap handle—sturdy case.

**Finish**—Gray wrinkle lacquer with nickel trimming. Reversed etched, nickel-silver panel—large, soft rubber feet.



STOCK No. 151  
**\$39.95**  
 Net Price  
 Also available as  
 Stock No. 151-A, for  
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### RCA 1-inch Cathode Ray Oscillograph

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This extremely low priced instrument is popular with scores of service men from coast to coast. Its specifications and features are identical with Model 151-2, except

that it uses an RCA-913 one-inch Cathode Ray tube and has a sensitivity of 1.75 volts (RMS) per inch. Comes complete with calibration screen and light shield. See specifications on Model 151-2 for complete details.

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