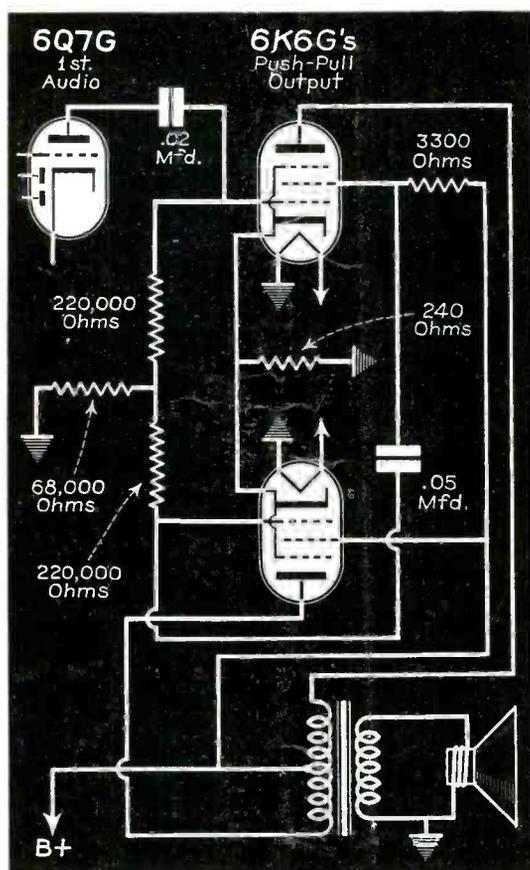


SERVICE

A MONTHLY DIGEST OF

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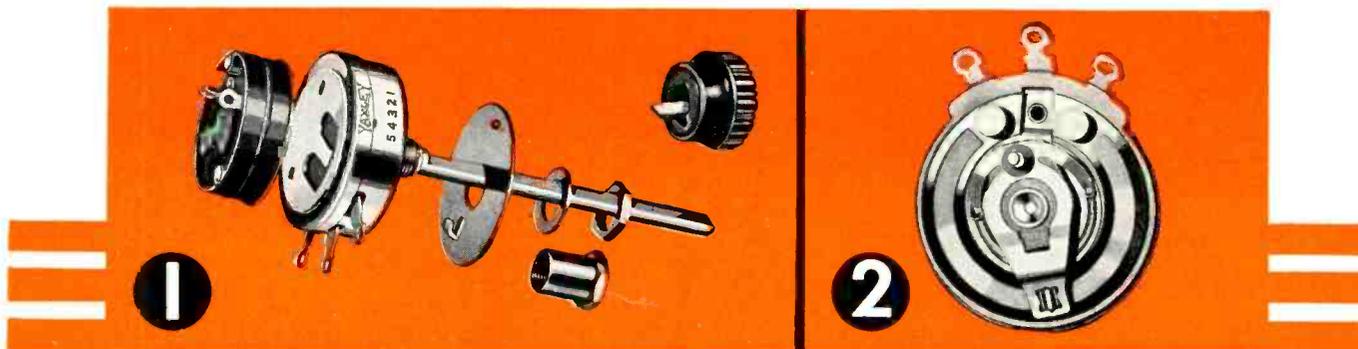


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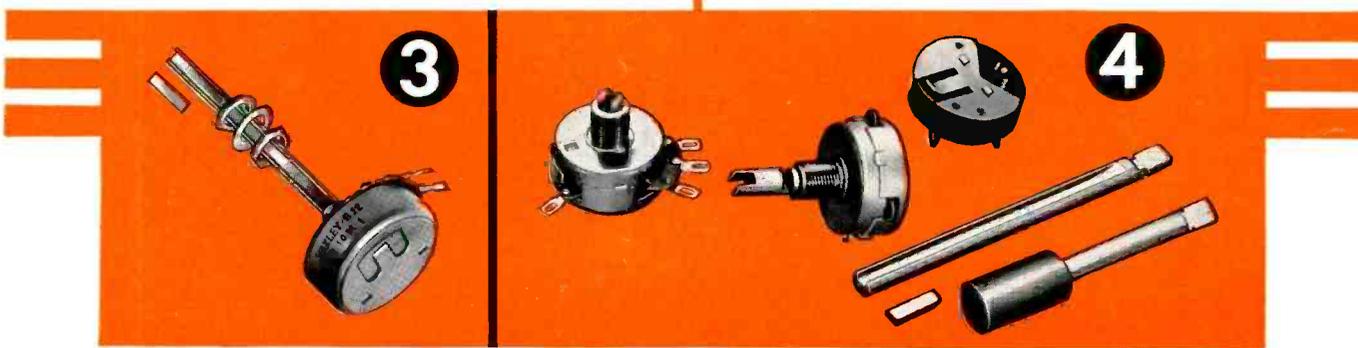


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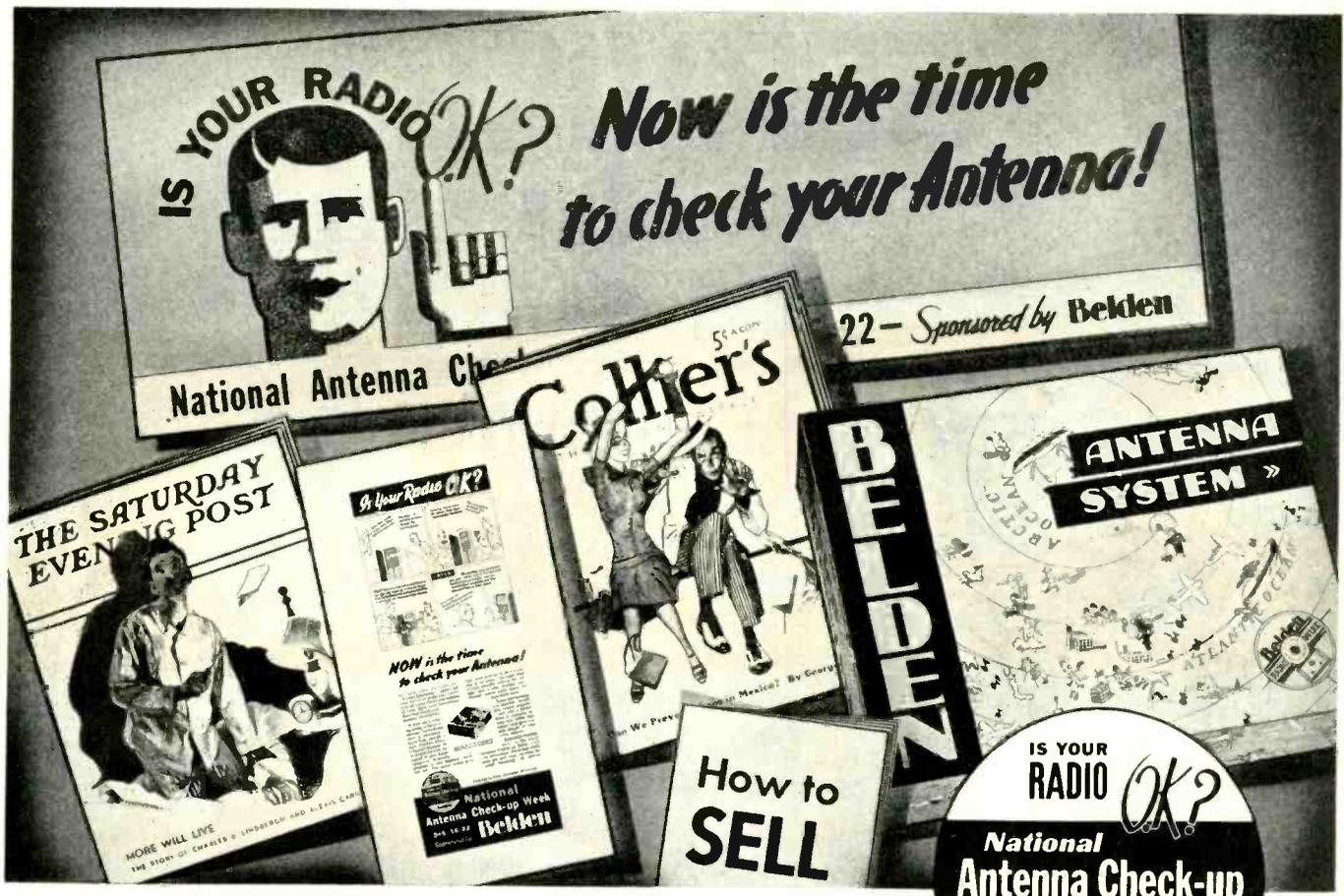
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SEPTEMBER, 1938 •

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EDITOR

ROBERT G. HERZOG

SEPTEMBER, 1938

VOL. 7, NO. 9

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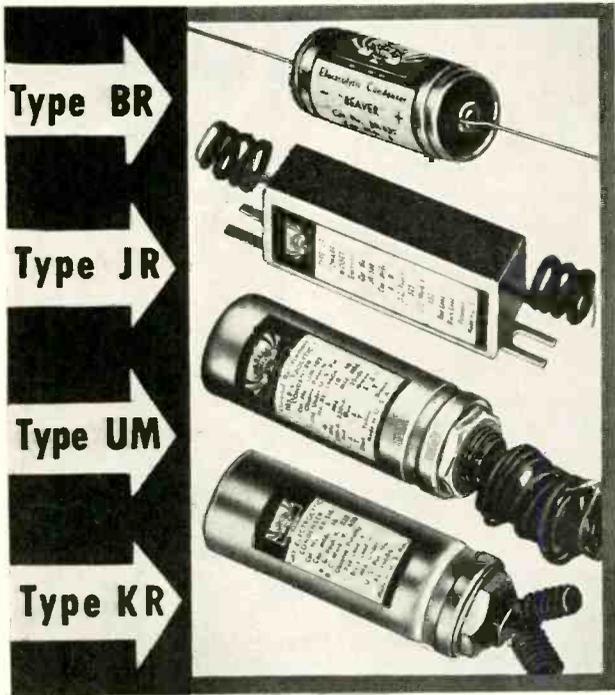
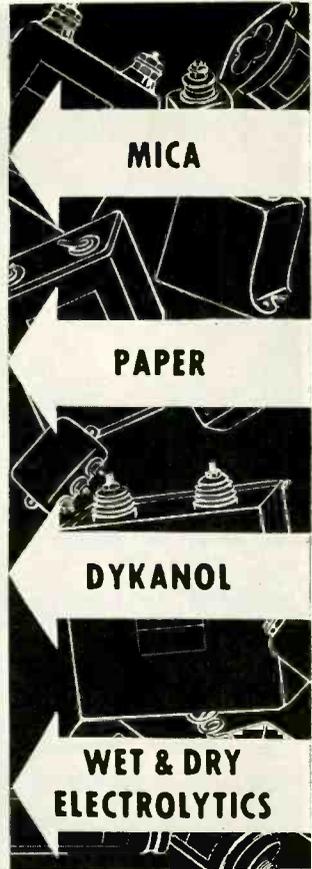
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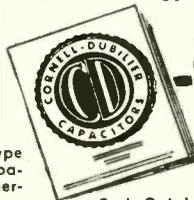
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The Antenna

TELEVISION

IT HAS been rumored from usually reliable sources that several large mail order houses are all geared to announce the sale of television kits by the first of next year. These kits to sell at about \$100 or \$125.

The ice has already been broken. We had the pleasure of sitting in on a demonstration of a television set built from a kit marketed by a New York set manufacturer for about \$100 complete with tubes. These kits are already on sale.

Here, in the United States, television has long been around the proverbial corner. Perhaps it has finally emerged into the light. Who can tell?

The 1939 New York World's Fair and its promise of public television demonstrations should create a demand for receivers and programs. This might be the deciding impetus.

Transmission is now on an experimental basis. There are only about three stations operating on what might be called a regular schedule. However, several additional stations are scheduled, and others have asked for licenses.

In England, television sets have been on sale, and regular broadcasts scheduled for the last two years. Recent remarkable improvements there, and also in Germany, have made television transmission and reception more of a reality.

For the coming year, English manufacturers have announced combination sight and all-wave radio consoles with 9-, 12- and 15-inch cathode-ray tubes, retailing from \$100 up. Those to be demonstrated and on sale at the coming Radiolympia.

German manufacturers have attained remarkable success with a 12- by 14-foot projection of the televised image on a special screen.

Of greater moment, however, is the German mantel type receiver. This is a complete all-wave radio and television receiver, with an 11-inch cathode-ray tube, in a cabinet 12 by 14 by 22 inches. It will retail for about \$225. Both this latter machine and the larger projection type were demonstrated at the recent Berlin Exposition and are promised for the October market.

That all this means money in your pocket, goes without saying. In the early days of radio broadcasting most sets were made in the kitchens and cellars of ardent enthusiasts and experimenters. It would not be at all surprising if television got its beginning that way. Putting the various kits together for early enthusiasts should prove very profitable to the conscientious Service Man. And as the art advances it will bring an additional unit into the home to require his services, virtually making two customers of each present one.

OUR POSITION

WHEREVER we go we hear the question raised, "What are you going to do about television?"

Whatever SERVICE does will depend upon its readers. We will give space only to the type of material you request. Write us your wants, or rather your needs, on this marvelously interesting and important subject.

As it stands now, we feel that we should confine ourselves to featuring only that type of material which is not easily available elsewhere. We do not think it advisable to take up a lot of valuable space with text book material, such as definitions and the like, which can be found in any elementary book on the subject.

However, to assist you in selecting the proper books we will review a number of texts on the subject in an early issue.

IN THIS ISSUE

ON PAGE 28 of this issue we present the complete circuit diagram of a television receiver. The kit of parts for this receiver is already on sale. We feel that this is the first published complete diagram of that kit. When additional kits are available we will attempt to supply our readers with complete and accurate technical information.

On page 15 of this issue we have used a novel method of presenting alignment operations. We would like to hear from you as to your opinion of this presentation. Does it meet with your approval? Can you suggest any improvements?

A FEW REMINDERS

IN THE last issue of SERVICE we mentioned that the manufacturers of antenna kits were sponsoring "Antenna Checkup Week" for the week of October 15 to 22. Don't forget to get on the bandwagon and reap your share of profit from the added publicity that antenna checkup will get by virtue of the advertising campaigns of these companies.

And may we again suggest that you keep informed on new developments by writing to the parts manufacturers for their sales literature. If television should come, you must know the names and ratings and even the prices of the various components so that you can give intelligent estimates on wiring, repairs and replacements. We know of no better source for this type of information than the manufacturers sales literature.

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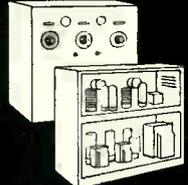
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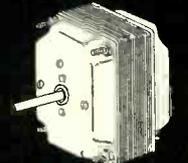
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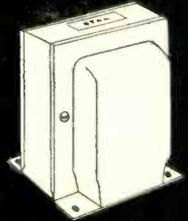
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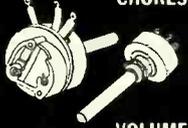
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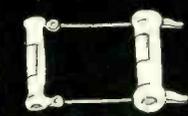
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SERVICE

A Monthly Digest of Radio and Allied Maintenance

FOR SEPTEMBER, 1938

EFFICIENCY AND HIGH-FIDELITY

By MAURICE APSTEIN*

THE average Service Man is vaguely aware that a wide frequency range is not necessary for the proper reproduction of speech. To a great degree, however, he does not realize that a broader response than absolutely necessary may actually impair the results obtained from any given system. Stated in another way, by properly curtailing the frequency response or by choosing components having just the right response, a considerable increase in efficiency and power handling capacity of any given system may be obtained, providing the installation is meant for the reproduction of speech at high intensities. Since most high power outdoor *p-a* systems are primarily used for this purpose, a study of the necessary requirements should prove extremely useful in enabling the installer to obtain the highest speech intensity per electrical watt output.

WIDE RESPONSE REDUCES EFFICIENCY

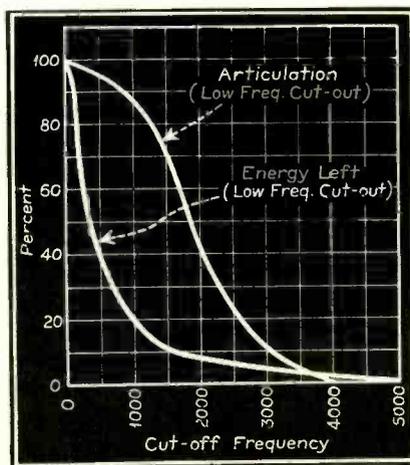
It is generally known that the broader the response of any given electro-mechanical system, the lower its efficiency. This is so because such a system is most efficient at or near its resonance frequencies, and in order to broaden out the response, it must be operated in a region far removed from resonance, or else the resonances must be damped out so that they will not cause irregularities in the response. Either mode of operation results in a very low operating efficiency. The above line of reasoning applies to speakers and microphones as well as any other electro-acoustic or electro-mechanical device. It explains in general why high-fidelity microphones have lower output levels, and high-fidelity speakers have lower efficiencies than their corresponding types with less broad frequency

*Morlen Electric Co.

SO MUCH attention has been paid to the high-fidelity characteristics of sound systems in general in the last few years, that the other aspects of the subject have more or less been thrust into the discard, in spite of the fact that certain other factors may be more important than overall fidelity for special applications. The advent of wide-range amplifiers and speakers of flat frequency response characteristics, has resulted in the gradual neglect of the fact that the widest and flattest frequency response obtainable is not necessarily the best frequency response for any given system.

range. It can be readily appreciated that, if under certain circumstances efficiency is important, it may be advantageous to sacrifice fidelity in its favor.

Fig. 1. Variation of intelligibility or articulation for voice as the low end of the frequency spectrum is cut out, together with the fraction of the original sound power removed after the frequency band has been restricted.



In fact a broader response than absolutely necessary can very often become a drawback.

RESTRICTION SAVES POWER

Fig. 1 is a curve showing the distribution of power and "articulation" in normal speech sounds. Articulation may be defined as the capability of a system to reproduce the original speech; in other words it is roughly a measure of the understandability or intelligibility of speech reproduction. The curves show the variation in articulation for voice sounds as one end of the frequency spectrum is cut out, together with the fraction of the original sound power remaining after the frequency band has been restricted. It can be seen from a casual inspection that by far the greatest amount of intelligibility lies in the middle and upper frequency regions and that these frequencies contain only a small fraction of the power represented by the whole spectrum. Similarly, the lower frequencies contribute very little to the intelligibility but require large amounts of power to reproduce. By cutting out the low-frequency end of the response range, a given voice can be maintained at approximately the same intensity as before with only a small fraction of the power handling capacity previously required.

Specifically, by cutting off the low-frequency end at 500 cycles, only three percent of the intelligibility is lost in spite of the fact that the power output has been reduced 60 percent. With a given amplifier and speaker system, the amplifier gain control could then be advanced until the restricted response output equalled the previous broad-band output. The result would be that even though the actual power output was the same in both cases, the useful power, and therefore the speech intensity would

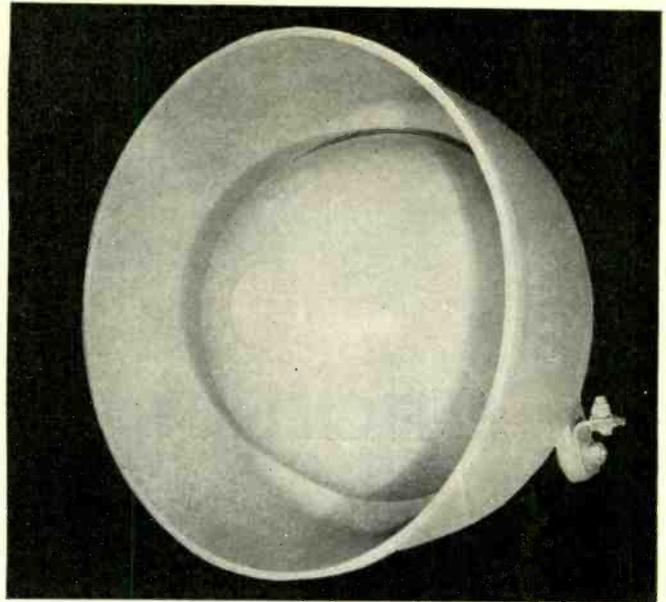
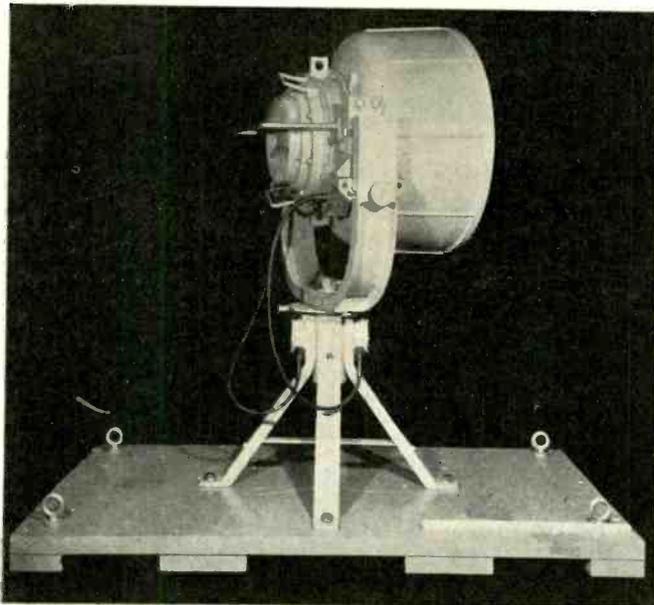


Fig. 3. The Western Electric Bull Horn. The response has been restricted to between 400 and 4000 cycles. A high efficiency dynamic unit works into a reflex horn; 500 watts can be handled at an efficiency of 50 per cent.

be two and one-half times as great in the restricted band case as in the wide range condition.

To take a definite example: Assume a 20-watt amplifier of high-fidelity characteristics and a speaker of the same response. By driving the speaker at twenty watts input, a certain speech intensity is set up at a given distance from it. If all frequencies below 500 cycles are cut off in the amplifier, the power output will drop to 8 watts but the speech intensity will remain practically the same at the reference point, leaving two methods of further procedure. The 20-watt amplifier can be replaced with an 8 watt amplifier of restricted response with practically no loss in speech intelligibility, or the gain of the 20-watt amplifier can be increased so that with the low frequencies cut out its output will still be 20 watts. The latter condition will result in a speech intensity of 2½ times that of the high fidelity adjustment at the reference point, even though in both cases the actual power being fed to the speaker is 20 watts.

INCREASES SPEAKER LIFE

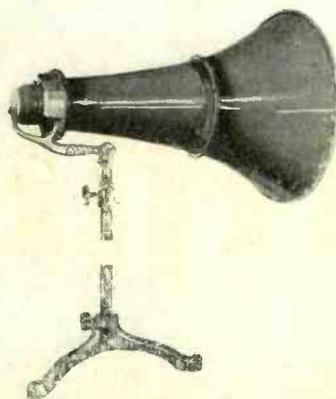
Another aspect of the situation tends to increase the desirability of curtailing the low-frequency response. The amplitude of sound waves varies inversely with frequency. This means that in order to reproduce low frequencies a speaker cone or diaphragm must move further than is necessary for the reproduction of high frequencies. Many speakers overload mechanically at low frequencies long before they reach their electrical power handling capacities. If the low frequencies are attenuated such speakers can be made to handle considerably more power without rattling and with increased life since their mechanical sus-

pensions are thus prevented from being strained to the limit of movement.

EFFICIENCIES

It has been previously noted in the remarks above concerning resonances in electro-mechanical and electro-acoustic devices, high-fidelity speakers as a rule have lower efficiency than those of restricted range. A recent comparison of two widely used 12-inch permanent magnet dynamic speakers, one of high fidelity type, and the other of the so-called public address, speech, or high efficiency type, showed that with the same input, the high efficiency cone actually delivered three times the sound output delivered by the high fidelity cone. This in spite of the fact that both speakers had the same magnet structure, were sold at the same price, and were made by the same manufacturer. The difference was simply a matter of design, in which in order to get the high fidelity response, the overall efficiency of the speaker had to be lowered.

Fig. 2. A typical high-efficiency cone unit with an air column.



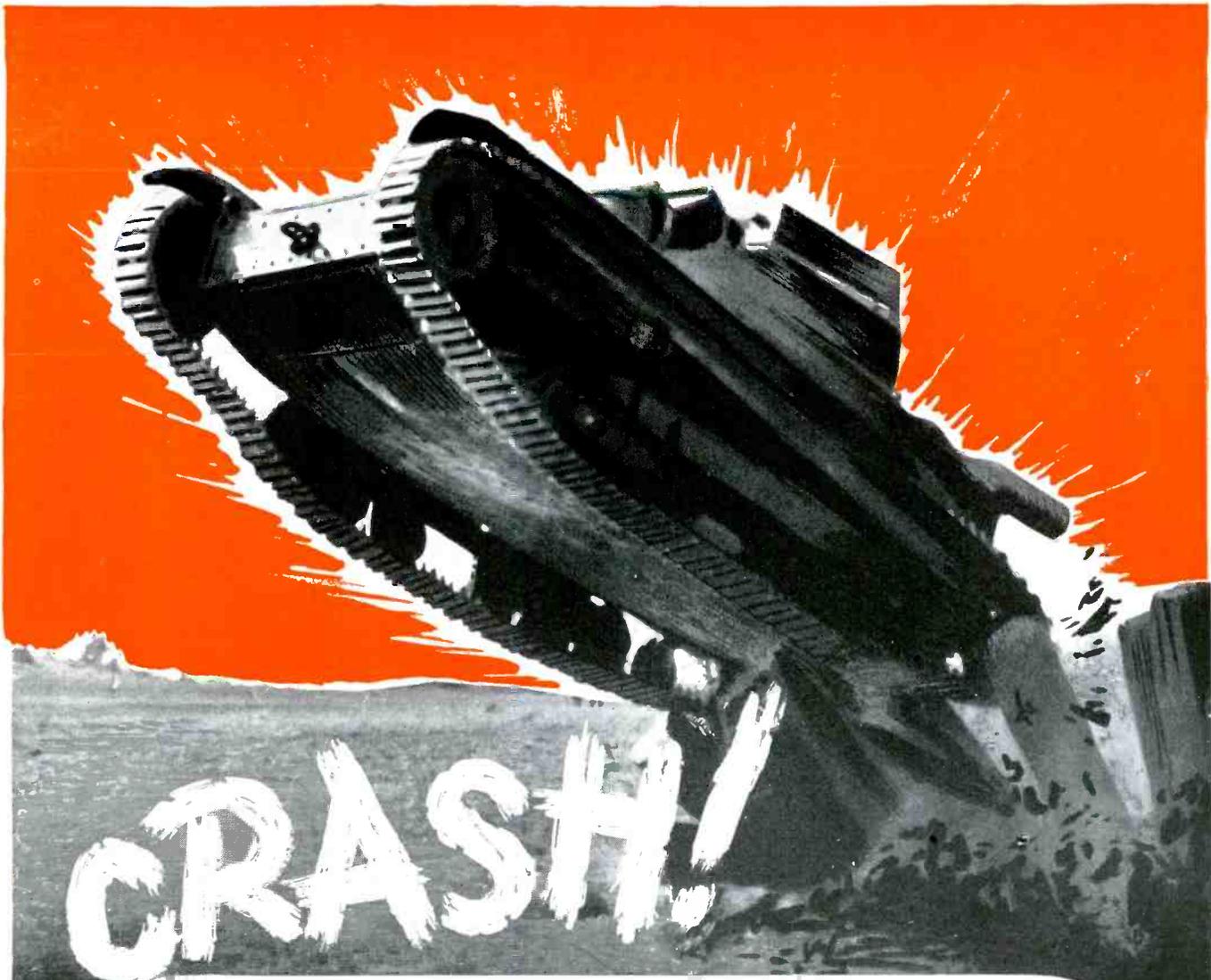
Similarly, exponential horns with either cone or diaphragm type units, have considerably higher efficiencies than straight cone speakers, but due to the horn dimensions have a very sharp low-frequency cutoff, usually in the neighborhood of 200 to 250 cycles in the public-address type horn. Below this frequency the air column no longer loads the diaphragm properly with the result that lower frequencies tend to overload the unit. Such speakers should be operated with amplifiers having attenuated low-frequency response to prevent damage to the speaker and when so operated will deliver reliable output at surprising efficiencies.

A tabulation of the relative efficiencies in the speech range of the different types of reproducers follow:

Hi-Fi cone.....	2% to 4%
Hi-Efficiency cone.....	4% to 10%
Hi-Efficiency cone with air column.....	10% to 18%
Specially designed cone unit with air column up to.....	25%
Diaphragm type dynamic unit with exponential horn.....	25% to 40%

In one special case where the response has been restricted to between 400 and 4000 cycles, a high efficiency dynamic unit working into a reflex horn has been built which actually handles 500 watts at 50 percent efficiency. Care has been taken, however, to insure that no low-frequencies are fed to this unit unless at greatly reduced power; otherwise, the diaphragm and suspension would rattle apart under the high amplitudes.

(Continued on page 22)

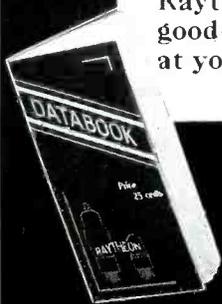


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“WORLD’S LARGEST EXCLUSIVE RADIO TUBE MANUFACTURERS”

PRACTICAL SUGGESTIONS¹

WHERE your customer is definitely interested in obtaining the utmost in reception from his receiver it is to your advantage to be able to give him such reception, even at the expense of changes in the receiver circuits. This article deals with slight changes which will noticeably improve reception.

AVC CIRCUIT

When separate diodes are used in the avc and second detector circuits, it may be desirable to feed the avc diode from the primary, rather than from the secondary, of the last i-f transformer. With this connection, advantage is taken of the difference in selectivity between the input and output terminals of this transformer. The primary connection facilitates tuning and provides better quality when the receiver is detuned slightly. The voltage-frequency (resonance) curve taken across the primary of the usual i-f transformer is broader than that taken across the secondary. Thus, when the avc diode is fed from the primary, the avc voltage does not fall rapidly as the receiver is detuned slightly. Because of this characteristic, the high audio frequencies are not over emphasized for slight detuning. The necessary changes in a typical second detector circuit are indicated in Fig. 1.

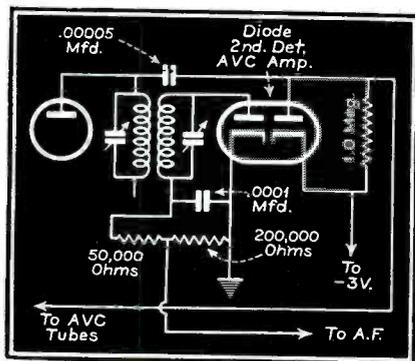
SECOND DETECTOR

In many receivers, the distortion present in the output at low signal levels increases rapidly with the degree of modulation of a signal. The results of a number of tests show that most of this distortion originates in the second-detector circuit and that it can be minimized by changing some of the circuit constants.

In order that a diode will rectify a

¹Material for this article was taken from RCA Application Notes Nos. 56 and 58. Copyright, RCA Mfg. Co., Inc.

Fig. 1. Typical second detector-avc stage with separate avc diode fed from the primary of the last i-f transformer.



IT IS often possible for the Serviceman to correct an abnormal characteristic of a receiver by making one or two comparatively simple changes in the receiver circuit. Usually, these changes do not require any alterations in the basic design and, therefore, their effects can be investigated readily. This article discusses briefly a variety of topics that relate to receiver design. The material contains information on the characteristics of tubes and circuits and definite suggestions for correcting peculiar behaviors.

high-percentage modulated signal with little distortion, the a-c and d-c diode load impedances should be nearly equal. Practically, this condition can be fulfilled by making the value of the first avc filter resistor high in comparison to the resistance of the d-c diode load. This practice should supplement the now established procedure of using an a-f grid resistor which has a value high in comparison to the resistance of that portion of the d-c diode load across which the a-f grid resistor effectively connects. The necessary circuit changes in a typical receiver circuit are indicated in Fig. 2.

MULTI-PURPOSE TUBES

A receiver which uses a multi-purpose tube as diode second detector and first a-f amplifier may have some a-f output when the volume control is set in the zero-volume position. It has been found that this output is often due to a small amount of capacitive coupling between the diode plates and the output plate of the tube. When the signal is strong enough, rectification takes place in the grid circuit of the following tube. To reduce this zero-setting output, a 200-mmfd condenser should be connected from the output plate of the multiple-purpose tube to ground. The effect of this condenser is to decrease the r-f impedance of the output plate circuit to a small value.

The output of a receiver which uses a multi-purpose tube as a diode second detector and first a-f amplifier may be severely distorted at some low setting of the volume control. This distortion is probably caused by a small amount of capacitive coupling between the diode plates and the control grid of the tube. When the signal is strong enough, rectification takes place; the resulting a-f output is out of phase with the original

output of the diode circuit. The percent distortion is, therefore, increased. Since the impedance in the grid circuit determines to some extent the r-f voltage developed across the grid and cathode and since the output is most distorted when the two a-f voltages are equal in magnitude, the distortion is maximum at a certain low setting of the volume control. The remedy is to reduce the impedance of the grid circuit to r-f voltages by connecting a 100-mmfd condenser from grid to ground. The same result may often be accomplished by shielding the lead to the grid of the a-f section of the tube.

R-F CIRCUIT

The cause of dead spots in the tuning range of many receivers has been traced to absorption of energy from the active tuned circuit by an adjacent unused circuit. This condition is prevalent in three-band sets that have three r-f coils inside a single shield can. Usually, two of the unused coils are connected in series and short circuited. The larger of the two unused coils acts as an r-f choke in parallel with the smaller coil; the smaller coil is then free to absorb energy from the tuned circuit in use. The remedy in this case is to short circuit the unused coils individually. It may be necessary to change the band switch to accomplish this.

RECTIFIER TUBE SHIELDS

Shields for glass rectifier tubes usually have a number of holes to provide ventilation for the tube. Increase in the size or number of holes decreases the operating temperature of the tube, but at the same time reduces the shielding action. It has been found that black paint on the inside and outside of the shield increases heat radiation to such an extent that fewer holes are necessary to provide bulb cooling.

TYPE 84 TUBE

The maximum current rating of the type 84 rectifier tube has been increased from 50 to 60 ma for full-wave operation. The current rating for half-wave operation with both plates in parallel, however, remains at 75 ma, maximum.

6R7 OUTPUT CHARACTERISTICS

When the triode section of the 6R7 is operated as a Class A amplifier, an output of about 300 mw at 6 percent distortion can be obtained. This output was measured under the following conditions: Plate voltage, 250 v; grid bias, -9 v; a-c plate load, 8,500 ohms; d-c plate load, nearly zero. These con-

ditions are easily satisfied in practice, since the low plate impedance of this tube permits coupling it to the following tube by a transformer. Another desirable characteristic of the 6R7 is that power output and distortion are not critically dependent on plate load. Output measurements show that a decrease in load impedance from 20,000 ohms to 6,000 ohms produces an increase in power output from 260 to 275 mw, respectively. The maximum output of about 300 mw is obtained with a load of 8,500 ohms. The distortion, which increases with decreasing load impedance, is 3 percent with a 20,000-ohm load and 8 percent with a 6,000-ohm load.

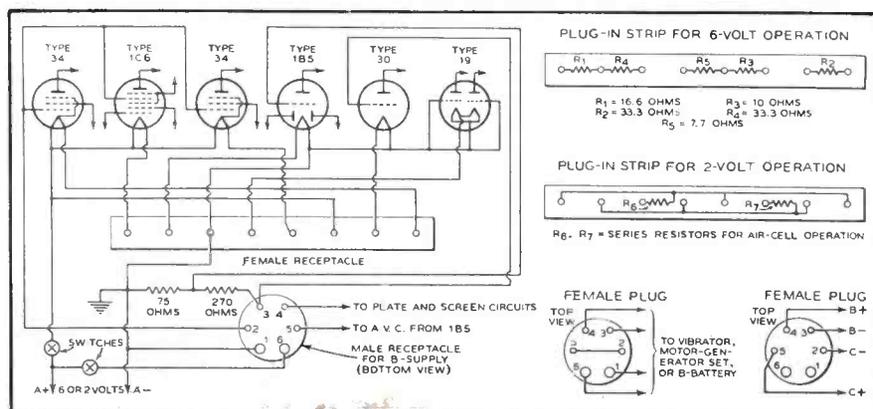
VOLTAGE RATING OF TUBES

It is common practice to design the power-supply system of a receiver to deliver recommended maximum voltages to the plates and screens of the tubes at a specified line voltage. When the line voltage exceeds the specified value, the electrode voltages may rise high enough to shorten tube life appreciably. As a remedy, it is suggested that the equipment provide recommended heater voltages for a line voltage of 117 v and maximum plate and screen voltages for a line voltage of 125 v. The design of heaters is such that a rise in line voltage from 117 to 125 v does not seriously reduce tube life. It is not advisable to operate heater type tubes with less than recommended values on the heaters.

2-VOLT TUBES

Series filament operation of the 2-volt tubes is recommended, provided certain precautions are taken to insure normal life performance. First, the filament circuit should be arranged so that the removal of a single tube does not cause excessive rise in the filament voltage of the remaining tubes. Second, shunt resistors should be employed across certain filaments in order to by-pass the plate current flowing in the filament circuit.

Fig. 3. Filament connections for series to parallel switching.



Some 6-v, series-filament receivers that employ mechanical B-supply units use separate rectifier tube to obtain bias voltage for the output tube. When such a circuit arrangement is used, it is suggested that the filament of this rectifier be connected in series with that of the output tube. This arrangement insures that the output tube is inoperative when the rectifier is removed from the circuit. If this precaution is not observed, the plate current of the output tube may rise to an abnormally high value when the bias rectifier is removed from the circuit.

The grid biases for certain tubes in most 6-v, series-filament receivers are

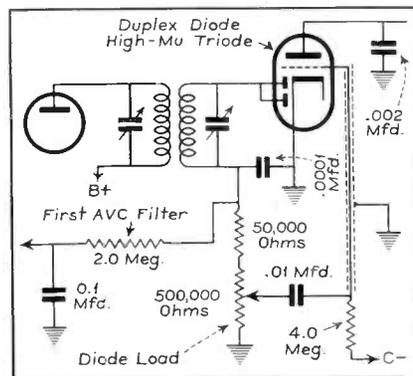


Fig. 2. The diode load circuit of a typical modern receiver, showing the large avc filter resistor and the large first a-f grid load.

obtained by connecting the grid return leads to appropriate points in the filament circuit. If the comparatively large plate current of the output tube flows through a filament circuit to which grid return leads are connected, the potential of all these grid return leads may vary in accordance with the plate current of the output tube. Thus, regeneration or degeneration may be present. To minimize the effects of this condition, the filament of the output tube should be connected in series with that of another tube whose input signal is large com-

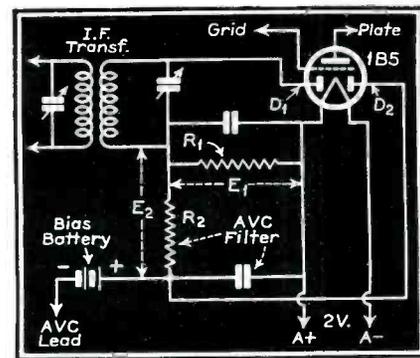


Fig. 4. Delayed avc circuit using the 1B5 type tube.

pared to the possible variation in bias. For example, the filament of the output tube should be connected in series with that of the final i-f amplifier tube. The filament of the second detector should be connected in series with that of the oscillator-mixer tube.

By means of suitable switching, a receiver that employs 2-v tubes can be designed to operate from several types of A and B voltage sources. For example, the switching scheme can easily permit series filament operation from a 6-v source or parallel operation from a 2-v source. If the B voltage is furnished by a mechanical B-supply unit, the switching scheme can also connect the grid return leads to the proper points in the filament circuit in order to obtain bias. Thus, a single switching arrangement can provide for the operation of the receiver from either a 6-v storage battery and mechanical B-supply unit or from a 2-v air cell and dry B and C batteries. The accompanying circuit (Fig. 3) shows a plug-in switching scheme that has been installed in several receivers in order to facilitate operation from these typical voltage sources. The exclusive use of filament type tubes insures low-power consumption, regardless of the source of filament power.

DELAYED AVC

Fig. 4 is the diagram of a simple avc circuit that delays avc action until the carrier voltage at the detector exceeds a certain value. This circuit uses the filament voltage of the 1B5 as the delay voltage; hence, no separate battery is required for delay purposes. When no signal is received, diode D_2 is positive with respect to the negative side of the filament; therefore, current flows through R_1 , R_2 , and the D_2 filament circuit. When the carrier voltage at the detector exceeds $(E_1 + E_2)$, the avc diode (D_1) does not conduct; the full avc voltage is then applied to the controlled tubes. No avc action occurs until the carrier voltage at the detector equals $(E_1 + E_2)$. The voltage drops

(Continued on page 31)



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VELOCITY **AMPERITE** MICROPHONES

SELLING SERVICE

By LUCIUS S. FLINT

RADIO SERVICE MEN, generally speaking, fall into two classifications: the man who does only a small amount of work but makes a good profit on each job and the one who works on a narrow margin and goes after volume. Al Wascher, head of the State Radio Service, Oakland, Calif., doesn't fit into either group. He is one of those exceptional repair men who have proved that it is possible to develop volume and still make a substantial profit on every job.

Wascher's method of operation enables him to give a full one-year guarantee on all jobs amounting to \$15 or more. That feature justifies high prices in the customer's eyes and builds repeat business.

"The guarantee plan has made us a lot more money than it has ever cost," says Wascher. "Out of the 5,000 odd jobs we have done on this basis, not more than 50 have ever come back. And, they represented a profitable investment in good-will. We feel that if a machine is given a complete going-over such as it gets in our shop, there is very seldom any occasion for it giving trouble within a year. If it does hold up in good shape, we have made a fine impression on the customer without any cost. If something should go wrong, and we take care of it, we have made an equally good impression. The guarantee assures us that no other radio man will touch the machine for a year. At the end of that time, we have satisfied the customer to the point where we can depend on her repeat business."

The guarantee angle is one of the "clinching" appeals used in getting price-minded customers away from the idea of free inspections, low labor charges and use of cheap parts and materials.

At the home, Wascher's mechanic starts out by checking the tubes. If the trouble lies here, the bad tubes are replaced. If not, the mechanic comes out flatly and tells the customer: "Madame, this machine will have to go to the shop." Experience showed that any "tinkering" with a unit in the home or an excess amount of conversation about the machine kills confidence.

Where tubes are at fault and the customer complains that, "Mrs. Jones next door has had the same tubes in her radio for seven years," the mechanic

comes back this way: "That's quite possible, Mrs. Smith, but Mrs. Jones can't have a sensitive ear like yours. She must not recognize the difference between tone quality and lack of it."

If the machine is to be taken to the shop, the Service Man explains that should the examination indicate a cost of more than \$5, the customer will be called and given an estimate beforehand. Cost of making the follow-up contacts renders estimating unprofitable on work under \$5. Wascher never includes tubes in preliminary estimates for experience has convinced him that some tubes will not develop noise until they have been heated for at least a half-hour.

At the shop, the following parts are always checked as a matter of course: resistors, condensers, wiring throughout, audio transformers, volume controls, speaker cones and tubes. All parts which are not according to factory specifications are immediately marked for replacement. If a volume control is over two years old, it is always replaced.

Through this thorough checkup, the company is able to give practically exact estimates and thus avoid losses on the figures quoted.

"Replacement of other than factory specification parts is one of the most important and yet most 'ticklish' phases of any quality radio repair job," says Wascher. "What happens is this: One

low-priced repair man puts in a part which isn't exactly the thing called for but which is so close he thinks it won't make any difference—and individually it probably won't. The next time the machine goes into a shop, the same thing happens with another part. After three or four of such off-brand replacements, the customer begins to notice a difference in the machine.

"When a shop goes through and makes a complete inspection, the difficulty becomes obvious. Those 'off' parts must be replaced with ones which meet factory specifications. Yet, the customer has paid for the work once and he hesitates to do it again.

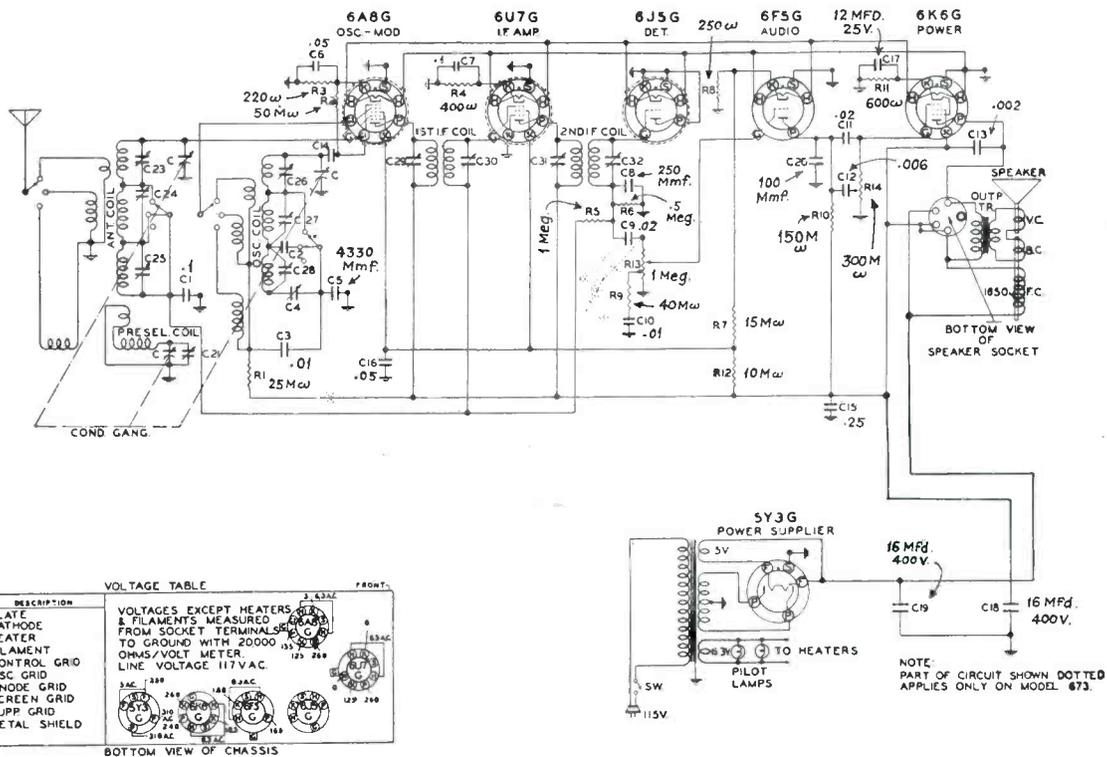
"The best way to handle such a case, we've found, is to carefully avoid 'knocking' shops that did previous jobs on the machine but to lay the cards on the table with the customer. We find out if the customer wants to keep the set for some time and if so, urge him to have the complete job done right. If he's planning to get a new machine shortly, we urge him to go ahead and do it now.

"We also find it important to avoid making the customer expect too much, for we know there is no such thing as a perfect radio repair record. This is where our guarantee comes in. When we sell a job, we tell the customer that it is well done and should give satisfaction but that if it doesn't we'll make it right."

Service bench, State Radio Service, Oakland, Calif.



MAJESTIC 167, 1673 CIRCUIT DIAGRAM AND ALIGNMENT OPERATIONS



VOLTAGE TABLE

PTM	DESCRIPTION	VOLTAGES EXCEPT HEATERS & FILAMENTS MEASURED FROM SOCKET TERMINALS TO GROUND WITH 20000 OHMS/VOLT METER. LINE VOLTAGE 117 V.A.C.
P	PLATE	250
K	CATHODE	0
M	HEATER	5.0
F	FILAMENT	5.0
G	CONTROL GRID	0
G1	OSC GRID	0
G2	ANODE GRID	0
SC	SCREEN GRID	0
SU	SUPP GRID	0
S	METAL SHIELD	0

FRONT

BOTTOM VIEW OF CHASSIS

OPERATION NUMBER 5

SHIFT the signal generator frequency to 5.0 mc and tune the receiver to the signal. Adjust trimmer C24 for maximum. Rock dial while making this adjustment. Two peaks may be obtained. The correct one is with the trimmer at its greater capacity (trimmer screw tighter).

OPERATION NUMBER 3

SHIFT the signal generator frequency to 16 mc and tune the receiver to the signal. Adjust C23 for maximum. Rock the receiver or generator dial during this adjustment. Two peaks may be obtained. The one with the trimmer at the greater capacity (trimmer tighter) is the correct adjustment.

OPERATION NUMBER 2

WITH the band switch in the short-wave (full clockwise) position and the tuning condenser wide open, apply an 18.5-mc signal to the antenna post through a 400-ohm carbon resistor. Unscrew trimmer C26 to a minimum capacity, then slowly increase the capacity until the signal is heard.

OPERATION NUMBER 7

SHIFT the generator frequency to 1500 kc and tune the receiver to the signal. Adjust trimmers C21 and C25 for maximum. Shift generator frequency and receiver dial setting to 600 kc and adjust trimmer C4 for maximum. Rock dial during this adjustment. Repeat broadcast band alignment.

OPERATION NUMBER 4

WITH the band switch in the middle position and the tuning condenser wide open, apply a 5.7-mc signal to the antenna post through a 400-ohm carbon resistor. Unscrew trimmer C27 to a minimum capacity and then slowly increase until the signal is heard.

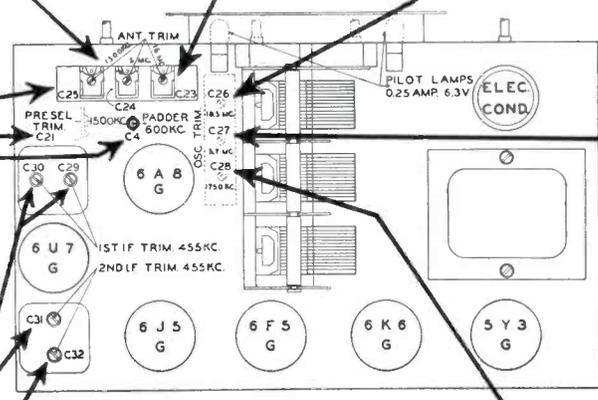
OPERATION NUMBER 1

WITH the band switch in the broadcast position and the tuning condenser at a quiet spot near 538 kc, feed a 455-kc signal to the grid of the 6A8G mixer tube through a 0.1-mfd condenser. Adjust i-f trimmers C30, C29, C31, C32 for maximum. Repeat the adjustment.

Tuning: Manual
 Ranges: 538 kc to 18.5 mc
 I.F.: 455 kc
 Power Supply: 105 to 130 volts, 50 to 60 cycles
 Speaker: Electrodynamic; Field Resistance: 1650 ohms
 Pilot Lights: Mazda No. 44

OPERATION NUMBER 6

WITH the band switch in the broadcast (full counter-clockwise) position and the gang condenser wide open, apply a 1750-kc signal to the antenna post through a 200-mmf condenser. Adjust trimmer C28 for maximum.



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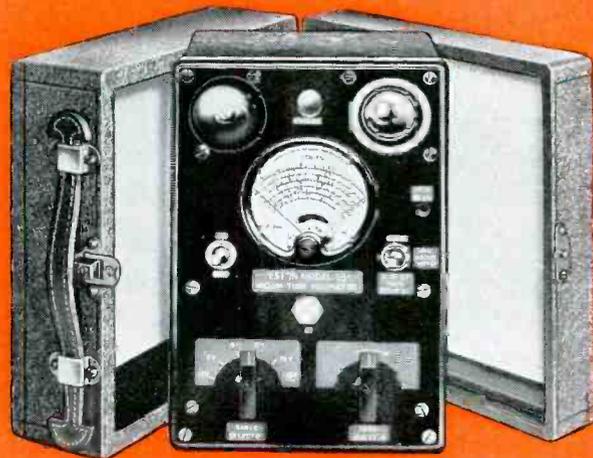
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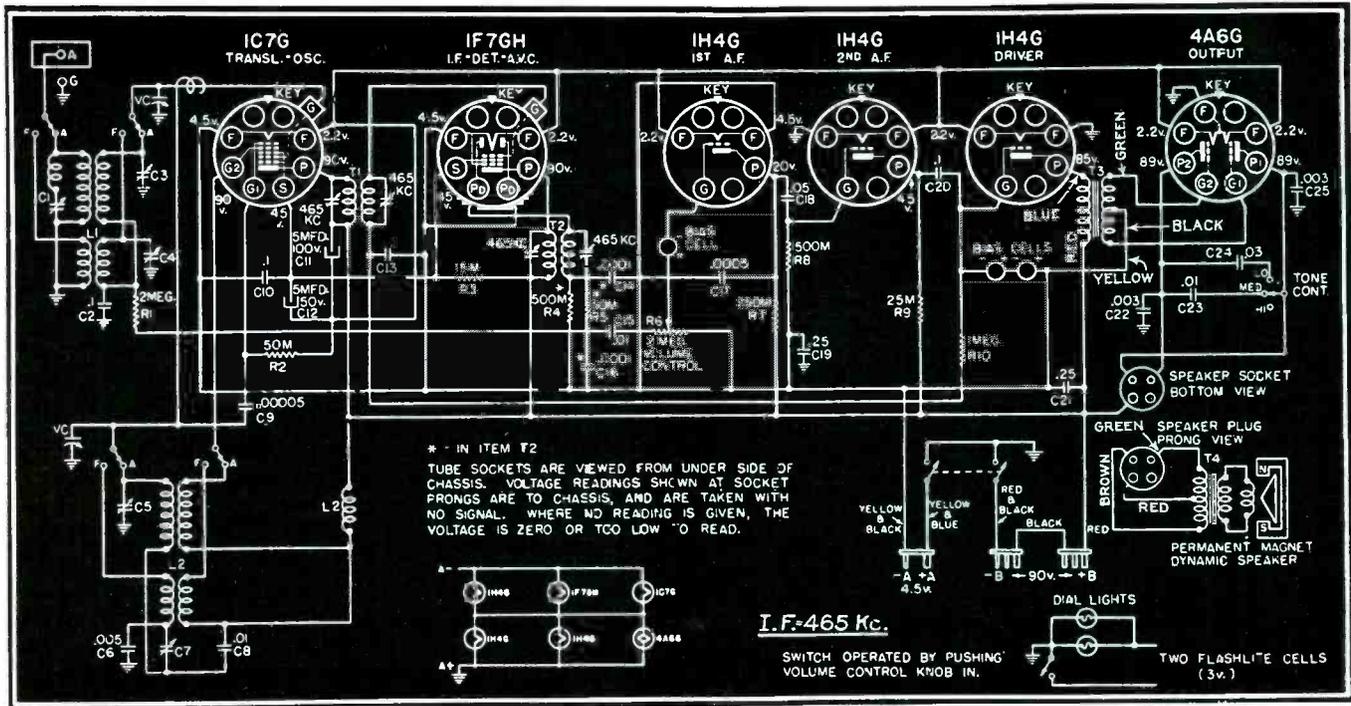


WESTON Model 669 Vacuum Tube Voltmeter. Direct reading, measures gain, per-stage-r.f. amplitude in oscillator circuit of superhets—all test on AVC circuits, PA systems, and all measurements where high frequency is a factor.



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Silvertone 6016, 6017, 6046, 6047, 6146 (chassis 101.512) circuit diagram.

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

SINCE the tubes have 2-volt filaments and the A supply is 4 volts, a series parallel arrangement is used for the filament circuit. If any one tube burns out, it will affect the filament voltage and current of the other tubes. A simplified filament circuit diagram is given in conjunction with the accompanying schematic.

SPECIFICATIONS

- Tuning: Push-button.
- Range: 540-1730 kc and 5.9-18.5 mc.
- Power supply: One 4½-volt dry battery or one 4-volt storage A battery and two 45-volt B batteries.
- Speaker: 6-in permanent magnet dynamic.

SILVERTONE 6016, 6017, 6046, 6047, 6146 (CHASSIS 101.512) ALIGNMENT OPERATIONS

Connect Generator to	Dummy Antenna	Generator Frequency	Band Switch Position	Dial Setting	Peak Trimmer
1C7G Grid	0.1 mfd	465 kc	A	540 kc	T2, T1
Antenna	200 mmfd	465 kc ¹	A	600 kc	C1 ¹
Antenna	200 mmfd	1730 kc	A	1730 kc	C5
Antenna	200 mmfd	600 kc	A	600 kc	C3 ²
Antenna	200 mmfd	1400 kc	A	1400 kc ³	C7
Antenna	400 ohms	16 mc	A	16 mc	C4

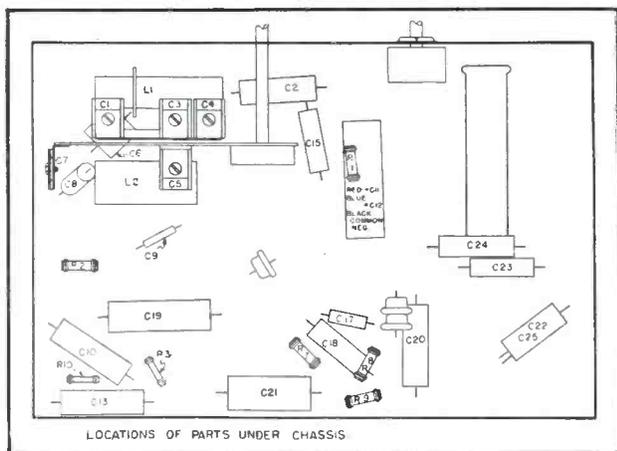
¹The generator should be adjusted for a high output. The trimmer should be adjusted for a minimum.
²The receiver or generator dial should be rocked during this adjustment.
³Tune the receiver to the signal.

SERVICE NOTES

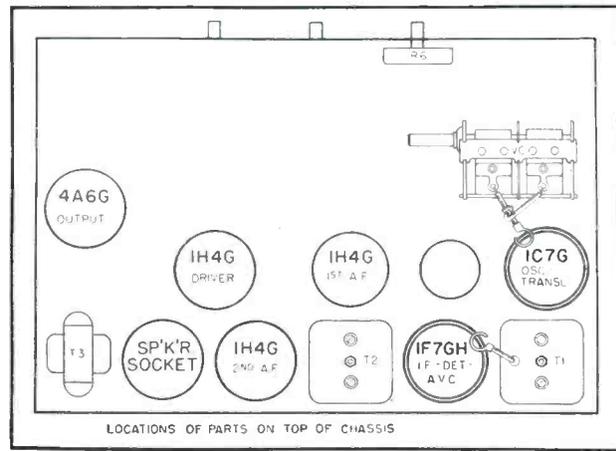
Do not attempt to test the bias cells with a voltmeter. Ordinarily these cells have an indefinitely long life and should

not cause trouble. Their condition can be determined by checking the plate current of the tube in which the cell is used. A new cell may be substituted for comparison. The cells must be in their holders in the proper direction so that the polarity of the bias applied to the tubes will be correct. The zinc

Parts and tube layout.



Chassis view showing trimmer locations.



shell of the cells is the negative terminal and must connect to the tube grids.

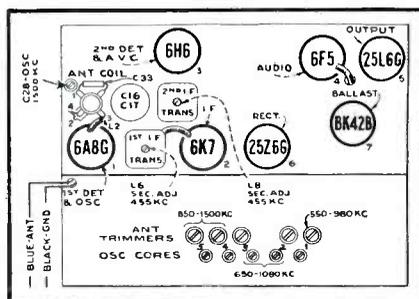
SETTING UP PUSH-BUTTONS

(1) Make a list of the desired stations in the order of their frequency. The stations selected must give strong and reliable reception.

(2) Remove the four screws that hold the push-button escutcheon plate and remove the plate. On table models it will also be necessary to remove the snap-in button at the right-hand end of the receiver cabinet.

(3) Push the tuning knob in and turn it so that the dial pointer comes to the right end of the dial. On table models the key supplied is inserted in the hole from which the snap-in button was removed. The key engages with a slot at the end of the push-button locking mechanism. Unscrew (turn counter-clockwise) the unlocking mechanism a few turns. (A screwdriver can be used in place of the key.)

On console models the mechanism can be loosened by unscrewing a wing nut provided at its end. This nut can be



RCA 97X tube and trimmer locations.

easily reached from the back of the cabinet.

(4) Push the top left button (No. 1) all the way in and hold it in firmly. Push the tuning knob in and turn it until station No. 1 (lowest frequency) is tuned in exactly. Then let go of the button.

(5) Proceed in the same manner for the other stations on the list, setting the stations with their respective station buttons.

(6) When all the stations have been set, push the tuning knob in and turn it so that the dial pointer comes to the

left end of the dial. Then lock the mechanism by tightening the wing nut on console models or the key slot on table models. Replace the snap-in button on table models.

(7) Punch out the call letters of the stations from the call letter sheets provided. Insert these in the celluloid holders at the back of the escutcheon. Be sure to insert them so that they are opposite their respective station buttons. Then replace the escutcheon.

The station selection may be changed at any time by loosening the mechanism and readjusting any button to a new station. The mechanism must always be relocked after adjustment.

RCA 97X

WHEN it is necessary to operate this model on 25-cycles a-c, connect a 16-mfd, 150-volt electrolytic condenser in parallel with C16.

SPECIFICATIONS

Cabinet: Table.

Tuning: Push-button.

Range: 540-1720 kc.

Power supply: 105-125 volts, 50-60 cycles; or 105-125 volts d-c. May be used on 105-125 volts, 25 cycles by adding an electrolytic capacitor.

Speaker: Electrodynamie, diameter: 5 inches, voice-coil impedance: 3 ohms at 400 cycles, field resistance: 400 ohms.

Undistorted power output: 1.0 watt.

Power line rating: 55 watts.

Tuning drive ratio: 6 to 1.

SERVICE NOTES

The accompanying figures give the

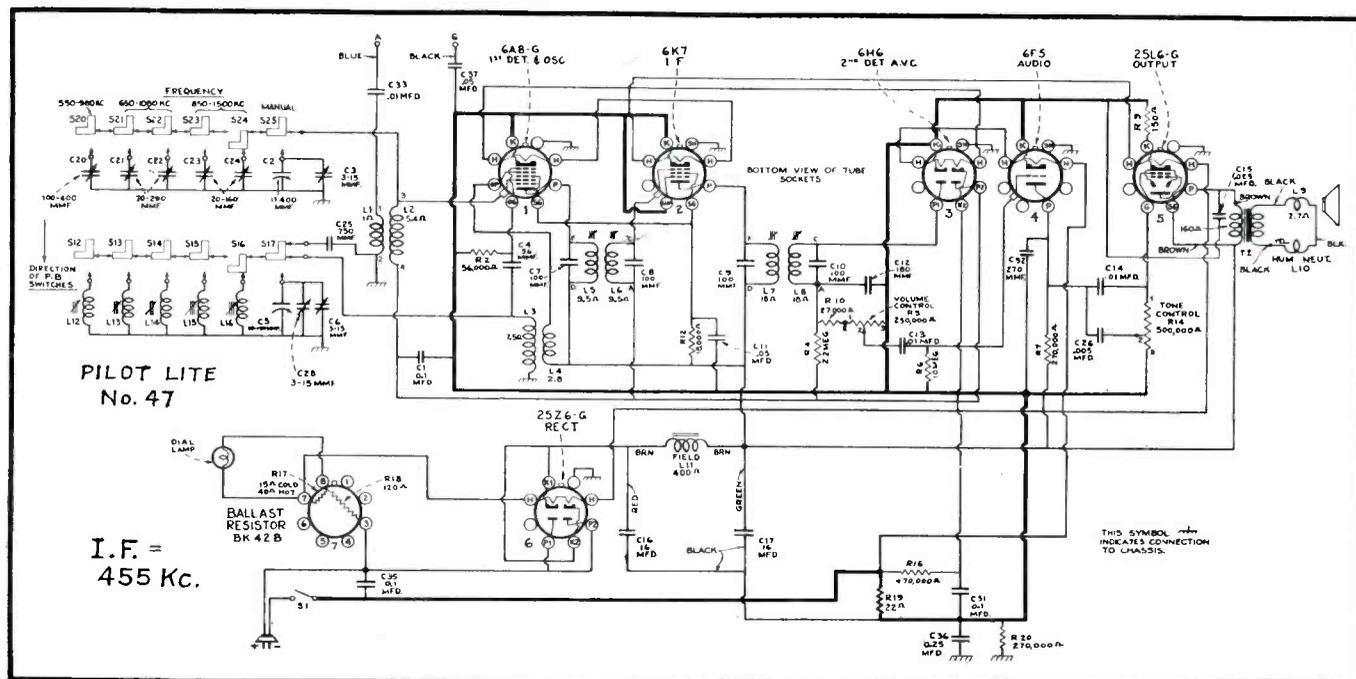
RCA 97X ALIGNMENT OPERATIONS

Signal Generator Connection	Dummy Antenna	Generator Frequency	Dial Setting	Peak Trimmer
6K7 I-F Grid	0.01 mfd	455 kc	540 kc	L7, L8
6A8G Grid	0.01 mfd	455 kc	540 kc	L5, L6
Antenna	200 mmfd	1500 kc	1500 kc	C6, C3

Use minimum capacity peak (trimmer screw out) if two peaks can be obtained. The oscillator section of the gang condenser has two trimmers, one on top accessible through a hole in the chassis, and the other on bottom. It may be necessary to adjust both of these trimmers to obtain a peak on 1500 kc.

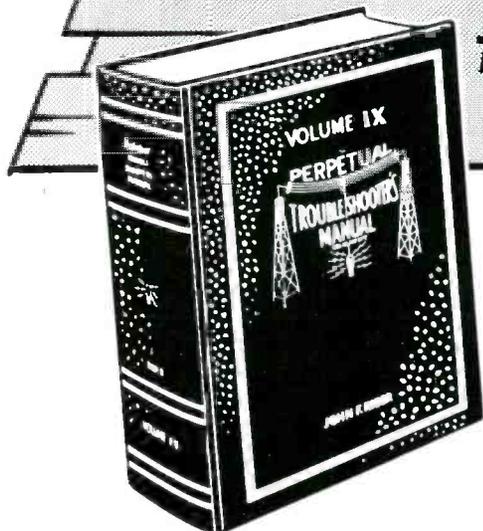
Note: The tuning dial is fastened in the cabinet and cannot be used for reference during alignment. Calibration marks corresponding to 600 kc and to 1500 kc have been stamped on the front of the chassis for this purpose.

RCA 97X circuit diagram.



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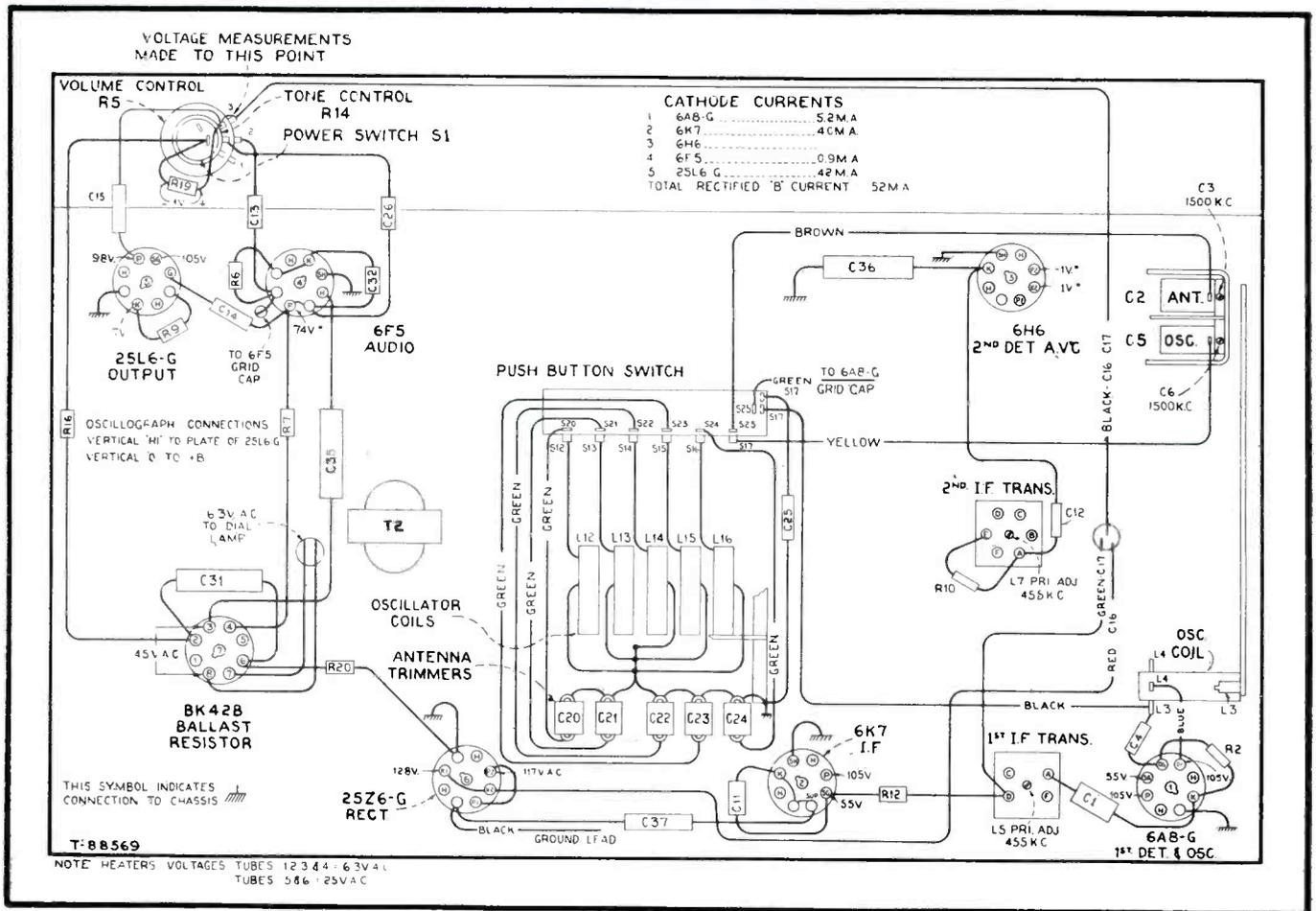
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RCA 97X parts layout and chassis wiring. Voltage values measured from the low side of the volume control.

circuit, trimmer locations and voltages encountered in this model. The voltage measurements were made to the low side of the volume control with the set tuned to a quiet point and the volume control at minimum. Values should hold within approximately + or - 20 percent with 117-volt a-c supply. On d-c the voltages are approximately 10 percent lower, except the heaters, which remain the same. Values with the asterisk (*) are operating voltages in circuits with high series resistance. The actual measured voltage will be lower, depending upon the voltmeter loading.

ELECTRIC TUNING ADJUSTMENTS

This model has six push buttons. The right-hand button connects the gang condenser for dial tuning. The other five buttons are for instantaneous tuning of five different stations in the standard broadcast range. The station buttons connect to separate magnetite-core oscillator coils and to separate antenna trimmers which must be adjusted for the desired stations. Use a regular antenna for the preliminary adjustments.

1. Make a list of the five desired stations, arranged in order from low to high frequencies.

2. Push in the dial tuning button and

manually tune to the first station on the list.

3. Push in the station button No. 1

EMERSON AL-164, AL-202 PARTS VALUES¹

Item	Value
R1	50,000 ohm, ¼ w
R2	30,000 ohm, ½ w
R3	410 ohm ½ w, ww
R4, R8	2 meg, ¼ w
R5	½ meg, vol cont & sw
R6, R7	240 ohm, ½ w, ww
R9	250,000 ohm, ¼ w
R10, R13, R16	500,000 ohm, ¼ w
R11	140 ohm, ½ w, ww
R12	L49B, L49BG ballast
R14	1.5 meg ¼ w
R15	Tone control & sw
C3	0.002 mfd, 600 v
C4	0.0012 mfd, mica
C12, C17	0.1 mfd, 200 v
C13	0.00005 mfd, mica
C14	0.1 mfd, 400 v
C15	0.02 mfd, 200 v
C16	0.05 mfd, 200 v
C18, C21	0.0002 mfd, 600 v
C19	0.01 mfd, 400 v
C20, C26	0.02 mfd, 400 v
C22	0.025 mfd, 400 v
C23, C24	.20 mfd, 150 v
C25	0.00025 mfd, mica
Pilot light	Mazda No. 44

¹The circuit diagram for these models was given in the August 1938 issue of SERVICE, page 15.

(left hand) and adjust No. 1 oscillator core (L-12) to receive this station. Screw the core all the way in to the lowest frequency and then unscrew it until the station is received.

4. Adjust No. 1 antenna trimmer (C20) for maximum output of this station.

5. Adjust each of the remaining four stations in the same manner.

Note—Clockwise adjustment of the oscillator cores and antenna trimmers tunes the circuits to lower frequencies.

6. Make a final careful adjustment of the oscillator cores and antenna trimmers, using a short length of wire as an antenna to ensure sharp peaking.

WELLS-GARDNER 5 TUBE A-C, D-C

Distortion at low volume levels: Due to variations in 6J7 tube characteristics, distortion may be encountered at medium or low volume levels. This can be remedied by changing the 0.5-meg detector screen series resistor (R5) to a 0.7-meg resistor. The same result, of course, can be obtained by placing an additional 0.2-meg resistor in series with the 0.5-meg resistor.

Later production models have the 0.7-meg resistor.

A COMPLETE SERVICE LABORATORY!



1

SUPREME LABRACK

The SUPREME LABRACK contains every function of a service laboratory, with the exception of 'scope and signal generator—and all in less than one square foot of bench space!

MODEL 596 SUBSTITUTION BOX by means of nine push-buttons allows rapid, accurate, temporary replacement from 1 ohm to 50M, 100M, 250M, 500M, 1 meg.; also capacitors 0.1, 0.5 and 8 mfd. Speeds up your replacement work 100%.

MODEL 594 TUBE TESTER with a new, modern tube testing circuit which utilizes the Model 592 set-tester's meter, and its GOOD—?—BAD scale. TOMORROW'S TUBE TESTER!

MODEL 593 ANALYZER designed to be used with any multimeter or set tester. Just connect your multimeter to the 593's two pin jacks, put the analyzer plug in the set's socket, the set's tube in the 593 and make voltage or resistance measurements!

MODEL 592 SET TESTER gives you a total of 47 ranges and functions with two D.C. volts sensitivity—both 1000 ohms per volt and 25,000 ohms per volt—in the same instrument! Completely self-contained. Push-button operated.

Cash price for the complete LABRACK, only \$91.25. Or can be bought for only \$8.36 down and \$8.36 for 11 months.

SUPREME OSCILLOSCOPE

Model 546 OSCILLOSCOPE is complete. Nothing else to buy or build. High gain amplifiers for vertical and horizontal plates. Built-in linear sweep circuit. Built-in "Snap-Lock" synchronizing control holds image on screen stationary. No wandering or wavering. Provisions for internal or external sweep and also for internal or external synchronization. High impedance, low capacitance amplifier circuits give flat frequency amplification to 90,000 cycles per second. Built-in sweep circuit is linear from 15 to 30,000 cycles, allowing observation of frequencies on the screen up to 300,000 cycles per second. Full 3" tube. Nine times as much effective screen area as a 1" tube.

Cash price, complete with six tubes, only \$59.95. Or \$5.50 down and \$5.50 for 11 months.

2



3

SIGNAL GENERATOR

Model 582 A SIGNAL GENERATOR gives you rapid, accurate PUSH-BUTTON tuning! That is possible because the 9 most frequently used frequencies (5 I.F. and 4 R.F.) are laboratory calibrated to an accuracy of 1/10 of 1%.

With your 546 scope connected to the proper output circuit, and the 582A connected to the first I.F. stage, all the necessary I.F. frequencies are instantly available by pushing the proper button. You always get the exact frequency you need. You make a complete visual alignment of the receiver.

And by moving the output selector of the Model 582A from "Amplitude Modulation" to "Frequency Modulation" your scope shows a picture of the true I.F. circuit conditions. You adjust for maximum amplification and the required selectivity characteristics. To balance the R.F. circuit connect the 582A to the receiver input. Check at 1400 KC, 1000 KC and 600 KC for balance with "Amplitude Modulation." Repeat with "Frequency Modulation" and the job is done.

Cash price, only \$66.95. Or \$6.14 down and 11 payments of \$6.14.



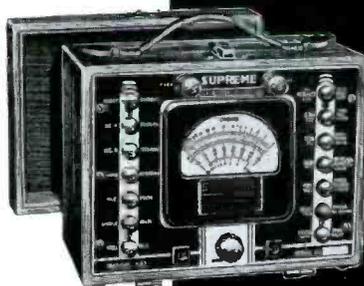
SUPREME

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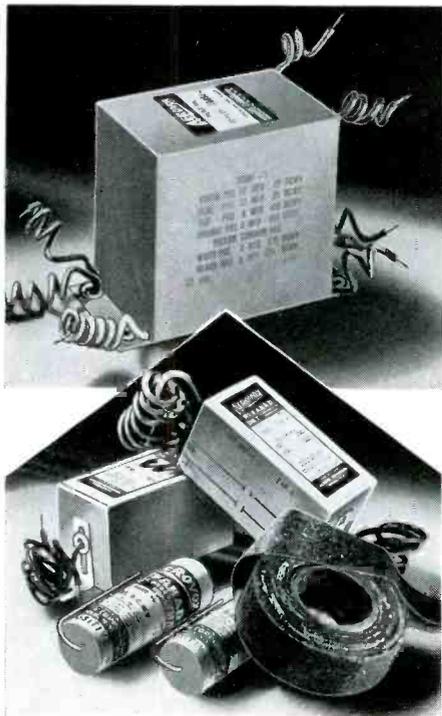
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Ask for DATA . . .

● Your jobber can give you a copy of our latest catalog containing listings of exact-duplicates and general-utility units. Or write us direct.



EFFICIENCY AND HIGH FIDELITY

(Continued from page 8)

HIGH FIDELITY HAS ITS PLACE

The above information should not be misconstrued to mean that there is no point to high-fidelity reproduction of music, and certain types of speech. It merely indicates that for many outdoor installations, especially the types used for announcing or high-power paging, certain facts concerning efficiency should not be neglected in the scramble for wide-range reproduction.

On the other hand, the Service Man should not feel that the fact that the system has poor bass response means that speech will sound tinny or highly distorted. Although reproduced speech in a restricted response system does not sound as natural in the sense that a given person's voice is not as easily recognized, at the same time restricting the frequency response often makes the speech actually clear and more crisp, due to the fact that low-frequency tones have a tendency to mask the upper frequencies of speech sounds. It is true that talking of a p-a system which has poor response below 250 or 300 cycles evokes a mental picture of the type of sound that used to emanate from the speaker of fifteen years ago. This is far from the type of results to be expected from a modern system in which the response is knowingly controlled. Every Service Man is familiar with the fact that midget a-c, d-c sets of the very compact type reproduce speech and announcements with particularly good clarity, although their reproduction of music leaves much to be desired. These sets very rarely have appreciable response below 250 cycles. They usually depend on the reproduction of the harmonics of bass notes to give a semblance of bass response in the reproduction of music. With that fact in mind, the Service Man should appreciate that the advocacy of narrow-band response for public-address work is not by any means a step backward. On the contrary, properly applied, such treatment results in extremely beneficial results in terms of performance reliability and economy. These principles are not new. They are very widely used in telephone transmission, in speech amplifiers and modulators for voice transmission in radio transmitters, and in certain types of properly engineered commercial speech address systems; in short, wherever it is required to generate the maximum amount of intelligibility with the minimum amount of power. The judicious application of a similar line of thought to the selection of components for speech address systems in general should result in improved efficiency and greater reliability at reduced cost.

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PHASE INVERSION

(See Front Cover)

IN ORDER to obtain push-pull operation of output tubes certain requirements must be met. The signal to be amplified must be supplied to each branch of the push-pull circuit with the same amplitude and in opposite phase.

COMMON METHODS

A common method of obtaining push-pull operation is to make use of an input transformer with a center tapped secondary which supplies each grid with a signal of equal magnitude and opposite phase.

An alternate method of obtaining push-pull operation is by phase inversion. This method makes use of the fact that the signal at the output of an amplifier tube is exactly out of phase with the signal at the input. In general practice one grid of a push-pull stage, using this method of phase inversion, was fed directly from the preceding tube which also fed an extra amplifier tube. This in turn fed the other grid of the push-pull stage. The signal as applied to the latter grid has passed through one more tube than the signal at the other grid and is consequently out of phase with it. In order to keep the signal voltages equal at both grids the extra or phase inverter tube receives only the correct fraction of the full output of the preceding tube.

UNUSUAL TYPE

A rather unusual type of phase inversion appears in the 1939 Stewart-Warner Models 91-81, 98-81 and 910-81 receivers. A 3300-ohm resistor is inserted in series with the screen grid of one of the output pentodes. This means that part of the audio output voltage is impressed across this resistor. This audio voltage is fed into the grid of the second output tube through a 0.05-mfd. coupling condenser. The value of the resistor has been chosen so that the audio voltage fed to the second output tube is equal to the incoming voltage to the first.

Since the signal fed to the second output tube has passed through one more tube than the signal fed to the first output tube it is exactly out of phase with latter. The outputs from the plates of both tubes can be fed to a common center tapped output transformer. The first output tube performs the dual function of output tube and phase inverter.

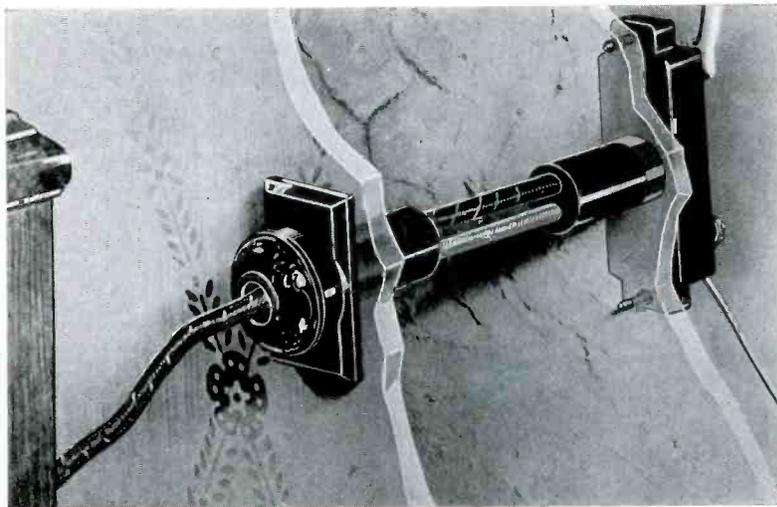
The output circuit of these receivers also uses degeneration to reduce distortion. A common cathode bias resistor and a common section of the grid load resistor are used without by-passing. This has a tendency to improve the tone quality.



COR-NEX CONNECTOR

De Luxe Aerial-Receiver

Eliminates frayed, untidy wires and window strips;
Complete, practical, astonishingly easy to install



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Easily Installed . . .

- Bore $\frac{3}{8}$ " 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 . . .

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Auto-Radio

WELLS-GARDNER C6-A, C6-B

THE WELLS-GARDNER Series 66-A auto radio receiver has a rectangular dial scale with a sliding pointer. The Series C6-B has a circular dial scale with a rotating pointer disc. The two models also differ in the allowable antenna capacities. These are discussed below under "Antenna Capacity."

Tuning: Manual and automatic.

Range: 528 to 1550 kc.

Power consumption: 5.5 amps at 6.3 v.

Sensitivity: 10 mv at 0.5 w output.

Selectivity: 42.5 kc broad at 1000 times the signal.

Speaker: 6-in electrodynamic; field: 3.4 ohms.

Power output: 0.8 w undistorted.

Vibrator: Synchronous.

PRODUCTION CHANGES

The last digit of the number on the chassis number label identifies the chassis as to the issue number. In these models this label will be found on the inside of the bottom chassis cover. The changes introduced in the chassis of the later production (issue 2) are shown on the schematic diagram. The original

wiring (issue 1) is also drawn on the diagram in dotted lines.

VIBRATOR

The vibrator unit can be inserted in two ways. The proper position will depend on which terminal of the car battery is grounded. If the positive (+) terminal of the car battery is grounded, line up the + mark on the top of the vibrator with the arrow on the chassis base. If the negative (-) terminal of the car battery is grounded, line up the - mark on the top of the vibrator with the arrow on the chassis base.

ANTENNA CAPACITY

The antenna coil on the Series C6 type A (rectangular dial scale) is designed for car antennas with a capacity of 300 mmfd for the HC connection and the 38 mmfd for the LC connection.

The antenna coil on the Series C6 type B (circular dial scale) is designed for car antennas with a capacity of 190 mmfd for the HC connection and 60 mmfd for the LC connection.

These capacities are the totals of the respective antennas and their shielded leads.

ALIGNMENT PROCEDURE

Remove the bottom and front chassis covers.

To remove the front cover, first pull the knobs and buttons off the shafts. Remove the 3 screws at the top and the 2 screws at the sides of the front cover. Press in the sides of the chassis case to release the lugs at the sides of the front cover. Pull outward on the bottom of the front cover and then push the cover up until the lugs at the top are released.

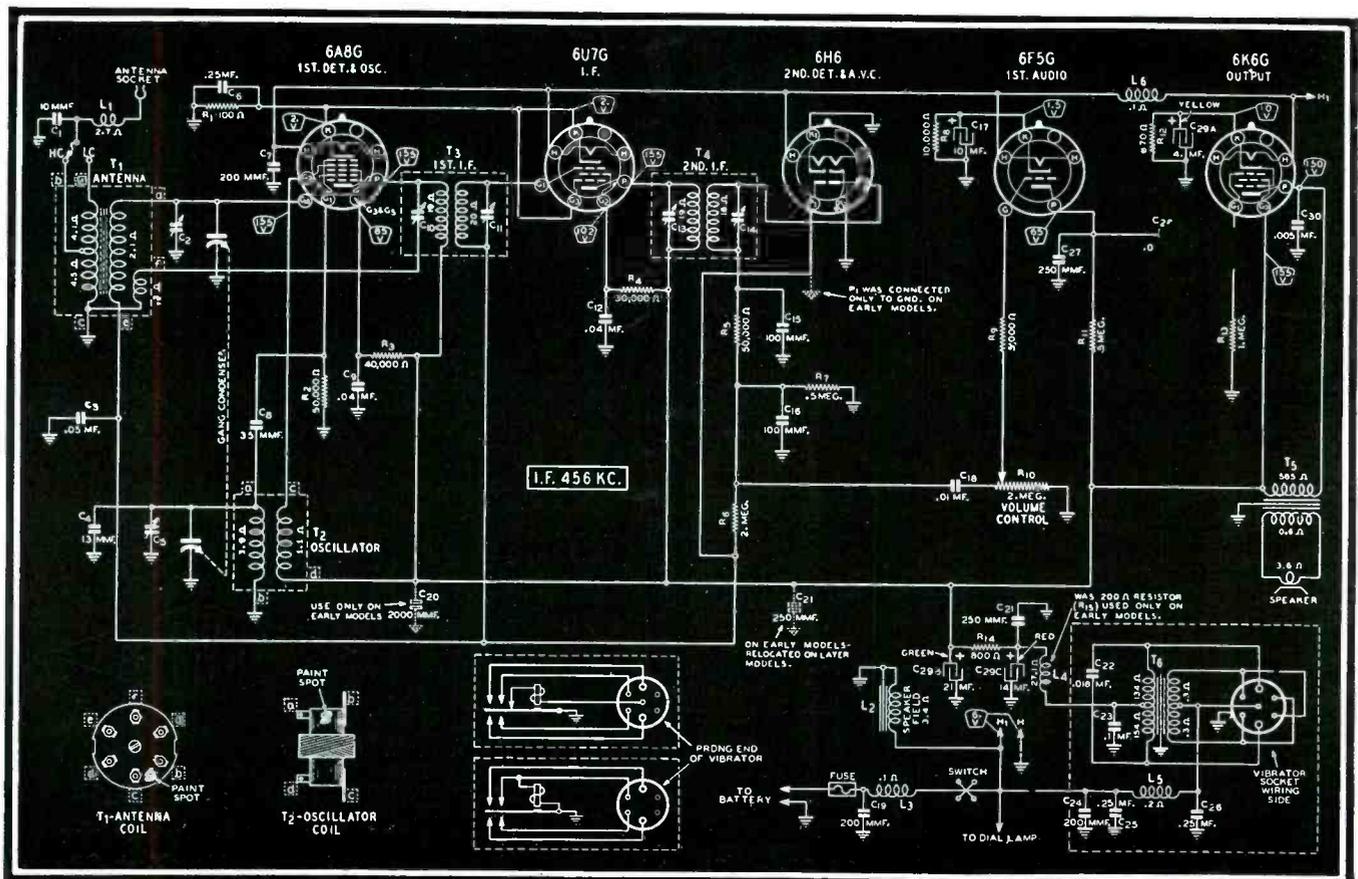
I-F ALIGNMENT

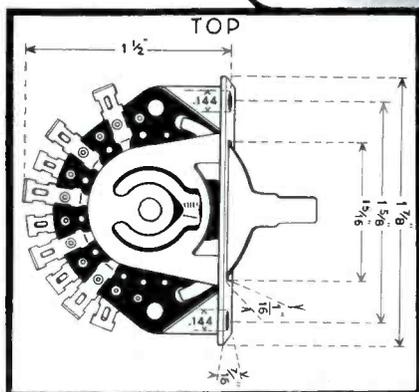
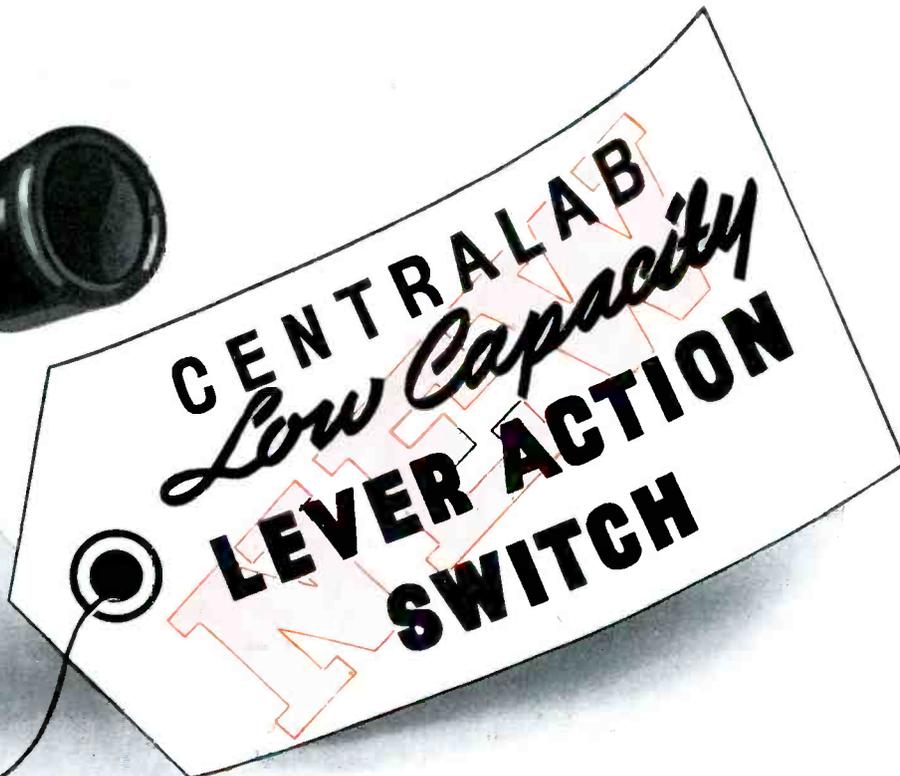
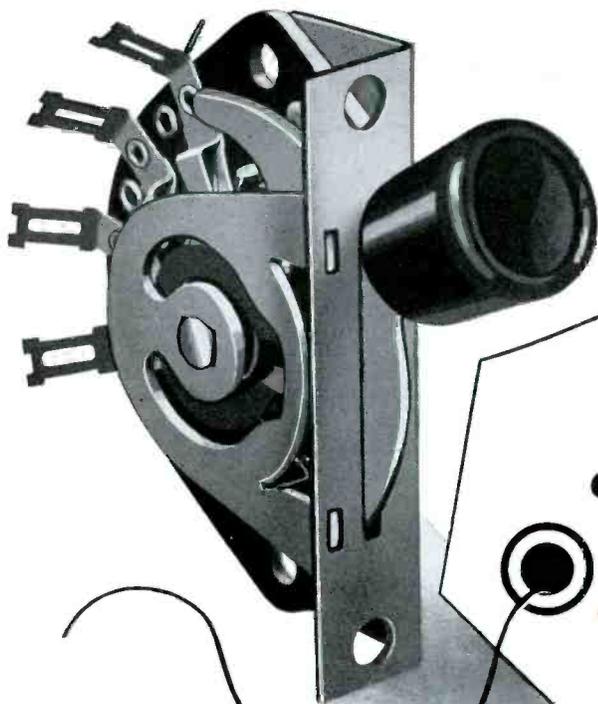
Set the signal generator for 456 kc and connect the output of the signal generator through a 0.5-mfd condenser to the control grid of the first detector. Connect the ground lead of the signal generator to the chassis. Set the volume control at maximum. Attenuate the signal from the signal generator to prevent the leveling off action of the avc.

Then adjust the 4 i-f trimmers until maximum output is obtained. These trimmers can be reached through the 4 holes in the back wall of the chassis case. It will be necessary to pull out

(Continued on page 35)

Wells-Gardner C6-A, C6-B circuit diagram. Many of the new RMA standardized symbols are used in this schematic.





A space-saving lever action switch that can be furnished singly or assembled to an attractive mounting plate with any required number of switches in a group. Each switch will take up to 12 contacts that can be used in countless shorting or non-shorting sequences. Contacts are of the long lived double wipe type.

Centralab Lever Action Switches are furnished with either two or three positions. Index action can be positive in all positions, or spring return to center from either side.



Send for specification sheet number 628 for further electrical and mechanical details.

Centralab

DIVISION OF GLOBE UNION, INC., MILWAUKEE, WISCONSIN

SEPTEMBER, 1938 •

SAY YOU SAW IT IN SERVICE

25

Test Equipment

RESISTANCE RANGE LIMITS

MANY Service Men already own test instruments with scale divisions reading down to 1 ohm, so spaced that resistances as low as 0.1 ohm can be estimated with fair accuracy. Recently, in line with the general trend to increase available ranges on test instruments, direct scale divisions of 0.1 ohm have been offered, and the ability to read values as low as 0.01 ohm has been mentioned.

On other multi-range test instruments, high-resistance ranges provide readable pointer deflection at 30 megohms, and a new multi-range ohmmeter with a 300 megohm top (25 megohms center scale) has been introduced. Naturally, Service Men seeking a practical instrument which is also obsolescence-proof are concerned with the present and future value of these extra ranges at both ends of the scale. In particular, the question arises as to the relative importance and significance of readings below 0.1 ohm, as compared with readable resistance values above 1 megohm.

Now it happens that all ohmmeter measurements made with this type of instrument bear a reciprocal relation to current flow through the instrument movement; in other words, that on any range the lowest resistance values are shown by the greatest deflection of the pointer. Also, the scale divisions are widely spaced at the low-resistance end of the scale, and the spacing decreases continuously up to infinite resistance

(zero current flow) at the high-resistance end.

With this type of circuit, it will be seen that the conditions requiring a high-sensitivity meter occur at high-resistance values. To provide an accurate and readable deflection above 100 megohms without subjecting the resistance under test to abnormally high voltages calls for an instrument responsive to 2 or 3 microamperes. At the low-ohm end of the scale, on the other hand, current flow necessary to actuate the pointer is always available even at low voltages. The practical range limit at the low-resistance end is not so much a matter of instrument design as it is of reasonable accuracy and usefulness in service.

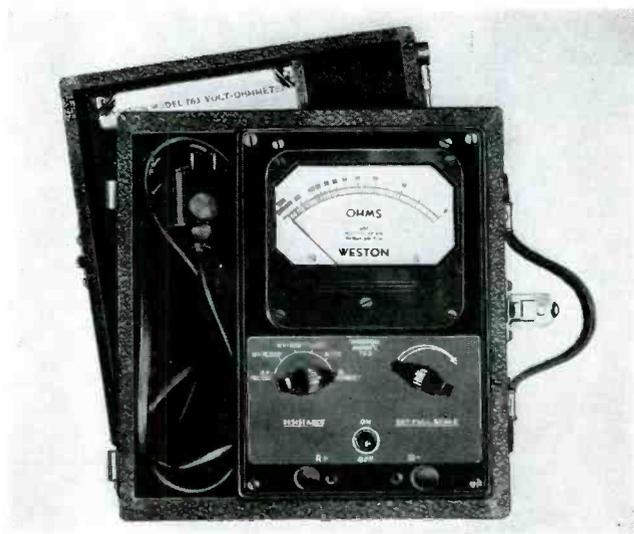
So far as the average radio Service Man is concerned, the most common applications of low-resistance readings are for measuring transformer primaries, vibrator-coil and voice-coil windings to detect shorted turns, and to measure contact resistance on variable-condenser shafts, and the like. In research work, of course, there may be others, but one fundamental difference in test procedure between the two fields must be emphasized. In research work, the extra time and care necessary to eliminate contact resistance where connection is made to the instrument leads can usually be justified. If necessary, soldered joints can be made, and careful checks made to eliminate other sources of variable resistance in the test set-up.

In servicing work using test prods. on the other hand, it is practically im-

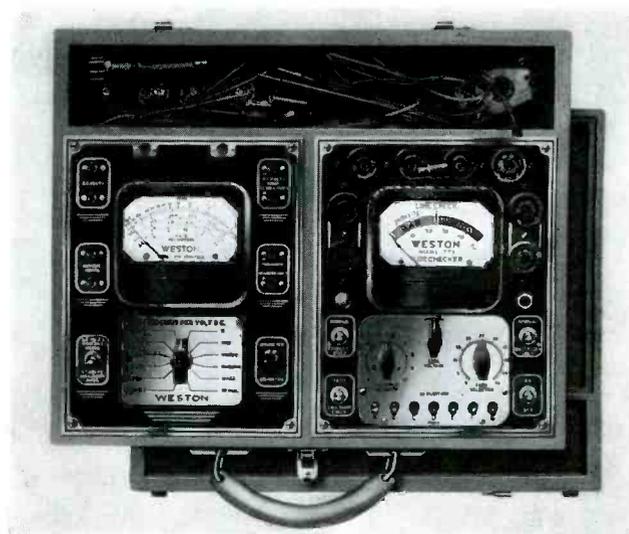
possible to eliminate contact resistance of an order of 0.1 ohm or even higher. Thus, the variables occurring in the test set-up may be 100 percent or more of any reading. Furthermore, the care necessary to avoid such variables may not be justified in view of alternate methods of testing the voice coil or similar piece of equipment which are available. In other words, the significance say, of a reading of 0.17 as contrasted to 0.27, for example, if the contact resistance is some unknown figure between 0.1 and 0.2, may be slight.

Moreover, in some cases the technical information supplied by the set, transformer, or speaker manufacturer does not give d-c resistance values. All indications are usually given in a-c voltage or impedance values which cannot be readily converted into d-c values. Therefore d-c resistance measurements on this type of equipment are not well founded. Transformers are designed to step up or step down a-c voltages. It is, therefore, much more advisable to apply the proper primary voltage and measure the resulting secondary voltages at their proper load. Only a "hot" test of this nature will show all cases of shorted or open transformer windings. Shorted voice-coil windings can best be detected by connecting a permanent magnet or magnetic speaker directly to the plate of the output tube or tubes by means of 0.5-mfd coupling condensers. If good output is obtained, the speaker is at fault. In making this test the speaker should be discon-

A multi-range ohmmeter.



A combination instrument in which a high-sensitivity meter permits measurement of high resistances.



nected to prevent the loading effect of any possible shorts.

In direct contrast to measurements below 1 ohm, resistance readings above 1 megohm, if made on an instrument providing reasonably legible pointer deflection in this range, are of immediate practical importance to the Service Man. Modern receiver circuits and other electronic equipment show more and more resistors from 1 to 100 megohms. Moreover, if a direct-reading ohmmeter of this range is not available, there is no simple alternative method of checking up on faulty resistors, making tests of condenser leakage, and the like.

V. E. Jenkins

WESTON ELECTRICAL INSTRUMENT
CORP.

PHILCO 38-14

Sustained noisy operation: Change grid leak of 6A7 oscillator from 120,000 ohms to 50,000 ohms.

Willard Moody

RIDER CHANALYST PARTS LIST¹

- C1.....0.0014 mfd 500 v
- C2.....0.015 mfd 400 v
- C3.....0.15 mfd 400 v
- C4, C5, C6, C8,
- C9, C10, C11, C12, C13....0.1 mfd 400 v
- C7.....r-f, i-f tuning condenser
- C14, C24.....0.001 mfd 500 v
- C15.....0.0002 mfd 500 v
- C16, C18, C19, C20, C21,
- C23, C28, C31, C32.....0.01 mfd 400 v
- C17.....0.0001 mfd 500 v
- C22.....osc tuning condenser
- C25, C26, C33.....0.05 mfd 600 v
- C27a, C27b.....8-8 mfd 450 v
- C29.....0.01 mfd 1000 v
- C30.....10 mfd 25 v
- C34, C35.....r-f, i-f probe condenser
- C36.....100 mfd
- R1, R45, R46.....250,000 ohms, 1/2 w
- R2.....9000 ohms, r-f level control
- R3, R8, R11, R20.....350 ohms, 1/2 w
- R4, R7, R9, R12, R18,
- R28.....100,000 ohms, 1/2 w
- R5.....4000 ohms, 1/2 w
- R6, R10, R13.....1500 ohms, 1/2 w
- R14, R15, R22.....500,000 ohms, 1/2 w
- R16, R23, R38, R47.....2 meg, 1/2 w
- R17, R24, R39, R48, R49....1 meg, 1/2 w
- R19.....9000 ohms, osc level control
- R25.....8 meg, 1/2 w, 1%
- R26.....1.5 meg, 1/2 w, 1%
- R27.....400,000 ohms, 1/2 w, 1%
- R29.....6000 ohms, 1/2 w
- R30.....2000 ohms, ww adjustable
- R31.....25,000 ohms, 2 w
- R32.....10,000 ohms, zero adjustment
- R33.....8000 ohms, 1/2 w
- R34.....17,000 ohms, 1/2 w
- R35.....1 meg, wattmeter comp control
- R36.....1 meg, wattmeter control
- R37.....111,000 ohms, 1/2 w
- R40.....5 meg, 1/2 w, 5%
- R41.....50,500 ohms, 1/2 w, 5%
- R42, R21.....75,000 ohms, 1/2 w
- R43.....2 meg, a-f level control
- R44.....20,200 ohms, 1/2 w
- R50.....1 meg, 1/2 w 5%

¹The circuit diagram of the Rider Chanalyst was given in the August issue of SERVICE, page 19.

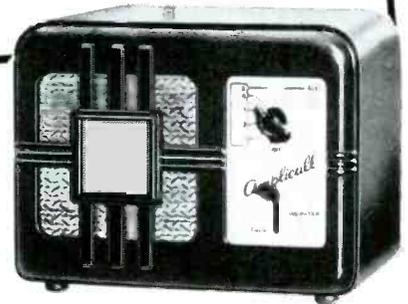
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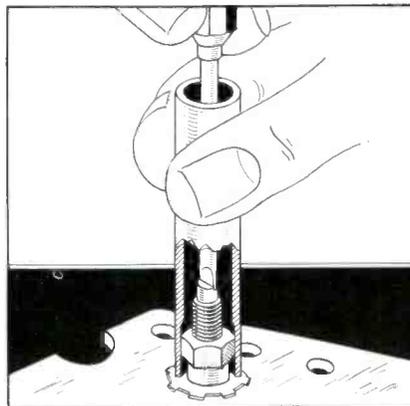
Please send me Free of Charge, your Brochure on "The Greatest Money-Making Opportunity in Sound History."

Name

Address

City State

SCREW 'N NUT TRIMMERS



THE I-F circuits of many small receivers are adjusted by means of a nut and screw arrangement. In these sets the screw, located inside the nut, tunes one trimmer and the nut tunes the other. It is often difficult to effect one adjustment without disturbing the other. This may be accomplished, however, through the use of the tool shown in the accompanying illustration.

A hollow spintight is used to hold or adjust the nut while the trimmer screw is held with a slender bladed screw-driver through the center of the former.

Television

GAROD 100 TELEVISOR

A LOW-PRICED television kit, with which a practical sight receiver can be constructed, was announced at a recent New York demonstration by the Garod Radio Corporation. The set in its knockdown form is already on sale.

The completed set employs 15 tubes (for sight only) and the 5-in. cathode-ray tube. They are designed for the standards of the NBC Empire State Building transmitter and the forthcoming CBS Chrysler Building station. The proposed RMA standards of scanning, field and frame frequencies are used. It is anticipated that these standards will be adhered to in other sections of the country. Although programs are still experimental, they are being presented with greater regularity.

SPECIFICATIONS

Range: 45.0 to 52.0 mc.

Tubes:

- R-f amplifier: 1852.
- Electronic mixer: 6K8.
- I-f amplifier: 1852 (3).
- Demodulator: 6H6.
- First video amplifier: 1852.
- Second video amplifier: 6V6G.
- Synchronizing impulse selection and separation: 6H6.
- Sweep amplifier: 6L7G (2).
- Sawtooth sweep oscillators: 6F8G (2).
- Rectifier: 5Z3.
- High-voltage rectifier: 879.
- Televisor: 2005—5 in.

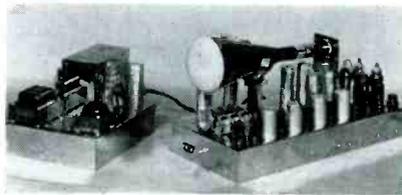
- I-f peak: 13 mc.
- Scanning: 441 lines.
- Frame frequency: 30 per second.
- Field frequency: 60 per second, interlaced.
- Deflection: Electrostatic.
- Power supply: 105-125 v, 50-60 cycles.
- Picture size: 2¾-3¼ in.
- Controls:

- (1) Cathode-ray bias (intensity).
- (2) Cathode-ray focus.
- (3) & (4) Spot location.
- (5) & (6) Fine and coarse frequency sweep adjustments.
- (7) & (8) Synchronizing separator and selector.
- (9) Overall gain.

At the demonstration the video was received on 46.5 mc. The synchronized sound wave was received on an auxiliary radio receiver at 49.75 mc.

CORRECTION

The 0.005-mfd and the 0.00001-mfd condensers used to couple the plate of



The Garod 100 televisior. Fig. 1 (Below) The circuit. Fig. 2 (Above) The completed television receiver.

the 6H6 synchronizing separator to the grids of the 6L7G high- and low-frequency sweep oscillators are shown interchanged on the circuit diagram of Fig. 1. The 0.005-mfd condenser should connect the grid of the low frequency sweep and the 0.00001-mfd that of the high frequency sweep.

EUROPEAN TELEVISION

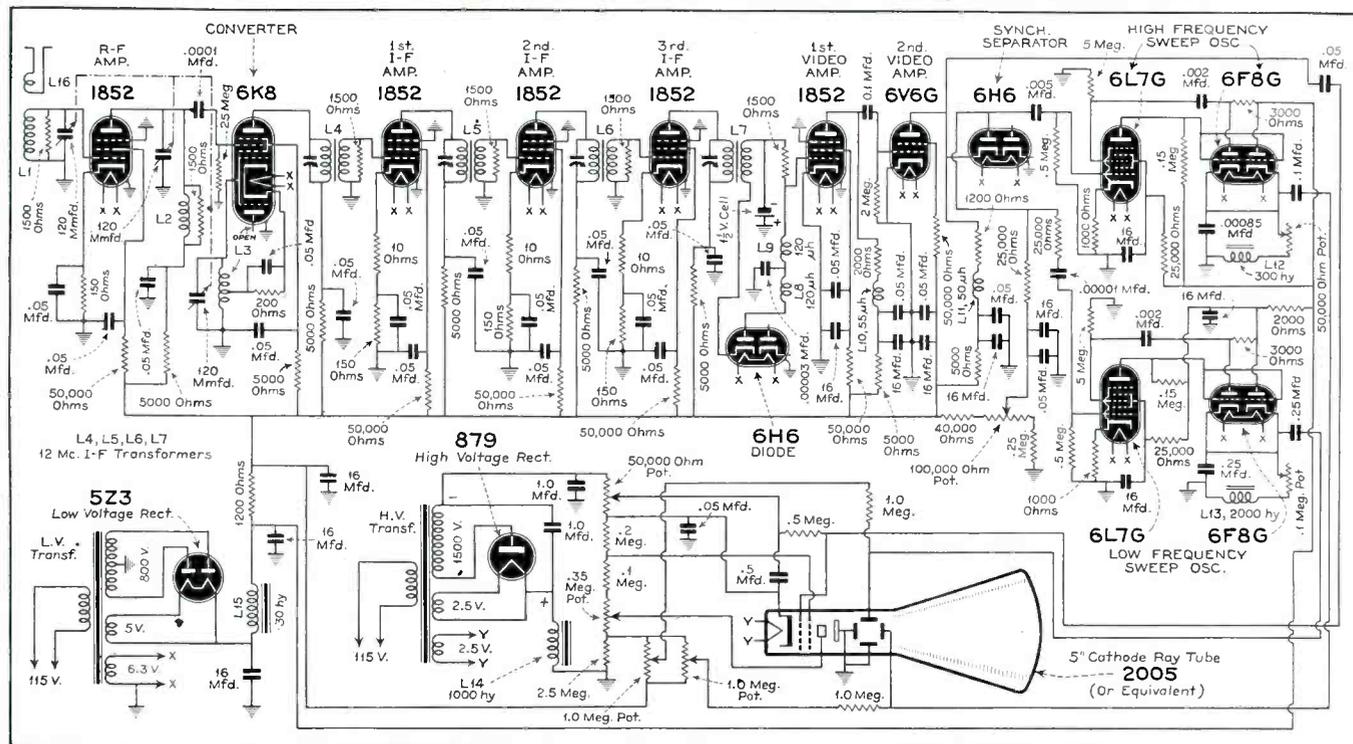
Returning from two months study of television in England and Germany, Marshall P. Wilder, television development engineer, National Union Radio Corp., Newark, N. J., reports noteworthy advances.

Highlights of Mr. Wilder's report indicate a definite trend toward smaller receivers for home use combining both television and all-wave radio. He states that English manufacturers discovered sales tremendously retarded by bulky receivers and lack of all-wave radio built into one unit.

In Germany, as an entertainment medium, projection television has been developed for showing on a screen approximately 10 by 12 feet. Production of a new type screen in Germany which increases the light factor by approximately twenty makes this possible.

Another stride forward by the German makers is a device which will take motion pictures, develop them and have them ready to put into the television transmitter in eighty seconds.

Mr. Wilder reports picture quality as excellent in both England and Germany. He was impressed particularly by the fact that groups of people viewing television were enjoying it thoroughly as entertainment without being particularly impressed by the fact that it was television. Mr. Wilder believes television must be first and foremost an entertainment medium if it is to achieve success. SERVICE.



push-button
TESTING

**THAT IS PROTECTED
AGAINST
OBSOLESCENCE**

For 1939 Servicing

Push-button Testing must have wide flexibility to safely guard against obsolescence. Triplett has protected the service dealer with a unique circuit together with push-button individual selection to balance.



Rotating
Chart Shows
Correct Buttons
To Push

**DYNAMIC
MUTUAL
CONDUCTANCE**

TUBE TESTER and VOLT-OHM MILLIAMETER

Many misleading names indicate a Dynamic Mutual Conductance Circuit... Triplett's is a true dynamic mutual conductance tester in every sense of the word.

Push-button control gives a new order of simplification. The buttons are clearly marked on chart at base. Just rotate the chart to the tube to be tested—then the button to push is indicated in line under each row of push buttons. What could be simpler?

A second revolutionary improvement is the arrangement of the measuring circuit of the dynamic mutual conductance test for amplifiers and power tubes. The tube tested not only shows GOOD or BAD but the percentage of mu to the 100% good condition also is indicated. In critical sets this permits the service dealer to pick his tubes with confidence. Diodes and rectifiers are tested for emission according to the latest approved engineering standards. Ballast tube continuity test. Gas test also included.

Rotate chart to Volt-Ohm-Milliammeter settings—push button for D.C. scale: 0-10-50-250-500-1000 Volts at 1000 Ohms per Volt; 0-10-50-250 M.A.; .2 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's. (Ohmmeter is line powered.) Uses two interchangeable plug-in type rectifiers, simplifying replacement in case of unintentional damage. Replacement rectifiers are all precalibrated at the factory.

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

MODEL 1616
\$73.34
Dealer Price

MODEL 1615

• Dynamic Mutual Conductance Tube Tester only with Push-Button testing. Same tube tester circuit and push-button panel as Model 1616, but for tube testing only.

Dealer Price **\$63.34**

MODEL 1610

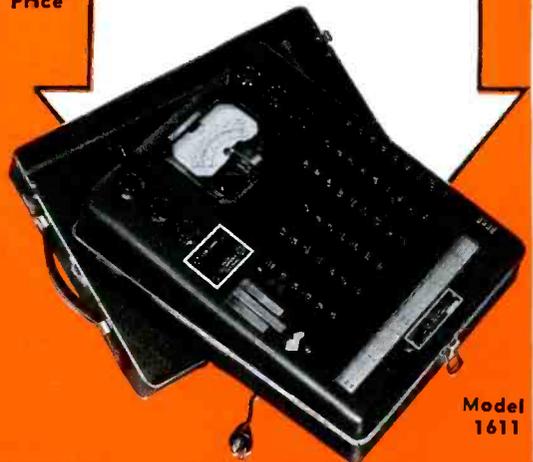
• Emission Type Tube Tester with Push-Button testing. Has new R.M.A. approved circuit with every essential for dependable emission test on all type tubes. Testing greatly simplified by Triplett push-button operations. Installed in metal case with removable cover.

Dealer Price **\$39.00**

MODEL 1611

• Emission Type Tube Tester with Push-Button Testing and Volt-Ohm-Milliammeter. Similar to Model 1610 above described except Volt-Ohm-Milliammeter added. Ranges similar to those of Model 1616. Complete with accessories.

Dealer Price **\$49.50**



Model
1611

Be Sure to Enter Triplett's \$500.00 Radio Service Puzzler Contest . . . Get Entry Blank from Your Local Jobber

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Precision
ELECTRICAL INSTRUMENTS

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179 Harmon Drive, Bluffton, Ohio

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 Model 1610 Model 1611
 Details on Radio Service Puzzler Contest

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I hereby make application for membership in the Radio Servicemen of America.

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Address

I am enclosing \$2.00 National Yearly Dues (Plus Nominal Local Chapter Dues).
Bill me \$2.00 National Yearly Dues.

Servicemen must keep abreast of the times. Membership in RSA helps servicemen to be better business men. It provides advance technical information, it lets you know what other servicemen are doing, it provides an organization composed only of qualified servicemen, its membership reaches every state in the union, it has the sponsorship and backing of the entire industry. We want you as a member if you are a good serviceman.

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YOU EVER INVESTED

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Joe Marty, Jr., Executive Sec'y, 304 S. Dearborn St., Chicago

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PRACTICAL SUGGESTIONS

(Continued from page 11)

across R_1 and R_2 must be considered when the bias applied to the controlled tubes is determined.

RECTIFIER-TUBE SPUTTER

If a close-spaced rectifier tube is connected between a power-supply line of low impedance and a condenser-input filter, the initial charging current of the first filter condenser may be high enough to damage the cathode of the tube. This effect is also present when plate voltage is applied repeatedly while the cathode is emitting electrons. To remedy this condition, it is necessary to limit the initial charging current to a safe value. A receiver that employs a power transformer is not subject to such rectifier-tube failures, because the leakage inductance and resistance of the usual power transformer is great enough to limit the initial charging current to a safe value. However, the effect is prevalent in 220-volt receivers that do not use transformers. The remedy in this case is to insert a 100-ohm resistor in series with each plate of the rectifier tube. This connection has the advantage of retaining the current-limiting action of 100 ohms of resistance for each half of the rectifier; yet, it produces the same line-voltage drop as only 50 ohms connected in a circuit that is common to both rectifier plates.

INCREASED RATING OF 6H6

The direct-current output rating of the 6H6 has been increased to 4 milliamperes, maximum, for either full- or half-wave operation. The a-c voltage per plate remains at 100 volts (RMS), maximum. This higher current rating permits the use of the 6H6 in a wider variety of circuits than was heretofore possible. The use of this tube as a power rectifier to furnish a fixed C bias to a power amplifier is suggested.

PHILCO 16X

Fading: Bakelite which holds stator of oscillator tuning condenser expands or contracts allowing set-screws and rivets to loosen. This causes stator to shift slightly and changes oscillator frequency. Remove gang condenser and tighten screws and rivets. Re-alignment will then be necessary.

RCA Service Tip File

PHILCO 611-J

Cross talk at 1,010-1,500 kc: Replace 6A8G with 6A8; align perfectly. Install shielded wave trap where powerful nearby station is causing cross talk or overloading.

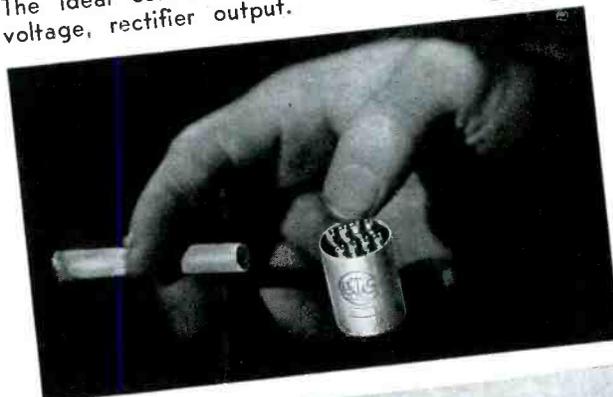
Willard Moody



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The ideal control for light, heat, line voltage, rectifier output.

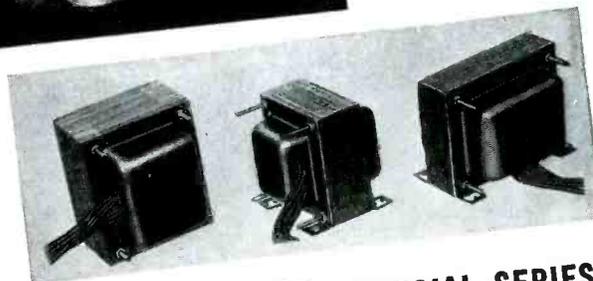


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Push-Button selection of 7 favorite stations *plus volume control* from any convenient location!

Simply connect to the aerial and ground posts of any receiver by means of a special 15-foot cable supplied, and plug into any 110 volt AC or DC outlet! A turn of the fingers sets each button to a station—permanently.

Each Remote Control comes, complete with tubes, all tested and ready to operate. Housed in a handsome light Walnut cabinet 4½" high, 5⅜" wide, 9-13/16". Retail for only \$26.50.

Write Dept. S-9 for full details on the Meissner Remote Control and Push-Button Converter units.



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"A FAMOUS NAME FOR TWO DECADES"

Association News

RADIO SERVICEMEN OF AMERICA

THE National Office, on behalf of the Board of Directors, announces that charters have been approved for all of the 48 chapters as of record August 1, 1938.

New RSA groups have been formed in Tulsa, Okla., and St. Paul, Minn. Several other groups are carrying out the necessary preliminary steps to affiliate with RSA. We have established a chapter of the RSA in Holland under the direction of A. F. L. de Quant, secretary of the Netherland Radio Service Association. Applications are pending from Sweden, Ireland, and Switzerland.

Binghamton

Our Treasurer, Ed Donnelly stole a march on us and entered the state of matrimony. A meeting or so after the news was announced, the Chapter presented Ed with a silver coffee urn.

We have started a series of meetings wherein each member gives a technical talk. Some of the subjects covered have been "Scope Alignment of AFC Circuits," "Mathematics for the Servicemen," and "Methods of Cost Accounting for Servicemen." We are hopeful that this method of conducting meetings will prove very successful.

Boston

The plans for a very interesting series of quiz meetings are being prepared by the director of district 20, A. C. W. Saunders, for the use of all of the chapters of RSA.

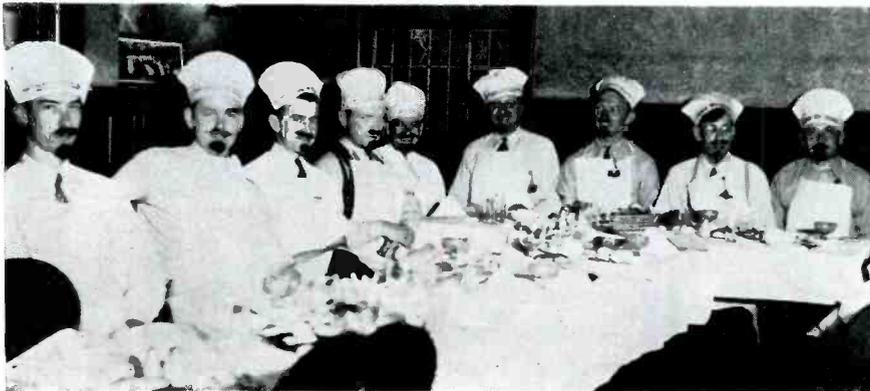
Buffalo

Buffalo Chapter had J. Cummins, service manager of Appliance Wholesalers, give a demonstration of high-fidelity set alignment. Mr. Cummins' talk was illustrated with lantern slides. Fred Lyson won the raffle and collected the prize money. The next activity is a bowling party planned for October 1.

Chicago

The Chicago Chapter announces a Test Equipment Show and round table discussion to be held at the Stevens Hotel in Chicago, September 28. Many test equipment manufacturers have signified their intention of participating in this opening meeting of the 1938 Fall season. John F.

It all happened in Staten Island at a dinner held in honor of John Nisslein, one of our fellow members, who recently said, "I do." From left to right: Jim Taylor, Roland Cortelyou, Tom Costigan, Arnold Gunderson, George Muccino, Frank La Penna, James Reeves, John Nisslein and Herb Leaf. All good RSA men.



Rider, Walter Weiss, O. J. Morelock, Paul Jackson, and others have signified their intention of participating.

Cleveland

The Cleveland Chapter will hold its annual picnic on September 25, 1938, at Haag's Grove, Parma, Ohio. A complete program of games for men, women and children, has been worked out. Refreshments and food will be plentiful as usual. Everybody in the Cleveland area is invited to attend.

Danville

During the Fall series of meetings, a round table discussion lead by program chairman McArdle will be held on the "Cathode Ray Tube Applications in Service Work."

Decatur

The Decatur Chapter has started a series of round table discussions using a different subject each week, at which each member turns in a brief written statement of his personal views. These are discussed at the meeting. We expect to have a test equipment lecture the latter part of September by Walter Weiss of Hickok.

Detroit

Detroit Chapter devoted considerable time and thought to backing a Fair Trade Practice Act in Michigan. Regional meetings have been held with the Flint, Pontiac, and Lansing Chapters.

Walter Jones of Hygrade Sylvania addressed the Chapter on August 22.

Duluth

Duluth Chapter announces the Radio Servicemen's Jamboree to be held in Duluth on September 24 and 25. Invitations have been sent to all Service Men in the Northwest urging them to attend this get together. Cooperation will be extended by the chapters in St. Paul and Minneapolis, as well as Fargo, N. D. A complete program of technical talks, charter presentation, as well as games and boat trips, have been planned.

Flint

The Flint Chapter will have Joe Cole.

director from district nine speak at the next meeting.

The joint meetings held by the various chapters in district nine have proved very valuable and are helping the chapters iron out all manner of difficulties. We trust that all other chapters are doing this.

Freeport

The technical lectures by F. W. Whitlock have been continued throughout the summer with good attendance and much interest. On August 19, A. G. Mohaupt, of the Radio Training Association spoke on "Applications of the All-Wave Signal Generator in Modern Service Work." Numerous guests of surrounding towns including members of the Rockford Chapter were present.

Fremont

On August 22 Mr. Mohaupt addressed the Fremont Chapter on the use of the signal generator in service work. A large turnout was present and everyone felt he had gained something from the meeting.

Green Bay

The Green Bay Chapter was organized July 13 at the Radio Doctors in Green Bay. A. Nejedlo had been instrumental in getting the Service Men together and in doing all of the preliminary work necessary for the meeting. The various aspects of the RSA were presented by Joe Marty, executive secretary. After a general discussion, applications for membership were filled out and dues paid, thereby starting the chapter of RSA.

The following officers were elected: chairman, George Thelen; secretary, Harold Dole; treasurer, Fred Olsen.

Houston

Houston Chapter held an interesting informal get together on the lawn of Mr. Schley's home. Watermelon and other refreshments were served.

Johnstown

The Tri-County Chapter, Johnstown, Pa., had its yearly election of officers. The following men were elected: president, Ralph Galasso; vice president, D. L. Kaufman; treasurer, George Martin; secretary, Ken Vaughan.

The Johnstown Chapter conducted a very successful stag party on the night of August 23. While expenses were high, much entertainment and a substantial profit was shown on operations.

Lansing

A committee under the chairmanship of Harry Carlisle of Charlotte, reported that the Wilcox Gay Co. will furnish a speaker for one of our meetings to be held in the near future.

A committee on by-laws was appointed with Cecil Rich as Chairman together with Ed Bloom, Earl Budd, Ralph Keyes and Max Huntoon.

(Continued on page 36)

WELLS-GARDNER C6-A, C6-B

(Continued from page 24)

the fiber insulating sheet a slight amount.

Insert the antenna cable plug in the antenna socket on the chassis.

R-F ALIGNMENT

Series C6-A: If the antenna is connected at the HC terminal and the 60-inch shielded cable (70 mmfd) is used, connect the antenna wire at the other end through a 230-mmfd condenser to the antenna post of the signal generator.

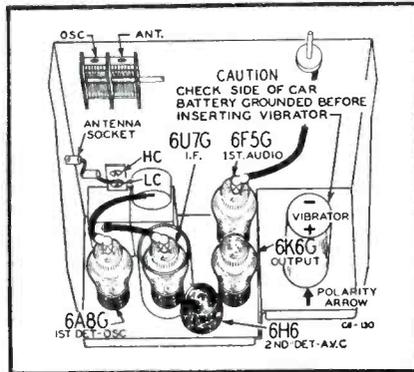
If the antenna is connected at the LC terminal and the short shielded cable (19 mmfd) is used, connect the antenna wire, in this case, through a 20-mmfd condenser to the antenna post of the signal generator. If the long cable has been cut to length and is being used, the total capacity of the cable and the series condenser should be 38 to 40 mmfd.

Series C6-B: If the antenna is connected at the HC terminal and the entire 60-inch shielded cable (70 mmfd) is used, connect the antenna wire at the other end through a 120-mmfd condenser to the antenna post of the signal generator.

If the antenna is connected at the LC terminal and the antenna cable has been cut in half (30-inch length), the capac-

ity of the antenna cable is approximately 35 mmfd. Connect the antenna wire, in this case, through a 25-mmfd condenser to the antenna post of the signal generator.

Both models: Set the signal generator for 1550 kc. Turn the rotor of the tun-



Wells-Gardner C6-A, C6-B chassis layout showing locations of tubes and trimmers.

ing condenser to the full open position. Adjust the trimmer of the oscillator section of the gang condenser until maximum output is obtained.

Set the signal generator for 1400 kc. Turn the rotor of the tuning condenser carefully until maximum output is obtained. Adjust the trimmer of the antenna section of the gang condenser for maximum output.

DIAL SCALE CALIBRATION

Series C6-A: The pointer assembly in this model is clamped to the drive cord and it is seldom necessary to reset it to obtain proper dial calibration. If recalibration is required, loosen the clamps with a screw driver, bringing the pointer assembly first down to one end of the dial scale and then down to the other end. Tune in a signal of known frequency near one end of the dial scale. Move the pointer assembly to this frequency on the scale and tighten the clamps with long nose pliers.

Series C6-B: To obtain dial scale calibration of this model, tune to an 800-kc signal. Hold the tuning shaft and turn the pointer disc until the pointer is at the correct position when the chassis front cover is put back in place.

ATWATER KENT 61 DC

Intermittent: Set plays well then cuts off suddenly. Traced to a bad lead on the speaker cone. The voice coil wires are cemented to the cone over a distance of two or three inches. Under the cement, and barely visible, one lead had broken causing momentary contact. Lengthen the lead and carefully solder the break. Apply another coat of speaker cement to hold the lead in place.

Willard Moody

IN THE MOVIES THEY WOULD CALL IT

Super Colossal

— but we call it the greatest tube tester ever built to sell at **\$26.50**

— THE NEW SIMPSON MODEL 333

● Here's the tube tester you have been waiting for. Small—only 7½"x10½"x5". Light in weight—only 7 lbs. . . . and at a price to fit your pocket book. But more than that it is a tester that will do more things than any tester you ever heard of.

We can't begin to tell you all the jobs this new Model 333 will handle . . . tests everything from Christmas tree lights to gaseous rectifiers . . . double filament switching . . . double everything!

You will want one of these amazing little tube testers right now. Get in touch with your jobber and place your order today.

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Send your bulletin on the new Model 333 Tube Tester.

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 STAMFORD, CONNECTICUT
 EXPORT DEPARTMENT
 100 VARICK ST., NEW YORK

QUALITY
COMPLETE LINE
COMPETITIVELY PRICED

ASSOCIATIONS

(Continued from page 34)

Metropolitan, N. Y.

Metropolitan, N. Y. Chapter has devoted their past several meetings to the discussion and adoption of a set of by-laws for the use of their members. With the coming of Fall, renewed activity is evident and a comprehensive membership drive will be carried out in the New York area during the months of September and October.

Minneapolis

One of the newer and larger additions to the growing RSA family was the Radio Dealers Association of Minneapolis. This group, which includes such members as William Warmington and Ralph Viles, has voted to join forces with the RSA and are laying plans to take a very active part in the association work in the Northwest.

The group is under the direction of the executive secretary, Harry Cory.

Newark

The first annual outing of the Radio Servicemen of New Jersey was held at Farchers' Grove, Union, N. J., on August 21. More than 50 Service Men attended. Games and contests were held: indoor baseball, potato sack races, and other interesting games. Prizes were awarded and we are reliably informed that Mr. La-Penna, one of the Staten Islanders received a special prize after having been lost in the wilds of New Jersey for most of the day. For our first meeting in September, Chairman Rauber will address the group on "How to Increase Your Income By Servicing Allied Appliances."

New Hampshire

At our last meeting Homer Sawtelle described a method of showing up intermittent condensers by the use of r-f oscillators.

Our treasurer, George P. Lefebvre is enjoying a vacation in Canada at the present time.

Cooperative advertising stressing the benefits to the public of having an RSA man repair their sets, is being worked out.

We have planned entertainment and refreshments for our next meeting.

Oklahoma City

Oklahoma City Chapter held a picnic on August 2 and it was definitely established that some of our "hot-shot" Service Men were not so hot when archery, rifles or golf was concerned.

Pittsburgh

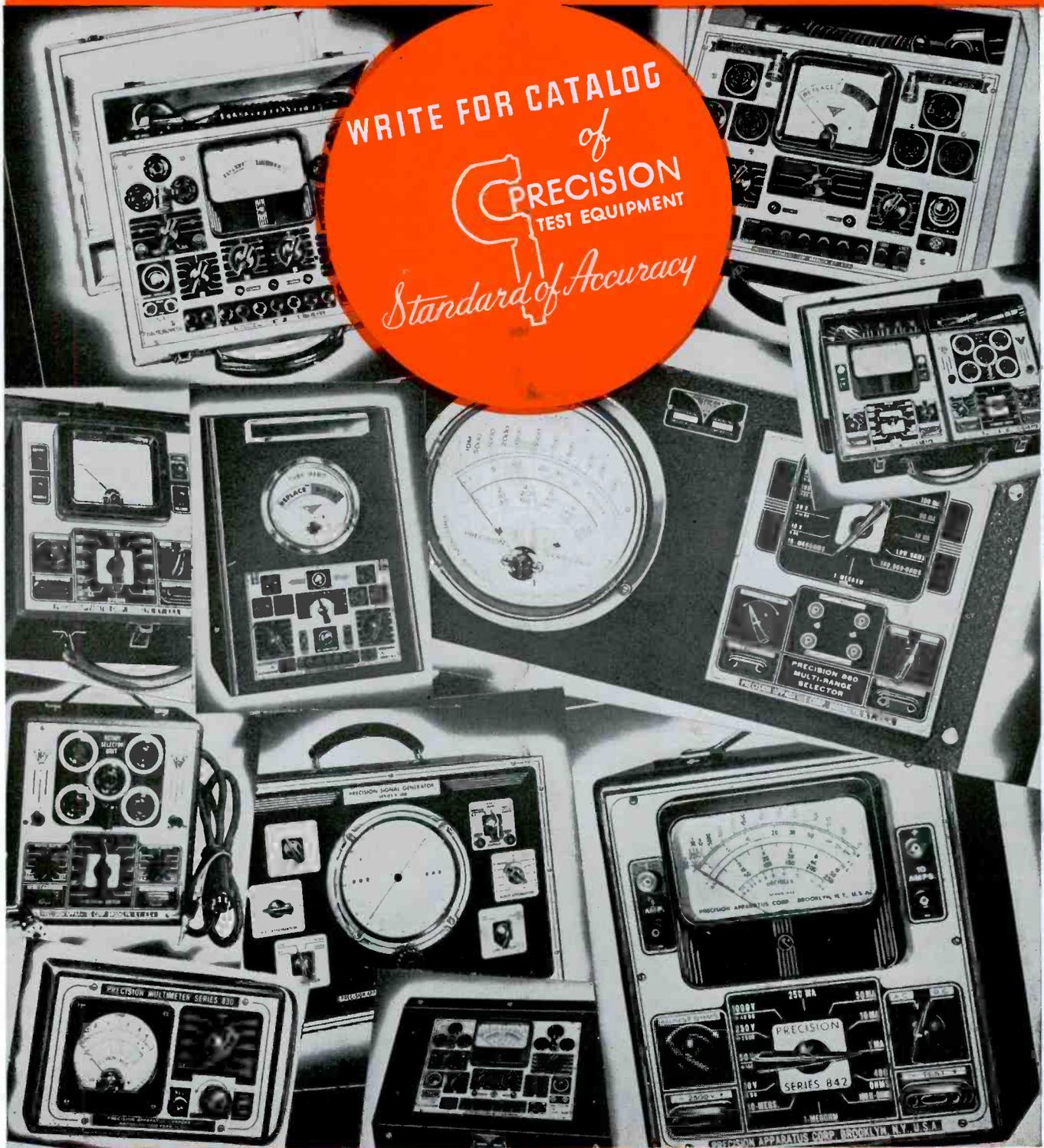
It is with deep regret that we announce the death of the wife of our secretary, William Irlam. All members of the Pittsburgh Chapter as well as the RSA extend condolences to Bill in his bereavement. The Pittsburgh Chapter, one of the latest affiliates of the RSA, has for its chairman, J. Guzik.

Westchester

Westchester Chapter RSA had the pleasure of hearing John F. Rider explain the uses and advantages of the Chanalyst as a means of rapid location of radio trouble. The lecture included an actual demonstration and was thoroughly enjoyed by all present.

• SERVICE FOR

THE NAME TELLS THE STORY...



WRITE FOR CATALOG
of
PRECISION
TEST EQUIPMENT
Standard of Accuracy

EXPORT DIVISION - 458 BROADWAY - NEW YORK, N. Y. U. S. A. - CABLE ADDRESS: MORHANEX

PRECISION *Apparatus Corporation*
821 EAST NEW YORK AVENUE
BROOKLYN, NEW YORK

SEPTEMBER, 1938 •

SAY YOU SAW IT IN SERVICE

37

The Manufacturers

RCA ANTENNA TRANSFORMER

An antenna coupling transformer which makes it possible to convert existing antenna installations to provide the features of the noise-reducing RCA Victor Magic Wave Antenna when used in conjunction with the proper receiver coupling transformer, has been introduced by the RCA Parts Division, *RCA Manufacturing Co., Inc.*, Camden, N. J.

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

ESICO IRON STAND

A thermostatic control stand for maintaining a constant temperature of electric soldering irons has been introduced by Electric Soldering Iron Co., Inc., manufacturers of the Esico brand of soldering irons.

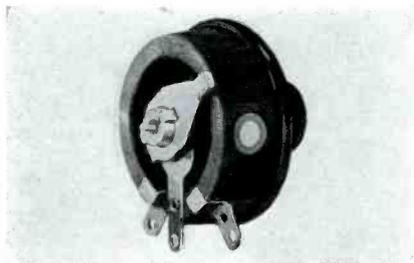
A descriptive bulletin may be obtained from *Electric Soldering Iron Co., Inc.*, Deep River, Conn. SERVICE.

BROWNING OVAL DIAL

The 7½-in dial shown in the accompanying illustration is available for use with the Browning '35 tuner. These dials are manufactured by *Browning Laboratories, Inc.*, 750 Main St., Winchester, Mass.

OHMITE POWER POTENTIOMETER

A 75-watt power potentiometer is available from Ohmite. The unit, Model G, has the permanent protection of Ohmite vitreous enamel which covers and separates the individual turns of wire.



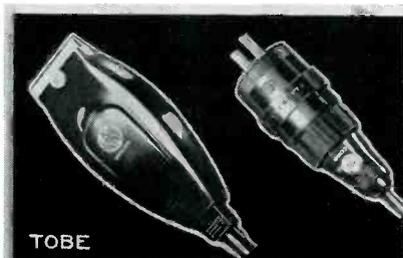
Additional information can be obtained directly from *Ohmite Manufacturing Co.*, 4835 Flournoy St., Chicago. SERVICE.

KEN-RAD BATTERY TUBES

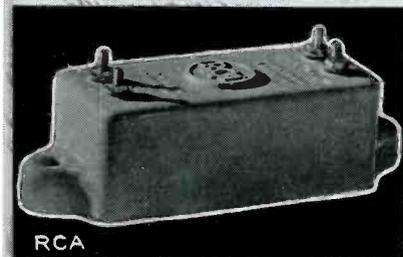
The Ken-Rad Tube & Lamp Corp. have announced a line of tubes for battery-operated receivers. These tubes require less current than available battery types. No C battery is necessary as the output tubes may be operated self-biased and the other types operate at "zero" bias. Mechanically the tubes are somewhat smaller than previous tubes due to the use of a T-9 straight side bulb.

The following types comprise this line: 1A5G output pentode; 1A7G pentagrid converter; 1C5G output pentode; 1H5G triode with single diode; 1N5G r-f pentode.

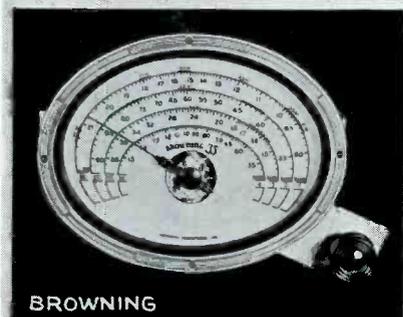
With the exception of the 1C5G, which requires 0.100 amp at 1.4 v, all types operate at a filament voltage of 1.4 v and a current drain of 0.05 amp. All types operate with



TOBE



RCA



BROWNING



CLOUGH-BRENGLE



OPERADIO

a "B" battery of 90 v. Technical information on this new line of tubes is available from the *Ken-Rad Tube & Lamp Corp.*, Owensboro, Ky. SERVICE.

TOBE FILTERETTE

The Tobe Type R-1 filterette, shown in the accompanying illustration, is designed to overcome radio interference created by electric shaving devices. The unit is listed by the Underwriters' Laboratories.

The Type R-1 Filterette is manufactured by the *Tobe Deutschman Corp.*, Canton, Mass. SERVICE.

CLAROSTAT CONTROLS

A line of p-a equipment controls including faders, gain controls, delta-T pads, T-pads, L-pads, constant-impedance output attenuators, etc., is announced by the *Clarostat Manufacturing Co., Inc.*, 285 N. 6th St., Brooklyn, N. Y.

Text on the various controls, listings and application data are included in bulletins J-11 and J-13, obtainable from the company directly. SERVICE.

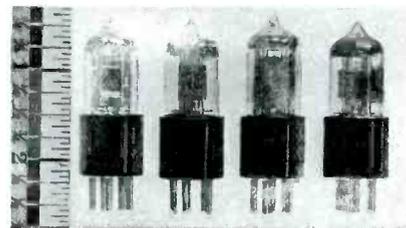
CLOUGH-BRENGLE TUBE TESTER

A tube tester and "Unimeter" has been announced by Clough-Brengle. The instrument will test the mutual conductance of tubes and also provides for measurements of milliamperes, db, a-c and d-c volts, resistance and capacity.

Additional information can be obtained from *Clough-Brengle Co.*, 2817 W. 19 St., Chicago. SERVICE.

HYTRON MINIATURE TUBES

Hytron Corp. have announced a line of miniature tubes measuring 1⅝ in from top



of the glass to the bottom of the base with a bulb 9/16 in.

The new tubes, called Bantam, jrs, have a drain of 0.07 amp at 1.4 volts. They are available in a triode, input pentode and output pentode, with or without bases.

Additional information can be obtained from *Hytron Corp.*, Salem, Mass.

OPERADIO SCHOOL SYSTEM

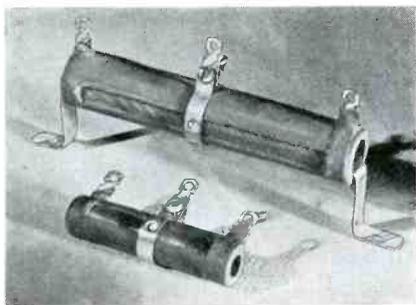
A complete 10 room sound distribution system, Model TES has been announced by Operadio. Included in the system are: Master control; unit amplifiers; ten speakers with cabinets and a microphone and stand. A radio set and high-impedance phonograph pickup unit can be used with the system. Communication can be made to one or all rooms simultaneously. Return speech and call in features may be obtained if desired.

Additional information may be obtained from *Operadio Manufacturing Co.*, St. Charles, Ill.—SERVICE.

(Continued on page 40)

Look for these green resistors.

Inorganic cement coated. Won't blister or crack even at red heat.



Power Resistors

Fixed and adjustable types.

10, 25, 50, 80, 100, and 200 watt ratings.

All popular resistance values.

• Yes, it's taken until now for CLAROSTAT to introduce its wire-wound power resistors. Because, rather than introduce just another brand, CLAROSTAT has wanted to introduce a provably better resistor. You can judge the results for yourself.

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

NEW 208-page CLAROSTAT Service Manual direct from factory at \$.05 per copy.

CLAROSTAT Manufacturing Co., Inc.

285-287 NORTH SIXTH STREET
BROOKLYN, NEW YORK, U.S.A.
• OFFICES IN PRINCIPAL CITIES •

AGED..

FOR EFFICIENCY

No better vibrator is made than the Meissner. But to our knowledge *no other vibrator*—even the other well designed ones—are aged at the factory to *guarantee* their uniform efficient operation!



Lying on a jobber's shelf, the several metals used in any vibrator undergo slight metallurgical changes which may seriously affect its efficiency and life. *Only Meissner* goes to the expense of *aging vibrators at the factory* and re-testing them to eliminate those where the efficiency has deteriorated.

Order Meissner from your parts jobber and *know* that you can *always* guarantee a replacement.

Meissner MT. CARMEL ILLINOIS
VIBRATORS

This Combination Means
MORE PROFIT
FOR *You!*

ARCTURUS DEALER HELPS!

If you have not yet received your copy of the ARCTURUS DEALER HELPS folder, send for it today! Here's everything you need to win the big sales contest that goes on right in your own store—every day! New displays; new, up-to-the-minute sales promotional items; new office and store necessities; new electros and mats . . . most of them absolutely FREE to ARCTURUS dealers! Use these tested sales-builders to bring new customers into your store and to keep the old ones coming to you again and again.



RADIO'S FINEST TUBES!

When you sell ARCTURUS TUBES you sell top quality. ARCTURUS' outstanding achievements in tube design . . . skillful workmanship . . . careful inspection . . . make ARCTURUS TUBES the finest engineered tubes on the market today. That means satisfied customers and increased tube sales for you!

The IMPROVED ARCTURUS EQUIPMENT DEAL!

Better, more complete than ever—with a new assortment of the very latest models—the ARCTURUS EQUIPMENT DEAL enables you to equip your shop with the most efficient test equipment money can buy . . . at almost no cost to you! Lower Down Payments . . . Low Tube Requirements . . . Tubes at Standard Prices . . . Immediate Delivery of the equipment you select! ARCTURUS actually gives you EXTRA PROFITS in the form of this valuable, modern equipment!



GET THE FACTS! Send for your FREE copy of the ARCTURUS DEALER HELPS folder and full details on the new items just added to the ARCTURUS EQUIPMENT DEAL. DON'T DELAY . . . put this profit-making combination to work for you at once! Mail the Coupon!

ARCTURUS

ARCTURUS RADIO TUBE CO., Newark, N. J.

8-11

Without cost or obligation, send my copy of the ARCTURUS DEALER HELPS Folder and details of your new equipment deal.

Name.....

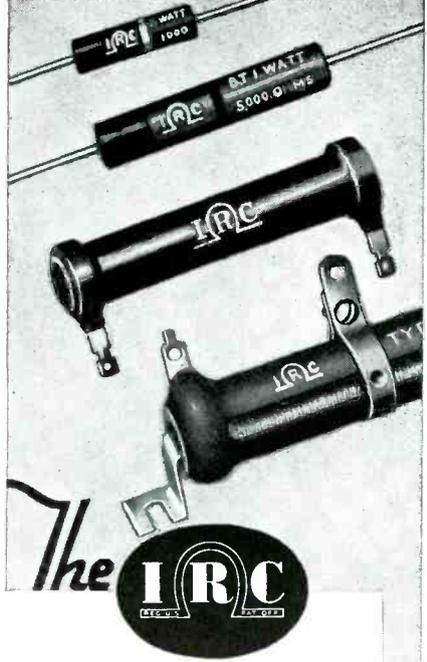
Street.....

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

I am a dealer I am a serviceman My jobber is.....

For your convenience this coupon can be pasted on a penny postcard

PROTECTION



The IRC Secret of TROUBLE-FREE RESISTORS

It is a matter of record that nine out of ten resistor breakdowns are caused solely by failure of the protective covering, either in its job of keeping moisture from the element, or in dissipating heat properly.

... It is also a matter of record that the outstanding popularity of IRC Resistors results in no small part from their perfection in this respect. Hand in hand with engineering improvements inside of the resistors themselves, IRC has pioneered and perfected BOTH Molded phenolic insulation for IRC BT Metallized Resistors and other types, as well as the famous Cement Coating for heavy duty power wire wounds.

By whatever test you choose to make—even boiling hot and freezing cold salt water immersion—you'll find these IRC protective coatings supreme.

"They Stay Put"

INTERNATIONAL RESISTANCE COMPANY

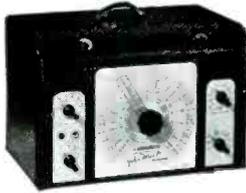
401 N. Broad St., Philadelphia, Pa.
In Canada, 187 Duchess St., Toronto, Ont.

MANUFACTURERS

(Continued from page 38)

MECK BRIDGEMASTER

The Pattern 10 Meck Bridgemaster measures capacity from 0.00001 mfd to 50 mfd, resistance from 1/2 ohm to 1000 meg and coil inductance from 10 to 4000 mh.

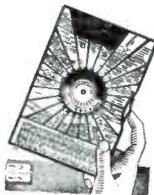


Power factor can also be determined on the instrument.

Additional information can be obtained from John Meck Instruments, 164 N. May St., Chicago, Ill. SERVICE.

GHIRARDI WORLD TIME INDICATOR

A gadget known as the Radio World Time Indicator has been issued by Alfred A. Ghirardi. The object of the gadget is to show, at a quick glance, the exact time



for any part of the world.

A detailed description may be obtained from the Radio & Technical Publishing Co., 45 Astor Place, New York City. SERVICE.

SIMPSON TUBE TESTER

A light weight tube tester with provisions for testing pilot lights and Christmas tree bulbs has been announced by Simpson Electric Co. The tester uses the latest RMA standard circuit and will also test plug-in ballast resistors and gaseous



rectifiers of the 0Z4 type.

Additional information may be obtained directly from the Simpson Electric Co., 5218 W. Kinzie St., Chicago. SERVICE.

(Continued on page 42)

Now... Get REAL RESULTS with

1939 BRACH Antennas

Scientifically Designed
to Insure—

- ✓ BETTER RECEPTION
- ✓ EASY INSTALLATION
- ✓ PERMANENCE
- ✓ SATISFIED CUSTOMERS
- ✓ GOOD PROFITS
- ✓ MORE SALES

The BRACH line is a complete line and every item is priced right. Large stocks on hand at all times insure prompt deliveries. Send for new catalog today!

World's Largest Makers of Antenna Systems

L. S. BRACH Mfg. Corp.

55-67 Dickerson Street

Newark, N. J.



Established 1906

BARGAINS! FOR SERVICE MEN

You don't need cuts or pictures to tell you how great these values are! Just check them against any catalog in your shop and compare the prices. They're typical of SUN's low WHOLESALE PRICES. Hundreds of Servicemen shop by mail from us because we guarantee every sale to satisfy or your money back.

Discontinued TESTERS and Repossessed

These are Up-to-Date and Fully Reconditioned

Supreme 450 Analyzers	\$22.50
Supreme 540 Analyzer	26.50
Supreme 540 3" Oscilloscope complete with tubes.....	39.50
100-1 watt resistors including 6 drawer wood chest.....	\$4.95

AC-DC Amplifier Kit	SPECIAL
A compact, 4 watt amplifier useful for small installations. Uses 1-6J7, 1-6C5, 2-25L6, 2-25Z5. The kit, less tubes is only	For those building their own, we offer!
\$10.55	3 3/4" 1 ma. meters metal case..... \$2.69
	3" 1 ma. meters square bakelite.... 2.95



RADIO CO.

12 Fulton Street, New York, N. Y.

Cable Address: SUNRADIO NEW YORK

it takes
more than a slap on the back



IT TAKES a Nationally known and accepted brand

IT TAKES a policy of dealer merchandising cooperation

IT TAKES insurance against slow turnover and obsolescence

IT TAKES protection from cut-price houses

IT TAKES guarantee of only *clean* competition

IT TAKES a proposition which gives the dealer ample stock without tying up his capital

IT TAKES a tried and tested program which is making money for better dealers everywhere

**IT TAKES THE
TUNG-SOL CONSIGNMENT PLAN
TO TURN TUBE SALES INTO
TUBE PROFITS**

*Take time out now and ask the nearest
Tung-Sol wholesaler or branch office*

TUNG-SOL LAMP WORKS, INC.
Dept. D Radio Tube Division

TUNG-SOL
Tone-flow Radio Tubes

SALES OFFICES: Atlanta • Chicago • Dallas • Denver • Detroit • Kansas City
Los Angeles • New York • General Offices, Newark, N. J.

THREE

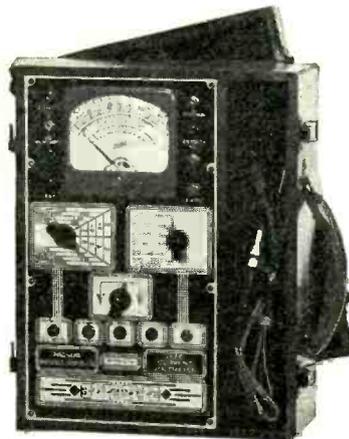
HICKOK

LEADERS

**ZERO CURRENT
VOLTMETER AND
CIRCUIT ANALYZER**

Model 4900-S

Thoroughly and accurately diagnoses all circuits in a radio set. Also indicates *D.C. Volts at Infinite Ohms per Volt*. Also A.C.-D.C. Volts, Ohms, A.C.-D.C. Milliampères, Microfarads, Decibels and Henries. The best instrument for A.V.C. measurements in Radio Service, Public Address and Theatre Sound Systems.



UNIVERSAL SIGNAL GENERATOR

Model 18

With Five Output Selections — Frequency Modulated R. F. Output—Amplitude Modulated R.F. Output (400 cycles) — Unmodulated R.F. Output—all 100 KC to 30 M.C.; 100 to 10,000 cycle variable Audio Frequency Output; 400 cycle fixed audio output.

Self-contained power level meter with three ranges. Output voltage variable 0 to 1.0 volt.

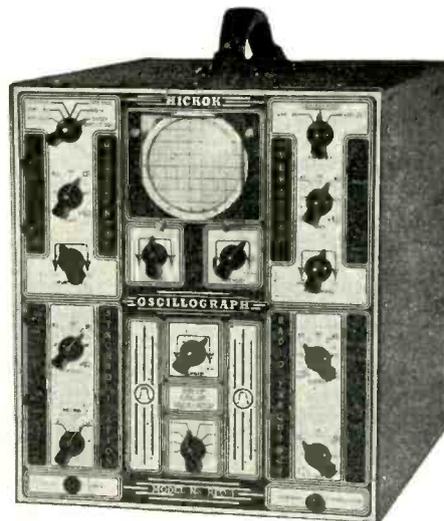


**OSCILLO-
GRAPH**

Model RFO-4

This instrument gives complete coverage of all stages R.F., I.F. and A.F. Self-contained Demodulator and Video Amplifiers permit use in R.F. and I.F. Stages. Single or consecutive stage by stage trouble shooting from antenna post to speaker.

Self-contained dual sweep electronic frequency modulator.



All instruments are HICKOK QUALITY throughout. Mail coupon for copy of new 1939 Catalog No. 10 showing all Hickok Testing Instruments.

Hickok Electrical Instrument Company

10408 Dupont Avenue

Cleveland, Ohio

HICKOK ELECTRICAL INSTRUMENT CO.

CLEVELAND, OHIO.

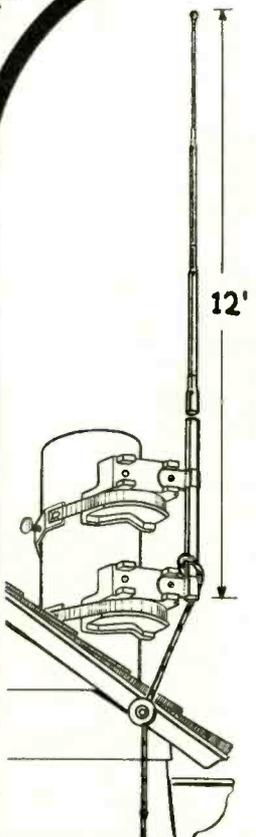
Gentlemen: Please send your catalog No. 10 to

Name

Address

City and State

WARD'S Deluxe HOME AERIAL MAST



CHECK THESE "ALL-STAR" FEATURES:

- ★ PROVIDES BETTER RECEPTION. Operating on same principles as modern broadcasting stations with their vertical antenna masts. WARD'S new home aerial assures better pick-up, better reception than old style "clothesline" aerials.
- ★ GUARANTEED RUSTPROOF. Constructed of attractive nickel-plated, super-sized bronze tubes. 4 sectional. 12 ft. in height.
- ★ EXTRA SAFE. Lightning Arrestor on WARD'S new home aerial houses a .002 MFD condenser for additional capacity required by old and new sets.
- ★ EASY TO INSTALL. No poles, supports or guy wires required. Everything needed for installation comes packed with aerial. WARD'S new home aerial mounts vertically to soil pipe, or against chimney, cornice, window frame, garage, etc.

FREE! —Write or wire today for free catalog of WARD'S complete line of low-priced, fast-selling aerials for car and home.

The WARD PRODUCTS Corp.
WARD BUILDING CLEVELAND, OHIO

MANUFACTURERS

(Continued from page 40)

HICKOK SERVICE PANEL

The Hickok Electrical Instrument Co. announce the illuminated service panel shown in the accompanying illustration.

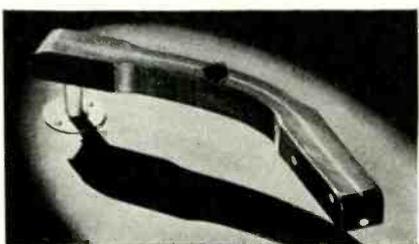


The panel is designed to house one, two or three Hickok instruments and display them to the greatest advantage and utility.

An illustrated bulletin describing the service panel and the instruments with which it can be used is available from Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland, Ohio. SERVICE.

WEBSTER PICKUP

The Model X-78A-3 is another new design in the Webster Electric line incorporating a solid wood tone arm in walnut finish and the standard rubber sealed cartridge. A metal outer shell serves as an



electromagnetic or electrostatic shield as well.

Additional information can be obtained from the Webster Electric Co., Racine Wis. SERVICE.

PRECISION TUBE TESTER

Precision Apparatus Corp. announce their series 900 dynamic mutual conductance tube tester. The instrument is push-button operated and is combined with an



a-c, d-c volt-ohm-decibel-milliammeter meter.

Additional information can be obtained from Precision Apparatus Corp., 821 E. New York Ave., Brooklyn, N. Y.

BINAURAL SOUND SYSTEMS

A recent public-address development offered by Lafayette is its new "Binaural" third dimensional sound systems, Models 380-T, 382-T, 384-T. These systems have been designed to emulate the direction-finding, three-dimensional effect of the human hearing apparatus.



PICK IT UP BETTER with the new Shure Uniplex

★
Really Solves Feedback Background Noise and Reverberation Problems

Sensitive at the Front—Dead at the Rear—the new Shure UNIPLEX Crystal Microphone brings you all the advantages of true uni-directional operation for the first time at such amazingly low cost. Makes better sound pick-up possible in countless microphone installations. Smooth, high quality wide-range front-side response—yet practically unaffected by sound approaching from the rear. Tilting head for aiming at source of sound. Equally outstanding in appearance with its distinctive "speed-line" design and rich Satin Chrome finish. Equipped with new Shure built-in Cable Connector and 25 ft. of special new noise-free Super-Shielded cable. Model 730A—UNIPLEX. List Price..... \$29.50

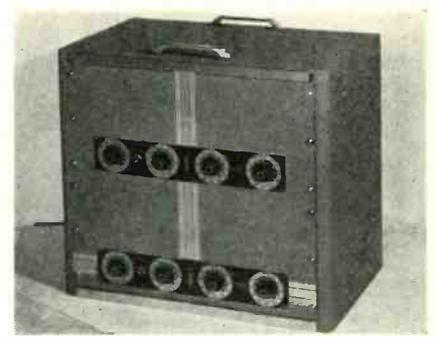
Ask Your Jobber for a Demonstration or write today for new Catalog 150S.

"Sound Systems Sound Better with Shure Microphones"

Shure Patents Pending. Licensed under patents of the Brush Development Company.



For additional information, write to



Wholesale Radio Service Co., 100 Sixth Ave., New York City.—SERVICE.
(Continued on page 44)



"A
**MILLION
DOLLAR
BABY!"**

THAT DOES A MAN-SIZED JOB

That's the way servicemen are referring to the new Sprague ATOMS! For ATOMS (midget dry electrolytics) have all the quality of a real "million dollar baby." They're backed with all the engineering resources of the world's largest manufacturer of quality condensers. They're built better, more scientifically than larger old-style units they're designed to replace. And they're selling like hot cakes among those who know them best—wherever the demand is for really good condensers at rock-bottom prices.

SAVE TIME • MONEY • SPACE

Made by an exclusive Sprague etched-foil process. ATOMS are available in all standard capacities including DUAL COMBINATIONS. You save real money. If you haven't tried them yet—TRY THEM NOW!

SPRAGUE PRODUCTS COMPANY
North Adams, Mass.



**SPRAGUE
ATOMS**
"Mightiest Midgets of All" . . .

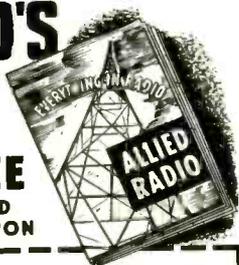
SAVE \$1.00!!!

- 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

Ready Now! **ALLIED'S
1939 Catalog**

Servicemen! You need this big guide to Everything in Radio at lowest prices! Over 14,000 exact duplicate and replacement parts; all leading lines of new Test Equipment: new Rider's Chanalyst, new Push-Button Testers, etc.; new Sound Systems—8 to 65 watts; new books, tools, kits, Amateur Gear; 62 new 1939 Knight Radios—4 to 16 tubes—ideal price-leaders as low as \$6.95! 180 pages of real values—this new ALLIED Catalog for 1939 is Radio's Biggest Book! Write for your copy today!



**FREE
SEND
COUPON**

ALLIED RADIO CORP.
Dept. 19-J-9,
833 W. Jackson Blvd.,
Chicago, Ill.

Send me your 1939 Catalog—
Free.

Name

Address

ALLIED RADIO

SEPTEMBER, 1938 •

Interested In
TELEVISION?



**—Sylvania announces
cathode-ray picture
tube type 906**

IF you are one of today's modern radio men...this announcement will prove of value to you. Sylvania's new television tube, type 906, has been especially designed for that small-sized receiver you plan to build. Its adaptable size—3" screen, overall length, 12"—and the brilliance of its image make this cathode-ray tube ideal for your needs. And of course, type 906 is high in quality, like every other Sylvania tube. Send the coupon today for technical data on this new tube. Hygrade Sylvania Corporation, Emporium, Pennsylvania.

Also makers of famous Hygrade Lamp Bulbs.

SYLVANIA
Set-Tested Radio Tubes

HYGRADE SYLVANIA CORP. S-98
Emporium, Pa.

Please send me technical data on television tube type 906.

Name

Address

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

Dealer
 Amateur

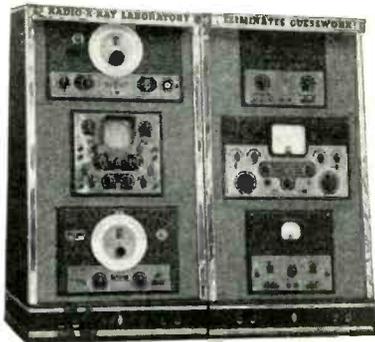
Serviceman
 Experimenter

Name of Jobber.....

SAY YOU SAW IT IN SERVICE

C-B Modernizing Sets Pays Better than Trading

QUALITY STANDARD OF THE RADIO INDUSTRY



Auto and Home Radio Service Laboratory

Experts Make More Through Stepping Up Tone of Old Receivers by Audio Dynatesting

FIGURE trade-in loss, overhead, cost of selling, installation and free service, and what you've got left out of selling a \$100 receiver is a fraction of the clear profit from a \$15 to \$20 audio modernization job, requiring not more than three hours to perform, by modern dynamic method.

Is it any wonder that experts who boast the needed equipment and knowledge of how to use it are making money, while less skilled service men are having a hard time getting by?

"Complete Dynamic Testing, Step-by-Step, with Time-Saving Cathode Ray,"

by Kendall Clough, president and chief engineer, is the key to top notch service profit through teaching how to diagnose, in quickest fashion, any trouble in any receiver, including audio deficiencies, and so to apply swift and sure correction. Best of all, it takes no college degree to learn, but can be put to work by anyone able to read receiver diagram, in quick time.

Supplied free with the purchase of any C-B instrument. Also sold by leading jobbers, or mailed direct anywhere for 50c. See your jobber, or write, enclosing stamps or coin, TODAY!

2817 W. 19th. St.

The CLOUGH-BRENGLE CO.

Chicago, Ill., U.S.A.



LOCKHEED PLANE OHMITE-EQUIPPED

Hughes' dash around the world in his LOCKHEED Plane adds another "case history" to the service-record of Ohmite Vitreous-Enameled Rheostats and Resistors. Their ability to withstand overloads and abuse, shock and vibration, heat and humidity, has made Ohmite resistance units standard equipment on such major airways as Pan-American, United Air Lines, and others, both here and abroad—as well as in the wide radio, electronic and industrial fields.

★

Be Right with Ohmite! Ask Your Jobber for Ohmite Vitreous-Enameled Rheostats, Fixed and Adjustable Resistors—and, of course, the popular Ohmite "Brown Devil" Replacement Resistors. Send for your copy of New Catalog 17 today.



OHMITE MANUFACTURING COMPANY
4827 W. FLOURNOY AVE. ★ CHICAGO, ILL., U.S.A.



MANUFACTURERS

(Continued from page 42)

RADIO CITY INSTRUMENTS

A multi-tester, tube tester and trouble shooter have been added to their line by

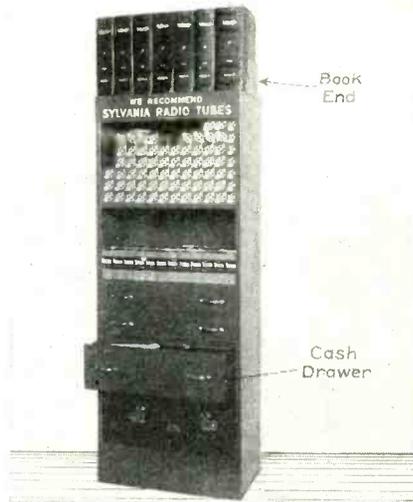


Radio City multi-tester.

the Radio City Products Co., 88 Park Place, New York City. Literature is available upon request. SERVICE.

SYLVANIA STOCK BOY

The Hygrade Sylvania Corp. has added two features to its Stock Boy cabinet. One is metal book ends which attach to the roof of the cabinet for holding manuals and technical books. The other is a cash



Hygrade-Sylvania Stock Boy.

box with a modern positive lock built into one compartment of the large drawer.

Additional information from Hygrade Sylvania Corporation, 500 Fifth Ave., New York City. SERVICE.

(Continued on page 46)

• SERVICE FOR
SEPTEMBER, 1938 •

Page 44



NEW 1938 EDITION

Here's the only complete Handbook for students, amateurs, operators, and inspectors. It covers the entire field of radio in

1,000 pages with hundreds of illustrations and diagrams. It is actually a complete course of training in radio operation and a complete reference book for everyone in the field. It gives instantly the answer to every question about principles, methods, and apparatus of radio transmitting and receiving.

THE RADIO MANUAL

The author, G. E. Sterling, is Assistant Chief, Field Section, Engineering Dept., Federal Communications Commission. The book is bound in durable flexible Fabrikoid.

EXAMINE THIS BOOK FREE

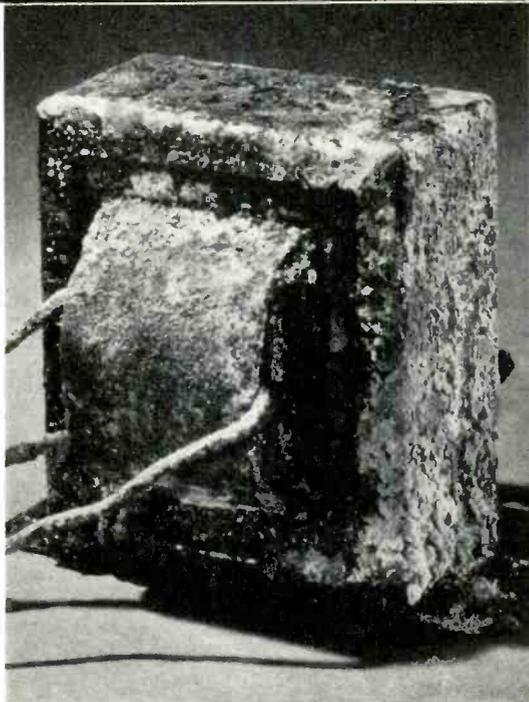
D. VAN NOSTRAND CO., 250 Fourth Ave., N. Y.
Send me on approval THE RADIO MANUAL. Within 5 days after I receive the book, I can return it and owe nothing. If I keep it, I will send you \$2.00 as first payment and I will pay \$2.00 monthly thereafter for 2 months—\$6.00 in all. (5% discount for cash.) (8-9-38)

Name
Address
City..... State.....
Reference
Address

This is NOT an Antique!

IT'S A THORDARSON AUDIO TIME HAS TESTED

This Thordarson audio transformer (T-33A91) was subjected in the laboratory to conditions far worse than any it would ever encounter in actual use. The air surrounding it was filled with salt water vapor and plenty hot, too. Yet it emerged from this stiff test with full operating efficiency. Positive proof of Thordarson quality. That's just one reason why exacting servicemen demand Thordarson transformers.



THORDARSON ELECTRIC MFG. CO.
500 W. HURON ST., CHICAGO, ILL.

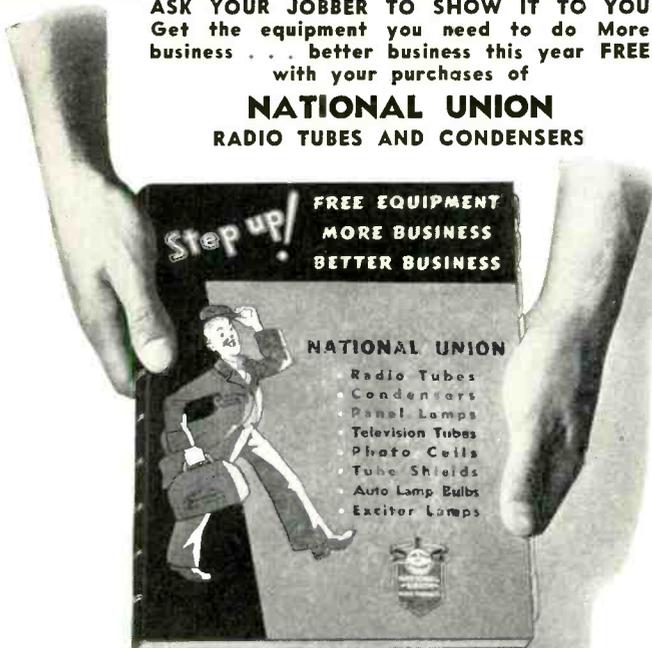
TEST CONDITIONS

120° Fahrenheit; 85% Humidity; Saturated salt solution atmosphere (constantly agitated); 300 volts at 5 M. A. through the primary, and 300 volts between primary and ground. (T-33A91).

BE SURE YOU SEE THIS BIG NEW CATALOG!

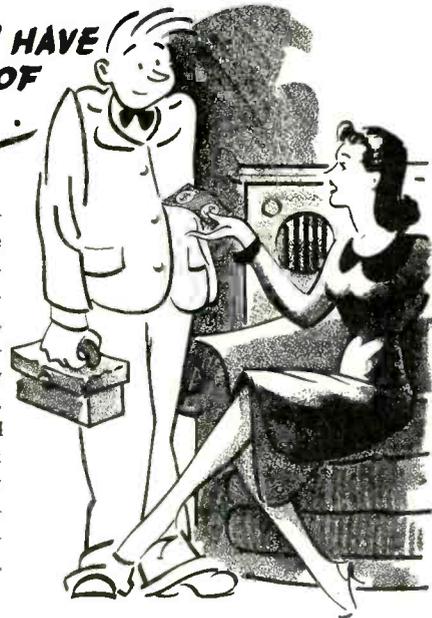
ASK YOUR JOBBER TO SHOW IT TO YOU
Get the equipment you need to do More business . . . better business this year FREE with your purchases of

NATIONAL UNION
RADIO TUBES AND CONDENSERS



For nearest Distributor's name write:
NATIONAL UNION RADIO CORP.
Newark, New Jersey

I'D RATHER HAVE A BOTTLE OF BEER . . .



Customers are grateful for good service work. Some do express their appreciation by gratuities . . . all by continued patronage. That is how a business is built up. The use of Ward Leonard Replacement Parts goes a long way toward giving satisfaction. They are conservatively rated . . . so stand up.

WARD LEONARD ELECTRIC CO.

36 SOUTH STREET, MOUNT VERNON, N. Y.

Please send me Price List Bulletin 507-A.

Name

Street

City State

Jobber

Highlights

HALSON APPOINTMENT

Halsion Radio & Television, Inc., Meriden, Conn., announce the appointment of Eric Foster Storm as general sales manager.

Mr. Storm was, for a number of years, associated with the Connecticut Telephone & Electric Manufacturing Co. The Trumbull Electric Manufacturing Co., and Cooper Thermometer. SERVICE.

CLARION CATALOG

The Transformer Corp. of America have released their 1939 catalog of Clarion sound systems and accessories. Copies may be obtained directly from TCA, 69 Wooster St., New York City.

AEROVOX EMERGENCY STOCK

An emergency stock of all standard types of condensers set up in the Middle West is available to jobbers for filling their orders during the Aerovox C. I. O. strike at the Brooklyn plant. The Aerovox management reports that there will be no delay in taking care of the jobber business. SERVICE.

UNIVERSITY LABS MOVE

The University Laboratories have moved to larger quarters at 195 Chrystie St., New York City.

The University Laboratories manufacture reflex loudspeakers, horns and horn units. SERVICE.

TURNER BROCHURE

The Turner Co., Cedar Rapids, Iowa, have issued an illustrative bulletin describing their line of microphones and microphone stands. Copies may be obtained by writing for bulletin No. 40. SERVICE.

TRIPLETT TUBE TESTER

The Model 1616 Triplett instrument shown in the accompanying illustration is a dynamic mutual conductance tube tester combined with a volt-ohm-milliammeter. Push-button operation is provided.

An illustrated bulletin describing this and other Triplett instruments can be ob-



Triplett tube tester.

tained from the manufacturers, Triplett Electrical Instrument Co., Bluffton, Ohio. SERVICE.

SYLVANIA FOOTBALL SCHEDULE

Announcement of a 1938 football score schedule booklet for Service Men to give to their customers was made by the Hygrade Sylvania Corp.

More than 400 national college and professional games are listed. Space is provided for the football fan to mark down his own forecast of scores next to the column in which the actual scores are to be filled in.

The Hygrade Sylvania Corp. also announced a new fall window display for Sylvania Service Men and dealers. They will be distributed through Sylvania jobbers.

"SUPER SERVICE" PLAN

Arthur E. Rhine has inaugurated a novel "Super Service" plan for experienced, ambitious Service Men only, in Metropolitan New York. To those who indicate their interest, he believes he can produce an unlimited number of service calls by broadcasting over one of the larger stations. It will be possible, he believes, to capitalize on a highly publicized trade name to secure quantity production; larger incomes with small investment and lower monthly overhead will also be possible.

Under the plan each man is to retain full control of his own business, he promises.

Write to him at 158 W. 230 St., New York City.

AUDAK CATALOG SHEETS

Literature giving detailed specifications and response characteristics of the Audax Relayed Frequency and Microdyne type pickups, in the form of sheets suitable for catalog insertion, is available from the Audak Co., 500 Fifth Ave., New York City.

Additional literature will be available within a few weeks.—SERVICE.

MANUFACTURERS

(Continued from page 42)

AMPERITE VELOCITY MIKE

The Amperite acoustic compensator, formerly used on the higher priced numbers



Amperite velocity mike.

only, is now available on several lower priced microphones such as the RSHK and RBSK.

The acoustic compensator is a mechanical shutter that gradually closes the back of the microphone, changing it from velocity to pressure operated. This has the effect of raising the pitch.

Additional information can be obtained from the Amperite Co., 561 Broadway, New York City. SERVICE.

PAR-METAL CATALOG

The Par-Metal Products Corp., 3529-41 Ave., Long Island City, have issued a catalog featuring a line of rack and panel equipment. Copies may be obtained directly from Par-Metal. SERVICE.

UTC BULLETINS

United Transformer Corp., 72 Spring St., New York City, have issued a bulletin illustrating and describing their line of set replacement transformers and another describing amplifier and transmitter kits. Copies may be obtained upon request. SERVICE.

RECOTON NEEDLES DISPLAY

Recoton Corp. has produced a colored display card to help Service Men and dealers sell their phonograph needles. The display is available from regular jobbers or directly from Recoton Corp., 178 Prince St., New York City. SERVICE.

RIDER CHANALYST BOOKLET

A 16-page illustrated booklet on the Rider Chanalyst is now available for Service Men. The booklet covers the various applications of the instrument as well as the theory behind it.

Copies may be obtained directly from Service Instruments, Inc., 404 Fourth Ave., New York City. SERVICE.

ARCTURUS EQUIPMENT DEALS

Among additional items included in the Arcturus Equipment deal are various Weston, Precision and Supreme Test instruments, a standard cash register, an electric clock and a neon sign.

Complete details can be obtained directly from Arcturus Radio Tube Co., 720 Freylinghuysen Ave., Newark, N. J. SERVICE.

ERIE CONDENSER

Erie Resistor Corp. announce their Type F silver-mica type condenser with unusually stable characteristics. It can be supplied in sizes from 15 to 2500 mmfd. The unit is impregnated and sealed with high-grade waxes in a low-loss ceramic case.



Erie silver-mica condenser.

Additional information can be obtained from the Erie Resistor Corp., Erie, Pa. SERVICE.



BRUSH introduces
a high level mike
with **PRICE** appeal

This new Brush H. L. microphone is sure to gain popular appeal. It's ideal for use with public address systems, amateur radio transmitters—in fact, any place where an inexpensive and high level microphone (minus 46 db) is needed.

The Vari-swiv mounting is another feature. It enables the mike to be used in an upright position or tilted to any angle. Mike obtainable with three prong male plug assembly if specified.

Write for details. Complete with 25 feet of cable—\$23.50.

THE BRUSH DEVELOPMENT COMPANY

3317 PERKINS AVENUE
CLEVELAND, OHIO

A GOOD NAME GOES A LONG WAY

Satisfied customers bring more customers—more business. **KEN-RAD** Radio Tubes give complete satisfaction.

KEN-RAD TUBE & LAMP CORPORATION
Owensboro, Ky.

KEN-RAD

DEPENDABLE RADIO TUBES

Radiojac The Ideal Tool To Support Your Radio Chassis

• Whatever system you are using, how often do you swear in supporting your chassis?
• **RADIOJAC** is the only device which will accommodate all sets, old or new, small or large.
• From a handy stand requiring little bench space, you can readily select any length of support—simply insert the needed rods (which have a spring-tight fit) into respective bases; and you have a substantial support for any chassis, without screwing or clamping.

Your distributor has it—otherwise write direct.

\$1.60

COOKS MFG. COMPANY
274 Mile Square Rd., Yonkers, N. Y.

Sky High PERFORMANCE at Down-to-Earth PRICES



DYNOPTIMUM TESTER
RCP's new Tube Tester is so far ahead in quality, in accuracy and in economy—it's no wonder servicemen say "the best ever"! Compare the advantages of this outstanding tester! Convince yourself of its real money-saving value. Tests all type tubes, both metal and glass. Tests ballast tubes. Hot interelement short and leakage test. Hot cathode leakage test. Tests each section of rectifiers and all multi-purpose tubes. Line voltage control with indication on meter. Model 307 Dependable Tester...\$18.95. Also in combination portable and counter type (Model 307P) only...\$18.95



FREE!! New catalog, just off the press, describing in detail the complete new line of **DEPENDABLE** RCP Test Instruments. Use convenient coupon.

AC-DC MULTITESTER

Here is versatility plus quality construction—at a price that's hard to believe, but easy to take. Four range A.C. vm.—0/5/50/500/1000v. Three range ohmmeter, 0/500/50,000/500,000 ohms. Low Scale measures in tenths of an ohm. Four range D.C. voltmeter, 0/5/50/500/1000 volts. Four decibel ranges: minus 12 to plus 54 db. Three current ranges, 0/1/10/100 ma. Model 444 AC-DC Multi-tester your cost only **\$9.95**

RADIO CITY Products Co. Inc.

88 PARK PLACE NEW YORK CITY

FREE RADIO CITY PRODUCTS CO., INC., 88 Park Pl., N. Y. S-98
Rush me free new descriptive catalog on Dependable Instruments.

Name

Address

City State

■■■■ PASTE COUPON ON POSTCARD ■■■■

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. Test instruments. Technical books. Complete new line of "Ham" sets and transmitters. Power tools. Electrical appliances, etc. Every item guaranteed.

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.

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Send me the Radolek Radio Profit Guide **FREE**.

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Serviceman? Dealer? Experimenter?



A Big Value . . .

- ★ Only \$5.00 list. Yet Type 600 Antenna System is fully noise-reducing in all wave bands.
- ★ Single aerial wire, antenna transformer unit, twisted-pair downlead, set coupler, insulators — complete.
- ★ Factory wired and soldered. Just string up—in an hour or less.

Write for details on this and other home antenna systems. Also for free manual on master or community antenna for apartments, clubs, hospital and store demonstrations.

TANCO

TECHNICAL APPLIANCE CORP.
17 East 16th Street - New York City
Lic. A. A. K., Inc. Patents



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 Test
- Ballast Tube Continuity Test
- Uses Attractive Triplett
- Direct Reading Instrument 3" size. (GOOD-BAD) Scale
- Line Voltage Adjustment
- New Improved Low Loss Switch

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

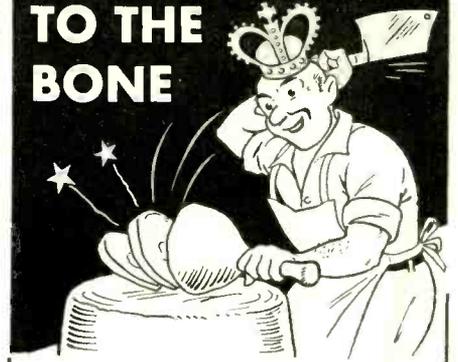
Model 431 checks all receiving tubes. (No ballast test.) Tester uses dependable Readrite Meter. Quartered-oak case same as for Model 432. Dealer Price . . . \$15.90

READRITE METER WORKS
917 College Avenue, Bluffton, Ohio

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Cut FREE SERVICE TO THE BONE



Free "Recalls" are where your profits go. Cut them to minimum by using our complete line of Replacement Transformers. Available in exact duplicate or universal mounting to fit all types of Radio Sets.

PRICED RIGHT!

We are "there" with the right price, and fast dependable service when you need it most. Don't fail to send for your Free Catalog showing the complete line.

FREED

THE REPLACEMENT KING



FREED TRANSFORMER CO.

72 SPRING STREET NEW YORK, N. Y.

Now! BALLAST REPLACEMENT

made **AMAZINGLY SIMPLE**

- Servicemen, with only 4 standard types of Amperite AC-DC Regulators you can replace 90% (over 100 types) of AC-DC Ballast Tubes now in use! Consult your jobber.

- Amperite Regulators are equipped with a patented Automatic Starting Resistor to prevent untimely burnouts and save pilot lights.

- New Low Price on Amperite AC-DC Regulators: \$1.00 LIST

Amperite Replacements for 2V Battery Set ballasts \$1.25 list



AMPERITE Company

561 BROADWAY NEW YORK

WRITE FOR CHART A R

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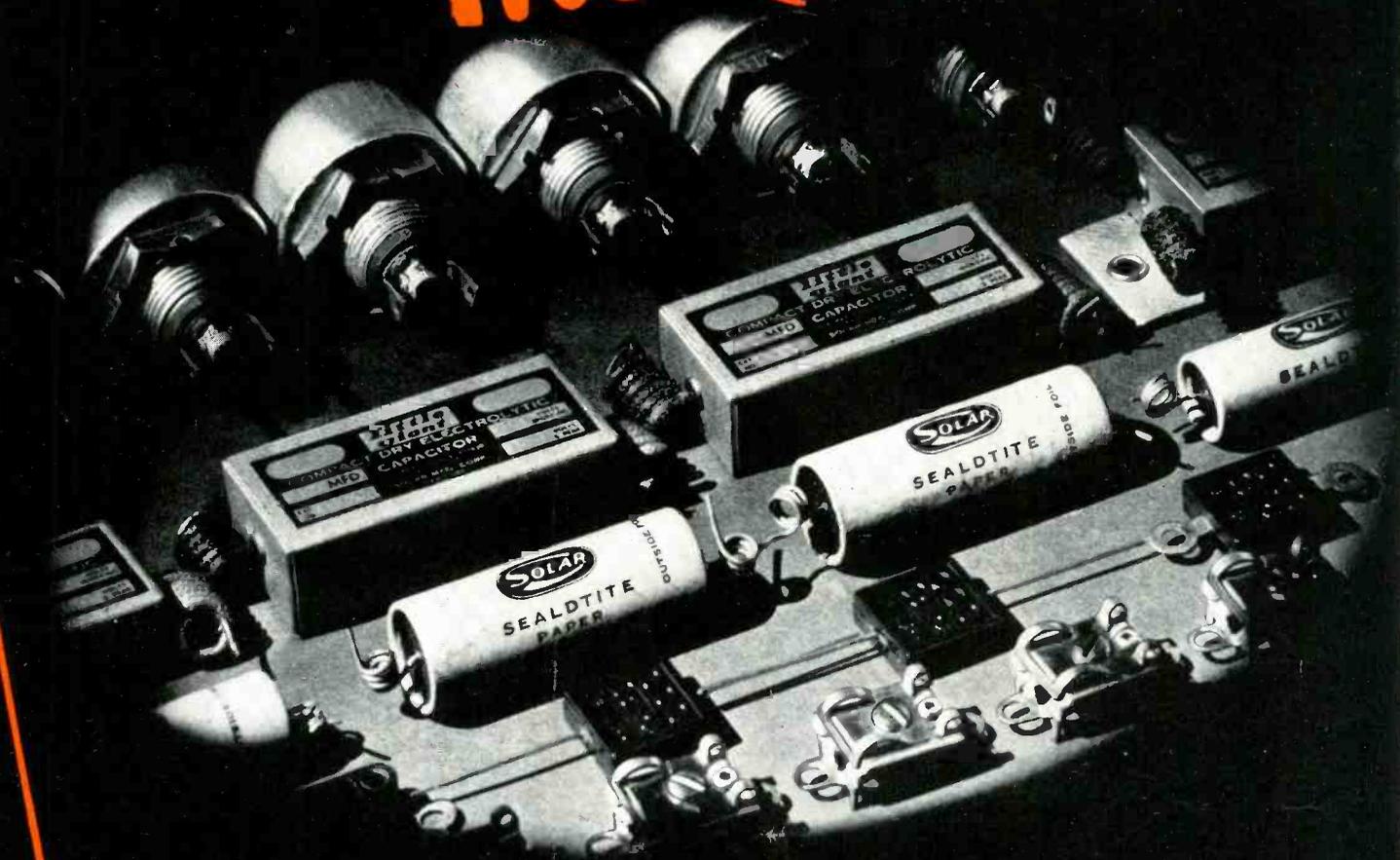
AUTOMATIC REGULATORS

SOLAR

GIVES YOU

more

FOR YOUR MONEY



Condensers are much alike mechanically... but behind SOLAR Capacitors there is something more... the broad and deep experience of our laboratory and deep experience powerful hidden ingredient makes the marked difference in PERFORMANCE which benefits the Radio and Electrical industries. Standardize on SOLAR... QUALITY ABOVE ALL

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Catalogs upon request

**STOP!
LOOK!**



**And Read the News About
RCA'S SENSATIONAL
NEW TUBE TESTER!**



COSTS ONLY
\$37.95
Stock No. 156-A

Dealer's Price

Only RCA Radio Tube Tester Offers All These Features

- 1 Tests new 1-1/2 volt battery tubes.
- 2 Tests every standard type of receiving tube including all ballast tubes. Also tests cathode ray tubes for shorts and emission. All tests made according to RMA standards.
- 3 Tests four prong and octal base ballast tubes for noisy welds and opens.
- 4 Tests Magic Eye tubes for brilliance and opening and closing of eye.
- 5 Tests voltage drop on all types of Gas Tubes, such as OA4-G, OZ4-G, 874 and others.
- 6 Easily operated. All operating instructions and settings shown on simplified roller chart.
- 7 One Finger Operation. Buttons released or retained automatically as required for testing.
- 8 Shows line voltage up to instant of actual test. Not necessary to set line voltage before inserting tube in socket.

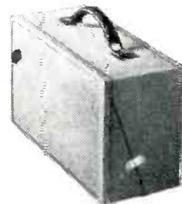
Again, RCA comes through with a winner! This time, it's the sensational new tube tester—that not only offers you more stand-out features than any other—but which costs only \$37.95.

Look at the features this great new tube tester offers! Compare them with any other

—at anything like this price! And you'll be convinced that once more, RCA combines the finest quality with the greatest value!

Over 325 million RCA radio tubes have been purchased by radio users . . . in tubes, as in parts and test equipment, it pays to go RCA All the Way.

RCA presents the Magic Key every Sunday, 2 to 3 P. M., E. D. S. T., on the NBC Blue Network.



Easily Portable . . . Ideal for Service Work!

The large illustration at the top of this page shows the RCA Radio Tube Tester as designed for counter use. Stock No. 156-A, net price \$37.95.

Service men will be glad to know that the RCA Tube Tester is also available for portable use. The instrument itself is the same as that designed for the counter but has a rugged cover and snap type handle (illustrated above). The portable type is Stock No. 156, Dealer's price **\$39.95**

RCA 3" Cathode Ray Oscilloscope

This is RCA's newest and finest general purpose 3" Oscilloscope. Has many new features—all at an attractive price. Provides an easily read image without requiring expensive accessory equipment of larger tubes. All controls located on front panel. Sensitivity—20 volts (RMS) per inch deflection without amplifier—with amplifier, 0.5 (RMS) per inch deflection. Stock No. 155



\$63.95
NET



Test Equipment