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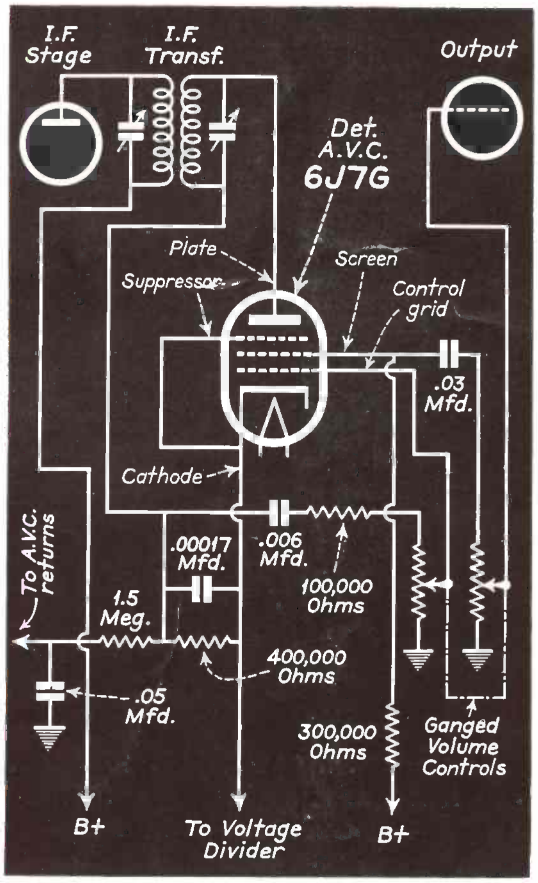

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(*See Page* 414)

SEPTEMBER
1936

Patent applied for

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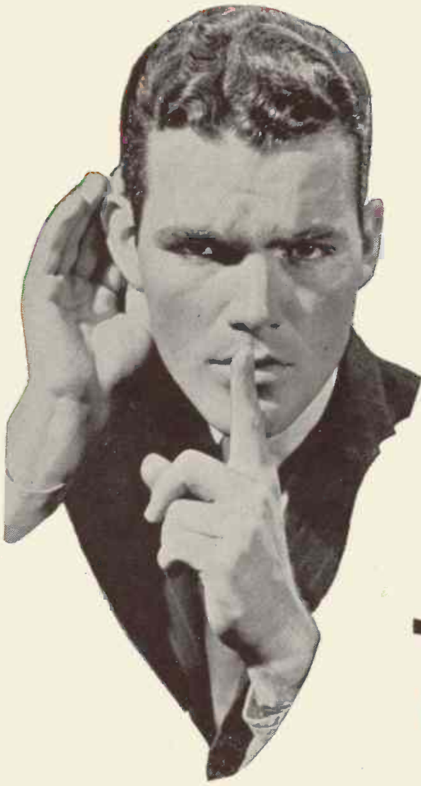
Pure Silver Shortouts for Switch Action.

New Spring Wedge Prevents Loose Terminals.



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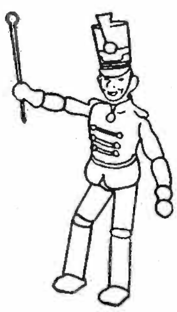

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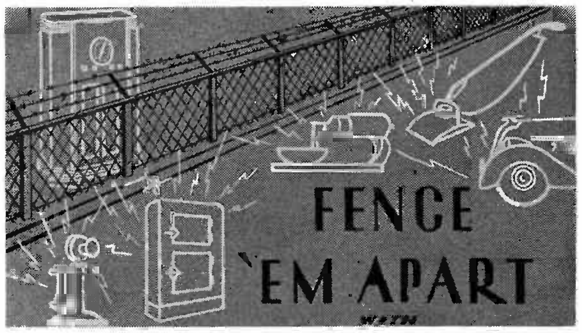
radio and "man-made" static



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SERVICE

A Monthly Digest of Radio and Allied Maintenance

Reg. U. S. Patent Office. Member, Audit Bureau of Circulations

EDITOR
Robert G. Herzog

SEPTEMBER, 1936

VOL. 5, NO. 9

EDITORIAL CONTENTS

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Published Monthly by the
Bryan Davis Publishing Co., Inc.
19 East 47th Street
New York City
Telephone: Plaza 3-0483

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Wellington, New Zealand—Tearo Book Depot.

Cleveland Office—10515 Wilbur Ave.—J. C. Munn, Mgr.
Telephone: Republic 0905-J
Melbourne, Australia—McGill's Agency.

Entered as second-class matter June 14, 1932, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Subscription price $2.00 per year in the United States of America and Canada; 25 cents per copy. $3.00 per year in foreign countries; 35 cents per copy.

THE ANTENNA . . .

IN THIS ISSUE

PADDING THE LOW-FREQUENCY end of each band has always presented some difficulty. Not only is considerable time spent trying to accomplish three things at once but there is no assurance as to the accuracy of the adjustment, if the present accepted method of padding is used. The Service Man usually hopes that the adjustment finally selected is the one giving the "maximum output from the combined operations," but he cannot be sure.

In the May issue of SERVICE, Mr. G. F. Devine described a method designed to accomplish accurate padding condenser adjustment without rocking the tuning control during the adjustment. This method is used successfully at the General Electric Company, and has since been adopted by other receiver manufacturers for their production lines.

In this issue Mr. Alfred Teachman, in presenting his "Impact Excitation Generator," a similar broad-band generator, goes further by giving complete constructional details. In addition the many uses for his inexpensive device are discussed and complete instructions presented.

The use of either the multi-vibrator described in the May issue of SERVICE or the impact excitation generator covered in this issue gives the Service Man a method of completing the padding condenser adjustment easily and accurately. He will find himself well repaid for the expense and time entailed in the purchasing or building of the impact excitation generator, especially if he learns to use it for the many purposes set forth in this issue of SERVICE.

• • •

INCREASED FALL BUSINESS

WITH THE PASSING OF LABOR DAY the season of vacations is over. The annual wanderlust that invades the body must be put aside as we buckle down to business again. People returning home in September have always brought increased business to the Service Man—he should be prepared to meet this increase.

New tubes, new parts, new antennas and other new accessories will be in demand. The Service Man should stock up and then make a concerted effort toward encouraging this business. Complete check-ups should be suggested to his customers at an attractive price in his window advertising, direct mail advertising and in all other advertising. The time to act is now—tomorrow may be too late!

• • •

FREE SERVICE INSPECTIONS

MUCH HAS BEEN SAID BY Service Men and editors both for and against free service inspections—mostly against. Without taking sides in the matter permit us to mention that although these calls have been used as a come-on racket there *are* two sides to the question.

• • •

FREE ADMISSION TO THE TRADE SHOW

COINCIDENTALLY WITH THE APPEARANCE of this issue the Fourth Annual New York IRSM Convention and Trade Show opens on the mezzanine floor at the Hotel Pennsylvania in New York City. A list of the exhibitors and their booth numbers is included in this issue on page 444.

The Institute of Radio Service Men invites the public as well as the entire radio trade to visit the show and listen to the attending lectures. No admission fee is charged.

SERVICE also invites you to visit booth number 48.

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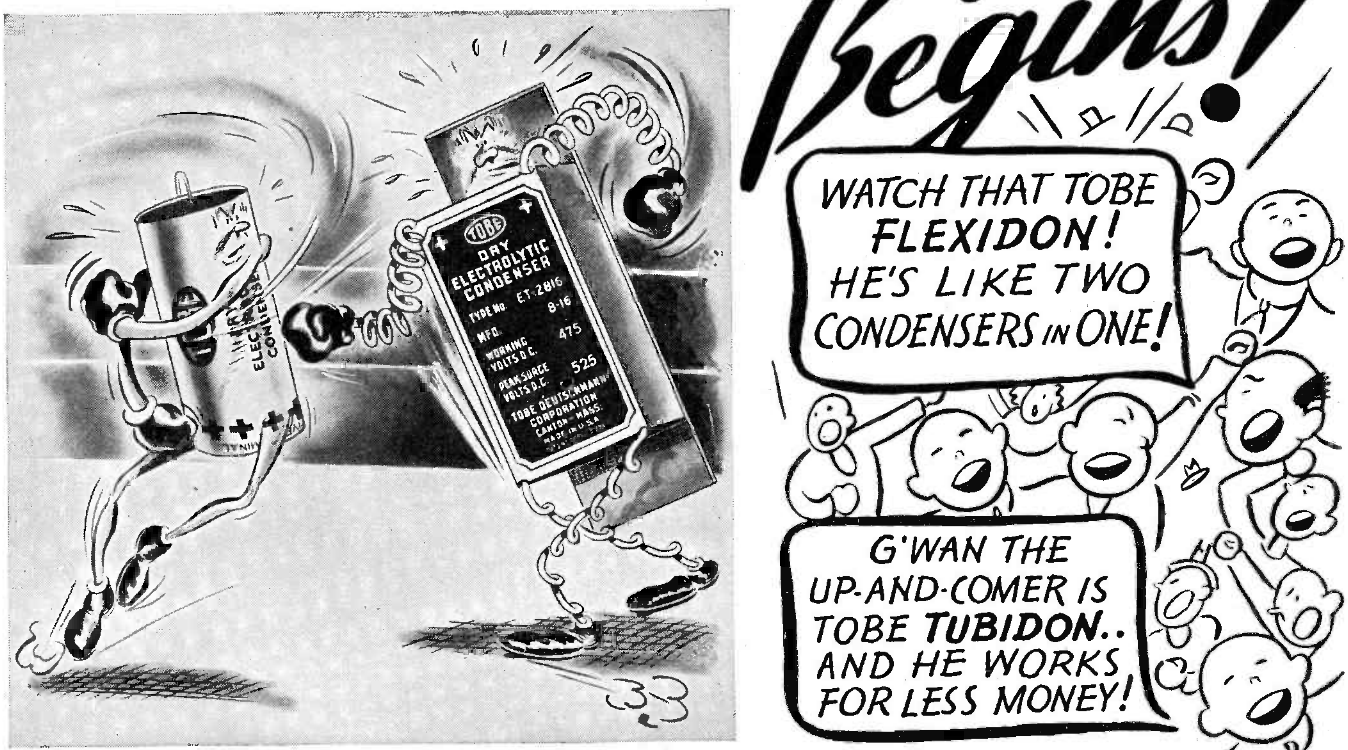

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We consider TOBE TUBIDON and TOBE FLEXIDON such ultra-fine condensers that we just can't imagine how either can lose in this big fight for condenser supremacy. But the answer is up to you ... compare their advantages: TOBE TUBIDON is tubular-shaped, up to 525 volts, self-supporting, easier to install, and *lower* in *cost.* TOBE FLEXIDON is rectangular-shaped, up to 525 volts, space-saving design . . . with the big feature of *flexibility* (the fact that if one section breaks down, it is necessary to replace *only* the broken section.)

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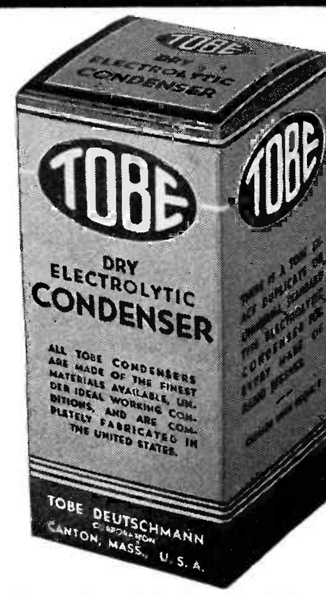
MINIMUM SIZE	2-¼" x ½"	2-⅛"x⅞"x⅞"
TYPE LEADS	solid bare tinned copper wire	insulated tinned copper wire
LEAD LENGTHS	2-½"	6"
MOUNTING	self supporting by leads	metal eyeletted tabs
PRICE (typical 8 mfd.-475v.)	$.75	$.95



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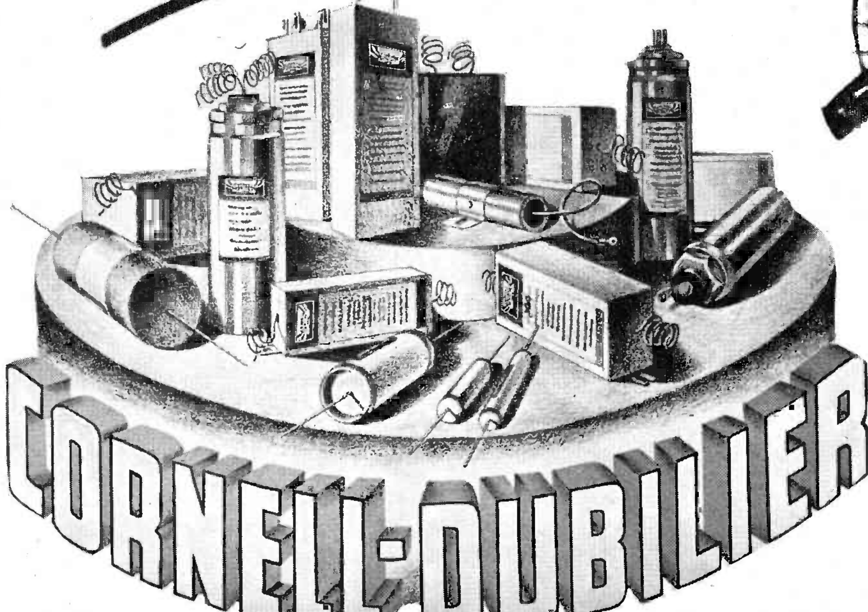

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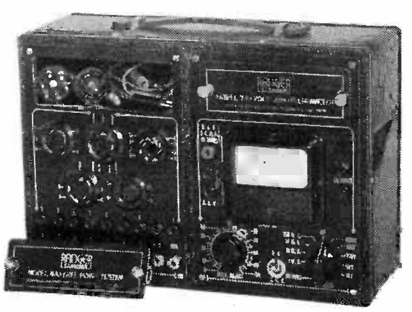
Model 440 Tube Tester checks all type tubes. Condition of tubes is read directly on GOOD-BAD instrument scale while load values are applied. Circuit designed to indicate inter element shorts and leakages. Illuminated dial A.C. instrument for line volts adjustment, also shows when tester is connected to power supply.

Model 540 Signal Generator uses plug-in type coils. Five frequency bands cover 110 to 20,000 K.C. All readings are direct on fundamentals. Each coil is individually calibrated by peaking with trimmer condensers. Accuracy, within one percent (1%) from 110-3000 K.C.—2% for higher readings. Completely shielded. Attenuation and stability are outstanding features. Complete with coils, two type 30 tubes, batteries and necessary accessories.

Model 440-540 consists of these two instruments installed in a sturdy metal case with built-in compartment having snap on cover for accessories, finished in electro black baked enamel, panels in silver and black. Every essential feature is incorporated in these outstanding instruments. No extravagance. No added unnecessary cost. To see one—to use one—means you will be glad to own this outstanding tester.

COMBINATION FREE POINT TESTER AND VOLT-OHM-MILLIAMMETER MODEL 640-740



Model 640 Free Point Tester has five (5) sockets. Panel includes automatic switch type and single action jacks.

Model 740 VOLT-OHM-MILLIAMMETER Unit has a Triplett Precision Instrument scale reading 10-50-250-500-1000 A.C. and D.C. volts at 1000 ohms per volt. 1-10-50-250 M.A.; low ohms 0-300; high ohms to 250,000 at 1.5 volts. Rheostat adjustment.

Model 640-740 is contained in the standard size metal carrying case above described.

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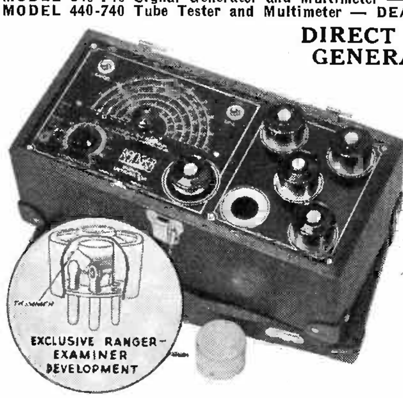
ADDITIONAL COMBINATIONS

Using the same standard size metal carrying case the following additional combinations may be had; the testers in all cases being identical with foregoing descriptions and complete with necessary accessories.

MODEL 540-740 Signal Generator and Multimeter — DEALER PRICE $36.00
MODEL 440-740 Tube Tester and Multimeter — DEALER PRICE $37.50

DIRECT READING SIGNAL GENERATOR MODEL 557



Model 557 has the same features as described for Signal Generator Model 540 except that it is installed in a black leatherette carrying case and is an integral part of the case. The five individually calibrated coils are nested on the side as shown, handy for instant use. The attractive panel is silver and black.

Dealer Price $18.00

Model 554-A is the same as Model 557, but not direct reading. Calibrated graphs included for accuracies under 1% on any band.

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D.C. POCKET VOLT-OHM-MILLIAMMETER MODEL 735

D. C. Pocket Volt-Ohm-Milliammeter-Model 735. Contained in sturdy black molded case with silver and black panel, rounded corners. Ranges are 15-150-750 volts; 1.5-15-150 M.A.; 1/2-1,000 low ohms; 0-100,000 high ohms at 1.5 volts. Provision for external batteries to be used for higher resistance measurements.

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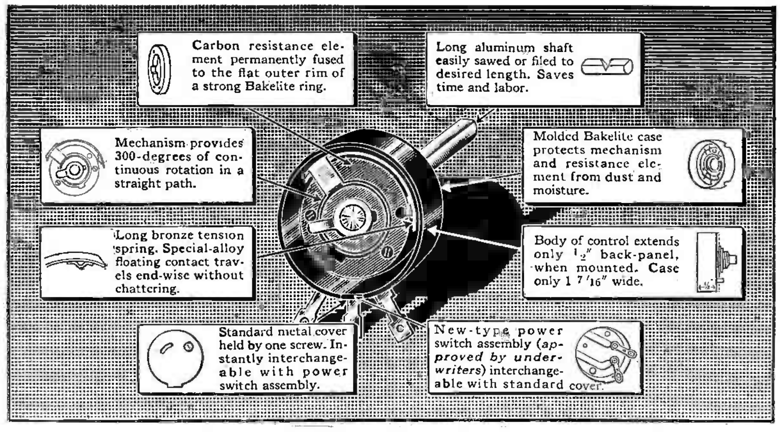

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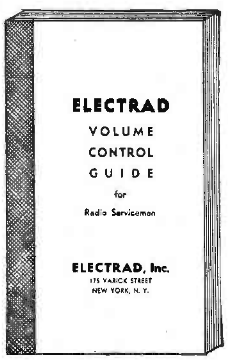

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SERVICE

A Monthly Digest of Radio and Allied Maintenance

FOR SEPTEMBER, 1936

AN IMPACT EXCITATION GENERATOR

By ALFRED E. TEACHMAN

At one time or another it has probably been the dream of every Service Man to own a flock of calibrated crystal oscillators with enough separate oscillators to cover the entire radio spectrum. Barring the expense of such a layout, there are some very practical possibilities in the idea. If a number of test oscillators were spaced 10 kc apart over the entire radio spectrum, all having the same output intensity and fed through a master attenuator, we would at once have a rapid and easy method of testing receivers for regions of low sensitivity by merely sweeping the tuning dial over the range. Improper tracking could be quickly detected since it is the most common cause of low sensitivity when confined to a portion of the band.

A single oscillator rich in harmonics might be used having a base frequency of 10 kc and therefore a harmonic every 10 kc. The difficulty here is that the harmonics do not have the same intensity and grow rapidly weaker at the higher frequencies. Some success might be had in using a motor to drive the tuning condenser of a regular generator and thus keep the spectrum alive. In fact, something of this nature is now widely recommended for locating the optimum adjustment of 600-kc padding condensers. The procedure is to use an oscilloscope signal wobbulator attached to the signal generator for providing a band of frequencies in the region of 600 kc. The point of maximum output is located without reference to the exact frequency at which it occurs. Even at first glance the idea seems worthy of further investigation as a new method of attack since anything which will speed analysis and adjustment and assure accuracy in service work is greatly needed.

The idea of the harmonic generator seems to be the most practical approach to the development of a generator satisfactory for the purpose. In effect, what is required is an essentially continuous spectrum of radio frequencies of equal amplitude, thus obviating the need for a tuning control on the signal generator. If a harmonic generator is to be used, it must have harmonics of practically equal strength. The strength of the harmonics is governed by the wave shape of the plate circuit impulses, but in common r-f oscillators these impulses cannot be developed into a form sufficiently rich in harmonics suitable for the purpose.

To have uniform harmonic strength, it is essential that the waveform be very steep. In fact, it is because of the steep waveform produced by X-ray machines and various other electrical devices that they create radio interference troubles over wide bands of frequencies. The spark coil and buzzer were used to impart radio oscillations in the tuned circuits of early radio transmitters and wavemeters. The buzzer in particular was widely used to excite wavemeters into oscillation. Its waveform output (see Fig. 3) contains harmonics of sufficient strength to excite tuned circuits from the lowest radio frequencies to well up in the short wavelengths. Although the harmonics are not strictly uniform in strength, the falling off is very gradual with frequency being most noticeable toward the high-frequency end. The trend is so gradual as to be hardly noticeable over the range covered by a single band in a home receiver.

The Impact Generator

The small size and convenience of the buzzer leads to its choice as a most suitable generator of the desired harmonic waveform. Considered from the viewpoint of harmonic theory, it is capable of furnishing harmonics of less than 1 kc apart since its fundamental frequency will generally be somewhere below this figure. Actually it will ex-

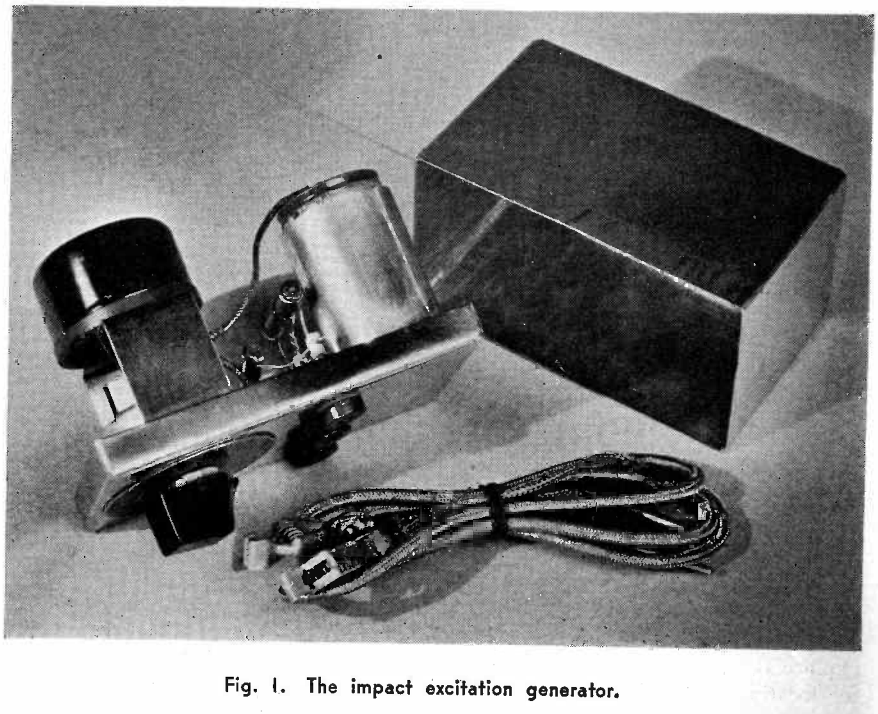

Fig. 1. The impact excitation generator.

cite any r-f circuit regardless of its harmonic relation, for at such high harmonic ratios the r-f oscillations of the tuned circuit will cease before the next impulse. Such a generator might well be called an impact generator and the system impact excitation.

The high steep part of the buzzer waveform illustrated in Fig. 3a is caused by the sudden interruption of the current when the contacts open. The energy stored in magnetic lines of force about the magnet instantly collapse and if there were no escape for the resultant reverse voltage it would rise to infinite value. This cannot happen because the contacts cannot open faster than the voltage builds up and as a result a small arc dissipates some of the energy at the contacts. It is the erratic nature of this arc which causes poor tone when the buzzer is used to generate r-f oscillations. To overcome this difficulty, a resistor is placed in shunt to the buzzer magnet coil and serves to dissipate some of the energy, thus controlling the rise of inductive voltage to a point where the contacts can properly interrupt the current and produce a recurring wave pattern.

A practical circuit for an impact excitation generator is shown in Fig. 2. The output control serves both as a load resistor to shunt the magnet coil and as a variable output control. When the generator is connected to the antenna posts of a receiver it permits a rapid check of the sensitivity conditions existing throughout the various bands.

Figs. 3a, 3b and 3c show a stage-by-stage development from the waveform output of the buzzer to the audio output voltage at the speaker. The sketches are from observations made with an oscilloscope.

Fig. 4 shows graphically the results obtained when a standard multiband receiver was tested with a laboratory type signal generator and with the impact generator. Because of technical difficulties involved, it was found best to take the test with constant attenuator settings and plotting the output meter readings. The avc action had been disconnected and the input signal strength set at a minimum.

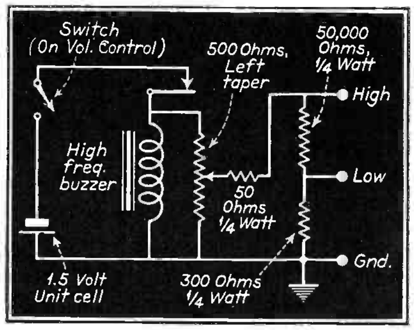

Fig. 2. Circuit diagram of the generator.

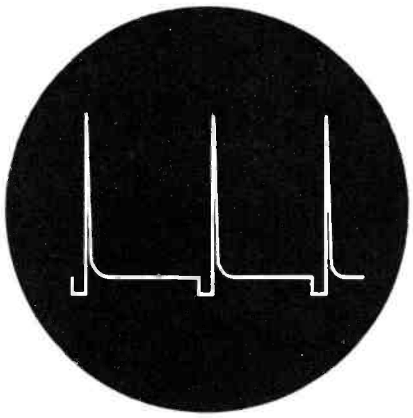

Fig. 3a. Buzzer wave.

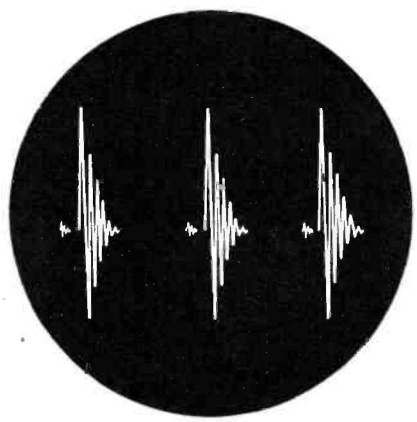

Fig. 3b. R-F oscillations.

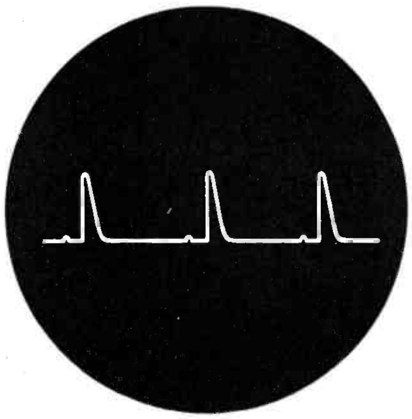

Fig. 3c. Audio wave.

Using the Impact Generator

From the foregoing discussion it is evident that the impact generator is a radically different approach to the test generator problem and in effect it generates a test signal which has no tuning characteristic. This is quite contrary to the accepted type of signal generator which makes use of a single frequency or one of its related harmonics.

Although it may be easily understood that such a generator could be used to explore the tuning range of a receiver for locating "holes" and low sensitivity regions, it may not be so apparent that it can be very successfully used in tuning-up processes. The question is—how can tuning or resonating be accomplished to a signal that has no tuning characteristic? The answer to this is simple and brings out an interesting fact. If the impact generator is connected to the antenna posts of a receiver it will shock the first tuned circuit into oscillation. The oscillations which follow each impulse will take on the frequency of resonance in the first tuned circuit. Thereafter as the signal passes on through the remaining tuned circuits it will be more sharply filtered or tuned. The fact that the first tuned circuit takes on its own frequency of oscillation is an interesting point since it means that at no time can the signal generator be out of tune with the receiver. The importance of this fact when making certain tests will later be shown. The frequency generated in the first tuned circuit will have broad resonance, and in general it will be somewhat broader than the natural selectivity of the circuit. The reason for this will be seen from a study of Fig. 5 in which the short vertical lines represent the harmonic frequencies present in the generator output. If the buzzer is tuned to 1,000 cycles, then the harmonics will fall 1,000 cycles apart over the entire spectrum and their effect on the resonant rise of voltage in a tuned circuit is illustrated by the curved line. The maximum rise in voltage will take place exactly at resonance, but the additive components of the adjacent frequencies will cause the resonance curve to be more rounded than the natural selectivity curve of the circuit. It is worth noting that there will be only one resonant rise of voltage in the spectrum and, if the tuned circuit is resonant at 1,500 kc, there will be no resonant rise at 3,000 kc or any other harmonic relation.

While practical tests indicate that the output of the impact generator falls off very slowly up into the region of 30 meters, there are some theoretical considerations which would seem to indicate that it should be much more rapid. It seems reasonable to suspect that the superheterodyne circuit has much to do with the results obtained since the greater amplification takes place at one fixed frequency.

In using the impact generator, it should be understood that there are certain service procedures which *cannot be accomplished* without a *tuned* type signal generator. However, the impact generator has a field of usefulness untouched by any other method.

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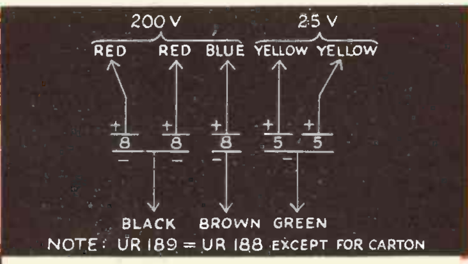

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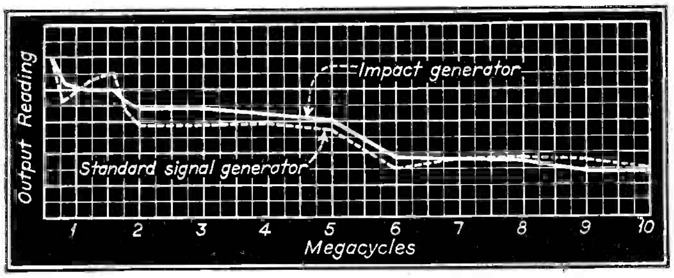

Fig. 4. Comparison test showing generator outputs over the tuning range.

off and on condition need no elaboration, but when this condition is due to a defect in the r-f stages the impact generator provides an excellent means of locating the dead stage in short order, and then the hardest part of the battle is over. The signal injection method is used, which is simply to bring the exposed tip of the shielded test lead close to the tube cap on the successive tuned stages beginning with the last i-f and working towards the first stage. The attenuator is adjusted to suit the conditions and it should be possible to decrease the generator output as more stages come into play. If a stage shows no gain or no signal, it is evident that the trouble has been localized. No generator tuning is involved and no additional consideration need be given to r-f or i-f stages. If the fading be of short duration, the impact generator permits a quick search by the injection method and, due to the fact that no physical contact is made with the chassis, the liklihood of "healing" due to a static surge is completely eliminated. The method is also a useful expedient in locating dead or weak stages affected by less fickle conditions.

Padding Condenser Adjustments

The common procedure in the adjustment of padding condensers has always been a little awkward and uncertain since it involved the trial by error method of juggling two adjustments—rocking the rotor and manipulation of the padding condenser screw. In all cases, the object has been to find the oscillator frequency which beats with the resonant frequency of the first circuits at a rate equal to the i-f peak. The fact that the impact generator will excite the first circuits into natural oscillation simplifies the matter greatly since it is then only necessary to adjust the padding condenser for maximum response. If the padding condenser be of the fixed type, a new one can be selected by using a calibrated variable condenser in substitution and noting the capacity required to obtain maximum response. If no more than an assortment of fixed condensers is at hand, they can be tried separately or in combination to find the correct value.

Finding Best I-F Peak

It frequently happens that an i-f differing from the manufacturer's specification will improve the performance of the set. This is especially so with sets having corrected or shaped plates for the oscillator section of the tuning gang. These sets have no padding condenser and the proper performance of the beat oscillator is dependent on the original design and its permanence. The beat frequency may not be correct, but since it cannot be changed it must be offset by shifting the i-f transformer tuning to a new beat frequency. Using the impact generator, this can be accomplished in a straightforward manner by simply adjusting the i-f tuners for maximum output. For this adjustment the generator is connected to the Ant and Gnd post with the tuning set at the low-frequency end of the band.

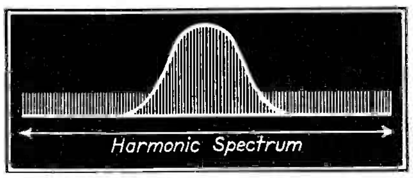

Fig. 5. Resonance response of a tuned circuit.

Compromise Adjustments

Very frequently, from poor design or ageing, it becomes impossible to achieve perfect tuning and a large part of the tuning range cannot be brought into line without sacrifice elsewhere. Consequently, it becomes necessary to select some compromise adjustment which will give the best possible performance under the circumstances. In this work the impact generator permits a fairly rapid trial-by-error method of juggling the tuning elements for the best sensitivity curve. Though no specific procedure for accomplishing this can be laid down, the principal aim is to try the various i-f and r-f adjustments noting, the while, those adjustments which tend toward raising the general sensitivity level without adversely affecting any other part of the band. At each step of the work, the tuning dial of the receiver is swept across the range to observe the affect of the adjustment. The fact that no generator tuning is involved greatly facilitates the work.

In Fig. 6 an attempt has been made to sketch an illustrative analogy which may help in visualizing the mechanics of tuning. In this sketch, the impact generator might be supplanted by a broad light beam a part of which passes through the selector hole in blade 1. With the proper line-up of all holes and the reflector, the light will emerge full strength from the last hole. If the cams in the sketch are properly adjusted, the selected light beams will pass through unimpeded at each blade. In many respects this parallels the requisits of a properly tuned receiver in which the light acceptance hole is replaced by the frequency acceptance circuit.

A further study of the sketch shows that in most receivers the low-frequency end of the r-f stages are without means of adjusting resonance lineup. When the oscillator is also without adjustment at this end of the band, i.e. no padding condenser, it may happen that the frequency difference does not correspond to the setting of the i-f amplifier. Eliminating any serious fault, this can best be taken care of by shifting the i-f tuning to a new frequency giving maximum response. This done, the dial scales reading may be corrected for the low-frequency end by slipping it to read correctly while tuned to a known station. Alignment of the high-frequency trimmers can practically always be ac-

(*Continued on page* 440)

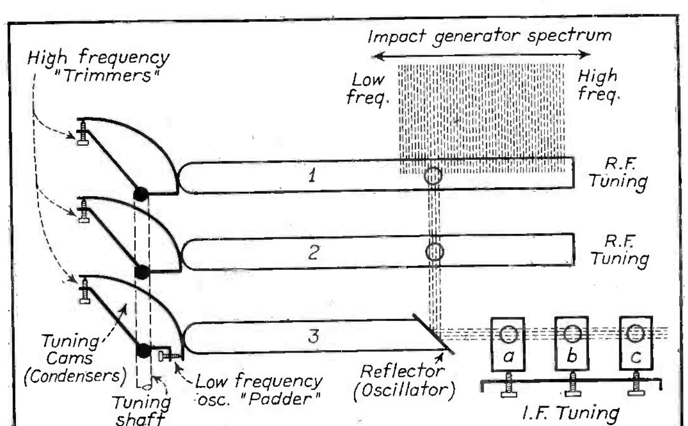

Fig. 6. Mechanical analogy of the impact generator.

AUTOMATIC VOLUME CONTROL*

AUTOMATIC volume control, normally identified as avc, has become an integral part of practically all present-day commercial radio receivers. It is true that a few t-r-f receivers, employing possibly three or four tubes in all, do not incorporate such control systems, but on the whole it is safe to say that every commercial superheterodyne is equipped with avc.

Need For AVC

When we stop to consider the conditions of signal input which are encountered in practice, and the consequent effects—it is not difficult to see why avc is essential. There are a number of factors which contribute to the presence of an extremely wide range of signal intensities at the antenna systems of any one radio receiving installation; this range may be as great as a million to one. As to the reasons for this wide range—we find first the fact that the power rating of different transmitting stations varies widely. Some stations may employ a power output as low as 100 w, whereas others may be 5,000 w, 50 kw and even 500 kw. Then again the variation in the distance between any one receiver and the various transmitting stations which are within its range, cannot help but result in reception of signals which may be as weak as 2 or 3 microvolts or as strong as a volt—such as exists across an antenna system located in close proximity to a very powerful broadcast station. The phenomenon of fading due to a change in the transmitting medium located between the transmitter and the receiver, contributes a received signal of fluctuating strength. All in all, these various influences are very undesirable and up to the time when automatic control systems were introduced, represented some of the objectionable characteristics of everyday radio reception.

Supplementary to signal strength fluctuation is the introduction of distortion as the consequence of overloading due to excessively strong signals or the attempts to reduce manually these signals to the required levels.

The desirability of some automatic control system which would eliminate or minimize these difficulties and which would keep the output of the receiver constant in spite of this tremendous variation of signal strength was extremely obvious. The result was the development of avc.

*Much of the material for this article was gathered from John Rider's book on avc.

In his "Hour-a-Day" series on avc John Rider discusses numerous avc systems, describing the operation of each.

AVC as Automatic Control of Sensitivity

As to sensitivity, each and every receiver is very definitely limited, which means that while avc. may be a part of the receiver system, it does not increase the sensitivity of the receiver over and above that which would exist if the receiver were not equipped with avc. It is a well-known fact that a prescribed input signal is required in order that a certain output signal be available from a receiver. This condition holds true with or without avc. If, during a fade, the received signal falls below the required minimum, no output signal will be heard. This is quite natural, because the maximum sensitivity which can be built up in a receiver is definitely limited and if the signal input falls below the required minimum, as established by the maximum sensitivity of the receiver, then there is not sufficient signal strength to actuate the various tubes.

The action of avc eliminates what has been often identified as *blasting when tuning,* which means that it is possible to tune a receiver equipped with avc over a tuning band and to shift from a weak to a strong station without being annoyed with a sudden blast of sound when passing over the strong stations. While it is true that the manual audio volume control can be used to minimize such blasting in a radio receiver, it is a customary thing to maintain this control at a reasonably high-level setting in order to be able to tune in a weak station properly, or at least to recognize the presence of a weak staiton. If the manual audio volume control is maintained at a low-level setting in order to prevent the excessively loud bursts of sound when passing over strong stations, then it is possible to pass right over or miss the desired weak station.

Another excellent and beneficial effect of avc is the *reduction of distortion.* In days gone by some receivers not equipped with avc and which employed a sensitivity control located in the r-f portion of the receiver, distorted signals badly as the result of overloading and as the consequence of the effect produced when the sensitivity control was so adjusted to reduce a strong input signal to a suitable level as it passed through the receiver. While it is true that this was not really the fault of the sensitivity control, but rather a limitation imposed by the design of the tubes then in use, the disadvantage of a variable control which required continual manipulation when tuning, still existed.

In order to comprehend the function of avc properly it is necessary to divorce the avc system from the manual volume control located in the audio system. Of course, the volume level of the receiver output is indirectly controlled, but this is not the essential point. The important thing to recognize is that the sensitivity of the receiver up to the second detector in a superheterodyne receiver, is automatically varied so as to insure constant output from the second detector. Expressed in another manner, we can say that the function of avc is to insure constant input to the a-f amplifiers, irrespective of the variation in intensity of the received signal across the antenna system of the receiver. The last named condition should be understood as to be within reasonable limits.

The development of avc systems has progressed over a period of time and, as a result, a number of different types of systems are in use. It is basically true that all of these systems are alike—but from the practical angle, some systems are simple,—some more complex, and still others very elaborately interlocked with the different parts of a radio receiving system.

Various Types of AVC Systems

To what extent do the various types of avc systems now in use provide a constant output signal from the second detector tube—an output signal which is independent of the strength, intensity or level of the received signal? . . . In order that we have a basis of comparison, it might be well to show the relation between the input signal level and the output of the second detector tube

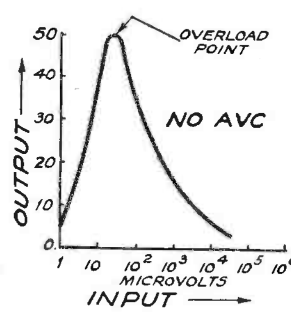

Fig. 1. Input-output relationship of receiver without avc.

in a superheterodyne receiver not equipped with any form of avc. Such a relation is illustrated in Fig. 1. If you examine this curve closely, you will note certain very significant details. First is the fact that a continual increase in input does not necessarily result in a continual increase in output. This is indicated by the fact that the curve representing output does not continue rising. Instead it reaches a certain maximum and then starts to decrease. This means that every receiver not equipped with avc is very definitely limited in the output which it can supply (for a given setting of the manual gain control). Input signals greater than that required to produce this maximum do not result in greater output. . . . As a matter of fact, as is evident in Fig. 1, they result in weaker output, and, in addition, produce distortion. . . . This is the second important detail. The reason why such receivers cannot be operated with input signals greater than a certain level is that if the input signal is greater than the value permitted by design—the tubes in the r-f and i-f amplifiers begin to draw grid current and load or damp the tuned circuits. This has the twofold effect of reducing the amplification and introducing distortion.

Simple AVC

How is this output-input characteristic modified in the case of a receiver which incorporates a simple avc system? At the present time it is not necessary to describe this system. Let it suffice if we say that the simplest possible avc system is employed. The output signal for various values of input for such a receiver is illustrated in Fig. 2. Certain significant details are evident in this illustration, which you should compare with Fig. 1. Note that in Fig. 2 the output for comparable values of input signals is substantially less than in the case of the receiver which does not incorporate any avc system. In other words, the output from the receiver with simple avc for small values of input signal is substantially less than in the case of the receiver without any avc. As the input signal is increased, there is a further marked difference in the output characteristic. Instead of increasing at a uniform rate until the overload point is reached, the output climbs slowly and then gradually tapers off.

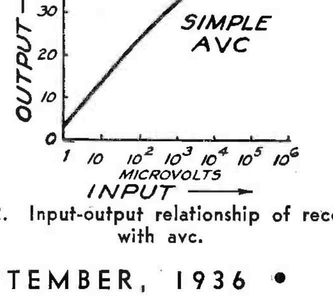

Fig. 2. Input-output relationship of receiver with avc.

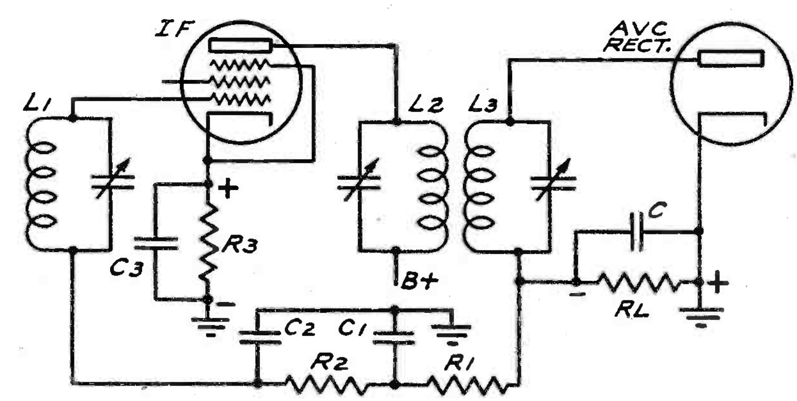

Fig. 3. Typical avc circuit.

Figs. 1 and 2 should not be construed as definitely signifying that all receivers which are equipped with avc possess less sensitivity than receivers which do not employ avc. This is a matter of design. As a matter of fact, the modern receivers equipped with avc are more sensitive than the older receivers which were not so equipped.

Referring again to Figs. 1 and 2, it is significant to note that in Fig. 2 there is an absence of an overload point. Whereas the receiver without avc, shown in Fig. 1, overloads considerably with an input signal of 100 microvolts, the receiver equipped with simple avc does not overload when the input signal is as much as 1 volt. An idea of the uniformity of output, which can be obtained with a simple type of avc, can be seen from the fact that a change in input signal from 10 microvolts to 1 volt changes the output of a receiver from 10 units to 50 units. In other words, *a change of* 100,000 *to* 1 *in the input signal voltage is effective in changing the output of the receiver in the ratio of only* 5 *to* 1.

Delayed AVC

A close examination of Figs. 1 and 2 shows that a receiver which is equipped with simple avc, has a lower sensitivity for very small input signals than one which does not have avc. The reason for this condition is that the avc acts to cut down the sensitivity of the receiver as soon as a signal is received, and this happens no matter how weak the incoming signal may be. This is a great disadvantage, because it is with weak signals that the maximum sensitivity of the set is desired. From a practical viewpoint, this would mean that weak signals would be difficult to receive or, at least, hear, because during the time when maximum sensitivity is needed, the presence of the avc lowers the sensitivity. Various remedies for this disadvantage are used in present day avc systems. These are discussed in Rider's book on avc.

The Basic Control Circuit

The function of the control voltage is to vary the gain of the r-f and i-f amplifier tubes in accordance with the strength of the signal impressed on the antenna. By distributing this voltage to the control grids of the several controlled tubes, the desired degree of control over the amplification in the r-f and i-f systems is obtained.

A typical simple circuit illustrating the coordination of all of the basic elements, which have been discussed so far in the preceding pages, is shown in Fig. 3. This circuit contains an i-f tube, which is controlled by the avc voltage, the avc rectifier, and the resistance-capacity filter. This is the simplest possible illustration and is by no means offered as an example of what would represent a complete circuit. However, it does illustrate the relation between the source of control voltage, the filter network and the tube being controlled. . . . What happens in such a circuit?

If we examine this circuit, we find certain significant details present. To start with, the i-f signal is transferred from the plate circuit of the i-f tube to the input circuit of the avc rectifier. Rectification takes place and the pulsating voltage is developed across the load resistor, R_L. The input to the filter circuit is connected to the most negative point along the control voltage supply resistor, which means that the control grid of the i-f tube is joined to this point. The filter circuit, consisting of R_1, R_2, C_1 and C_2, removes the alternating component of the pulsating voltage, so that a steady voltage is available for bias.

Speaking about the bias for the i-f tube, we note that the cathode of the i-f tube contains its own biasing resistor. . . . But why should this biasing resistor be in the circuit if we can secure an automatic bias from the avc rectifier?

The purpose of the i-f cathode bias resistor is to supply a fixed minimum bias, which sets the operating point of that amplifier stage for its maximum sensitivity position. If we depended solely upon the avc circuit to supply the entire bias, the i-f tube would be operating without bias during those moments when the receiver was being tuned between stations and no signal was passing through the receiver so as to develop the automatic bias. By providing a fixed minimum bias, safe operation of the i-f tube is at all times assured. Such an arrangement is not limited to the i-f amplifier only—but can also be used in r-f systems.

Now the polarity of the fixed minimum bias applied to the i-f tube and the control bias developed by the avc rectifier when a signal is passing through the receiver, is such that these two voltages are effectively in series—so that the avc bias is additive to the fixed minimum bias.

Let us now analyze in a qualitative way the exact manner in which this simplified circuit functions. We start off with the assumption that a weak signal is being picked up by the antenna. Under this condition the signal

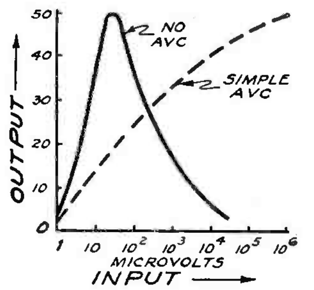

Fig. 4. Input-output relationship of same receiver with and without avc.

voltage is passed on to the i-f tube and across the secondary winding of the i-f transformer, which feeds the avc rectifier, there will be a moderate signal and consequently the control voltage produced across R_L will likewise be moderate in value. This in turn means that the control bias on the i-f amplifier will be of moderate value and the sensitivity of the receiver will be moderately great. As the input signal to the receiver is increased, the magnitude of the control voltage likewise increases in the same ratio. The effect of this increasing control voltage is to level out the response, because the greater the control voltage, the greater the bias applied to the i-f tube, and the less its mutual conductance, which can be interpreted in terms of the gain or amplification of the system. This action tends to make the output uniform regardless of the strength of the signal voltage fed to the input of the receiver. The output characteristic which such a system would have if it did not incorporate avc as against the output characteristic with avc is shown in Fig. 4. Note that the output characteristic, even with avc, is far from ideal in that the output is not the same for all values of input, but on the contrary does increase to a certain extent with increasing values of signal input. While it is true that the performance with avc is not ideal, it is still far superior to the action when the avc system is absent. . . .

Time Delay Considerations

The function of an avc system is to provide substantially constant output irrespective of changes in the signal input. As far as changes of received signal intensity are concerned, they may be either rapid or slow. Whatever the condition, the fact remains that the control voltage must be capable of following the fluctuations in intensity of the applied signal. In other words, the control voltage must be able to increase or decrease as rapidly as the occasion demands.

The filter network displays a great deal of influence upon the ability of the control voltage to follow rapid changes in the input signal. However, before we can really understand the nature of the action which takes place in the filter network consisting of R_1, C_1, R_2 and C_2 in Fig. 3, we must investigate some of the fundamental facts relating to the charge and discharge of a condenser through a resistor. As a rule we think of circuits in such a way that if the voltage is changed at one point in a circuit,—then the voltage instantaneously changes in every other part of the circuit in conformity with the initial change. In general this is quite true, but where the circuit involves large values of resistance and capacity, there is a definite appreciable time lag between the instant that the initial voltage change is made at one point in the circuit and the instant at which the corresponding effect is felt at other points in the circuit.

PENTODE USED AS DIODE AND HIGH-MU TRIODE

(See Front Cover)

THE circuit given on the front cover shows a 6J7G used as a combination second-detector diode with avc and as a high-mu triode first-audio stage. The particular values indicated on the cover diagram are those used in the 1937 Crosley model 526.

The Circuit

The signal from the i-f tube is fed through the doubly-tuned second i-f transformer the secondary of which feeds the plate of the 6J7G. The return leg of secondary is connected, through a 400,000-ohm (diode) load resistor, to the suppressor grid of the 6J7G. The suppressor is connected to the cathode which is suitably biased, for the tubes action as the first audio stage, by proper connection to the voltage divider (+ 4 volts). The secondary return leg of the second i-f transformer is also connected, through the 1.5-meg, 0.05-mfd resistor-condenser r-f filter to the grid returns of the r-f and i-f stages. The a-f signal developed at the second i-f return leg is fed through the 0.006-mfd coupling condenser and the 100,000-ohm filter resistor to the volume control. Any desired portion of this a-f signal is fed from the arm of this section of the control to the grid of the 6J7G. The screen of the 6J7G with a 300,000-ohm load resistor is coupled through the 0.03-mfd condenser to the second section of the a-f volume control. Any desired portion of the signal across this control is fed to the grid of the output stage, a 6N6 for the circuit shown. The two volume controls work from the same shaft.

Functioning of the Tube

The plate and suppressor of the 6J7G act as a diode and rectify the r-f signal delivered by the i-f transformer secondary. The rectified (d-c) voltage is developed across the 400,000-ohm load resistor; it is, however, still modulated by the a-f signal present on the original station carrier. This varying d-c across the load resistor, none the less, has a definite negative value with respect to the cathode at the end away from the cathode. This negative voltage is used for automatic volume control. The portion of the tube in which the plate and suppressor are located is sufficiently hot to enable rectification of the small amount of current required for detection and avc action.

The variations or a-f signals developed across the 400,000-ohm load resistor are passed on to the control grid of the 6J7G by means of the 0.006-mfd coupling condenser, the 100,000-ohm r-f filter and the first a-f volume control. This section of the dual volume control is used as the 6J7G grid load resistor. The screen of the 6J7G is used as the high-mu triode plate and collects the (amplified) signals. The screen receives full plate voltage through its 300,000-ohm load resistor. The signal is collected by the screen because it has the highest (+) potential and the suppressor and plate which surround it are at a much lower potential.

General Data . . .

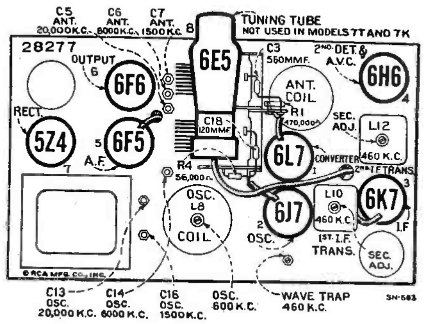

Fig. 2. Tube and trimmer locations.

RCA 7T, 7K, 8T and 8K

The model 7T is a 7-tube, table-type superheterodyne with an 8-inch dynamic speaker. The 7K is of the console type and has a 12-inch speaker. The 8T and 8K are similar to the models 7T and 7K, respectively, except for the addition of a 6E5 and different cabinet designs.

The Circuit

Design features incorporated in these receivers include: built-in doublet antenna coupler; improved plunger-type air-dielectric adjustable trimmer condensers in the antenna and oscillator coil circuits; high-efficiency first-detector-converter with separate oscillator; magnetite core adjusted i-f transformers; low-frequency oscillator compensation; wave trap; aural compensated volume control with music-voice switch; avc; phonograph terminal board, and a dust-proof speaker.

The tuning range is continuous through the standard-broadcast, medium-wave and short-wave bands. This range includes the 49, 31, 19, 16 and 13 meter broadcasts in addition to the channels assigned for police, amateur and aviation communication.

The 6F6 output tube provides an undistorted power output of 2 watts. The total a-c power consumption is (approximately) 80 watts.

Alignment Procedure

Connect the output indicator to the voice coil or to the primary of the output transformer (see Fig. 4). Advance the receiver volume control to its maximum position allowing it to remain in this position throughout the alignment procedure. For each adjusting operation regulate the test oscillator output so that the signal level is as low as possible and still observable at the receiver output. Use of a small signal will obviate broadness of tuning that would otherwise result from the use of a stronger one.

I-F Alignment

(a) Connect the output of the test oscillator to the grid cap of the 6L7 (with grid lead in place) through a 0.001-mfd capacitor and to receiver chassis. Tune the test oscillator to 460 kc.

(b) Adjust the two magnetite core screws of the second i-f transformer (one on top and one on bottom) to produce maximum (peak) output.

(c) The two first i-f transformer magnetite core screws (one on top and one on bottom) should be adjusted to produce maximum (peak) output. It is advisable to repeat the adjustment of all i-f magnetite core screws to assure that the interaction between them has not disturbed the original adjustments.

R-F Alignment

Calibrate the pointer of the tuning dial by adjusting it to the extreme low-frequency end of dial scale (beyond 55 on dial) with the plates of the gang tuning condenser in full mesh. Alignment must be made in sequence of short-wave band, medium-wave band, wave-trap and standard-broadcast band.

Short-wave band

(d) Connect the output of the test oscillator to the antenna terminal "A1" through a 300-ohm resistor, leaving the ground of the oscillator connected to the receiver chassis.

(e) Turn range selector to its short-wave position. Set receiver dial pointer to 20,000 kc. Adjust test oscillator to 20,000 kc. Set oscillator air trimmer

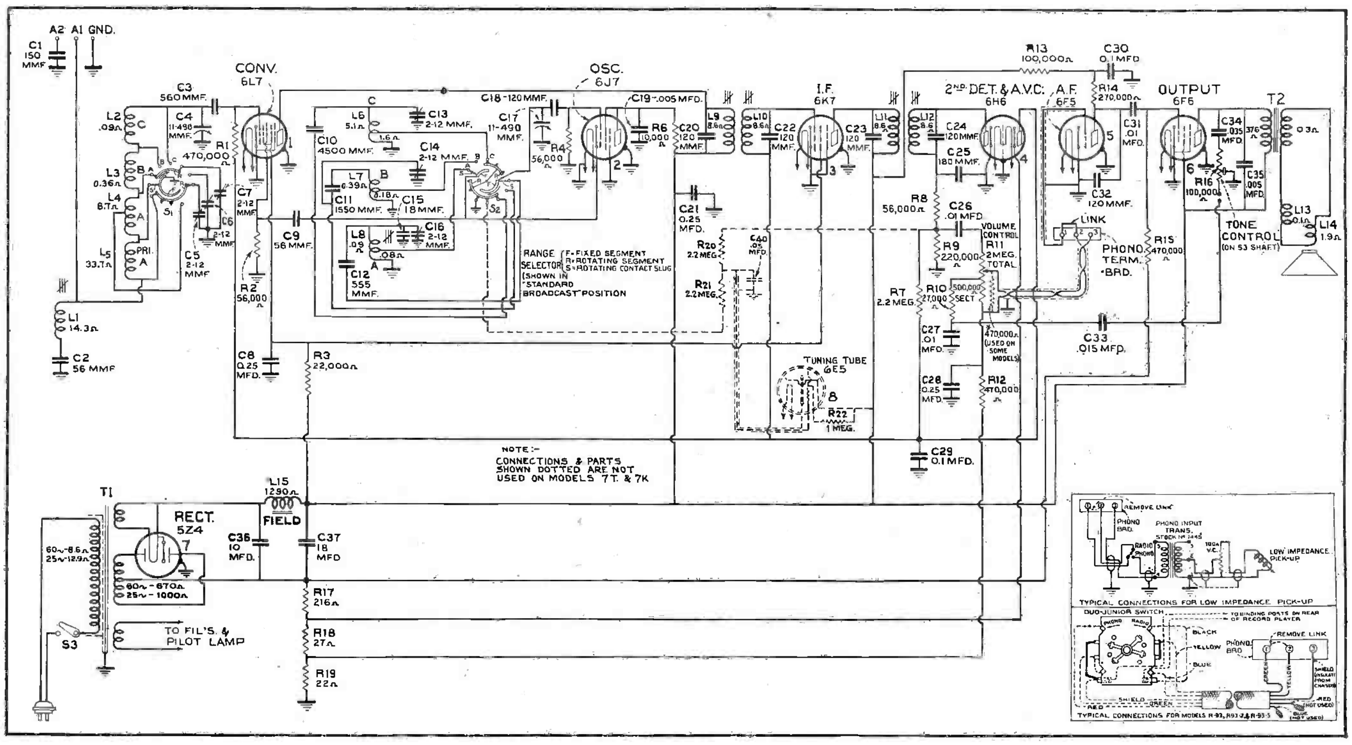

Fig. 1. RCA 7T, 7K, 8T and 8K circuit diagram.

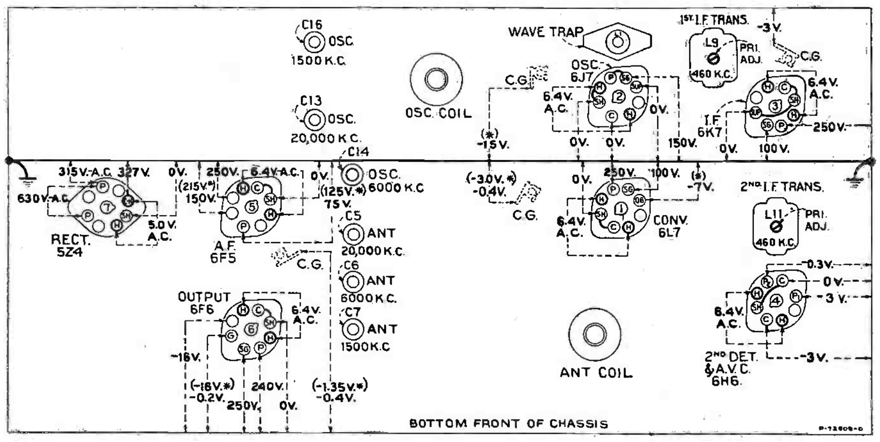

Fig. 3. Under-chassis view RCA 7T, 7K, 8T and 8K.

C13 (see Fig. 3) to minimum capacity (plunger full out), and antenna air trimmer C5 (Fig. 2) to maximum capacity (plunger full in). Slowly push in oscillator trimmer C13 until maximum (peak) output is reached. Two peaks may be found. Adjust C13 to the peak with minimum capacity (plunger near out) for maximum indication. Tighten lock nut. Slowly pull out plunger of antenna air trimmer C5 until maximum (peak) output is reached while slightly rocking the gang tuning condenser back and forth through the signal. Two peaks may be found with this circuit. The peak with maximum capacity (plunger near in) should be used. Tighten lock nut.

Medium-wave band

(f) Turn the receiver range selector to its medium-wave position, with the receiver dial pointer set to 6,000 kc. Tune test oscillator to 6,000 kc. Carefully adjust the oscillator and antenna air trimmers C14 and C6, respectively, so that each brings about maximum (peak) output. When adjusting the oscillator trimmer C14, two peaks may be found. The one of minimum capacitance (plunger near out) should be used.

Wave-trap adjustment

(g) Connect the output of the test oscillator to the antenna terminal "A1" through a 200-mmfd (important) capacitor. Turn the range selector to its standard-broadcast position and set the receiver dial pointer to a position of no extraneous signals near 600 kc. Tune the test oscillator to 460 kc. Adjust the wave-trap magnetite core screw to the point which causes minimum output (maximum suppression of signal). An increase of the test-oscillator output may be necessary before the point of minimum output, obtained by adjustment of wave-trap screw, becomes apparent on the output indicator.

Standard broadcast band

(h) Reduce output of test oscillator to a minmum. Tune the test oscillator to 600 kc and set receiver dial pointer to 600 kc. Adjust output of test oscillator until a slight indication of output is visible.

(i) Adjust the oscillator magnetite core screw (top of oscillator coil) so that maximum (peak) output results.

(j) Set receiver dial pointer to 1,500 kc. Tune the test oscillator to 1,500 kc. Carefully adjust the oscillator and antenna air trimmers C16 and C7 respectively so that each brings about maximum (peak) output.

(k) Tune the test oscillator to 600 kc. Tune the receiver to pick up this signal disregarding the dial reading at which it is best received. Adjust oscillator magnetite core screw (top of oscillator coil) for maximum (peak) output while rocking gang tuning condenser. After completing this adjustment, the trimmers C16 and C7 should be readjusted as in (j) to correct for any change in the oscillator high-frequency tuning which has been caused by the preceding adjustment.

Phonograph Terminal Board

A terminal board is provided for connecting a phonograph into the audio amplifying circuit. Typical methods of connecting a low-impedance pickup are shown on the schematic diagram (Fig. 1).

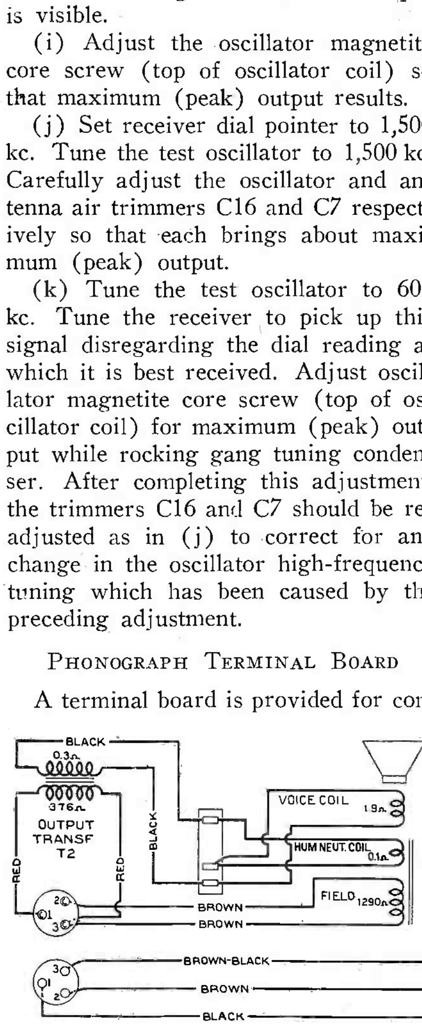

Fig. 4. RCA speaker connections.

Socket and Voltage Data

An underchassis view is shown in Fig. 3 giving the location of trimmers as well as the various voltages encountered at the socket prongs. Two voltage values are shown for some points. The higher value shown in parenthesis with the asterisk indicates operating conditions without the voltmeter loading. The lower value is the actual measured voltage and differs from the higher value because of the additional loading of the voltmeter. Each value as specified should hold within 20% when the receiver is normally operative with its rated line voltage. These voltages were measured with a 1,000-ohm-per-volt voltmeter with no signal received and with the volume control set at maximum.

Fairbanks-Morse 72

The Fairbanks-Morse 72 is a 7-tube, 3-band superheterodyne employing metal-glass tubes. A complete circuit diagram is shown in Fig. 2, with the tubes used, their functions and the various voltages encountered on the socket prongs lettered on the diagram. These voltages were measured with the set in full operating condition, the volume control turned to maximum and the antenna shorted to the ground. A 1000-ohm-per-volt voltmeter was used to make the measurements. Actual values may differ as much as 20 percent from those given.

Alignment Procedure

To insure obtaining the performance the model 72 is capable of delivering, it is essential that it be aligned perfectly. For this reason it is urged that the following instructions be studied carefully before any alignment adjustments are attempted.

Proper adjustment of the various tuned circuits will only be possible through the use of an accurate and reliable signal generator employed in conjunction with an output meter, which may be connected across the voice coil leads of the loudspeaker.

All adjustments should be made with the volume control at maximum position. Any desired variation in signal strength should be obtained by adjusting the output of the signal generator.

I-F Alignment

1. Turn the gang condenser to maxi-

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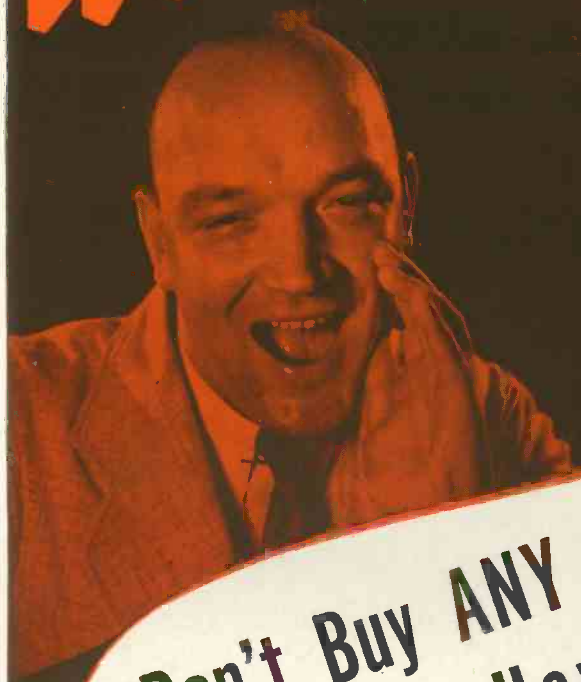

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Horizontal Mounting Centers 2 13/16" — L 3 5/16" W 1½" H 2"

S-31	1 plate to 1 grid 3:1 ratio, Vertical mount	$1.05
U-31	1 plate to 1 grid 3:1 ratio	1.05
S-32	1 plate to 2 grids 2:1 ratio, Vertical mount	1.11
U-32	1 plate to 2 grids 2:1 ratio	1.11
U-32X	1 plate to 2 grids 2:1 ratio split secondary	1.14
U-33	2 plates to 2 grids 1.75:1 ratio	1.20
U-47	Single power pentode to single voice coil	.90
U-247	Push pull power pentodes to single voice coil	.96
U-45	Single power triode to single voice coil	.90
U-245	Push pull power triodes to single voice coil	.96

UNCASED UTC MIGHTY MITE AUDIO TRANSFORMERS

For Transceivers. For compact head amplifiers. For Pee Wee and aeroplane receivers.

Horizontal Mounting Centers 2⅜" — L 2⅞" W 1⅜" H 1 11/16"

S-41	Interstage audio 4:1 ratio, Vertical mount	$ .90
U-41	Interstage audio 4:1 ratio	.90
S-51	Single plate to 2 grids 2½:1 ratio, Vertical mount	.93
U-51	Single plate to 2 grids 2½:1 ratio	.97
UPM	Single pentode 18, 20, 33, 41, 32, 2A5 plate to 4000 and 2000 ohms	1.05
UTM	Single triode 71, 45, 59 plate to 4000 and 2000 ohms	1.05
UMG	Single or double button mike to 1 grid	.96
UTG	Single plate and carbon mike to single grid	.99
UHO	Single 56, 27, or 864 plate to 500 and 200 ohms.	1.20
UPPM	Push pull triodes 71, 45, 59 to 4000 and 2000 ohms	1.05
UTTM	Push pull pentodes 18, 20, 33, 41, 32, 42, 2A5, 47 to 4000 and 2000 ohms	1.05
U30B	Driver 30 plate to Class B 19, 49, 79, 89 grids	1.05
U19B	Class B 19, 49, 79 or 89 plates to 5000 or 3500 ohms	1.05

PEE WEE DYNAMIC SPEAKER OUTPUTS

Horizontal Mounting Centers 2 13/16" — L 3 5/16" W 1½" H 2"

MA-1	Single power pentode to voice coil	$ .75
MA-2	Push pull power pentodes to voice coil	.81
MA-3	Single power triode to voice coil	.75
MA-4	Push pull power triodes to voice coil	.81

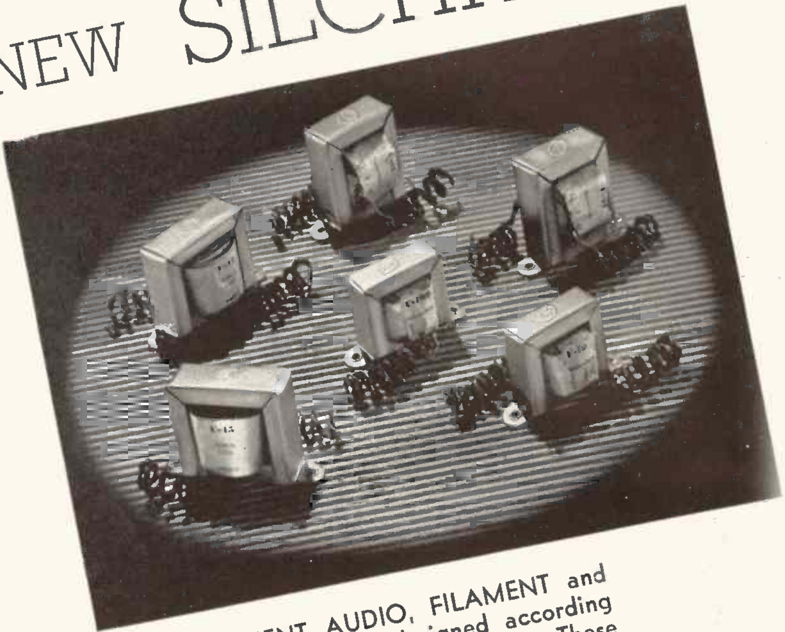
UTC ALL-PURPOSE REPLACEMENT OUTPUT TRANSFORMERS

Due to their ingenious mounting arrangement, these transformers will easily fit Rola, Wright DeCoster, Jensen, Utah, Magnovox, and other small dynamic speakers.

These units are compact. The mounting centers are from ¾" to 2⅜"; the height 1⅝". A fine grade of silicon core material is used and each unit has a high degree of efficiency. A tapped secondary winding will match voice coils from two to eight ohms. A top lug terminal bracket is supplied so that field coil leads may be soldered directly to each unit.

US-47	Single power pentode like 18, 20, 33, 41, 32, 57, 2A5 to single voice coil	$ .90
UPP-47	Push pull power pentodes like 18, 20, 33, 41, 32, 47, 2A5 to single voice coil	.90
US-45	Single power triode like 71, 45, or 59 to single voice coil	.90
UPPO	Push pull power triodes like 71, 45, or 59 to single voice coil	.90
UPP-45	Push pull 48's to single voice coil	.90
UPP-48	Compact type Universal output for single and push pull triodes or pentodes to any voice coil	.90

NEW SILCHROME



REPLACEMENT AUDIO, FILAMENT and FILTER COMPONENTS designed according to the best of modern standards. These units employ the finest high permeability silicon steel and the best insulating materials. The coils are fully vacuum impregnated and precision machine wound to assure long lasting service under the most adverse humidity conditions encountered.

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EXPORT DIVISION: 100 VARICK STREET NEW YORK, N.Y. CABLES: "ARLAB" mum capacity (fully meshed). With the range switch on the broadcast position.

2. Supply a 456-kc signal from the signal generator to the grid of the first detector tube (6A8G) through /a 0.1-mfd condenser connected in series with the signal generator lead.

3. Adjust the four trimmers of the two intermediate-frequency transformers (see Fig. 1) for maximum output with minimum input from the service oscillator.

Dial Adjustment

Before making any radio-frequency alignment adjustments, close the variable tuning condenser (maximum capacity), loosen the screw that secures the dial pointer, place the pointer in a horizontal position (gang condenser still closed) and then tighten the screw.

R-F Alignment

The parallel or high-frequency trimmer condensers for each coil are housed in the same shield can with the coil except the oscillator trimmers; these are air dielectric condensers and are mounted on the chassis. These trimmers are used for aligning the high-frequency end of each band. The location of the various trimmers is shown in Fig. 1.

The oscillator adjustable series-padding condensers are used for tracking the oscillator at the low-frequency end of each band. The padding condensers may be adjusted from the top of the chassis through the holes indicated in Fig. 1. Since a fixed mica padding condenser is employed on the short-wave band no adjustment is necessary. While making padding condenser adjustments the gang condenser should be rotated back and forth across the signal to insure adjustment to the peak of greatest intensity.

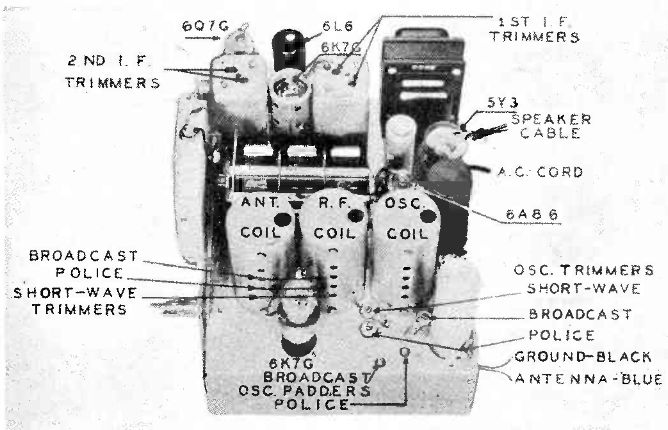


Fig. 1. Trimmer locations.

Police band:

1. Turn the band-selector switch to the police band (center) position.
2. Tune the receiver to 6 megacycles.
3. Supply a 6-megacycle signal from the signal generator to the antenna lead of the receiver through a 400-ohm carbon resistor (dummy antenna) connected in series with the signal generator lead.

7. Adjust the broadcast band oscillator padding condenser (top of the chassis, see Fig. 1) for maximum output with minimum input from the signal generator at the same time rocking the tuning condenser back and forth across the signal to insure the peak of greatest intensity.

8. Check at 1500 kc and then at 600

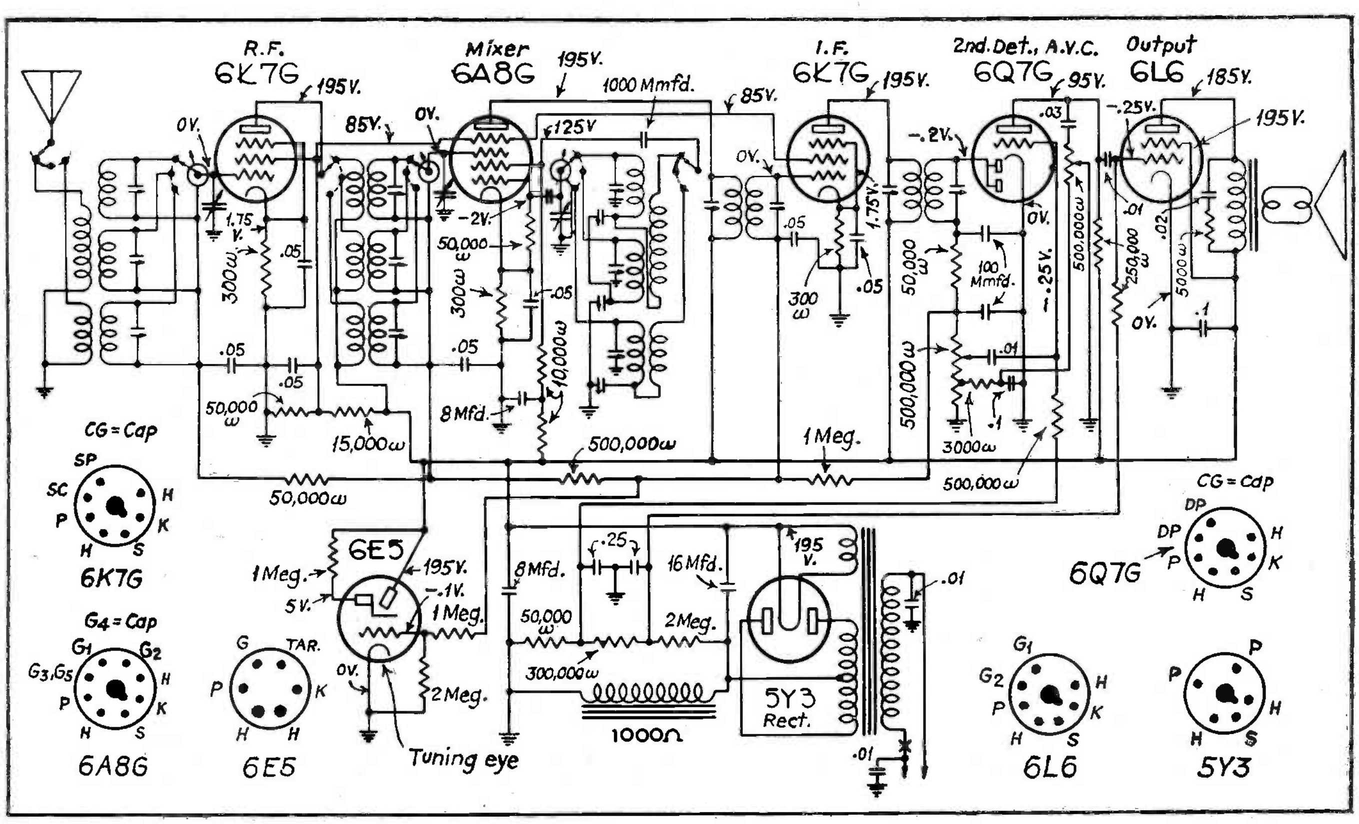


Fig. 2. Fairbanks Morse model 72 circuit diagram.

kc. Make any adjustments that are necessary to obtain satisfactory calibration.

Short wave band:

1. Turn the band-selector switch to the short-wave (clockwise) position.
2. Tune the receiver to 20 megacycles.
3. Supply a 20-megacycle signal from the signal generator to the antenna lead of the receiver through a 400-ohm carbon resistor (dummy antenna) connected in series with the signal generator lead.
4. Adjust the short-wave band oscillator trimmer condenser (Fig. 1) for maximum output with minimum input from the signal generator. Then adjust the short-wave band antenna and radio-frequency stage trimmers for maximum output at the same time rocking the tuning condenser back and forth across the signal to insure the peak of greatest intensity.
5. The 8-megacycle signal should be received near 8 megacycles on the dial. If this is not the case check the oscillator tube, switch connections, the fixed padding condenser and the coils. No adjustment is required at this point.

Warning:

The image signal should be received at approximately 19 megacycles on the dial. If not, the oscillator has been aligned to the image frequency and the oscillator trimmer condenser must be backed out until the correct signal is received at 20 megacycles and the image at approximately 19 megacycles. If readjustment is found necessary the antenna and radio-frequency stage trimmers should be checked again.

•

G. E. E-61, E-62, E-68

Models E-61, E-62 and E-68 employ six metal envelope tubes in a superheterodyne circuit giving the selectivity and sensitivity inherent in this type circuit. Two-watts undistorted output is obtained through diode detection and two high-gain audio amplifier stages.

The frequency range of the broadcast band is from 540 to 1750 kc; of the short-wave band, from 2.2 to 7.0 mc. The approximate power consumption is 70 watts.

The Circuit

The signal from the antenna is applied to the control grid of the 6A8 tube through the r-f coil, the secondary of which is tuned to the incoming signal by the rear section of the main tuning condenser. In the 6A8 tube the incoming signal is combined with the local oscillator signal which is 465 kc higher in frequency. The local signal is generated by the oscillator elements of this tube, and the proper frequency difference is maintained throughout the tuning range by the front section of the main tuning condenser in conjunction with the oscillator coil and padding capacitors.

The combination of the two signals produces the i-f of 465 kc. The i-f amplifier consists of a 6K7 tube and two i-f transformers, each with two tuned circuits. An i-f wave trap is provided across the antenna and ground terminals to eliminate interfering signals.

The output of the i-f amplifier is applied to one plate of the 6H6 diode rectifier, which is a combined detector, initial bias and avc tube. The direct-current component of the rectified signal, through one diode of the 6H6, produces a voltage drop across R-3. This voltage drop provides automatic bias for the converter and i-f amplifier tubes and so gives avc action. The other diode of the 6H6 provides an initial bias for the tubes on the avc circuit under conditions of little or no signal. This initial bias diode, under conditions of small signal, draws current which flows through resistors R-2 and R-3. The resulting voltage is the required minimum operating bias for the controlled tubes. Upon receiving signals above the level of the initial bias, the initial bias diode stops drawing current and the avc diode takes over the controlling bias.

The manual volume control, R-5, selects the amount of audio signal applied

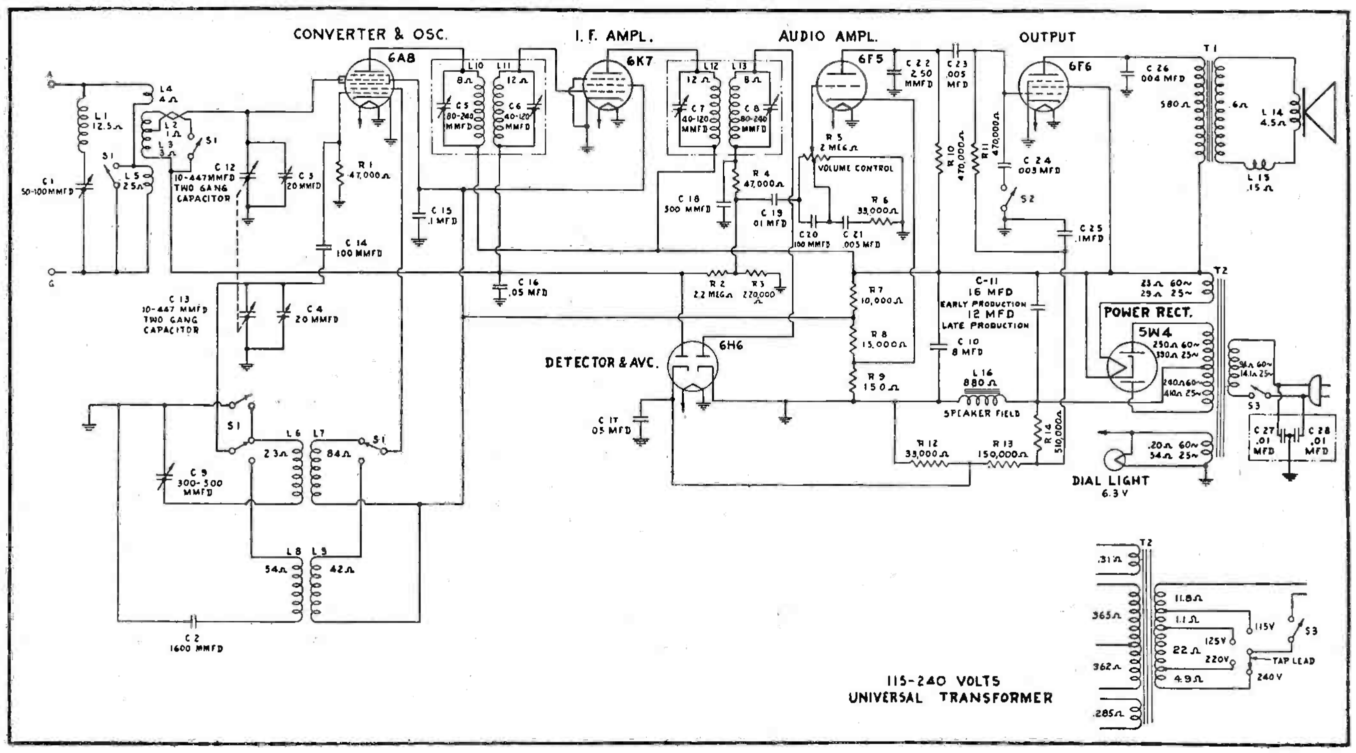


Fig. 1. G.E. E-61, E-62 and E-68 circuit diagram.

Technical Features of 1937 Zenith Radio Receivers • • • •

Model No.	4B-106, 4B-131, 4B-132	6B-107, 6B-129, 6B-164	5S-119, 5S-126, 5S-127, 5S-150, 5S-151, 5S-161	6D-116, 6D-117, 6D-118	7D-119, 7D-126, 7D-127, 7D-138, 7D-151, 7D-148, 7D-162, 7D-168	6S-128, 6S-137, 6S-147, 6S-152, 6S-157	8S-129, 8S-154	10S-130, 10S-155, 10S-156, 10S-160, 10S-147, 10S-153, 10S-157	12U-158, 12U-159	16A63, 16A61
Cabinet *	Boat, T, Ct	Boat, T, Ce	Ct, T, T, Ce, Ce, Ce	Ct, Ct, Ct	Ct, T, T, T, Ce, ET, Ce, Ce	T, ET, ET, Ce, Ce	T, Ce	T, Ce, Ce, Ce, ET, Ce, Ce	Ce, Ce	Ce, Ce
Power Supply	6V. Battery	6V. Battery	112 V. 60~	112V. AC/DC	112 V. AC/DC	112 V. 60~	112V. 60~	112 V. 60~	112V. 60~	112V. 60~
Range	550-1700 Kc.	538-19,250 Kc.	538 - 19,250 Kc.	533-5100 Kc.	538 - 19,250 Kc.	538-19,250 Kc.	538-19,250 Kc.	538 - 19,250 Kc.	538-19,250 Kc.	141-375 Kc. 550-1780 " 2.1-23 Mc.
Power Consumption	1.7 Amp. at 6V.	2.2 Amp. at 6V.	55 Watts	44 Watts	44 Watts	75 Watts	85 Watts	110 Watts	120 Watts	–
Audio Power	1 Watt	2 Watts	3 Watts	1.5 Watts	1.5 Watts	4 Watts	5 Watts	12 Watts	17 Watts	–
I.F. Peak (Kc.)	456	456	456	456	456	456	456	456	456	456
Dynamic sp'k'r	6" Perm. Mag.	8" P.M. / 12" P.M.	6" / 8" / 10"	5"	6" / 8" / 10"	8" / 10"	8" / 12"	8" / 12" / 12"	12" / 12"+6"	–
Tone Control	Continuously Variable	3-Position	Continuously Variable		Continuously Variable	3 Point	3 Point	3 Point	3 Point	–
Sensitivity Control		Yes				Yes	Yes	Yes	Yes	–
Shadow Meter							Yes	Yes	Yes	Yes
Doublet Terminal Board		Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Variable Condensers	2	3	2	2	2	2	3	3	3	3
Number of Tuned Circuits	6	7	6	6	6	6	7	7	7	9
Shadow Meter Tube							6C5 6C5G	6C5 - 6C5G	6C5 6C5G	6C5
R.F.		15					6K7 6K7G	6K7 - 6K7G	6K7 6K7G	6K7
1st. Det. Oscillator	15	6A7	6A8 - 6A8G	6A8 6A8G	6A8 - 6A8G	6A8 - 6A8G	6A8 6A8G	6A8 - 6A8G	6L7 6L7G / 6C5 6C5G	6A8
Intermediate Frequency	15	15	6K7 - 6K7G	6K7 6K7G	6K7 - 6K7G	6K7 - 6K7G	6K7 6K7G	6K7 - 6K7G	6K7 6K7G	6K7
2nd. Det.										
A.V.C.	75	75	6Q7 - 6Q7G	6Q7 6Q7G	6H6 - 6H6G	6H6 - 6H6G	6H6 6H6G	6H6 - 6H6G	6H6 6H6G	6H6
1st. Audio					6F5 - 6F5G	6F5 - 6F5G	6F5 6F5G	6C5 - 6C5G	6F5 6F5G	6F5
2nd. Audio		76						6C5 - 6C5G	6F6 6F6G	6F6
Output	38	19	6F6 - 6F6G	25A6 25A6G	25A6 - 25A6G	6F6 - 6F6G	6F6 6F6G	PP6L6 or PP6L6G	PP6L6 PP6L6G	PPP 6F6
Rectifier	Sync Vibrator	Sync. Vibrator	5W4 - 5Y3	25Z6 25Z6G	25Z6 - 25Z6G	5W4 - 5Y3	5W4 5Y3	5W4 or 5Y3	(2)5W4 or (2)5Y3	(4)5Y3
Chassis No.	5406	5635	5516	5633	5707	5634	5801	1004	1203	–

* T = Table   Ce = Console   ET = End Table   Ct = Compact

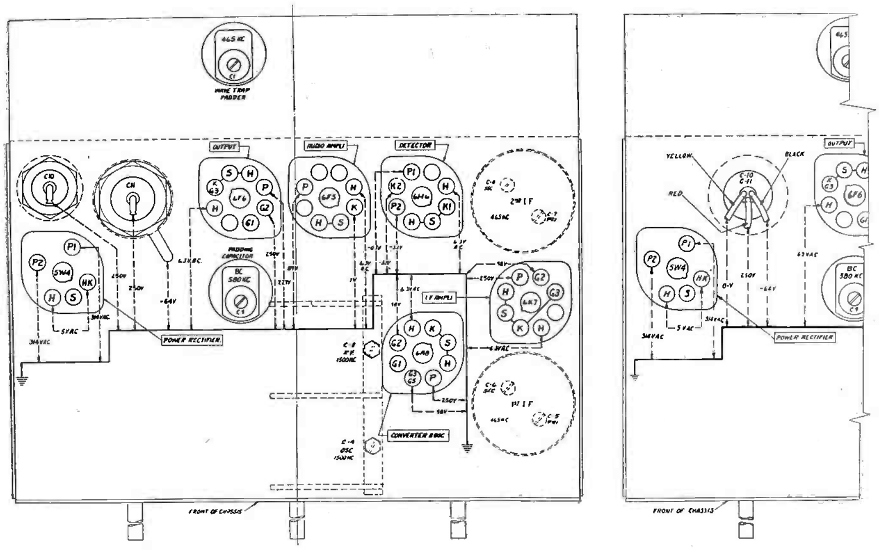


Fig. 2. Chassis views showing socket layout and trimmer locations.

to the grid of the 6F5 audio amplifier tube, and this regulates the output of the receiver. The output of the 6F5 tube is resistance coupled to the grid of the 6F6 power amplifier pentode. The plate circuit of the 6F6 is suitably matched to the loudspeaker by means of a step-down output transformer.

The tone control circuit consists of a 0.003-mfd capacitor, connected in series with a two-point grounding switch, S-2, in the grid circuit of the 6F6 power pentode. When it is desired to reduce the high-frequency output of the receiver, the switch, S-2, is turned to its counterclockwise grounding position.

Plate and grid voltages for all tubes are supplied by the power supply system employing a 5W4 full-wave rectifier tube which, together with a suitable network of resistors and capacitors, supplies the required voltages and filtering action.

Alignment Procedure

The receiver should first be allowed to run for fifteen minutes in order to reach its approximately normal operating temperature. Before making any adjustments, it is wise to determine the correctness of the existing alignment.

Set the frequency band switch of the receiver to the broadcast position and turn the volume control to the extreme clockwise position. Tune the receiver to some point above 1500 kc so that no signal is heard, short-circuiting the antenna and ground terminals if necessary, and ground the chassis.

I-F Alignment

Remove the control grid clip from the 6A8 tube and connect the test oscillator output between the chassis and the dome terminal of the 6A8 tube. The i-f amplifier is tuned to 465 kc; set the oscillator dial at this frequency. Make sure that a d-c path exists between the output terminals of the test oscillator; if an ohmmeter does not show continuity between the test oscillator terminals, connect a resistor of fairly high resistance between the 6A8 dome terminal and chassis to provide a d-c grid return path.

Connect the output meter across the cone coil of the speaker and adjust the test oscillator output control so that, with the volume control at maximum, a small indication is observed on the output indicator.

Adjust the secondary trimmer of the second i-f transformer until a peak output reading is obtained. Maintaining a small output indication, adjust next the primary trimmer of the second i-f transformer for maximum output. Continue this procedure, adjusting the secondary trimmer of the first i-f transformer, and lastly, the primary trimmer of the first i-f transformer. After completing this procedure, repeat it a second time for final alignment. The i-f alignment will then be complete.

During both i-f and r-f alignments, the test oscillator signal would be maintained at the lowest level that will give a good output indication, keeping the receiver volume control at maximum and adjusting the test oscillator output control to give the required indication.

Wave Trap Alignment

After completion of the i-f alignment, with the test oscillator still set on 465 kc, apply this frequency to the antenna post of the receiver through a dummy antenna. This dummy antenna consists of a 400-ohm resistor in series with a 250-mmfd capacitor and should be connected in series between the test oscillator output and the receiver antenna post. With the 465-kc signal applied to the receiver antenna post, adjust the wave trap trimmer for minimum output indication.

R-F Alignment

The r-f and oscillator trimmers are aligned at 580 and 1500 kc. First of all, check the position of the dial pointer. To do this, rotate the gang condenser to the maximum capacity position, i. e., plates fully meshed. While in this position, align the pointer with the last black line on the scale by loosening the dial drum set screws and rotating the drum on the gang shaft. Make sure the antenna and ground terminals of the receiver are not short-circuited and connect to them the output of the test oscillator, preferably using the dummy antenna described between the test oscillator and the receiver antenna terminal. Connect the output indicator across the speaker cone coil.

Broadcast 540-1750 *kc*

Set the frequency band switch to the broadcast position. Tune the test oscillator to 1500 kc and set the dial pointer on the receiver to this frequency. Adjust the broadcast oscillator trimmer on the front section of the gang condenser for maximum output, keeping the receiver volume control at its extreme clockwise position and adjusting the test oscillator output to maintain a small reading on the output indicator. When optimum adjustment on the broadcast oscillator trimmer is obtained, adjust the broadcast r-f trimmer on the rear section of the gang for maximum output.

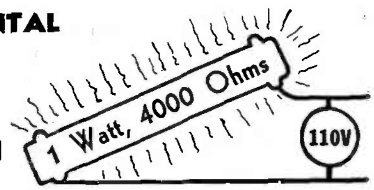
Now set the test oscillator at 580 kc and tune the receiver to that frequency. Slowly, rocking the tuning condenser back and forth through the signal, adjust the 580 kc padding capacitor for maximum output. When this has been done, return to 1500 kc on the receiver and test oscillator and recheck the alignment at that frequency for maximum output. The broadcast band should now be in alignment.

Short Wave 2.2—7.0 *mc* (2200-7000 *kc*)

No separate short wave trimmers are provided on this receiver. The correct adjustment of the broadcast band at 580 and 1500 kc automatically aligns the short-wave band.

Resistors . . . . . .

CONTINENTAL Insulated Carbon Resistors Withstand 300% Overload



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Code 135G, ½-watt, list price	5.95

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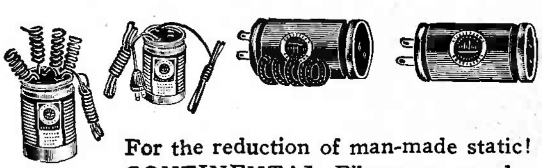

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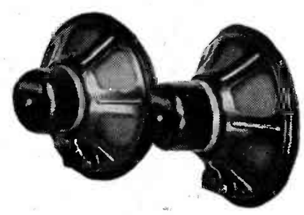

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Auto-Radio . . .

Crosley A-266

The Crosley model A-266 is a single unit auto-radio six-tube superheterodyne receiver. The power supply unit is built into a completely shielded compartment and is an integral part of the receiver chassis.

A circuit diagram is shown in Fig. 1 with the tubes used and with the various voltages encountered on the socket prongs lettered on the diagram. These readings were taken with a 1000-ohm-per-volt voltmeter with the receiver in operating condition and no signal input. The filament voltages were measured with a low range d-c voltmeter. Voltages taken in the field may vary 10 percent from those given.

Alignment Procedure

All the circuits in this receiver are very accurately adjusted at the factory and normally should need no further adjustment. However, if it is definitely known that an adjustment is necessary the circuits can best be properly aligned with the use of a modulated signal generator and an output meter.

Connect one terminal of the output meter to the plate and the other terminal to the screen of the 42 output tube. Be sure the meter is protected from d-c by connecting a condenser (0.1 mfd or larger—not electrolytic) in series with one of the leads.

Note: The receiver chassis must be in its case and a speaker similar to one used with the receiver must be connected to the chassis before making any adjustments. It is also advisable to use a spare control unit for making adjust-

PARTS LIST (SEE FIG. 1)

Condensers		Resistors	
No.	*Capacity*	*No.*	*Ohmage*
11A	0.1 mfd 160 v	23	300,000 ohm ¼ w
11B	0.1 mfd 160 v	24	750 ohm ½ w
11C	0.05 mfd 160 v	25	60,000 ohm ¼ w
11D	0.05 mfd 160 v	26	20,000 ohm ¼ w
12	0.02 mfd 200 v	27	1 meg ¼ w
13	0.00025 mfd moulded	28	100 ohm ½ w
14	0.00025 mfd moulded		
15A	0.5 mfd 160 v	29	100 ohm ½ w
15B	0.5 mfd 160 v	30	55,000 ohm 1 w
16	0.0005 mfd moulded	31	20,000 ohm ¼ w
17	0.1 mfd 200 v	32	450 ohm ½ w
18	0.0001 mfd moulded		
19	0.02 mfd 200 v	33	350 ohm ½ w
20	0.006 mfd 400 v	34	750,000 ohm ¼ w
21	0.005 mfd 1000 v	35	150,000 ohm ¼ w
22A	6 mfd 350 v	36	500,000 ohm ¼ w
22B	6 mfd 350 v		
43	M.N. plate riveted to chassis	37	300,000 ohm ¼ w
51	0.1 mfd 200 v	41	300,000 ohm volume control

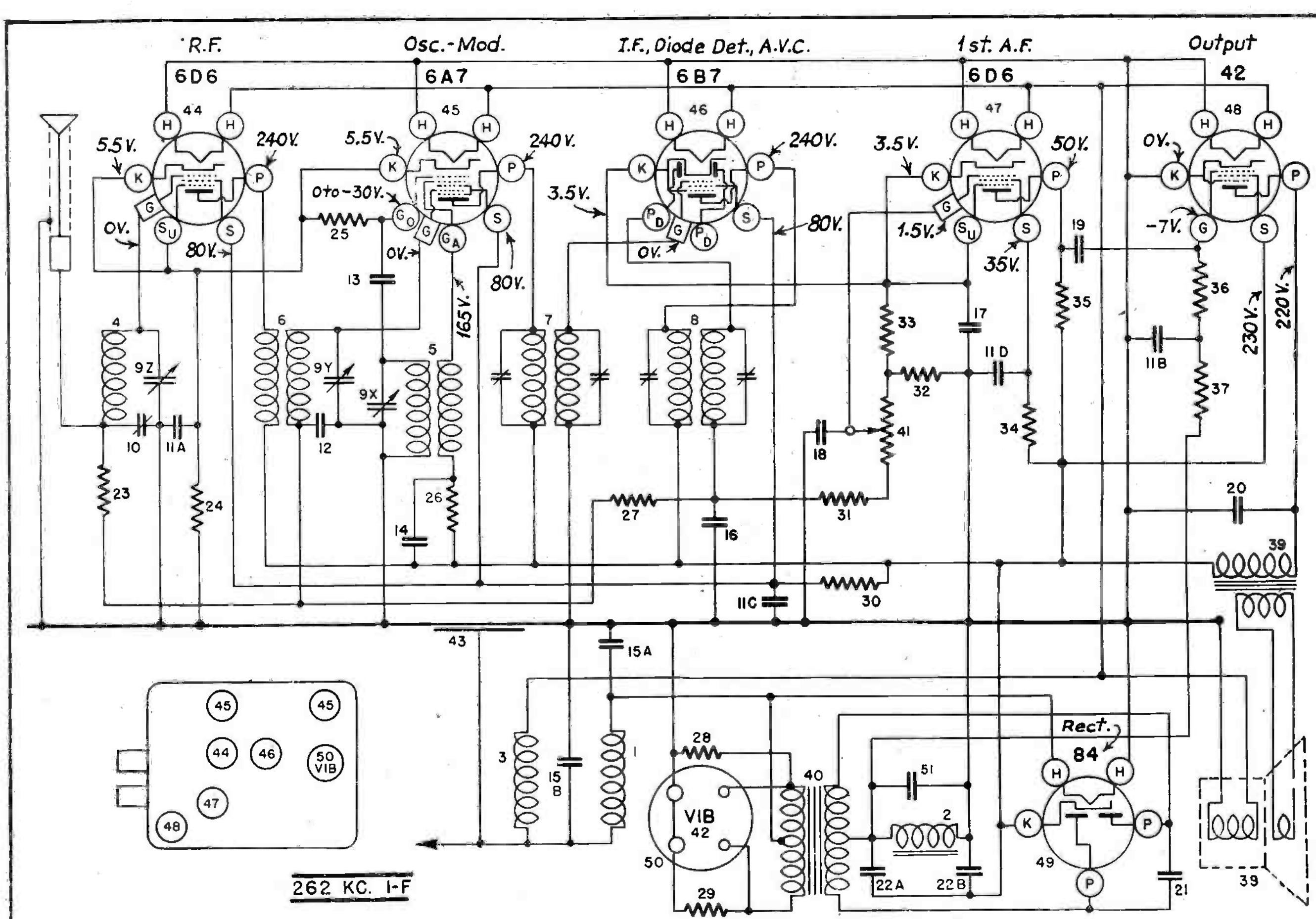
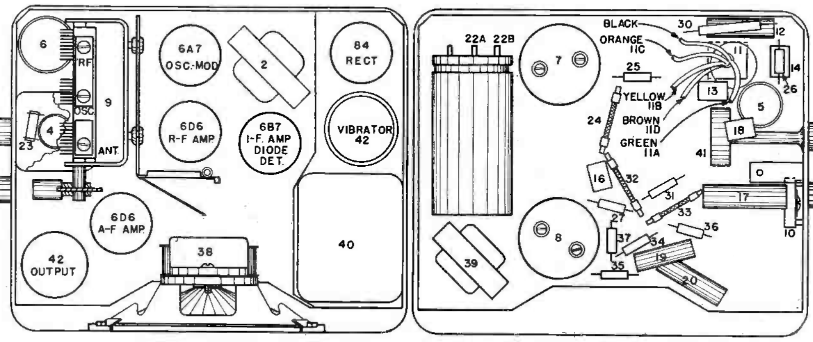


Fig. 1. Crosley A-266 circuit diagram.



Figs. 2 and 3. Chassis views Crosley A-266.

ments of the volume control and tuning condenser. A standard control unit with short cables (6 inches to 8 inches) makes a very convenient and useful tool. If it is desired to shorten a pair of long cables it will be absolutely necessary to heavily tin the cables before cutting them.

I-F Alignment

(a) Connect the output of the signal generator through a 0.02-mfd condenser to the top cap of the 6A7 osc-mod tube, leaving the tube's grid clip in place. Connect the ground lead from the signal generator to the receiver chassis frame. Keep the generator leads as far as possible from the grid leads of the other screen grid tubes.

(b) Adjust the station selector so that the rotor plates of the tuning condenser are completely in mesh.

(c) Turn the volume control of the receiver full on and turn the tone control to the treble position.

(d) Set the signal generator to 262 kilocycles.

(e) Adjust both trimmers located on the second i-f transformer for maximum output.

(f) Adjust both trimmers located on the first i-f transformer for maximum output.

(g) Repeat operations (e) and (f) for more accurate adjustments.

Always use the lowest signal generator output that will give a reasonable output meter reading.

R-F Alignment

(a) Connect the output lead from the signal generator through a 0.00025-mfd condenser to the antenna connection of the receiver.

(b) Set the signal generator to 1400 kilocycles.

(c) Adjust the station selector to 140 on the dial.

(d) Adjust the trimmer on the oscillator section of the tuning condenser for maximum output.

(e) Adjust the trimmer on the r-f section of the tuning condenser for maximum output.

(f) Adjust the trimmer on the antenna section of the tuning condenser for maximum output.

(g) Readjust the station selector for maximum output. Do not readjust the oscillator trimmer.

(h) Repeat operations (e) and (f) for more accurate adjustments.

Adjusting Antenna Compensator

(a) Set the signal generator to 600 kilocycles.

(b) Tune in the 600-kilocycle signal with the station selector for maximum output.

(c) Adjust the antenna compensating condenser, Illustration No. 10, Fig. 2, for maximum output.

(d) Repeat operations (b) and (c) alternately until no further improvement can be obtained.

(e) Set the signal generator at 1400 kilocycles again.

(f) Tune in the 1400 kilocycle signal with the station selector for maximum output.

(g) Readjust the trimmer on the antenna section of the tuning condenser for maximum output.

It will be necessary to adjust the antenna compensating condenser to the car antenna after the receiver has been installed in the car.

(a) After the installation is complete, tune in a weak station between 55 and 65 on the dial.

(b) Adjust the antenna compensating condenser for maximum volume in the speaker.

•

Cadillac and La Salle 6Q

This model is a six-tube automobile receiver using glass tubes in a conventional superheterodyne circuit. The tuning range is from 530 to 1650 kc. The power consumption at 6 volts is 9.0 amperes. The power output is 5.5 watts. A circuit diagram is shown in Fig. 1, with the tubes used, their functions, and the various voltages encountered on the socket prongs lettered on the diagram. The values given were measured with a 1000-ohm-per-volt voltmeter with the volume control on maximum and the antenna shorted to the chassis. The grid bias of the driver and output tubes were measured at the genemotor cable socket.

Referring to the first i-f transformer, T4 in Fig. 1, it will be noted that there is a coupling winding shown below the primary.

When the expander (selectivity control) is in the sharp position, the coupling winding is open circuited and the loose coupling which exists between the primary and secondary of this transformer results in high selectivity.

When the expander is in the broad position, the coupling winding which is wound under the primary is connected in series with the secondary. This provides overcoupling which results in a greatly widened resonance curve. Passage of a wide range of audio frequencies is thus obtained.

Alignment Procedure

Misalignment of condensers generally manifests itself as broad tuning and lack of volume at portions or all of the standard waveband. The receivers are all properly aligned at the factory with precision instruments and realignment should not be attempted unless all other possible causes of the faulty operation have first been investigated and unless the service technician has the proper equipment.

A signal generator that will provide accurately calibrated signals over the standard waveband and at the intermediate frequency, and an output meter are required for indicating the effect of adjustments.

I-F Alignment

Set the signal generator for a signal of 175 kc.

Connect the output of the signal generator through a 0.1-mfd condenser to the stator of the interstage section of the tuning condenser—see Fig. 2 for the location of this condenser. This can be done by connecting a lead to the lug on the top of this stator.

Connect the ground lead of the signal generator to the chassis ground.

Short out the oscillator section of the tuning condenser.

Turn the expander to the sharp position and keep it in this position for all adjustments.

Set the volume control at the maximum position.

Attenuate the signal from the signal

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Because the voltage of the "C" Battery is thus reduced, it is essential that new "C" batteries be installed with each new set of "B" batteries. Otherwise, the tubes will be considerably under-biased and the "B" battery current excessively high, so that the life of new "B" batteries will be seriously shortened if they are used with old, run-down "C" batteries.

Always replace the "C" battery with each new set of "B" batteries.

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generator to prevent the leveling-off action of the avc.

Then adjust the three i-f trimmers until maximum output is obtained. The location of these trimmers is shown in Fig. 2.

1650 *kc adjustment:*

Set the signal generator for 1650 kc.

Turn the rotor of the tuning condenser to the full open position.

Connect the shielded antenna lead from the chassis through a 110-mmfd condenser to the antenna post of the signal generator.

For this and *all* subsequent adjustments keep the volume control at the maximum position and attenuate the signal from the signal generator to prevent avc action.

Adjust the trimmer of the oscillator section of the three-gang condenser until maximum output is obtained—see Fig. 2 for location of this trimmer.

1400 *kc Adjustment:*

Set the signal generator for 1400 kc.

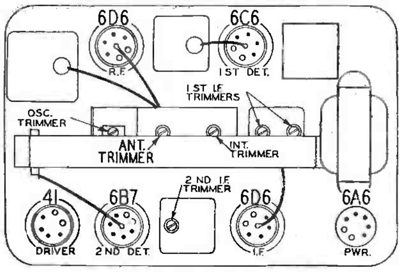


Fig. 2. Chassis view showing tube and trimmer locations.

Turn the rotor of the tuning condenser carefully until maximum output is obtained.

Adjust the interstage and antenna trimmers for maximum output—see Fig. 2.

Do not change the setting of the oscillator trimmer.

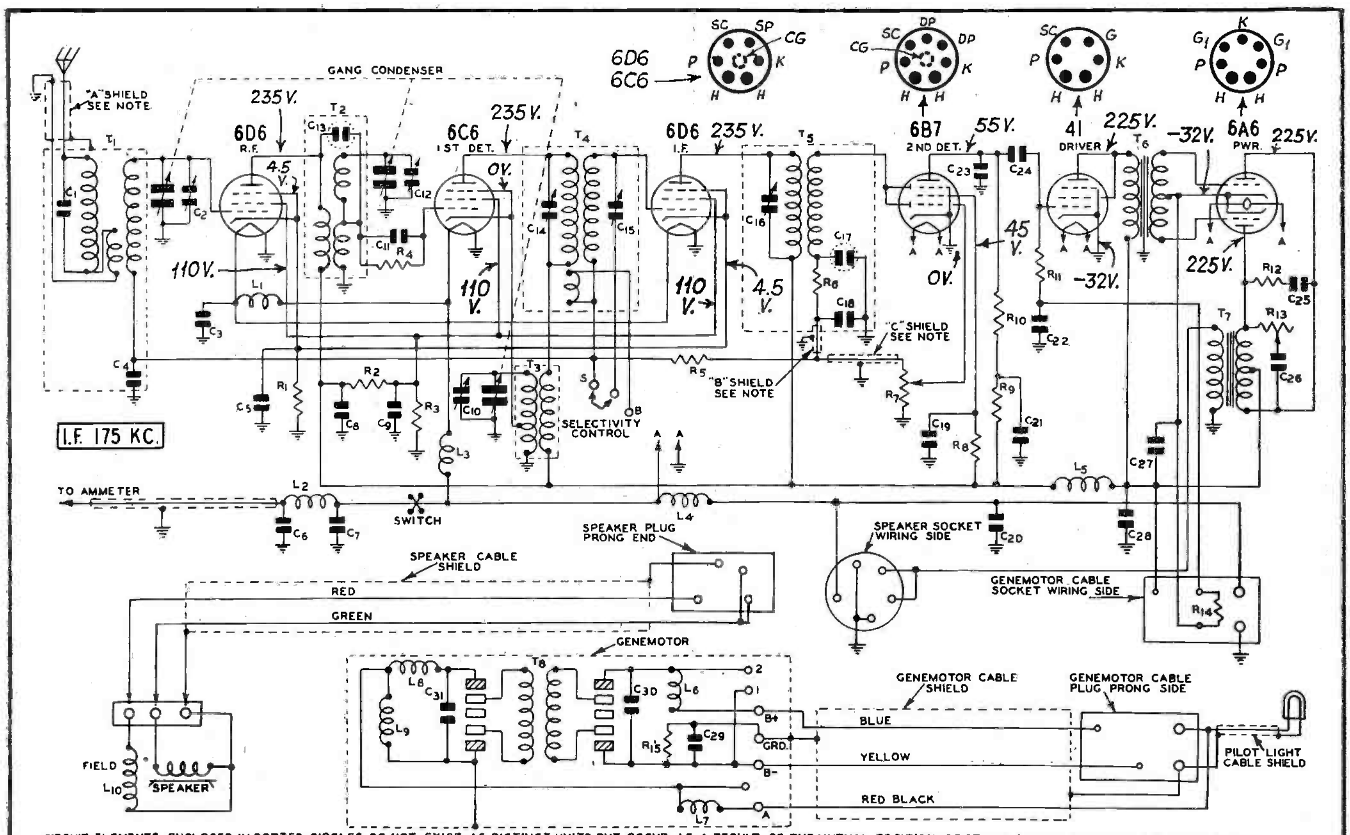
ADJUSTING ANTENNA TRIMMER

After the receiver is installed and the car antenna is connected it will be necessary to adjust the antenna trimmer. Tune in a weak signal between 1200 and 1400 kc with the volume control about three-fourths on. Remove the cover of the chassis case. The antenna trimmer is on the center tuning condenser section—see Fig. 2. Turn the adjusting screw of this condenser up or down until maximum output is obtained. Caution—Do not turn any of the other trimmer adjusting screws for this adjustment.

Antenna Shield Ground

It is often necessary to ground the shielded antenna casing every foot or two. In these cases it is advisable to run a heavy bare copper wire (about No. 12) along the shield wrapping the two together every foot or so and grounding the copper wire at each end.

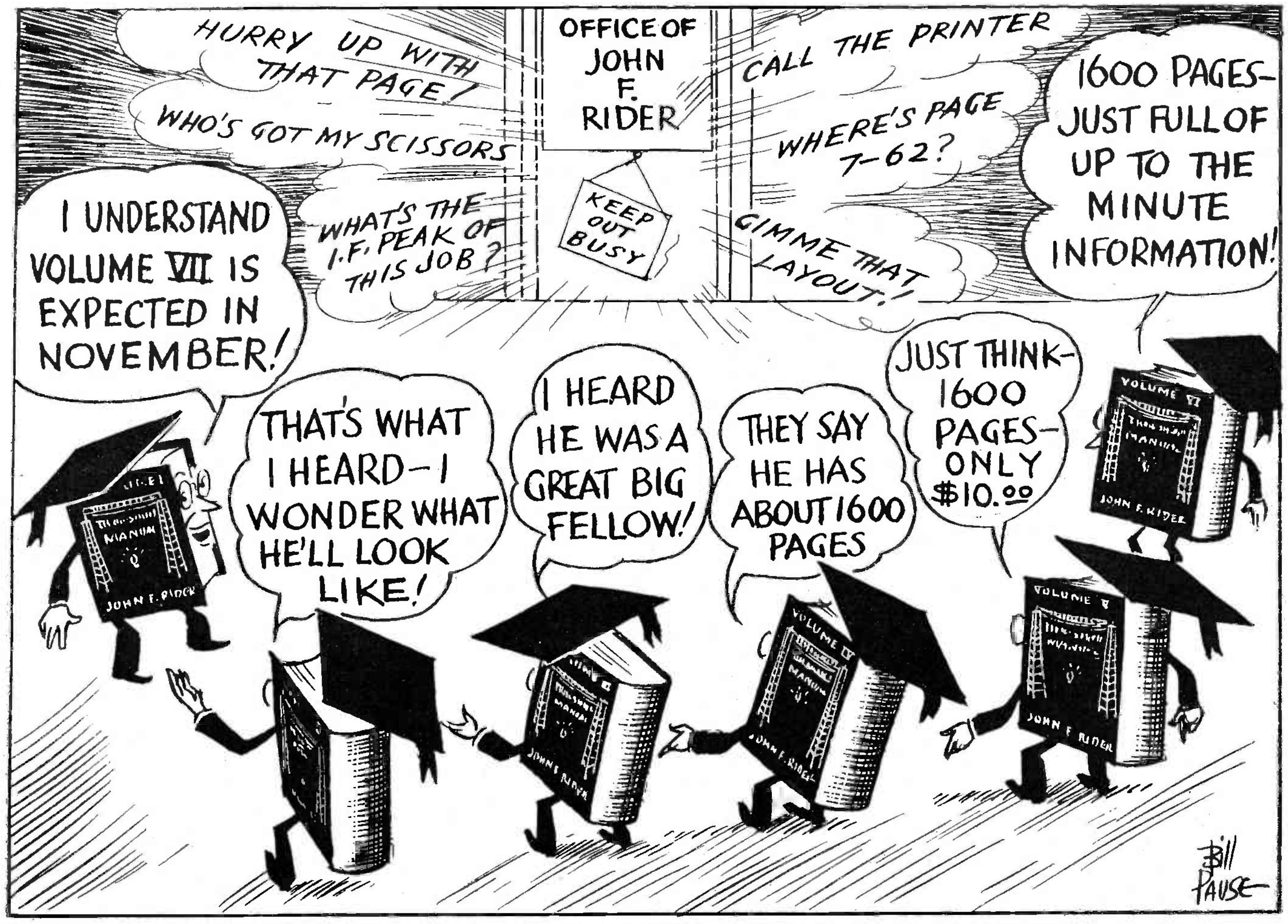
Hygrade Sylvania Auto-Radio Hints



CIRCUIT ELEMENTS ENCLOSED IN DOTTED CIRCLES DO NOT EXIST AS DISTINCT UNITS BUT OCCUR AS A RESULT OF THE MUTUAL POSITION OF OTHER CIRCUIT ELEMENTS OR THEIR PARTS.
"B" & "S" ON SELECTIVITY CONTROL DENOTES BROAD AND SHARP RESPECTIVELY.
THE CAPACITY OF "A" SHIELD IS 106 MMF, THE CAPACITY OF "B" SHIELD IS 16 MMF & THE CAPACITY OF "C" SHIELD IS 20 MMF.

C 1 500 mmf	C11 35. mmf	C21 .25 mf 360 V	C31 .50 mf 180 V	R 8 250000 ohm .5 W.	T1 Antenna R. F. Trans.	L 2 "A" Reactor
C 2 Gang Trimmer	C12 Gang Trimmer	C22 .10 mf. 180 V		R 9 20000 ohm .2 W	T2 Interstage R. F. Trans.	L 3 "A" Reactor
C 3 2000 mmf	C13 40. mmf.	C23 250. mmf.	R 1 260 ohm .2 W	R10 50000 ohm .5 W	T3 Oscillator Coil	L 5 "B" Reactor
C 4 .05 mf. 180 V	C14 150-250 mmf.	C24 .01 mf. 360 V	R 2 17000 ohm 1.0 W	R11 500000 ohm 2 W	T4 1st I. F. Trans.	L 4 "A" Reactor
C 5 .10 mf. 180 V.	C15 150-250 mmf.	C25 .01 mf. 600 V	R 3 20000 ohm .5 W	R12 15000 ohm 1.0 W	T5 2nd I. F. Trans.	L 6 "B" Reactor
C 6 2000 mmf	C16 70-150 mmf.	C26 .04 mf. 600 V	R 4 500000 ohm .2 W	R13 150000 ohm Tone Control	T6 Input Trans.	L 7 "A" Reactor
C 7 .50 mf. 180 V	C17 100. mmf	C27 8.0 mf. 450 V | Electro	R 5 1.0 Megohm .2 W		T7 Output Trans.	L 8 Series Field Winding
C 8 .10 mf. 360 V.	C18 50. mmf	C28 8.0 mf. 450 V | lytic	R 6 50000 ohm .2 W	R14 100000 ohm .2 W.	T8 Armature Windings	L 9 Shunt Field Winding
C 9 .10 mf 180 V	C19 .25 mf. 360 V	C29 .25 mf 180 V	R 7 500000 ohm Vol Control	R15 900 ohm 1.5 W Armored Wire Wound	L 1 "A" Reactor	L10 Speaker Field 4.0 Ohms
C10 Gang Trimmer	C20 .50 mf 180 V	C30 .10 mf 360 V				

Fig. 1. Cadillac and LaSalle auto-radio circuit diagram.



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A PRACTICAL A-C, D-C AMPLIFIER

THE practicability of a p-a amplifier capable of operating from either a-c or d-c mains need not be stressed. In large cities, such as New York, Philadelphia and Chicago, d-c is often encountered. In some areas 25-cycle a-c is the only current available. Many hotels and theatres generate their own d-c. In all these instances a good portable a-c, d-c amplifier can be used to advantage. The circuit diagram given in Fig. 1 is applicable for such service.

THE INPUT CIRCUIT

The circuit is of the high-gain type with separate, independent low-gain input terminals.

The high-gain terminals feed directly into a 6C6 (or 6J7) pentode grid with a 5.0-megohm load resistor. This is the specified load for satisfactory operation of a crystal microphone. The return leg of the microphone, usually fed through the shield portion of the microphone cable, must be rubber covered since it is connected to the power line (through the two filter chokes).

The plate of the input pentode is fed through a 0.1-mfd coupling condenser to the 250,000-ohm high-gain stage volume control. The arm of this control is fed through a 1-megohm resistor to the grid of the second stage, a 6C6 (or 6J7) pentode. A low-gain input circuit such as a phonograph pickup or a radio tuner, with its own volume control can be plugged into the closed circuit jack which feeds the second stage 6C6 (or 6J7) through a 500,000-ohm resistor.

By use of the special input circuit shown for the second stage suitable mixing of the two stages is accomplished with independent control of volume for either or both circuits.

The arrangement is such that when the first stage volume control is on maximum about one-third of the output of the first stage is fed to the grid of the second stage. This condition is altered only slightly by the position of the second stage control.

The grid of the second stage is tapped off between the 1-megohm and the 500,000-ohm resistors. These resistors are in effect in series (together with the second-stage volume control) across the output voltage from the first stage. Thus the second stage receives

$$\frac{500,000}{1,000,000 + 500,000} \text{ or } \frac{1}{3}$$

of that output.

Examination of the low-gain input circuit will show that about two-thirds of the voltage delivered to the input to this stage is fed to the second 6C6 grid. In this stage the 500,000-ohm resistor, connected in series with the input jack and the 6C6 grid, and the 1-megohm resistor are in effect across the voltage input to this stage. However, in this case the 1-megohm resistor is in the ground leg; the ratio will therefore read

$$\frac{1,000,000}{500,000 + 1,000,000} \text{ or } \frac{2}{3}$$

of the signal.

Enough gain is provided in the remaining stages of the amplifier to offset this apparent loss. Full excitation of the four 43's is obtained with the output of a crystal microphone, a phonograph pickup, or a radio tuner connected to their respective inputs.

The position of the first stage volume control will have little effect on the signal from the second-stage input because the fraction of the 250,000-ohm resistance over which the knob is adjusted during any change in volume is negligible as compared to the total 1,000,000 ohms or more across the second-stage circuit.

THE SIGNAL-DIVIDER STAGE

The output of the second stage is resistance coupled to a 76 (or 6C5)

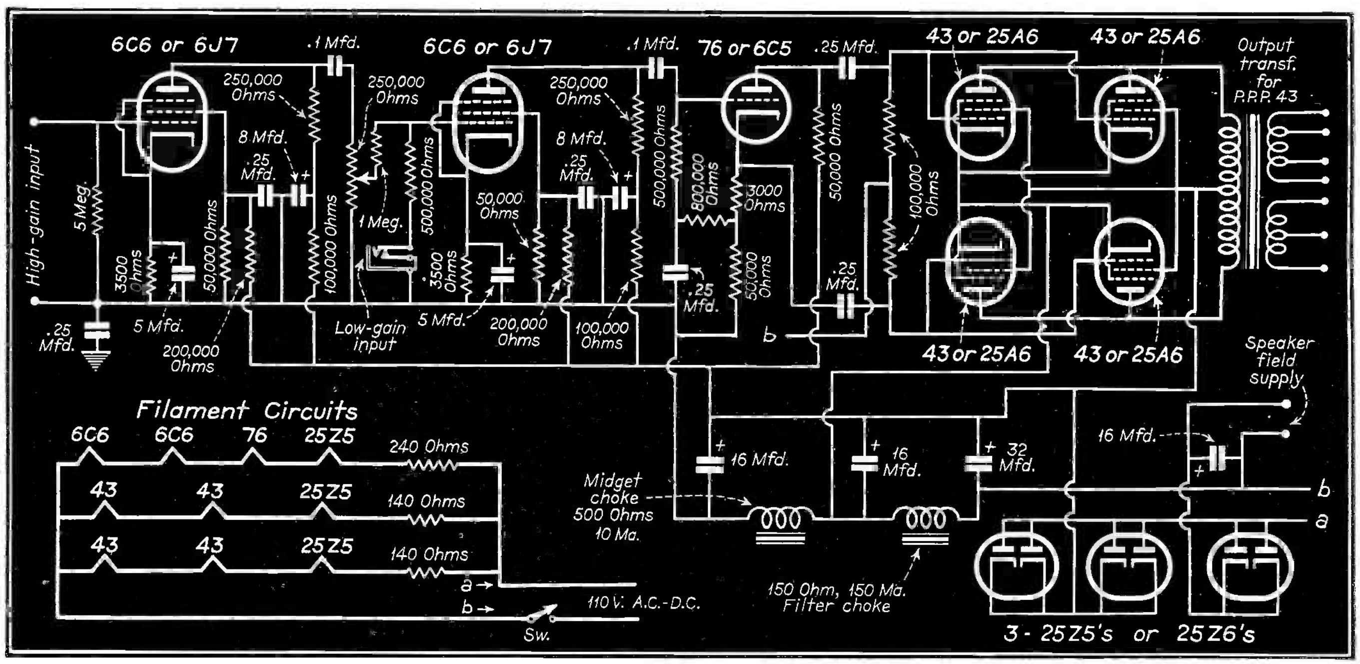
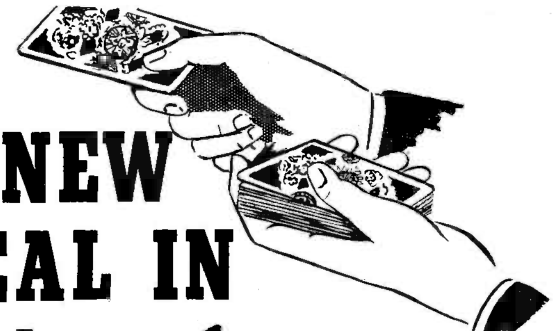


Fig. 1. Circuit diagram of a-c, d-c amplifier.



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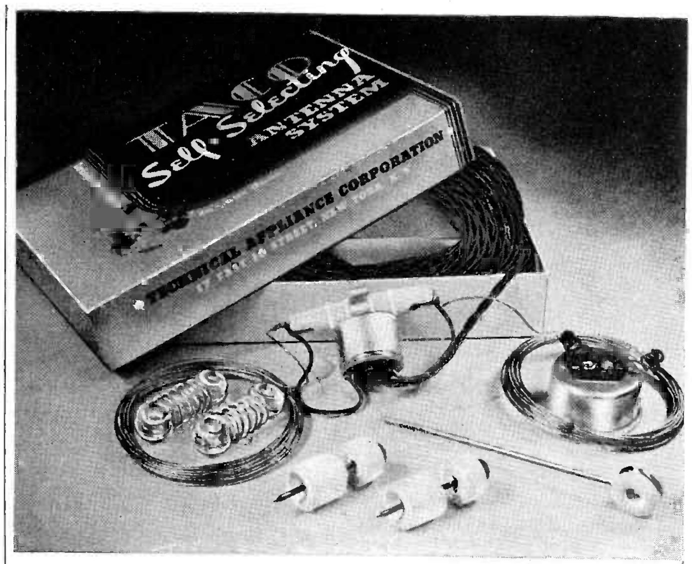

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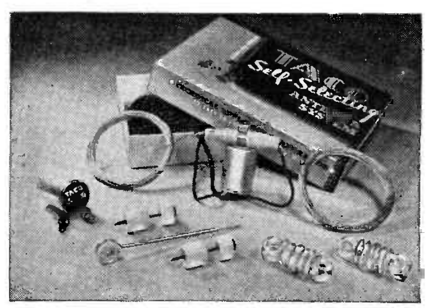

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signal-divider stage. The operation of this type of circuit was fully described in SERVICE for June on pages 260 and 263. The general details of this circuit are repeated in Fig. 2.

An ordinary triode has a resistor (R1) connected between plate and B plus and a resistor (R2) between the cathode return and B minus. Each resistor is approximately half the value of the plate resistor that would ordinarily be used with this tube in a typical resistance coupled stage. R4 is the self-biasing resistor of the usual value for the type of tube used and C1 is a high-capacity by-pass condenser of the low voltage electrolytic type. If a signal is now applied between the grid and cathode it will be amplified and appear across each of the load resistors R1 and R2 with equal amplitude and opposite phase. All that is necessary is to couple the plate and cathode to the next or push-pull stage through coupling condensers.

The signal-divider circuit used in the

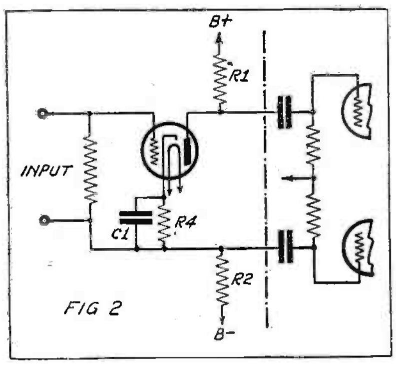


FIG 2

amplifier is similar to that pictured in Fig. 2. Bias is provided for the 76 (or 6C5) signal-divider stage by the 3,000-ohm resistor in series with the 50,000-ohm cathode load resistor. The grid return is led to the proper potential by means of the 800,000-ohm resistor which also serves to isolate the grid circuit from the cathode circuit. This resistor, which is in parallel with the 50,000-ohm cathode load resistor as far as the signal is concerned, is of such value that its shunting effect offsets the series effect of the 3,000-ohm bias resistor. Thus the cathode load is kept at the same value as the plate load.

THE OUTPUT STAGE

The output stage consists of four 43's in a push-pull parallel arrangement. A low value (100,000 ohms) of resistance is chosen to suitably load the grid circuit of this stage. The small value of this grid load makes the use of 0.25-mfd coupling condensors necessary for faithful transmission of the low-frequency signals. The grid return for this push-pull parallel stage is connected to the a-c, d-c line ahead of the two filter chokes. A resistance filter (not exceeding 100,000 ohms) may be used with a by-pass condenser of about 1-mfd returned to the common cathode connection of the 43 tubes. Should any hum feed through to the circuit at this point then the resistance capacity filter *must be employed.*

The bias for this stage is obtained from the d-c drop across the first (150 ohm) choke in the filter circuit. Because of this use of the filter choke its value is critical. Any small choke may be used in the second position.

The output of the amplifier is fed to a transformer and from the secondary to a suitable speaker voice coil or to a universal line. If an exact matching transformer for push-pull parallel 43's is not available a transformer designed for a single pair of 48's to the desired load, from a practical standpoint, is a suitable match for the push-pull parallel 43's.

POWER SUPPLY CIRCUITS

Power for the operation of the heaters is taken directly from the a-c, d-c line through the use of dropping resistors. Three separate circuits are employed to minimize the hum pickup from this source.

Two 25Z5's (or 25Z6's) are used in a parallel half wave circuit to rectify the current needed for plate supply. The plate and screen current for the 43 tubes is filtered by means of the 150-ohm choke in the negative return of the power supply circuit. A 32-mfd condenser across the rectifier output and a 16-mfd condenser at the output of the choke are used to assist the rectifier and filter circuit. A second choke is used in conjunction with another 16-mfd condenser to further assure smooth d-c for the plate circuits of the earlier stages of the amplifier.

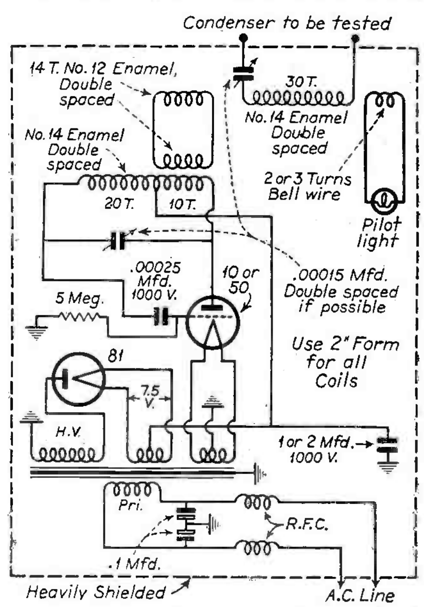
A third 25Z5 (or 25Z6) is used with a 16-mfd condenser to supply the d-c necessary for the excitation of the speaker field. To assure humless operation the speaker should be equipped with a bucking coil or similar hum filtering arrangement. A permanent magnet type dynamic speaker may be used; in this event the third 25Z5 may be omitted.

The layout of parts aside from following general practice is not critical. The absence of input and power transformers which might cause hum pickup contributes to this flexibility. The filament supply resistors should be mounted in such a manner so as to allow sufficient radiation of the heat generated. The electrolytic condensers should not be near these resistors nor near any other part or tube that radiates considerable heat.

Locating Intermittent Condensers

Probably the most difficult problem presented in the repair of radio receivers is the detection of open or intermittently open condensers. To definitely test a condenser unit for such condition is possible through the use of the apparatus described below.

An r-f oscillator capable of delivering about 10 watts to a linked circuit is required. A complete home-made circuit was described in the Philco Service Broadcast for July, 1935. The linked circuit is coupled to another tuned circuit as shown in the accompanying diagram. With the test leads shorted the circuit is tuned to resonance with the oscillator. The resonance condition will be indicated by the flickering of the pilot light. The by-pass condenser to be tested need not be disconnected from the receiver since the impedance of a condenser of say 0.01 mfd or larger is negligible at that frequency and will short circuit any resistance which may be connected across it in the receiver. With the circuit in resonance the test leads are then connected across the condenser to be tested. A slight retuning



of the resonant circuit may be necessary. An intermittent condenser will be completely burned out by the large current in the resonant circuit, whereas a good condenser will not be affected.

Harvey Schock

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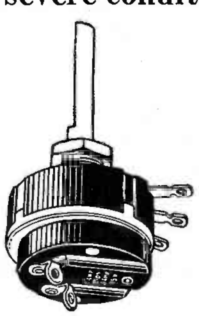

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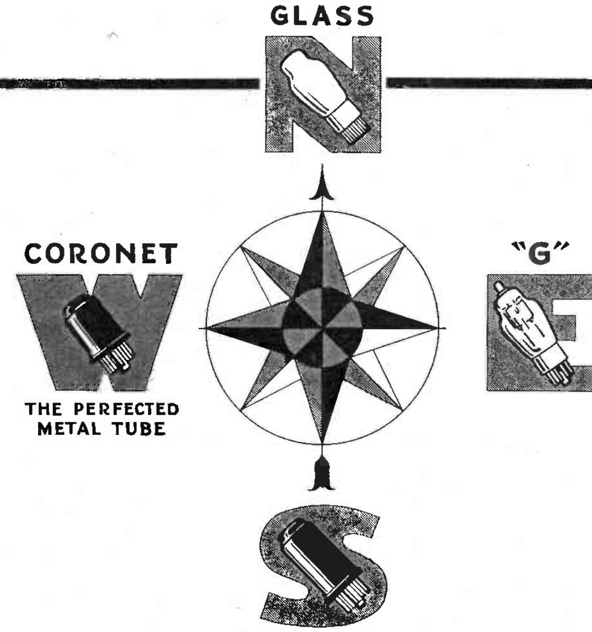

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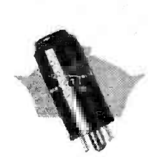

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RCA Universal A-C Bridge

This Universal Bridge consists of a variable-ratio-arm Wheatstone Bridge having three standards each of inductance, capacity and resistance. A vacuum tube 1,000-cycle oscillator and a two-stage amplifier, together with their power supply, make up the major part of the equipment. The only additional equipment required is a "null" indicator for which the usual high impedance headphones suffice. Power is obtained from a 110- to 120-volt, 25- to 60-cycle supply.

The two terminal posts in the upper left-hand corner of the panel, marked "X," are the points to which the component to be measured is connected. Beneath are the two phasing controls, used for balancing out the resistance component always present in inductors or capacitors. The upper control graduated from 1 to 100 is for coarse adjustment. The lower control, graduated from 1 to 10, is used when fine adjustment is required. The control, "Capacity Balance for Resistance, 100M-1 Meg.," in the lower right-hand corner is a phasing control necessary for obtaining balance in this range. Above this phasing control is the "Range" selector switch, which determines the type and range of measurement, i. e., whether it is resistance, capacity or inductance, and in conjunction with the "Low-High" switch, the bracket of measurement is indicated. The main dial (calibrated from 1 to 10), located in the center of the panel, is used for obtaining balance on all measurements. The switch marked "R in X Arm" and "R in Std. Arm" shifts the "phase" controls from the "X" arm to the "Std." arm of the bridge.

With the phones plugged in and with no external connections to the "X" terminals, make the 110-volt connection to the line and turn the "110-Volt A. C." switch "On." After a short interval, during which the tubes are warming up, a 1,000-cycle tone will be heard in the phones. The bridge is now ready for operation.

Caution: Do not connect the case or any part of this instrument to ground. The unknown unit being measured must not be grounded. This is necessary for the protection, operation and accuracy of this bridge.

The unit to be measured may now be connected to the binding posts marked "X" with its low terminal connected to the "X" terminal to the left. By low terminal it is meant that terminal nearest ground potential. The bridge may now be balanced (see specific instruction under Resistance, Capacity and Inductance measurements). Remember that the balance is indicated by *minimum 1,000-cycle* tone in the headphones. When this condition exists, the second harmonic, 2,000 cycles, often becomes quite loud in the phones. This, however, does not indicate an unbalance. The *1,000-cycle* tone is always the tone to adjust to a minimum.

If it is found impossible to obtain a null point on the bridge, the unit under test is either defective or outside the range of the bridge. Note, however, that it is impossible to measure with the bridge the resistance of an inductor. This does not indicate a faulty inductor or bridge, but is simply a characteristic of this type of bridge circuit.

Resistance Measurements

Connect the resistance to be measured to the binding posts marked "X." The low side of the resistor should be connected to the terminal to the left. The two phasing controls should be set so that each is at its counterclockwise posi-

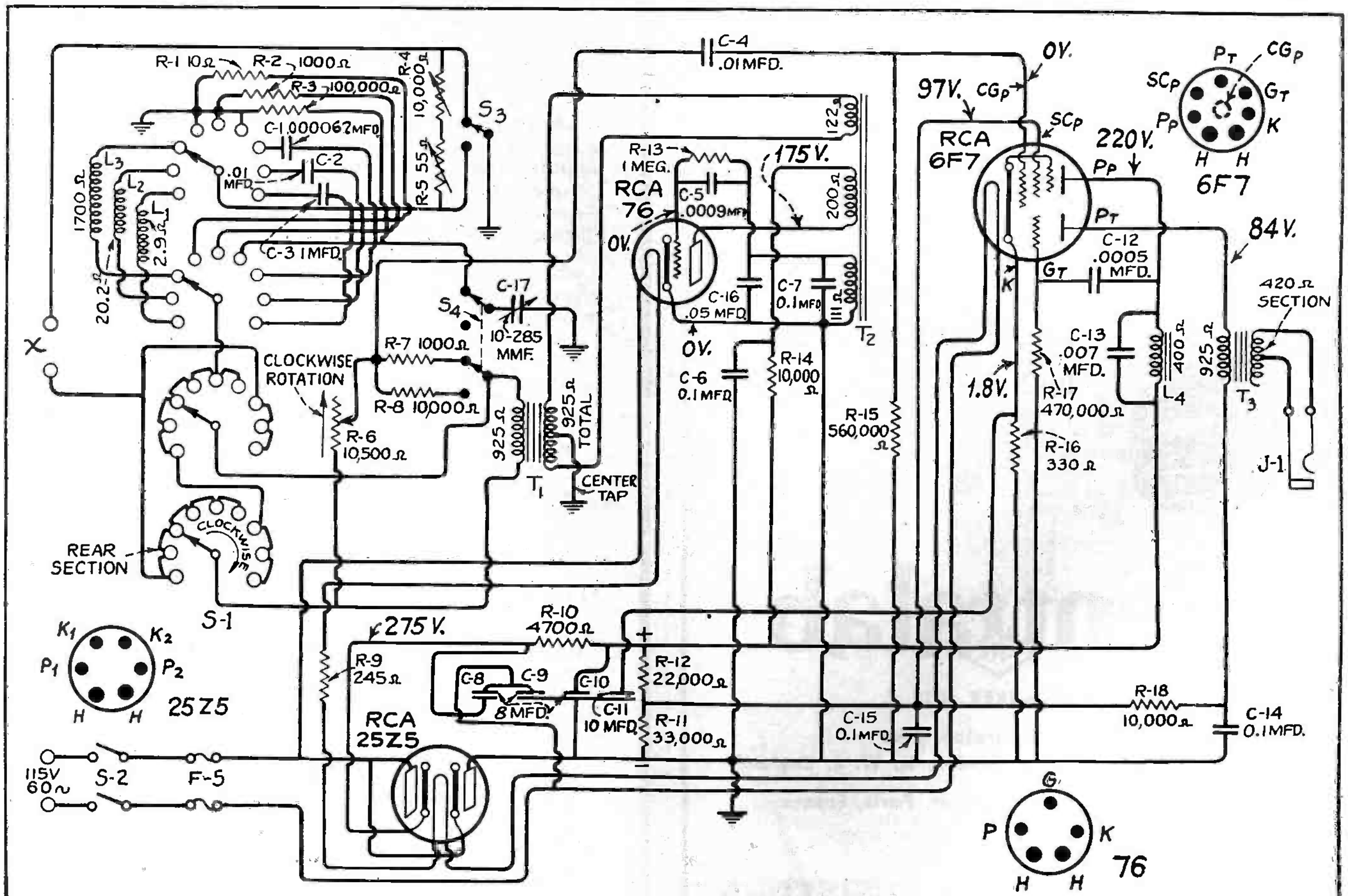

Fig. 1. RCA TMV-132A universal a-c bridge.

tion, since they are not used in resistance measurements. More conveniently, they may be cut out of the circuit by throwing the phasing toggle switch to the down, "R in Std. Arm" position. Now select the lowest resistance scale. This is done by throwing the range toggle switch to "Low" and by turning the Range Switch to the first resistance position (1-10 ohm). Now turn the large centrally located knob so that the pointer moves over the main scale from 1 to 10. If the resistance we have selected to measure lies anywhere between 1 and 10 ohms, a null point (balance) will occur and moving the pointer in either direction will *increase* the signal in the phones. If the null point is exactly at 5 on the scale, the resistance of the unknown is 5 ohms. If it occurs between 5 and 6 and exactly on the first small division to the right of 5, the resistance is 5.1 ohms. If no null point is found on this scale, throw the toggle switch to "High." The main scale now reads from 10 to 100 ohms. If still no null point is found, set the toggle switch on "Low" again and move the Range Switch one position to the right, so that just under ohms we read 100-1M. Since M represents 1,000, the scale now reads 100 to 1,000 ohms. In a like manner, by throwing the toggle switch to "High" the main scale becomes 1M to 10M; that is 1,000 to 10,000 ohms. On this latter scale, a null point at 5 means that the unknown resistance is somewhere between 1,000 and 10,000 ohms, then the range switch and the "Low-High" switch are set to select this range and the resistance reading obtained from the main scale after locating the null point. With this control set at approximately mid scale obtain an initial resistance balance. Then vary the capacitor for a null point.

Capacity Measurements

Set the bar pointer knob so that it is pointing to mmfarads, which is an abbreviation for the familiar micro-micro-

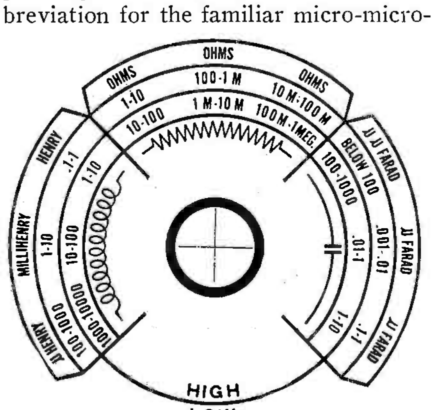

Fig. 3. Dial scale.

farads. Set the toggle switch to "Low" so that the range in use is "below 100." Now move the pointer over the main scale and at somewhere near 30 (scale division 3) a null point will be found. This is the balance point with no capacity across the "X" terminals. For convenience, we will refer to this reading as the capacity constant "K." If a small capacity is connected across the "X" terminals, say 20 mmfd, a new null point will be found at the capacity constant plus 20. Therefore when making measurements with the range switch in the lowest capacity position, the null point is found, the scale is read and "K" is subtracted from the reading.

At this point the two variable resistor phasing controls should be considered. For the very small capacitors treated above, their setting does not affect the null point appreciably. The reason for the inclusion of these controls in this bridge is that all capacitors and inductances have some resistance. The amount of this resistance is an indication of power loss. Ordinarily we are not interested in the exact power loss, but in order to secure a null point the effect of this resistance must be balanced out.

To continue with capacity measurements, leaving the range switch (pointer) at "Mmfarad," throw the toggle switch to "High." The scale is now from 100 to 1,000 mmfd. In this range, the phasing controls have more effect on the null point. Set the phasing controls at their minimum positions and with the main control secure a tentative null point. Then increase the upper (coarse) control to see if the signal increases or decreases. If the signal decreases, adjust the phasing control for a minimum signal. Then readjust the main control for minimum. The true null point is obtained by successive adjustments as outlined above.

If increasing the phasing control causes an increase in signal instead of a decrease, then the toggle switch to the right of the lower control should be thrown to the opposite position and successive adjustments made until the null point is obtained. In this capacity range (100 to 1,000 mmfd) the lower (fine) phasing control will have little effect. In this range also the capacity constant "K" is subtracted from the null point reading. If the null is at 500 mmfd and "K" is 30, then the true capacity is 500 minus 30 equals 470 mmfd. For all higher capacity ranges, this correction need not be made as it will be a negligible portion of the capacity.

Inductance Measurements

Connect the inductance to be meas-

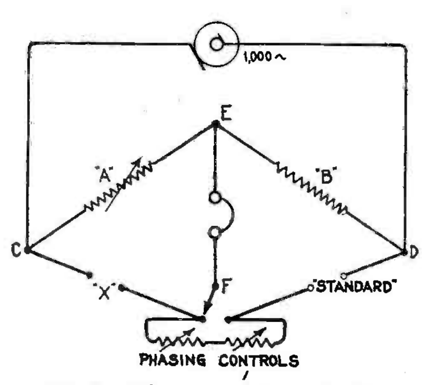

Fig. 2. Wheatstone bridge circuit.

ured to the "X" terminals and with its low side connected to the left terminal, a preliminary null point is obtained on the main scale. Then the phasing controls should be adjusted to reduce the signal in the phones to a new low point. Successive adjustments of the main control and phasing controls should be made until the lowest signal can be obtained. The inductance is read directly from the main scale. For illustration, suppose the range switch is set to "millihenry," the range toggle switch is on "Low" and the main scale reads 6, then the inductance is 6 millihenries. The setting of the phasing controls is not taken into consideration at all. The two phasing controls are in series and in measuring inductance it will usually be necessary to find the resistance component balance roughly on the "coarse" control and then adjust the "fine" control for the final balance. Facility in successively manipulating the phase control and ratio comes readily with practice. On the lowest inductance scales, the resistance balance is quite critical and some care will be required to secure the correct null point. This same care is necessary with a laboratory bridge as well.

Circuit Description

A simplified a-c Wheatstone bridge is shown in Fig. 2 to illustrate the principles of measurement involved, whereby, the value of an unknown resistance, capacitance, or inductance may be measured by comparison with a known standard resistance, capacitance, or inductance. This diagram shows an impedance network into which an unknown "X" may be connected in series with a known "Standard," a variable ratio arm "A," and a fixed arm "B." An a-c voltage of 1,000 cycles is connected across the bridge elements between points C and XD. An indicating device (headphones) is connected between points E and F to detect balance. Such a balance is indicated when a minimum signal is heard in the headphones, thus indicating that

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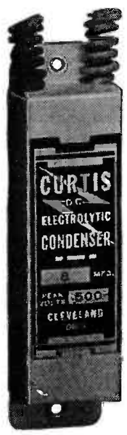

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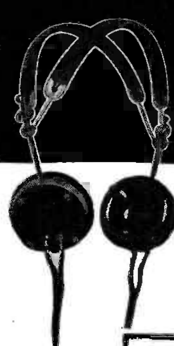

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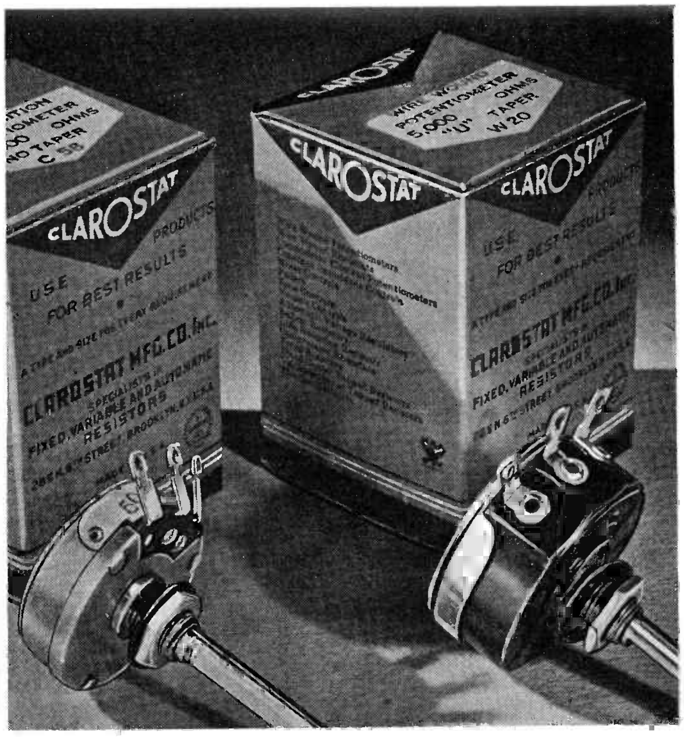

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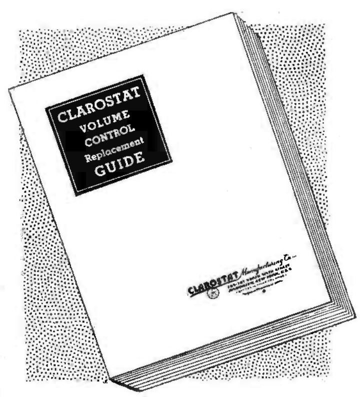

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the ratio of arm "A" to arm "B" is identical to the ratio of the unknown "X" to the "Standard." By calibrating arm "A" the value of the unknown may be read direct. By properly choosing the values of the standards, the various ranges may be made multiples of the basic range of 1 to 10.

In the schematic circuit of the TMV-132-A bridge (Fig. 1) the 1,000-cycle energy is delivered to the bridge elements through the transformer (T-1) which is balanced capacitively to ground. This transformer isolates the bridge elements from the auxiliary equipment; that is, the power supply and oscillator, and insures the desired capacity-to-ground of the "known" and "standard" arms of the bridge.

The differential voltage, which indicates unbalance, is fed from the bridge elements through condenser C-4 to the pentode-grid of the 6F7. This unbalance-voltage is amplified in both sections of the tube and then made audible by headphones connected to the secondary of the output transformer (T-3), the primary of which is connected in the plate circuit of the triode section.

Three standards each of capacitance, inductance and resistance contained in the bridge elements are so arranged as to be selected by the range switch (S-1). Two ranges for each standard are obtained by means of the "High-Low" switch (S-4).

Arm "A" is the "Main Linear Control" (R-6) calibrated over the range from 1,000 to 10,000 ohms. Arm "B" is 10,000 ohms (R-8) for the low position and 1,000 ohms (R-7) for the high position of the "High-Low" switch. This arrangement, for a given standard, gives ratios of 0.1 to 1 for the low position and 1 to 10 for the high position. An overall range for one standard is, therefore, 1 to 100. By this arrangement the ratio of the bridge arm is never greater than 10, thus preserving sensitivity.

For inductance and resistance measurements, the "X" arm is the unknown element being measured, and the standard is selectable by the range switch. The ratio of the unknown resistance or inductance is to the standard resistance or inductance as arm "A" is to arm "B." The two phasing controls R-4 and R-5 can be placed in either the "X" arm or standard arm by means of the "R in X arm—R in Std. Arm" switch (S-3). The two rear sections of the range switch act as a double-throw switch to reverse arms "X" and the standard for capacity measurements, since the reactance of a condenser decreases as its capacity value increases. This permits the use of the same linear scale for all measurements.

The oscillator which supplies the 1,000-cycle energy to the bridge elements consists of a type 76 tube and a transformer (T-2). The grid winding of the transformer is tuned to 1,000 cycles by the condensers C-7 and C-16 (Fig. 1). Self bias is obtained by the grid leak and condenser combination R-13 and C-5. A separate winding is provided to feed the energy to the bridge elements through transformer T-1.

A 6F7 triode pentode is used as a two-stage amplifier to provide adequate 1,000-cycle energy to the headphones for detecting balance. The signal from the bridge elements is amplified in the pentode section and then fed to the triode section through condenser C-12. The plate impedance of the pentode section is tuned to 1,000 cycles by L-4 and C-13, which permits maximum signal voltage to appear on the triode grid. This arrangement provides high sensitivity, giving a sharp balance. The energy is then transferred to the headphones through transformer T-3.

The rectifier, a 25Z5, comprises two separate diodes of the heater-cathode type. It is employed in a voltage-doubler circuit and acts as a full-wave rectifier with one-half of the tube passing current to the load on each half of the a-c input cycle. During the period that one-half of the 25Z5 is rectifying the condenser across the other half is discharging through the conducting diode and the load. The voltage across the load is the sum of the d-c output voltage of the conducting diode and the discharge voltage of the condenser. C-8 and C-9 are the condensers which are alternately charging and discharging. C-10 and R-11 constitute a resistance-capacity filter. R-11 and R-12 form a bleeder circuit.

IMPACT EXCITATION GENERATOR

(Continued from page 411)

complished, but it should be noted that this can occur at several levels. The trimmer blades may all be down tight or at some higher position. Their relative position affects the high-frequency tuning range of the receiver and to obtain correct scale reading the proper level must be struck as well as alignment.

In passing it should be noted that misalignment of one of the i-f tuning stages will cause a loss of sensitivity which will appear as a uniform drop throughout the band. Inversely a receiver which has adequate sensitivity at some point in the band must have very good i-f tuning and will probably require only tracking of the r-f and oscillator circuits.

Miscellaneous Uses

Sometimes with multiband receivers one band only may be dead and the trouble may quite likely be caused by poor contact on the band switch. This can be checked by connecting the impact generator to the antenna and ground posts and rocking the band switch over the troubled position. If the defect is due to poor contacts, it will be evident because at some critical position all the contacts in circuit will "carry through." The impact generator, because it requires no tuning, eliminates any guess work about a signal coming through when the critical position of the contact switch is reached.

One common procedure used in running down off and on conditions is to prod the wiring and elements of the receiver while it is in operation. Confusion often times results from inadvertent detuning of the incoming signal. The impact generator adequately solves this problem.

The same output posts and attenuation control of the impact generator supply an a-f signal which may be used in testing audio systems for gain, fading, etc. The maximum output is just sufficient to actuate a magnetic speaker directly.

The impact generator is an adequate demonstrator to show when a set is in need of tuning service. While repairing auto radios its small size and battery operation make it very useful for testing sensitivity, checking antennas and antenna tuning by the signal injection method.

An Inexpensive Impact Generator

In Fig. 2 are given the circuit details of a practical impact generator designed around a high frequency buzzer. This buzzer consumes about 30 ma at 1.5 volts giving a battery life of several months. When using other buzzers it will be necessary to do some experimenting to find the correct value of battery voltage and the value of the shunt resistor. A smooth operating buzzer for which the correct values of battery voltage and shunt resistor have been chosen will yield a musical steady tone. A buzzer which makes slight mechanical sound is preferred. Shielding requirements are very adequately met by enclosing the components in a simple metal case as shown in Fig. 1.

ON THE JOB . . .

Calibrated Condenser for the Service Bench

A calibrated variable air condenser can be a very useful item of equipment on the Service Man's bench. Such a condenser can be used to match r-f coils, to determine the exact size of padding condenser required to make an oscillator track or to check the variable condensers in a set. These and a great number of other cases will come to the mind of the Service Man.

Such a condenser can be calibrated in terms of a known standard very accurately and easily. A calibrated standard is almost always a part of the laboratory equipment of a technical school or college. Usually it may be rented or borrowed.

The condenser to be calibrated must be of good mechanical construction and especially with good bearings. A transmitting condenser with double spaced plates and about 0.0005-mfd capacity is excellent. A wiping contact between rotor and frame is preferred to the pigtail type. A good dial with an easy to read scale is essential. The condenser must be mounted in a shielded box or can. Tin cans such as are used in the kitchen for tea, sugar, etc., may be used to good advantage if they are sturdy. In any event, it is most necessary the mounting arrangement be such that the condenser cannot move with respect to the shielding or the dial. The writer used a wooden box lined with copper

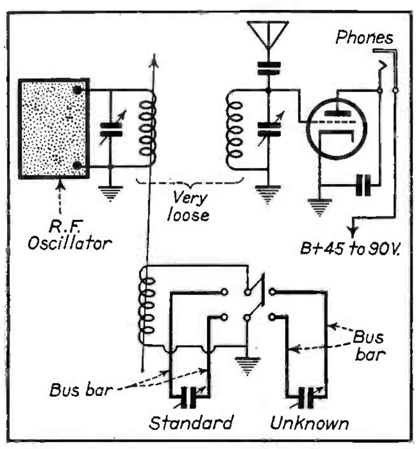

Fig. 1. Equipment layout.

and with a ¼-inch thick aluminum panel on top. Mount a pair of good husky binding posts on the panel and ground the rotor to the shielding. The condenser is ready for calibration.

In calibrating the condenser by far the best results will be obtained by using the substitution method. The writer used a modification of the usual substitution method which gave excellent results and was most accurate. The equipment layout is shown in Fig. 1. The r-f oscillator is tuned to zero beat with a convenient broadcasting station. This beat is heard in a detector, of the non-oscillating type, coupled just enough to easily hear the beat note. Normally a short piece of wire for an antenna will pick up enough of both oscillator and broadcasting station to be satisfactory. The oscillator should warm up for an hour or so to reach an equilibrium condition where it will not drift in frequency. It should, incidentally, be *unmodulated* and sufficiently strong so as not to lock into step with the broadcasting station near zero beat. Couple another coil to the oscillator tank and tune it with the *calibrated standard*. As this circuit comes into resonance a change in the pitch of the beat note will be observed. Adjust the coupling between this circuit and the oscillator so that, say, the beat changes about 20 cycles per division of the standard near the resonant point. When this condition obtains it will be easy to set the oscillator to zero beat with the broadcasting station by means of this separate circuit. If the circuits are judiciously placed and well grounded there will be little or no hand capacity. A little experimentation will provide this condition. To substitute the condenser to be calibrated for the standard a double pole double throw knife switch is used. It should be mounted solidly and the leads to both condensers be of the same length and of rigid wire such as bus bar.

To calibrate, merely introduce the standard into the circuit, tune to zero beat, note the capacity, substitute the condenser to be calibrated, retune to zero beat and note the dial setting. The capacity value of the standard will be the capacity of the condenser being calibrated for that dial setting. Calibrate about every ten divisions of the dial. More points will be necessary at the dial ends as the dial setting vs. capacity curve bends at each end. For most accurate results in using such a condenser only the range between 10 and 90 on a 100 division dial is used.

Some cautions are in order. Check and recheck your points. Do not disturb the detector tuning once it has been set. See that the headphone cord does not change the beat note when moved around.

Plot the points you have taken on rectangular coordinate paper and draw a line through them. If the condenser

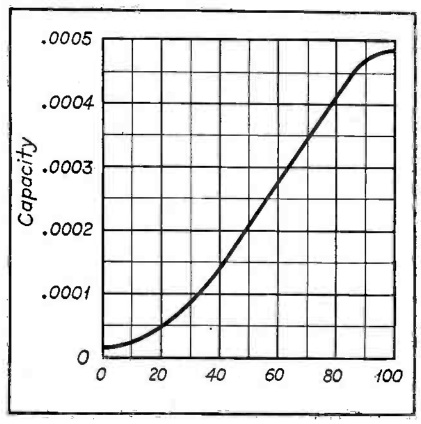

Fig. 2. Typical calibration curve.

is of the straight line capacity type this will be a straight line with a slight curve at each end. When these instructions are observed and reasonable care taken with the calibration the condenser will be within one percent or less of the standard and will hold this calibration to an exceptional degree for several years.

Robert C. Moody

•

Condenser Trouble

If you experience difficulty in having newly installed cartridge-type by-pass condensers open try giving the pigtails a little slack next time. Usually if pulled up snug while soldering the heat expands the wire and on cooling there is a tension on the wire which will more than likely cause the pigtail to pull apart from the foil in due time.

Hygrade Sylvania Service Hints

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Removing Knobs

To remove spring-type knobs without marring the cabinet panel slip a length of shoe-string behind the knob. Pull the knob off slowly with the string, pressing against the panel with the thumbs for leverage if it sticks. The use of the string gives an even pull on the shafts.

Hygrade Sylvania Service Hints

•

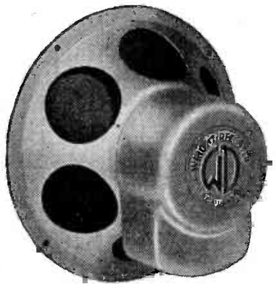
Detecting Faded Colors

To assist in determining the color of a condenser or transformer lead that has been faded or is covered with pitch a hot soldering iron may be used. Rubbing the wire with the iron will cause the color to stand out more clearly.

Harvey Shock

Specify NOKOIL

when ordering Permanent Magnet Speakers



Model 782
10" Reproducer
$7.82 list

THE word NOKOIL was originated by us to introduce and tell the story of our efficient, small Permanent Magnet Speakers, first in the field and previously unknown to the trade. Now the word NOKOIL is being generally used to signify P.M. Speakers. Play safe, specify NOKOIL when ordering Permanent Magnet Speakers.

New Catalog showing improved units and lower prices now out. Write for copy and name of nearest distributor. Wright-DeCoster distributors are always anxious to cooperate.

WRIGHT-DECOSTER, INC.
2253 University Ave., St. Paul, Minnesota
Export Dept.—M. Simons & Son Co., New York
Cable Address: "Simontrice."
Canadian Office, Associated Sales Co., Guelph, Ont.

3-in-1 Electrolytics

. . . for Better Filtering in Tight Places

- Six leads — two for each section.
- No larger than usual 8 mfd. 450 v. unit. Only 1⅜" by 4¼".
- Hermetically sealed. Seepage-proof. Inverted mounting.
- Two voltage ratings —250 and 450 v. working.
- In 4-4 4, 8-8-8, 8-8-16, and 8-16-16 mfd. units.
- Typical AEROVOX—in quality, variety, dependability.

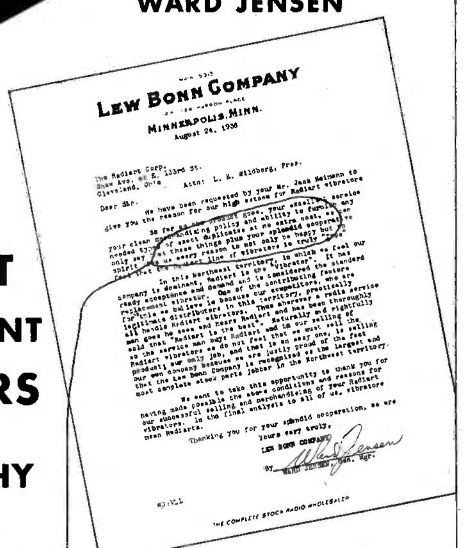
Three entirely independent, isolated sections in a single, hermetically-sealed can. These new 3GL electrolytics are "tops" for filter circuits of midgets receivers or other compact assemblies.

WRITE FOR NEW CATALOG covering complete condenser and resistor line. Also sample copy of monthly Research Worker.

AEROVOX
CORPORATION
80 Washington St. :: Brooklyn, N. Y.

INSIST ON **Radiart** VIBRATORS

THANK YOU WARD JENSEN



INSIST UPON RADIART REPLACEMENT VIBRATORS

HERE'S WHY

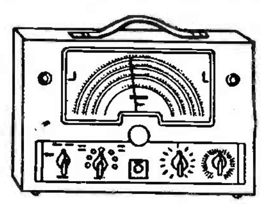
So far as the product goes, your excellent service, your clean merchandising policy and ability to furnish any needed types of exact duplicates at no extra cost, we can only say that these things plus your splendid cooperative spirit give us every reason to not only be happy, but to feel that the Radiart line of vibrators is truly "Tops."

THE RADIART CORPORATION
Shaw Ave. at East 133rd St. — Cleveland, Ohio

FOR PRECISE SPEEDY ALIGNMENT

THE BURTON OSCILLATOR

ACCURATE—STABLE



DIRECT READING DIAL. Seven arcs provide effective scale length over 50 inches. **VARIABLE RANGE** from 100 Kilocycles to 70 megacycles, 6 Bands. **ACCURACY** ½ of 1% on all I.F. Bands. 1% on B.C. Bands. 2% on all S.W. Bands.

STANDARDIZED FREQUENCY CALIBRATION. EXCELLENT CIRCUIT STABILITY manufactured under A. T. & T. license. **MODULATION** 400 cycle note, approximately 35% modulated is supplied by separate tube. Oscillator can be used for adjusting receivers by the unmodulated method.

Past performance counts. Burton Oscillators have, through merit, won a high place in the favor of the service man. They are soundly engineered and are built to do their job and do it well. See for yourself—examine one of these instruments at your jobbers', notice the cast aluminum case—the vernier controls—the dial sealed behind heavy glass. Burton Oscillators are fairly priced at $32.95 and are available on time payment plan. Ask your jobber. If he cannot supply you, use coupon below.

THE BURTON ROGERS CO.
755 BOYLSTON STREET — BOSTON, MASS.

Gentlemen:
Kindly send me full information about the Burton #111 Oscillator.

Name ....
Street ....
City .... State ....

ASSOCIATION NEWS . . .

INSTITUTE OF RADIO SERVICE MEN REPORTS

IRSM Board Meeting

The Board of Trustees of the Institute of Radio Service Men will hold its second regular meeting for 1936 on September 18 at the Hotel Pennsylvania, New York City.

At this time the Board will decide upon the next major activity for the Institute to engage upon, now that the Qualification Project for Service Men has been placed into capable hands.

It is anticipated, too, that the Board will take action at its New York meeting on the matter of changing the rules governing admission to the Institute, and that very shortly it will be necessary for an applicant for membership in the Institute to first have fulfilled the requirements of the Qualification Project.

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New York Trade Show

The 1936 New York Radio Trade Show, conducted by the Institute of Radio Service Men, and staged on the Mezzanine Floor of the Hotel Pennsylvania, will be one of the largest displays of radio parts and accessories shown in the eastern metropolis. Between 60 and 70 booths will be occupied (as of August 31).

The opening hour of the show is 2:00 o'clock, Friday, September 18, and the entire afternoon will be devoted to exhibits—no lectures are scheduled for the afternoon period of the first day.

Entrance to the exhibition hall will be by way of the stairway at the east end of the hotel lobby. Elevator service to the Mezzanine—or at least to the Trade Show—will not be available, except for service purposes.

On Saturday and also on Sunday the Trade Show doors will be open at noon, which will give the registrants plenty of time to view the exhibits before the technical lectures begin.

Although no complete program of events is available at this time, it is understood that Mr. C. Herbst, RCA service engineer, will describe technical receiver advances on September 18. Drs. V. K. Zworykin and G. A. Morton will demonstrate the electron multiplier the same evening. On Sunday evening Mr. R. G. Herzog, editor of SERVICE, will discuss noise reducing antennas.

The Trade Show will close at 11:00 p.m., Sunday, September 20.

Forest Arnold, Prog. Com.

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IRSM Qualification Project

Marked interest has been shown in the Qualification Project developed by the Institute of Radio Service Men and placed into the hands of especially formed bodies for effectuation. The National Board of Radio Service Standards reports that the applications to take the examinations have been coming into the office at the rate of between 30 and 40 a day, from a relatively small preliminary mailing of the details of the Project.

The returns from the restricted mailing mentioned above have given the office staff of the National Board of Radio Service Standards an opportunity to devise methods of handling the routine in an efficient manner.

A general announcement of the entire Project was being prepared for putting into the mail beginning September 4 and continuing until more than 14,000 had been sent forward.

IRSM INVITATION

THE entire radio trade is cordially invited to attend the Fourth Annual New York Convention of the Institute of Radio Service Men to be held on the Mezzanine Floor of the Hotel Pennsylvania in New York City, September 18, 19, 20, 1936.

NO ADMISSION CHARGE!

•

Cleveland Chapter

As per schedule the Cleveland chapter of the IRSM held their annual picnic on August 23. Both the Akron and Cleveland chapters attended with their wives and children.

The Cleveland chapter won the ball game 13 to 0. Seven and a half barrels of beer, eighteen cases of pop, ten gallons of ice cream and oodles of scotch were consumed during the frolicing which lasted till well after midnight.

The dates of the Cleveland Trade Show have been changed to November 1 and 2, to be held at the Hotel Cleveland in the grand ballroom.

A special feature of the show will be a telephoto demonstration arranged through the courtesy of the Acme News Service and the N.E.A. Service.

L. Vangunten, Secretary

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SOUTHERN MINNESOTA RADIO ASSN.

The annual convention of the Southern Minnesota Radio Association will be held in Rochester, Minn., September 26 and 27. All radio Service Men, dealers and amateurs are invited. Numerous prizes have been donated and will be distributed among those attending the convention.

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RADIO SERVICE ASSN. OF CALIFORNIA

Dr. Lester Reukema was the guest speaker at the August 17 meeting of the Radio Service Association of California. The meeting was held at the headquarters of the association, 921 Harrison St., Oakland, Cal. Mr. H. A. Schmidt, the association's president opened the meeting.

LIST OF EXHIBITORS

Fourth Annual IRSM N. Y. Convention, September 18, 19, 20, 1936

Exhibitor	*Booth No.*
Aerovox Corp.	56
All-Wave Radio	58
American Microphone Co.	32-R
American Phenolic Corp.	32-L
American Radio Hardware Co., Inc.	57
Amperite Corp.	50
Arcturus Radio Tube Co.	12
Astatic Microphone Laboratory, Inc.	47
Atlas Resistor Co.	69
Bendix Products Corp.	43 & 44
D. R. Bittan Sales Co., Inc.	31-33
The Brush Development Co.	45
BRYAN DAVIS PUBLISHING CO., INC.	48
B. O. Burlingame	30
Centralab	42
Cinaudagraph Corp.	21
Clarostat Manufacturing Co., Inc.	25
Clough-Brengle Co.	14
Cooper-DiBlasi	10
Cornell-Dubilier Corp.	7
Dale Parts, Inc.	51
The Dale Radio Co., Inc.	52
Tobe Deutschmann Corp.	28 & 29
Electrad, Inc.	41
Electronic Laboratories, Inc.	4
John M. Forshay	1
Sam Harper	5-R & 14
General Transformer Corp.	31
The Hickok Electrical Instrument Co.	1
Hygrade Sylvania Corp.	37 & 38
International Resistance Co.	11
Jefferson Electric Co.	40
J. F. Distributing Co.	23
P. R. Mallory & Co., Inc.	16 & 17
Meissner Manufacturing Co.	3
Micamold Products Co., Inc.	67
National Union Radio Corp. of N. Y.	15
Ohmite Manufacturing Co.	33
Operadio Manufacturing Co.	13
RCA Manufacturing Co., Inc.	70 & 71
The Radiart Corp.	24
Radio City Products Co., Inc.	34
Radio Retailing	66
The Radiotechnic Laboratory	5-R
Radio Today	54
Radio Weekly	—
Raytheon Production Corp.	36
Readrite Meter Works	39
John F. Rider	6
Roye Sales Agency	2-4
W. S. Scharp	42-47
F. Edwin Schmitt	68
SERVICE	48
Shure Brothers	68
Simpson Electric Co.	18 & 19
Paul C. Smalley	16 & 17
Solar Manufacturing Corp.	9
Sprague Products Co.	49
Standard Transformer Corp.	2
H. A. Steinberg	7
Supreme Instruments Corp.	30
Technical Appliance Corp.	5-L
Thordarson Electric Manufacturing Co.	10
Tilton Electric Corp.	65
Transducer Corp.	55
The Triplett Electrical Instrument Co.	20
United Transformer Corp.	53
Utah Radio Products Co.	35
Ward Leonard Electric Co.	22
The Webster Co.	46
Weston Electrical Instrument Corp.	8
Wholesale Radio Service Co., Inc.	26 & 27

HIGHLIGHTS . . .

RCA SERVICE MEETINGS

Announcement of a series of Service Men's meetings was made by F. B. Ostman, RCA Victor Service Manager. Beginning Sept. 14 the lecture meetings will take place in over 150 cities throughout the country and come to a close on Oct 23.

As in the past the meetings will be conducted under the joint auspices of the RCA Victor Service Department and the radio parts wholesalers who will announce the date and meeting place for each locality.

•

BRIGGS AND STRATTON MANUAL

Briggs & Stratton Corp., Milwaukee, Wis. manufacturers of gasoline motors, have just issued a sales manual and instruction book on the company's new 6-volt, 200-watt "Power-Charger" battery charging unit and lighting plant. The story of the advantages of electricity provided by gasoline motors in the home and on the farm has been told in a series of cartoons, leading into an analysis of the portable power and light plant and the possible markets into which it will go. Operating instructions and repair information and parts lists are included in a separate section illustrated with line drawings.

•

RAYTHEON SALES MANAGER

Mr. D. T. Schultz, vice-president and treasurer of Raytheon Production Corp., announces the appointment of Mr. E. S. Dietrich as manager of distributors' sales. Mr. Dietrich's headquarters will be at the New York Office 420 Lexington Ave. He will operate under the general supervision of the general sales-manager, Mr. E. S. Riedel, of the Chicago office 445 Lake Shore Dr., Chicago.

•

CORNELL-DUBILIER CATALOG

A special catalog has been issued by the Cornell-Dubilier Corp. covering the reduced prices recently announced for their line of "Dwarf-Tiger" condensers.

This catalog lists the entire line of this series, together with catalog numbers, and shows both the old and new price schedules. This catalog, No. 132A, will be mailed to those requesting it from the Cornell-Dubilier Corporation, 1000 Hamilton Blvd., South Plainfield, N. J.

•

NATIONAL UNION RADIO LOG

A sixteen page radio log has been released by National Union Radio Corp. for use as promotional material by radio Service Men and retail radio dealers.

Contents include listings of all broadcasting stations in the United States and throughout the World, more than fifty photos of radio stars, world distance charts for the short-wave enthusiast, information as to where to write for short-wave verifications of interest to the DX fan and a wave length frequency chart.

A feature of particular interest to radio retailers and Service Men is the fact that the log provides for a choice of complete outside back cover advertisements for the dealer, thus making the publication appear to be his own log.

Complete details may be obtained from the National Union Radio Corp., 570 Lexington Ave., New York City.

ATLAS RESISTOR CATALOG

The Atlas Resistor Co. have published their 1937 catalog, No. 7, describing their line of wire-wound resistors and voltage dividers. Very attractively prepared, it will prove of definite value and interest to all service men.

Copies of the catalog may be had by writing to the Atlas Resistor Co., 423 Broome St., New York City.

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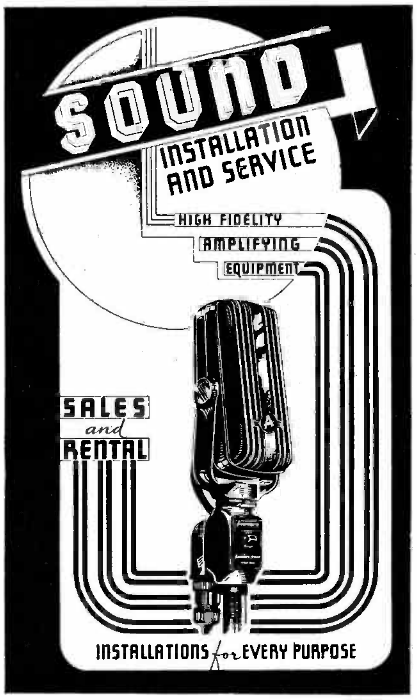
AMPERITE DECALCOMANIA

Amperite Co. offers the Service Man a useful help in the form of a decalcomania. Measuring over 9" by 5" and finished in brilliant gold, red, black and white this



window sign should attract business during the coming active p-a season.

The decalcomanias may be obtained directly from Amperite Co., 561 Broadway, New York City.

•

WEBSTER CATALOG

The Webster Co., 3825 W. Lake St., Chicago, have their catalog, No. 736, describing their line of synchronized sound systems and accessories, ready for distribution among the trade.

•

RADIO RECEPTOR BULLETIN

The Radio Receptor Co., 106 Seventh Ave., New York City, have released their latest bulletin, No. 3013. The bulletin, which may be obtained upon request, describes their series 7 dynamic microphones and contains much material of interest for everyone engaged in public address sales and installations.

•

HYGRADE SYLVANIA ENLARGES

The new Salem, Mass. plant of the Hygrade Sylvania Corp., is 400 feet long and 80 feet wide aside from the wings containing quarters for engineering research, restaurant and recreation rooms. The total floor space is 91,000 square feet.

TRANSMITTER GUIDE FOR AMATEURS

The Amateur Press, 1300 W. Harrison St., Chicago, have released a pamphlet called "Progressive II." This pamphlet is intended to be a supplement to the Progressive Transmitter Guide for Amateurs recently published.

Copies of the guide or supplement may be obtained from the Amateur Press or from the General Transformer Corp., 500 Throop St., Chicago.

•

FRANKLIN SALES MANAGER

Franklin Transformer Mfg. Co., 607-22nd Ave. N. E., Minneapolis, Minn., announces the appointment of H. Lawrence Mills as sales manager of their transformer division. Mr. Mills has had a varied experience in radio and allied fields.

There will be no great change in the sales policies of the company for the present. However, there will be numerous additions and improvements in the Franklin transformer line.

•

STANCOR TRANSFORMER GUIDE

The Standard Transformer Corp., 866 Blackhawk St., Chicago, Ill., is offering the Service Man a card file replacement guide. The guide consists of a set of printed cards, filed in alphabetical order according to the name of the receiver, giving replacement data on practically every commercial receiver ever built. Information on audio transformers and chokes is also included.

The card file may be obtained by any Service Man for 25c or by returning a Stancor box top to the manufacturer.

•

SPRAYBERRY BOOKLETS

The Sprayberry Academy of Radio is offering several booklets extolling the advantages of enrolling in the Academy. The booklets explain the Sprayberry course and give a summary of each lesson. Numerous testimonials from former students as well as letters of praise from successful men in the industry are included.

The booklets may be obtained by writing to the Sprayberry Academy of Radio, 2548 University Pl., N. W., Washington, D. C.

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ALADDIN DATA SHEET

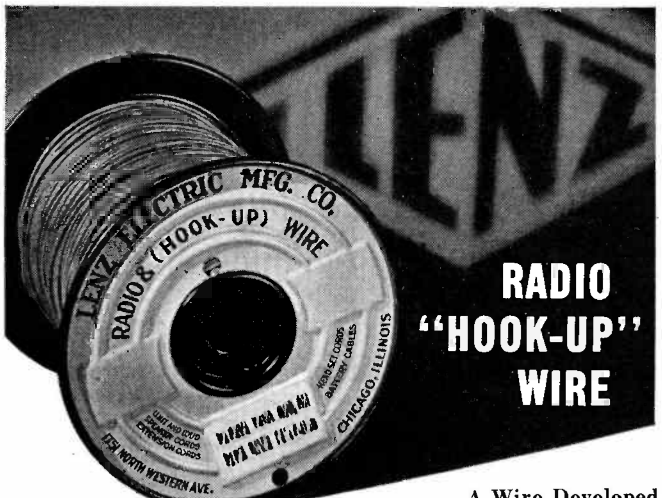
Aladdin Polyiron Data Sheet 536 is available to Service Men and dealers who write to the Aladdin Radio Industries, Inc., 466 W. Superior St., Chicago. The 8-page bulletin enumerates representative products produced in the Aladdin Radio Industries line during the last few years.

•

UNIT REPRODUCERS N. Y. OFFICE

In order to better handle the demands of New York and nearby manufacturers, jobbers, dealers and Service Men the Unit Reproducers Manufacturing Co., 999 E. Main St., Rochester, N. Y., have established a New York City office at 1472 Broadway.

The Unit Reproducers Co. manufactures a complete line of magnetic pickups and permanent magnet dynamic speakers.



A Wire Developed Especially for LOW LOSSES at High Frequencies!

LENZ R.F. Hookup Wire Dielectric Characteristics At 70 F. 50% RH.

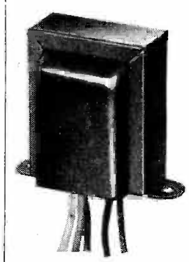
Power Factor—One-half of one per cent at 25 meters (12 megacycles), completely immersed in mercury.
Phase Angle—18 degrees and seven minutes.
Insulation Resistance—33,000 megohms per foot at 400 volts DC, completely immersed in mercury.
Capacity (to ground)—22 MMF. per foot at 25 meters (12 megacycles).
AC voltage breakdown—1600 volts per foot, completely immersed in mercury.
At 120 F. 90% RH.
Power Factor—1% at 25 meters (12 megacycles), completely immersed in mercury.
Capacity (to ground)—28 MMF. per foot at 25 meters (12 megacycles).
Moisture Absorption—less than 1% by weight.

Conductors supplied in several sizes either solid or stranded. Insulation pushes back easily without adhering to the conductor. Insulation impregnated in a high-resistant, low-loss, moisture resisting compound. Specifically designed for RF circuit.

Handled by Dealers and Jobbers All Over the Country

LENZ

1751 NORTH WESTERN AV.
CHICAGO ILLINOIS



At What Voltage does it Break Down

You can make your own check test . . . but you can be just as safe if you tell your jobber, I want

HALLDORSON TRANSFORMERS
Vacuum Sealed

Halldorson transformers are stocked by leading part distributors everywhere. It is no longer necessary for radio service dealers to take chances with transformers. For the same price you can get the quality transformer that for years has been used as standard equipment in leading American made radio sets.

The vacuum-seal safeguards against failure due to moisture.

See Your Jobber. Write

3
MORE EXPENSIVE TO MANUFACTURE
but
LESS FAILURES
and
NO INCREASE IN PRICE

THE HALLDORSON COMPANY,
4500 Ravenswood Ave., Chicago, Ill. S-9

Please send me your new Catalogue.

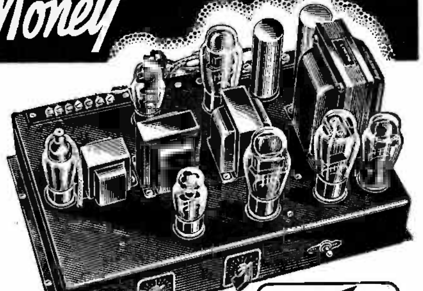
.... (Name)

.... (Street)

.... (City) (State)

Get a Political Job
It's Easy Money

STENTORIAN SOUND AMPLIFIER NUCLEUS



15 Watt Amplifier Nucleus
High Gain for Crystal or Velocity or Carbon Microphones

GTC

The hottest political campaign in years is directly ahead! Political organizations of all parties will need public address systems with a "Stentorian" tone. Dealers and Sound engineers can make good quick profit in selling or renting sound amplifiers built the "Stentorian" way. G.T.C. Nuclei furnished for stationary and mobile outfits. Easy to understand directions for wiring supplied with each Nucleus. Power supply units are the HEART—the very nucleus of Sound Amplifiers. Each "Stentorian" NUCLEUS includes matched power transformer, chokes, audios, outputs with neat black wrinkle finished chassis, lettered terminal strips, marked tube sockets. "Stentorian" Sound Amplifiers provide wide tone range and good clear sound coverage for convention halls, auditoriums, stadiums, refectories, athletic fields, ballrooms, night clubs, taverns, lodge halls, banquet programs, political rallies, office and factory call systems, truck or auto advertising for concession barkers, race track announcements, depot train call systems, and the like.

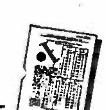
The "Stentorian" way is the most economical way for Quality Sound Amplifiers.

GENERAL TRANSFORMER CORPORATION
(Manufacturer of Replacement Units)
502 S. Throop Street
Chicago, Ill.

Free for the Asking!
Interesting illustrated bulletin on "STENTORIAN" Sound Amplifier Nuclei and name of distributor nearest you.

Mr. Service Man, can you fix my--er--er RADIO

Yes, indeed you can and because you do good work and use dependable Ward Leonard replacement resistors, you give satisfaction, and she will call on you again for your services. That is how a permanent profitable radio business is built. The Radio Service Bulletin 507A shows the Ward Leonard Line and gives prices. Be ready when she calls. Send for it today.



WARD LEONARD ELECTRIC CO.
South Street, Mount Vernon, N. Y.
Please send me FREE Bulletin 507A.

Name ....
Street ....
City .... State ....
Jobber .... S

THE MANUFACTURERS . . .

MALLORY CONDENSER REPLACEMENTS

P. R. Mallory and Co., Inc., Indianapolis, Ind., feature a line of 69 general replacement condensers which they claim will cover complete replacement requirements in all of the commercial receivers now in use. The new units are small in size, surge-proof, oven-tested and are sealed in metal (humidity-proofed).

Complete information concerning this line may be obtained from the manufacturers.

•

ACOUSTI-REFLEX SPEAKER CABINET

The Acousti-Reflex speaker cabinet, an Operadio development, is designed to reduce feedback, increase the efficiency of the speaker, reenforce bass response and present a neat appearance.

The cabinet accomodates only 12" speakers and contains a built-in exponential chamber which takes the sound from the rear of the speaker cone, expands it in the normal manner and projects it out in front to augment the sound generated at the front of the cone.

The cabinet is built of seasoned plywood

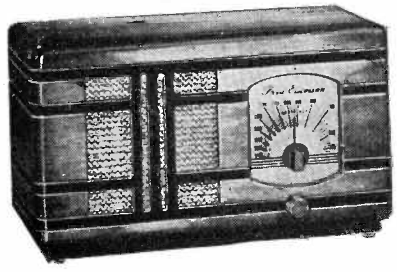
heavy enough to eliminate vibrations.

Catalog 10-E, giving full particulars, is obtainable by writing to the Operadio Manufacturing Co., St. Charles, Ill.

•

FREED-EISEMAN FE-60

The Freed-Eiseman Model FE-60 is an a-c, d-c, 6-tube superheterodyne covering the American broadcast band and the police calls within the tuning range from 540 to 1740 kc. The set has a multi-colored illuminated tuning scale and is mounted in a hand-polished, two-tone, walnut-veneer and gumwood cabinet.



The FE-60 is manufactured by the Freed Manufacturing Co., Inc., 44 W. 18 St., New York City.

TRIAD 25B5 AND 25N6G

The Triad Manufacturing Co., Inc., Pawtucket, R. I., have added a new member to the Triadyne family with the announcement of the 25B5 and its octal base counterpart the 25N6G. The new tube is intended for use as an output for a-c, d-c and transformerless a-c receivers. A somewhat greater output is afforded than was

previously obtainable with the type 43 tube.

Characteristics and other information can be obtained from the manufacturer.

•

SUPREME 1937 LINE

The Supreme Instruments Corp., Greenwood, Miss., have announced their series 500 line of test apparatus for 1937. Included in the new line are a model 545 "Cathoray Oscilloscope," a model 555 "Diagnomoscope" and a model 565 "Carrier Shift Indicator."

Additional information can be obtained directly from the manufacturer.

•

NEW SPRAGUE CONDENSERS

Working on the premise that condenser failures caused by humidity could be eliminated, the Sprague Products Co., North Adams, Mass., announces a specially treated tube and sealing compound. This humidity-proof tube construction is used in the manufacture of the entire Sprague line of paper, foil and gauze condensers.

Since the change is internal, the new Sprague units may be identified by a red dot imprinted upon the base to differentiate them from former Sprague units of the same general type and rating.

•

MICAMOLD JOBBERS LINE

Micamold Products Corp., Brooklyn, N. Y., will shortly announce a jobbers' line of paper, mica and dry electrolytic condensers and an assorted line of carbon and wire-wound resistors. Included in the line will be the Micamold patented bakelite-molded paper condensers and the Micamold patented bakelite-molded resistors.

Mr. E. B. Tyler, formerly with Polymet Mfg. Co., is in charge of the new line as general sales manager. He will be assisted by Mr. Nat Pomeranz.

FOUR-WAY MICROPHONE

Shure Brothers, 215 W. Huron St., Chicago, Ill., announce a new type microphone unit available in the general purpose crystal, in the communications type crystal, and in the carbon types.

A single unit provides 4-way utility. By means of an adapter on the base of the unit, the handle and the microphone may be removed to become a hand microphone or replaced on to the base to become a desk microphone again. A slot is provided in the adapter to accommodate the cable. The microphone may be removed from the handle and mounted directly on to a floor-stand or spring suspended in a carbon ring.

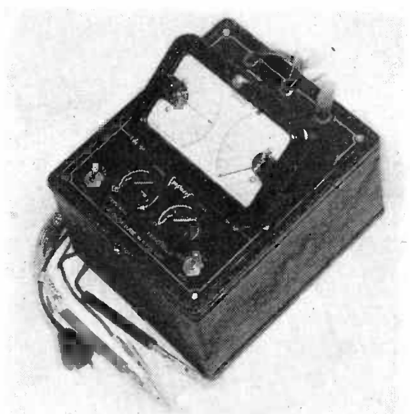
•

TRIPLETT VACUUM-TUBE VOLTMETER

The Triplett Model 1250 is a self-calibrating vacuum-tube voltmeter with accuracy independent of changing tube values.

The instrument will answer many purposes in measuring low voltages, both in a-c and d-c, without current drain.

Model 1250 has a twin instrument (tilting type); one of the instruments is a



sensitive galvanometer that indicates when the bridge is in balance; the other is a three-range voltmeter with linear scales reading peak voltages. Ranges are 2.5, 10 and 50 volts.

•

CORNISH NOISE-MASTER ANTENNAS

Cornish Wire Co., 30 Church St., New York City, announces material advances in their Amy, Aceves and King licensed

"Noise-Master" antenna. Several models are available to suit all sets and locations. Dealers and Service Men are invited to request information covering the 1937 Cornish wire products.

INDEX TO ADVERTISERS

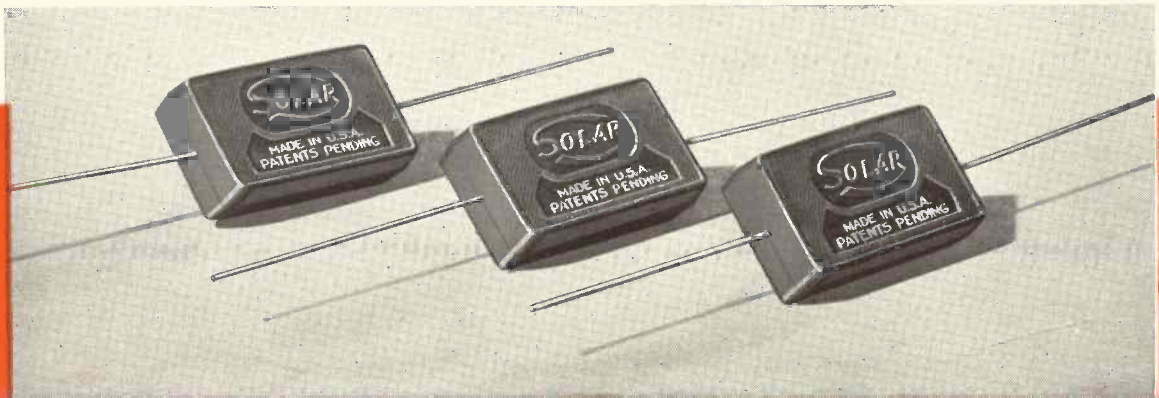
AN old favorite in a radically new form . . . attracting universal interest! Solar Dominoes are non-inductive paper condensers molded in Bakelite. They resist heat and moisture . . . offer permanent capacity and full voltage protection. Small, flat, easy to use. Dominoes combine all the quality features of Solar tubular paper condensers . . . plus the obvious advantages of protective and attractive molding in Bakelite. Compare their appearance and performance with ordinary paper tubulars. You will find Dominoes the better value.

Solar Dominoes are available in standard cartons of 10. A wide range of capacities may be obtained, up to .25 mfd. 200 volts, .1 mfd. 400 volts, .05 mfd. 600 volts. Complete listing furnished on request.

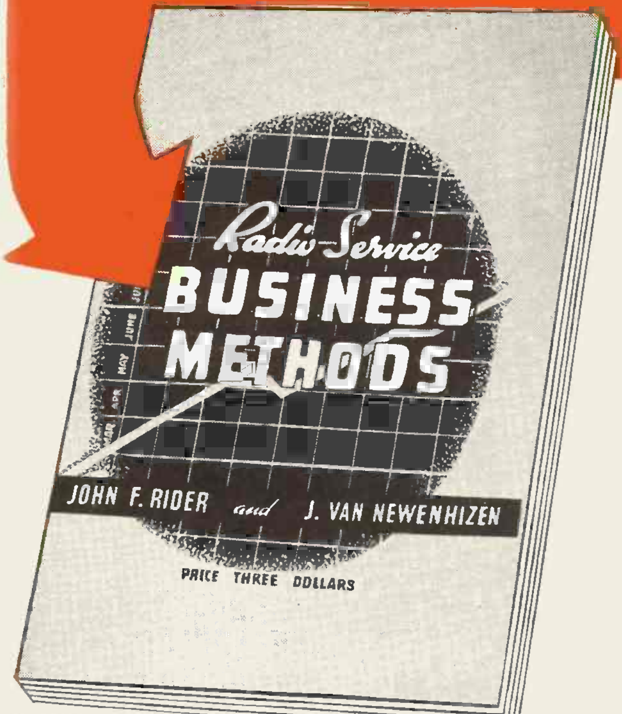
SOLAR MFG. CORP.

599-601 BROADWAY, NEW YORK CITY

SOLD BY LEADING JOBBERS EVERYWHERE



NOW READY TO HELP YOU MAKE MORE MONEY



Here is the Third Point of the RCA 3-Point Service System—"Radio Service Business Methods," by John F. Rider and J. Van Newenhizen, just out. Tells in detail how to make your business ability match your technical expertness, so you can make the money you are justly entitled to make.

Learn how to calculate your costs, so you can put a fair and proper price on every job. Book explains how to keep simple records, as the basis not only for charging, but for credit. Shows the forms needed, and how to get them. This section of the book is simple. Follow it, and just a few minutes a day will provide you with the figures that will show whether you are making money on your volume of business.

220-page book, price $3.00—but your RCA Parts Distributor or your RCA Tube Distributor will make you a deal so the book costs almost nothing. Ask him for details.

RCA 3-POINT SERVICE SYSTEM

Tells how to get more work, how to handle it more quickly, how to organize your business for profit.

1 "101 Sales Ideas for Service Men." Every idea tested, tried and proved, capable of increasing your volume of service business.

2 "The RCA Radio Service Tip File." A high quality steel card file, with 200 cards, each bearing a practical servicing tip. Indexed by make and model. New tips being constantly released in packets of 20 cards.

3 "Radio Service Business Methods." Just out.

These Three Points should be used together for best results, but can be had separately. Ask your RCA Parts Distributor or RCA Tube Distributor to explain how you can get the complete System, or any part of it, for less than actual cost.

RCA Parts for PROFIT

Parts Division, RCA MANUFACTURING COMPANY, Inc., Camden, N. J.

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