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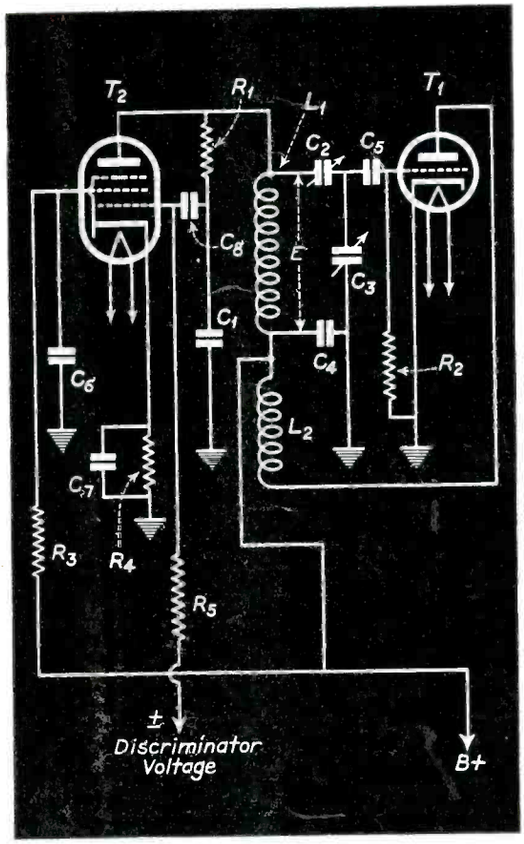

Automatic Frequency Control Circuit

(See Page 205)

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Yours very truly,
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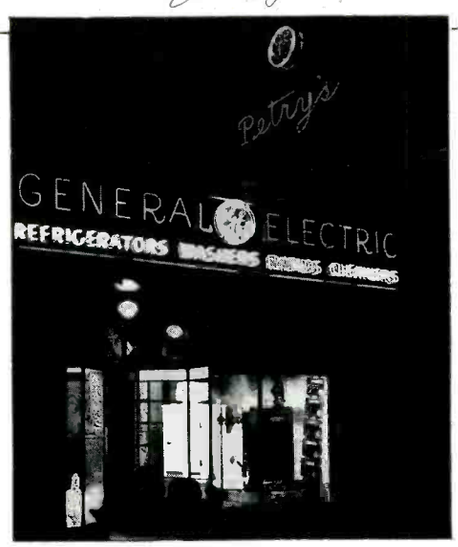

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SERVICE

A Monthly Digest of Radio and Allied Maintenance

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EDITOR
Robert G. Herzog

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EDITORIAL CONTENTS

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THE ANTENNA . . .

AUTO-RADIO COMPETITION

MANY FACTORS CAN BE stressed to show that the Service Man can give the prospect more for his auto-radio dollar than the automobile dealer can. The car dealer usually features one receiver at a special price, installed. The Service Man can offer a choice as to both price and quality. A better job can be made of installation and interference suppression by the Service Man, since the car dealer must cut these costs to the bone because of his special price. The Service Man knows of the best antennas available and of the methods of installing and using these antennas to the greatest advantage. But the most important factor, and the one least mentioned, is the necessity of the radio purchaser to protect his investment. Automobile receivers are subjected to very rough duty and although they are ruggedly constructed, they do require service. The Service Man is in a far better position to guarantee prompt service to his own customers.

The Service Man must, however, be alert and keep himself up to the very minute on all auto-radio installation kinks, shielding requirements, bonding, etc., if he expects to compete in this profitable market.

• • •

AUTO RADIO SALES

FEW CAR OWNERS transfer a radio from their old car to a new one. This leaves the new car owner without his much desired radio. More new cars were sold this year than in any previous year over the same period. Every new car—to say nothing of the older cars—in use today must be registered. The names and addresses of these registered owners can be obtained, in many cities, and furnish an excellent source for auto-radio sales. The Service Man should get on the bandwagon and fill the mail with as much direct to the customer propaganda as he can afford.

Many of these car owners may already have car radios. The Service Man's advertising should be worded to take care of these as well. A timely offer of adjustment and checkup at an attractive price (and no strings attached); with stress of the latest types of antenna systems now available and how they will greatly improve reception on any make auto radio, or mention of the better understanding of present-day interference problems and cures should bring many profitable clients to the Service Man's door.

WIDE-RANGE REPRODUCTION

WITH THE AVAILABILITY of wide-range or high-fidelity phonograph records the pickup manufacturers have been pressed to keep pace in pickup design. The problem of moving mass, a factor which has hindered perfect pickup performance in the past, has been solved in a newly manufactured magnetic pickup. The necessity of damping, another enemy of high fidelity, has also been eliminated.

The improvement in pickups, amplifiers, tubes and speakers has opened a large field for the Service Man. Every music lover is a potential customer for equipment capable of reproducing these wide-range records.

• • •

TELEVISION

WITH THE DEMONSTRATION of television given by the RCA Manufacturing Company, in Camden, on the 24th of April, the public again becomes television-conscious

Although the demonstration was highly successful, Mr. R. R. Beal, director of the RCA Television Committee, said that RCA had no intention of introducing television into the home for at least eighteen months. The demonstrations were merely a prelude to tests to be instituted in New York late in June.

The system of reception used was entirely electronic; mechanical scanning devices were completely eliminated in the demonstration shown the assembled representatives of the press. The image was transmitted on six meters, and received on an ultra short-wave set constructed especially for the occasion. The 343 line picture was about six by eight inches and was viewed on a mirror to which it was reflected from the kinescope in the receiver below it.

The General Television Company in Boston are experimenting with similar apparatus, but with a somewhat larger kinescope. Peck, in New York, on the other hand, is demonstrating mechanical scanning of televised pictures by means of a series of specially designed, rotating lenses.

• • •

AUTOMATIC FREQUENCY CONTROL

THE ARTICLE ON AUTOMATIC frequency control by D. E. Foster and S. W. Seeley appearing in this issue is, to the best of our knowledge, the first published account on this topic that gives complete circuit data and technical information.

Automatic frequency control is of definite importance to the Service Man. Many of the manufacturers will include this already popularized feature in their next year's receivers.

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PA133 from two 6C6 plates to two or four 6L6 grids in AB.

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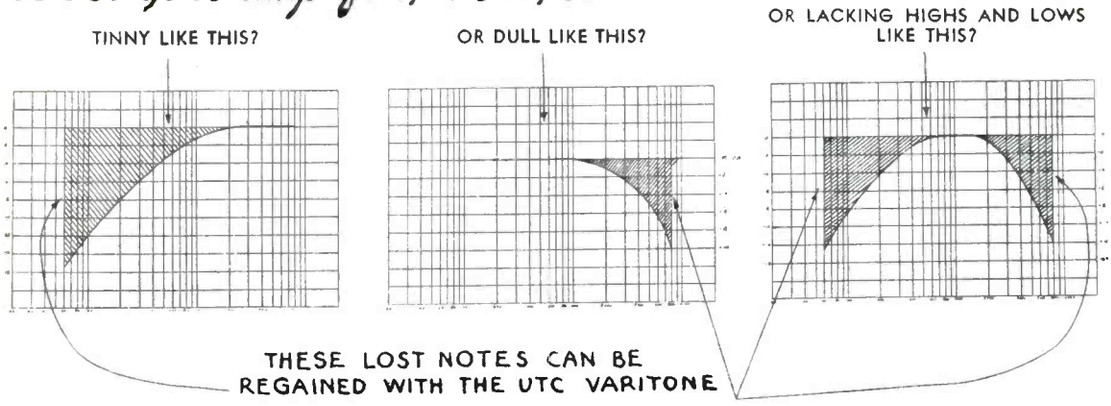

5 types of Varitone units are now available to meet circuit requirements in receivers, amplifiers or telephone lines.

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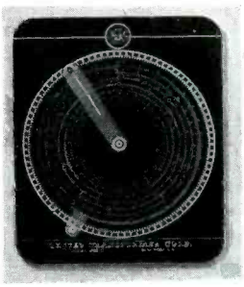
VT-4—A complete unit including variable control so arranged that with the control at one end high fidelity performance is effected by the increase of low and high frequencies, and with the control at the other end the high response is reduced to decrease static line noises and heterodyne whistles. Used with triode tubes.	6.00	**3.60**
VT-5—Same as VT-4, but used with screen grid tubes, pentodes or high mu triodes.	6.00	**3.60**

For complete description of Varitone circuit applications write for Varitone 1120 Bulletin.



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which includes data and circuits on amplifiers from one-half watt to 1,000 watts output, chapters on audio transformer design, application of power transformers and filters, also charts on decibel conversion in terms of watts and conversion of power or voltage ratios to DB, reactance data, filter ripple calculations, etc.

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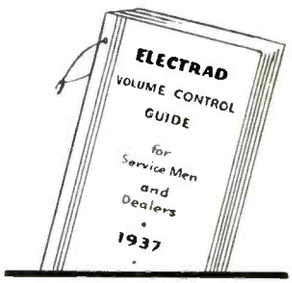
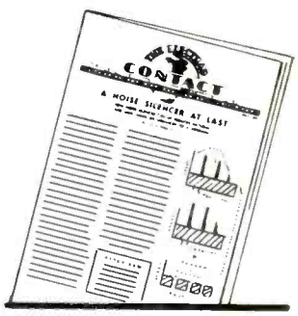


2. The "ELECTRAD CONTACT" . . a real service man's magazine, written by technical men. It is unbiased, professional in character, 100% devoted to the service man's point of view. It will be issued regularly every 60 days and each issue will keep service men posted on new developments in the field, discuss definite service problems, and furnish latest available information on controls. **This one feature alone** will put many added dollars of profit into the alert service man's pocket!



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ELECTRAD, INC.

175 VARICK STREET, NEW YORK

SERVICE

A Monthly Digest of Radio and Allied Maintenance

FOR MAY, 1936

AUTOMATIC FREQUENCY CONTROL†

By D. E. FOSTER and S. W. SEELEY

SINCE the advent of sharply-tuned all-wave superheterodyne receivers, problems of exact tuning and frequency drift of the local oscillator have become more acute.

Everyone knows that the vast majority of broadcast listeners is either unable or unwilling to tune highly selective receivers accurately and that by not tuning accurately, they fail to obtain the degree of fidelity of which the receivers are capable.

It is for this reason that so-called automatic frequency control circuits for superheterodynes have been developed.

The action of these circuits is such that any mistuning by the listener or any frequency drift in the receiver after it has been properly tuned is automatically corrected by the incoming signal itself.

The basic requirements for an automatic frequency control system are: (a) a d-c detector operated through an i-f frequency discriminator network and (b) an oscillator frequency control circuit.

The discriminator-detector network (a), as the name implies, discriminates between applied intermediate frequencies which are too low and those which are too high, and produces a corresponding direct current or voltage whose polarity depends upon the direction of frequency departure from a prescribed intermediate frequency. This d-c voltage is applied to a control element which in turn causes a shift in frequency of the local oscillator such as to bring the i-f signal to very nearly the correct intermediate frequency. Since production of the d-c voltage is due to departure from the resonant or center frequency of the i-f system, obviously the correction cannot be strictly complete; but in the system to be described a correction ratio of more than 100 to 1 is feasible. In other words, when the dial of the receiver is mistuned 10 kc for the received signal, the automatic correction may be made to bring the actual i-f signal frequency to only 100 cycles off resonance in the i-f system. Of course that is easily sufficient.

†From a paper presented at the I.R.E. Cleveland Convention May 12, 1936.

Frequency Discriminator

A method for obtaining differential d-c potentials (or currents) whose magnitude and polarity are determined by the amount and the sign, respectively, of the difference between an applied frequency and the true intermediate frequency is described herewith. Side circuits tuned above and below the center frequency are not used.

The action depends upon the fact that a 90-degree phase difference exists between the primary and secondary potentials of a double-tuned, loosely-coupled transformer when the resonant frequency is applied and that this phase angle varies as the applied frequency varies. Thus if the primary and secondary voltages are added vectorially, the absolute magnitude of the resultant vector will be greater on one side of resonance than on the other.

The vector sum of the primary and secondary voltages may be physically realized by connecting the two parallel tuned, coupled circuits in tandem, applying the input potentials to one circuit and taking the output across both circuits in series. In this manner, an action similar to that of a side circuit is produced even though the primary and secondary are both tuned to the center frequency. The potentials at either end of a secondary winding with respect to a center tap on that winding are 180° out of phase. Therefore if the center tap, rather than one end, of the secondary is connected to the primary, two potentials may be realized, one maximizing above and one maximizing below the center frequency (see Fig. 1).

If a transformer is connected in this manner and the resonant frequency is applied to the primary the two resulting output potentials will be equal in magnitude. If these are then applied to two separate, like detectors and the resulting d-c voltages (or currents) are added in opposition, the sum will be equal to zero. If, however, the applied frequency departs from resonance, the sum of their outputs will be some real value whose polarity will depend upon the sign of the frequency departure.

Referring to Fig. 2 the action is as follows. If the resonant or center frequency is applied to the grid of the amplifier tube, equal amplified voltages will exist between the point A and ground and between the point B and

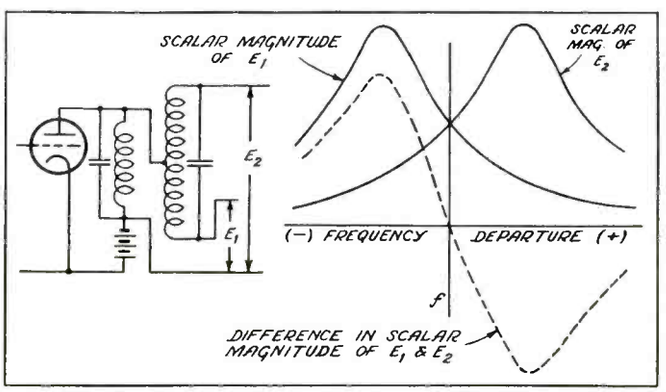

Fig. 1. Potentials on either end of secondary are 180° out of phase.

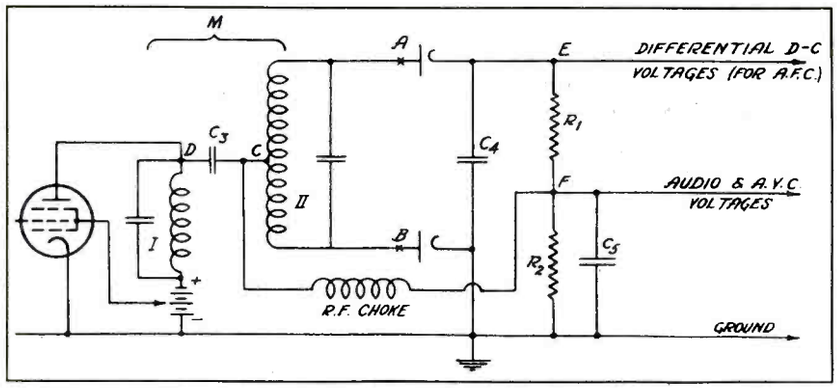

Fig. 2. The afc detector.

ground. These are rectified by the diodes and direct currents will flow in the resistors R_1 and R_2 in opposite directions with respect to ground. Thus, the net d-c potential produced by the two IR drops between E and ground is equal to zero. If, however, the applied frequency departs from resonance the potentials across the diodes will be unequal in magnitude, unequal IR drops will be produced in the two resistors and a d-c potential will exist between E and ground, the polarity of which will depend upon the sign of the frequency departure.

If a carrier at the resonant frequency with normal intensity modulation, but without frequency modulation, is applied to the system, the a-f as well as the d-c voltages across R_1 and R_2 will be equal and opposed. Therefore at resonance there will be no a-f potentials between E and ground, and as far as audio components are concerned the system acts exactly as though point E were grounded with the outputs of the two diodes acting in parallel. Actually if C_4 is sufficiently large to have negligible reactance at the lowest modulating frequency, this is the case. Then the point F becomes a potent source of audio voltages to supply the a-f amplifier system and no other audio detector is necessary.

It can be seen that the d-c potential between ground and the point F will have the proper polarity to be used for avc action, and that this potential will bear the same ratio to the developed audio voltages as is found in the conventional diode detector avc system. The fact that it maximizes at one side of resonance is of no significance if automatic frequency control is used. When the afc is cut out of circuit (manually) point E is grounded. This causes the d-c potential at F to maximize on resonance.

Control Circuits

A circuit which will convert d-c discriminator voltages into changes in oscillator frequency is shown on the front cover. In this figure T_1 is the oscillator tube and T_2 the control tube. The combination of R_1 and C_1 connected across the oscillator tank circuit produces a voltage on the grid of the control tube 90° out of phase with that existing across the tank circuit. Variations in grid bias of the control tube (obtained from the discriminator) vary the plate current of that tube. This plate current is 90° out of phase with the tank circuit voltage and therefore the control tube acts like a reactance in shunt to the tank circuit. The magnitude of the reactance and therefore the oscillatory frequency are varied by the control tube grid bias.

With the circuit shown on the front cover the control tube is equivalent to an inductance in parallel with the tuned circuit. An increase in mutual conductance of the control tube produces a decrease in the magnitude of this equivalent inductance and consequently an increase in the oscillator frequency.

Control Tube

The amount of control is proportional to G_m, but is also affected by the control grid voltage for this G_m, since a high value of bias permits R_1 or C_1 to be smaller for a given oscillatory voltage. Consequently maximum control is proportional to the product of G_m and E_c. Sensitivity of control is, however, another important requirement, since we wish the frequency change to be as large as possible for a given change in bias. This means the control tube should be of the short cut-off type. Further requirements are high r_p, linear change of G_m with bias, and for economy, low plate and screen currents. All of these requirements are best met by the short cut-off, r-f pentodes such as 57, 77, 6C6, and 6J7.

By proper choice of R_1 and C_1 the maximum amount of frequency correction can be adjusted to suit required conditions.

The frequency control readily obtainable by this circuit is of the order of 9.5% of the oscillator frequency in the broadcast band and 1.5% in the region of 10 megacycles.

In a receiver it has been found that a discriminator sensitively of 100 volts per kc and a control sensitivity of 7 kc per volt can be easily obtained, so that an overall control ratio of 700 to 1 results. A tuning misadjustment of 7 kc will therefore result in only a 10-cycle shift of the intermediate frequency.

The use of afc on the short-wave bands has the very much needed advantage of making the tuning operation easier. The tuning control has to be moved only until the frequency is close enough to resonance that the discriminator will develop sufficient voltage to bias the control tube the amount required for the departure from resonance. Short-wave stations are thus spread out on the dial, making them easier to locate and easier to hold.

In the broadcast band this characteristic would have the disadvantage that the receiver would appear to laymen to be broad in tuning in comparison with receivers without afc. This apparent disadvantage can be eliminated by combining the afc switch with the tuning mechanism so that the afc automatically becomes inoperative during the tuning operation.

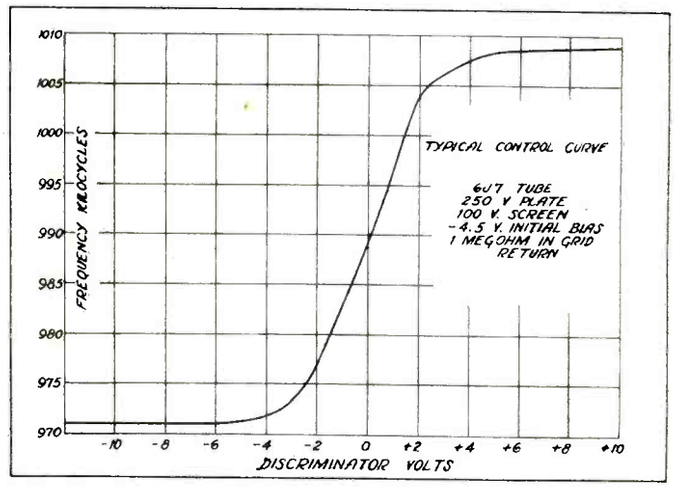

Fig. 3. Typical control curve for circuit on cover.

ALIGNMENT WITH THE WIDE-BAND GENERATOR

By G. F. DEVINE*

IF good performance is to be expected from a radio receiver, it is quite important that the r-f circuits *track* with the oscillator. If this tracking is not accurate the sensitivity and selectivity will be impaired. Tracking is obtained when a constant frequency difference is maintained between the oscillator and the r-f circuits at every point on the band. This difference is, of course, equal to the intermediate frequency.

A small trimming condenser in shunt across each tuned circuit is used to align the higher frequency portion of each band. In addition, a relatively large condenser in series in the oscillator tuned circuit is commonly provided. The series condenser is adjustable and permits the oscillator circuit to be tracked with the r-f to maintain the frequency difference in the lower frequency region of these bands.

Insuring Proper Tracking

Since the frequency to which the set responds is determined by the oscillator, and as there is usually no adjustment on the r-f circuits at the lower end of a band, some special procedure must be followed to insure that the circuits track in this region. The most common method to obtain this proper tracking is to try progressively different combinations of tuning condenser gang setting and oscillator series padder adjustment until the combination giving the greatest response to the test signal is obtained. This is accomplished in practice by rocking the gang back and forth through the signal while trying different settings of oscillator series padder or, vice versa, by rocking the series padder while trying slightly different tuning gang settings. When correct agreement between the signal frequency, the r-f circuits and the oscillator circuit has been accomplished, the dial calibration may not be exact, but will be, in all probability, within tolerable limits. This rocking process, while capable of giving accurate results when correctly done, is at best a somewhat tedious job.

A number of other means to accomplish correct padding are available. For instance, in one factory test procedure, the r-f and detector circuits are temporarily aligned as a simple t-r-f set and made to agree with the dial calibration.

*Radio Commercial Engineering, General Electric Co.

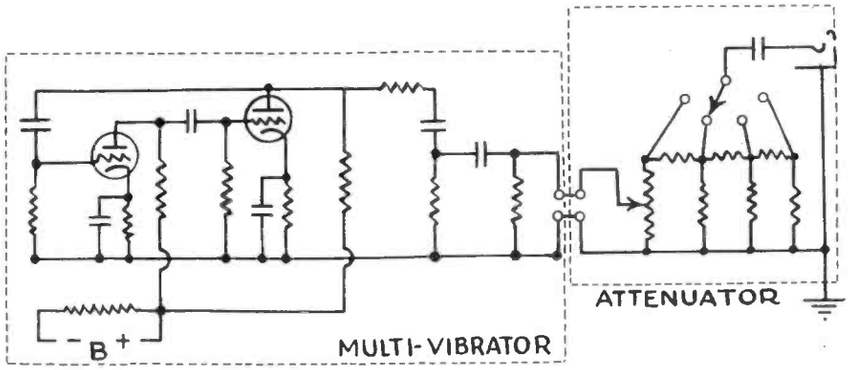

Fig. 1. The simple multi-vibrator.

Then the oscillator is separately aligned to conform to the r-f.

Another method frequently used employs a sweeping frequency signal instead of the manual rocking of the gang through a fixed signal as previously described. Then by merely adjusting the oscillator series padder for maximum output, correct tracking would be accomplished because, while the sweeping frequency signal would be heard at all settings of the padder, maximum output will be obtained only when the tracking (frequency difference between r-f and oscillator) is correct.

A method for the elimination of gang rocking is now presented which utilizes an oscillator having an output which is equivalent to a wide band of frequencies extending throughout the receiver's range.

Again, as with the sweeping frequency signal, it is merely necessary to adjust the oscillator series padder for maximum output to insure correct tracking in this region of the band. What happens here is that the r-f tuned circuits respond best to one certain point in the wide band of frequencies, and the set gives maximum output when the oscillator circuit is adjusted for the same point.

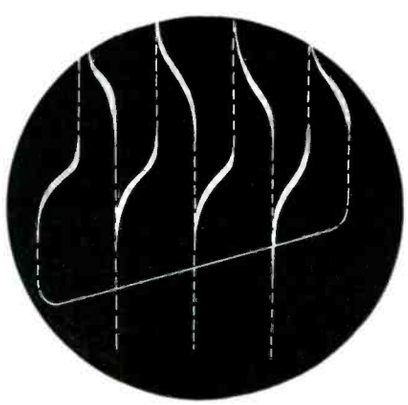

Fig. 2. Multi-vibrator waveform.

The Multi-Vibrator

A generator of such a wide band of frequencies is easily made from parts found in the service shop. It may take one of a number of forms; in fact, any constant source of r-f noise such as ignition noise or the r-f disturbance from an auto set's vibrator could be used. Probably the best source of a wide band of radio frequencies is found in the harmonics of a simple multi-vibrator oscillating at an audio frequency. This type of oscillator is easy and inexpensive to construct, and can be readily shielded and have its output controlled by an attenuator.

A multi-vibrator consists of a vacuum-tube oscillator in which the feedback voltage is returned in proper phase through a resistance-coupled tube. The circuit is shown in Fig. 1. The fundamental frequency of this oscillator is determined, principally, by the values of the grid and plate resistors and by the size of the coupling capacitors. This frequency may be conveniently adjusted by changing the value of these coupling capacitors. For the application considered here it should be set at some low audio frequency, say, 400 cycles.

The wave-form obtained from this type of oscillator is shown in Fig. 2. Portions of the wave-form change instantaneous value so rapidly that a complete picture of the cycle is not visible on the cathode-ray screen. Because of this steep wave front, this audio oscilla-

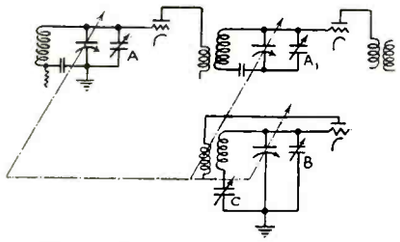

Fig. 3. Typical receiver r-f system.

tor will excite circuits tuned to any harmonically related frequency even up into the short-wave regions. It may be said that its harmonics are the equivalent to a band of frequencies, at 400 cycle intervals extending with useful intensity well beyond 18 mc. While the intensity decreases gradually with frequency, it is practically constant throughout any one band of a radio receiver.

Typical Alignment Procedure

An example of the use of this generator is included in the following alignment procedure for a typical broadcast receiver.

1. (I-F Circuits.) Connect the output meter and align the i-f at the correct frequency from the regular test oscillator. The i-f signal should be introduced at the grid of the converter tube.

2. (Broadcast band 550 to 1750 kc.) Set the regular test oscillator at the correct alignment frequency near the top end of the broadcast band, say 1700 kc. Introduce this signal at the antenna terminal and carefully adjust the trimmers a, a_1, and b (Fig. 3) for maximum output.

3. Connect the output of the wide-band oscillator to the antenna terminal and set the dial of the receiver to the lower end of the range, near 600 kc—adjust padder, c, for maximum output.

4. The preceding operation may have caused the oscillator to shift at the upper end of the range, so return to near that end and adjust only the oscillator trimber, b, for maximum output of the wide-band signal. The alignment of the r-f (trimmer a) and detector (trimmer a_1) circuits obtained in 2 is thus used as a reference to which the oscillator circuit is again made to track exactly.

The band is now aligned and a frequency calibration check can be made against broadcast stations.

Short Wave Band Alignment

On the short-wave bands there is usually no adjustable series oscillator padder, but another good use for the wide-band generator is found here. On such high frequencies a troublesome interaction between the detector tuned circuit and the oscillator is experienced which makes it difficult to obtain accurate alignment.

To overcome this difficulty, many different means have been adopted, one of which is to rock the gang while adjusting the high-frequency trimmer of the oscillator circuit. Most of these means, however, are somewhat involved and susceptible to errors.

The use of the wide-band generator offers an easy and sure alignment method to escape the effects of this interaction between the circuits.

For instance, to align a short-wave band extending from 6 mc to 18 mc:

1. Set calibrated test oscillator frequency and the receiver dial to 18 mc and bring in the signal by adjusting

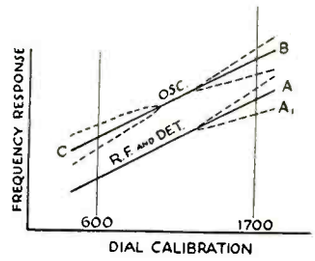

Fig. 3A. Graphical picture of tracking.

the oscillator trimmer b. Make sure that the image response falls at the right point on the scale.

2. Remove the test oscillator and, with the wide-band generator connected to the antenna terminal, align detector and r-f circuit trimmer a and a_1 for maximum output.

Correct alignment will now be accomplished. It is possible that the calibration will have been changed very slightly when the detector trimmer was adjusted, but the calibration usually remains as close as the dial can be read and the agreement between the oscillator and r-f circuits is always exact.

The above uses are only two of many possible applications of the wide-band generator. For instance, on sets using specially shaped oscillator gang condenser plates instead of a series padder, even the i-f alignment can be accomplished by simply adjusting the i-f trimmers for maximum output while the gang condenser is set at about 600 kc, and the wide-band generator is connected to the antenna terminal. Still another convenient use is to check, quickly, the sensitivity of a receiver over an entire band and to detect any insensitive or dead spots.

ESTIMATING SERVICE CHARGES

By S. R. COWAN

FAR too many Service Men consider that any amount charged over the actual cost of the parts used on any particular job may be taken as profit. This misconception is probably the most important reason for the inadequate return which Service Men in general receive for their work. The charge on any job must cover in addition to material and labor on the job, a percentage for idle hours, another for free calls, and a suitable amount for overhead, as shown below. To determine how much to charge for overhead the Service Man should keep some type of cost records.

Costkeeping differs from general bookkeeping in so far as it concentrates on a *unit* of production. In the Service Man's field this unit is *the job*. While costkeeping is a separate branch of bookkeeping, if it is accurate, it must be a part of the bookkeeping system. Large concerns have intricate cost-accounting records which insures this tie-in with the general books. Many small Service Men working alone, or even with one or two helpers, have no regular bookkeeping system. Their only records are often a list of customers from whom they hope to collect back money. Any cost records they might keep are too often haphazard and inaccurate.

The cost of any unit of production consists of three general factors. These are: labor, material, and overhead.

The Labor Charge

The labor charge at first glance appears easy to compute. The average Service Man merely puts down the number of hours spent on a job and multiplies it by the hourly rate. But time

spent going to and from the job is often ignored, as are repeat calls on difficult adjustment jobs which are gratis services. Another service that may be overlooked in costkeeping is free calls on guaranteed work. This is a very serious factor because through its oversight estimates quoted on guaranteed work are far too low. The problem of idle time is another factor not given proper stress. Many Service Men may use their idle time to keep equipment in order, or to act as combination salesmen and order clerks, but most of this time is a loss and it should be charged to the productive jobs. What the relative charge on each job should be, is an item that can be determined by experience. The rule roughly should be: determine the percentage of your own or your employees' time which is idle according to past or local experience. If possible, this should be the average of the year, not to vary with seasonal or accidental causes. Say it is 20%. Therefore a job that takes five hours should have an extra hour added in its cost for idle time.

The Charge for Material

This factor is self-explanatory. It may be haphazardly accounted for because Service Men put down actual parts, and neglect wires, screws, solder and many small items. Since the enumeration of these items would be a time-consuming nuisance, it is suggested that an average be struck between the total outlay for small items and the average number of jobs, and a percentage added to each job.

The Overhead Charge

How much should be charged for overhead on each job? The Service Man finds this the greatest stumbling block to his entire costkeeping system. Is it a fixed item which does not vary with the number of jobs? Can it be ignored altogether? Can't it be taken care of by some fixed percentage of each job? One must remember that the average Service Man cannot do much more than six or eight jobs per day, and the entire overhead must be paid for by these few jobs. With more employees doing more jobs, the proportion per job of course will be less, but it is still a respectable proportion of the actual cost of doing each job, and must be charged against each job if the Service Man expects to do business at a profit.

When overhead is mentioned, most Service Men think of rent, electric light, delivery service, and some even think of insurance. Very few think of adding the depreciation of their equipment, an often considerable figure, or the cost of scrapping parts gone out of style, a huge item in this line of business—to say nothing about stationery, postage, telephone, and the cost of advertising which includes, beside announcements in the local press, costs of mail, circulars, etc.

BLANK SERVICE REPAIR LABS

COST RECORD

Date: May 5, 1936

Name: Mrs. James Gotrocks

Address: 10 Park Avenue

Type of Receiver: Acme 974 Nature of Repair: Noisy

Material used:	
2 Volume controls	1 40
Window strip	06
Wire	15
1 type 45 Tube	37
Time started: 9:30 A.M.	
Time finished: 11:00 A.M.	
Time on job 1½ hours.	
At $1.50 per hour:	2 25
Amount allowed for overhead:	2 00
Total cost:	6 23
Charged:	9 50
Profit:	3 27
Service Man: John J. Jones	

Fig. 1.

Methods of Calculating Overhead

In the light of the foregoing, after having determined what factors go into the making of costs, the question is: In what form are these costs to be recorded, and what methods should be used in accounting for them? The form is comparatively simple. In any ordinary journal or ledger head a page for each job. On the caption place the name, address, etc., of the customer; the date, the nature of the job, etc., as indicated in Fig. 1. At first it will be impossible to tell exactly how much to charge for overhead, as it varies with the nature of the business, the amount of jobs done, etc. Correct overhead calculation can only be determined by experience. The Service Man lacking any accounts of previous expenses can do no harm in calculating it dollar for dollar; that is, at the same cost as his labor. It may be a little high, it is true, but overhead is always high, especially in a new business. Later, in three, six or nine months, or again at the end of the year, this percentage should again be determined. It is assumed that the Service Man keeps an accurate expense account, at any rate, and that he can thus figure his total expenses. Look over the jobs done in that period, and calculate your overhead in terms of your labor cost. Use the percentage thus obtained for the following period and again check up at end of the period. As time goes on you will get a very close percentage. You will learn to think in terms of jobs. You will think of your overhead in terms of labor cost. You will then be able to estimate correctly.

Possible Objections

Already we can visualize the objections to the methods of costkeeping outlined herein. The Service Man will object that his competitors do not determine costs so scientifically, and that they will consequently underbid him on jobs. The answer is that if it is necessary to reduce or cut out profits altogether to secure competitive jobs, that is the Service Man's right, but he should do so with his eyes open. If his competitors insist upon committing suicide by shutting their eyes to their real costs, that's their business, too.

But the good Service Man will follow no such ostrich-like policy. And if in following our methods of costkeeping most radio Service Men come to the conclusion that their charges have been hitherto too low for first-class service—we can only counter that that has been the object in writing this article.

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Correct Battery Polarization

In most auto-radio receivers the vibrator input is polarized and must be shifted to correspond to the polarization of the automobile to which it is connected.

A list of cars and their polarity follows: The Auburn, Cadillac, Chrysler, DeSoto, Dodge, Ford, Graham, Hudson, Hudson-Essex, Hupmobile, Lafayette, LaSalle, Nash, Packard, Pierce-Arrow, Plymouth and Studebaker all have the positive side of their storage battery grounded. The Buick, Chevrolet, Duesenberg, Lincoln, Oldsmobile, Pontiac, Reo, Stutz, and Willys all have the negative side of their storage battery grounded.

General Data . . .

Crosley Model 1155

The Crosley 1155 is an eleven-tube, four-band, superheterodyne receiver, using all metal tubes.

Specifications

The 1155 is available either with a standard 110-volt, 60-cycle power transformer, or with a universal power transformer.

The auto-expressionator circuit, items numbered 2A, 2B, 36, 54A, 54B, 74, and 79 (see circuit diagram Fig. 1), reduces the volume of soft tones and sustains the volume of loud tones. The transformer and condenser, items No. 79 and 96 (see Fig. 1), provide bass compensation by preventing the normal suppression of low-frequency tones. This expressionator circuit was completely described in March Service.

The tubes used in the 1155 are: 6K7, r-f amplifier; 6L7, modulator; 6C5, oscillator; 6K7, i-f amplifier; 6H6, diode detector; 6Q7, a-f amplifier; 6F6, output driver; two 6F6, output tubes; and two 5Z4, rectifiers.

The voltages indicated in Fig. 1 were measured from the tube socket contacts to the chassis with a 1000 ohm-per-volt voltmeter. The receiver was in operating condition with the antenna and ground shorted. Readings may vary 10% from the value given.

Alignment Procedure

This is a high-fidelity receiver and in order to secure maximum performance the alignment of its circuits should be done with precision instruments. The i-f amplifier employs two triple-tuned i-f transformers. Under no condition should their trimmer condensers be readjusted just to determine if they are properly tuned. Poor quality, loss of high-frequency response and poor selectivity are likely results of an improperly tuned i-f amplifier.

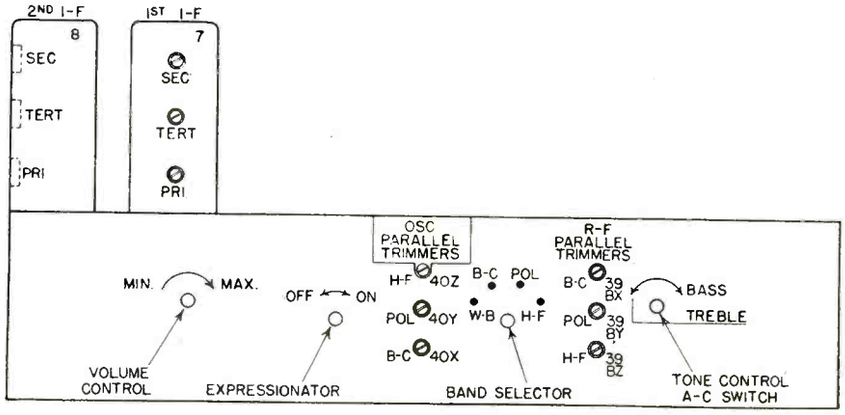


Fig. 4. Rear chassis view showing trimmer location.

The circuits of this receiver may be most accurately aligned with the aid of an oscilloscope. However, if an oscilloscope is not available a good alignment may be obtained by means of a signal generator and output meter, provided the following procedure is carefully observed.

Connect one terminal of the output meter to the plate of one of the 6F6 output tubes and the other terminal through an 0.1 mfd, or larger, condenser—not electrolytic—to the plate of the other 6F6 output tube.

Tuning I-F Amplifier

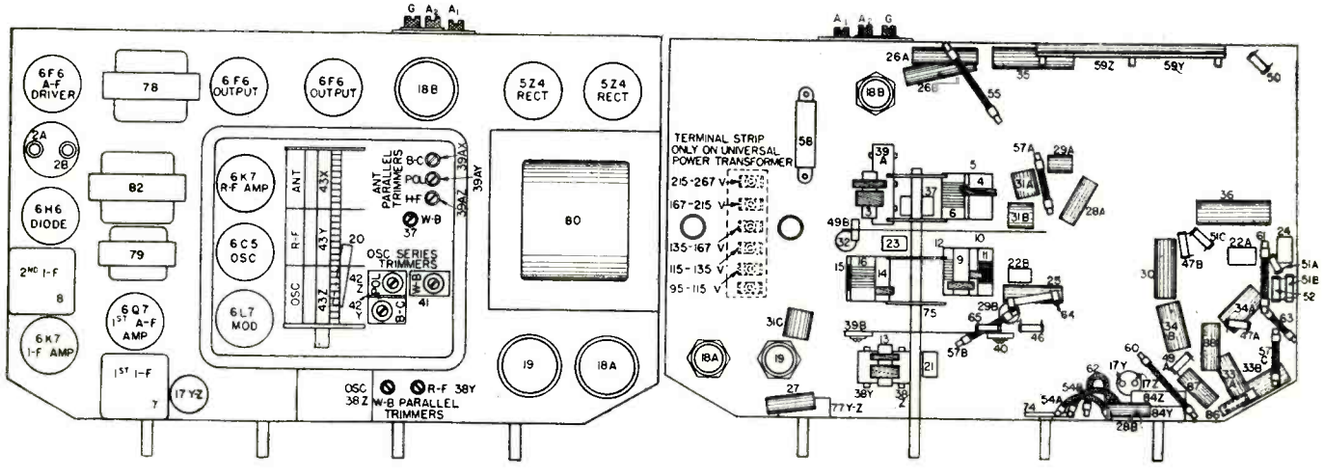
(a) Connect the output of the signal generator through a 0.02 mfd condenser to the top cap of the 6K7 i-f amplifier tube, leaving the tube's grid clip in place. Connect the ground lead from the signal generator to the ground terminal of the receiver chassis. *Keep the generator output lead as far as possible from the grid leads of the other screen grid tubes.*

(b) Set the band selector switch to the broadcast band and rotate the station selector to 60 on the broadcast band. Turn the volume control knob to the right (on), turn the tone control knob to the left (treble), and turn the expressionator control knob to the left (off).

(c) Set the signal generator to 450 kc.

(d) Close the middle trimmer condenser on the second i-f transformer (Tert. Fig. 4) so that it is moderately tight. (Do not force adjusting screw.)

(e) Adjust the top and then the bottom trimmers (secondary and primary) of the second i-f transformer for maxi-



Figs. 2 and 3. Chassis views showing tube and trimmer locations.

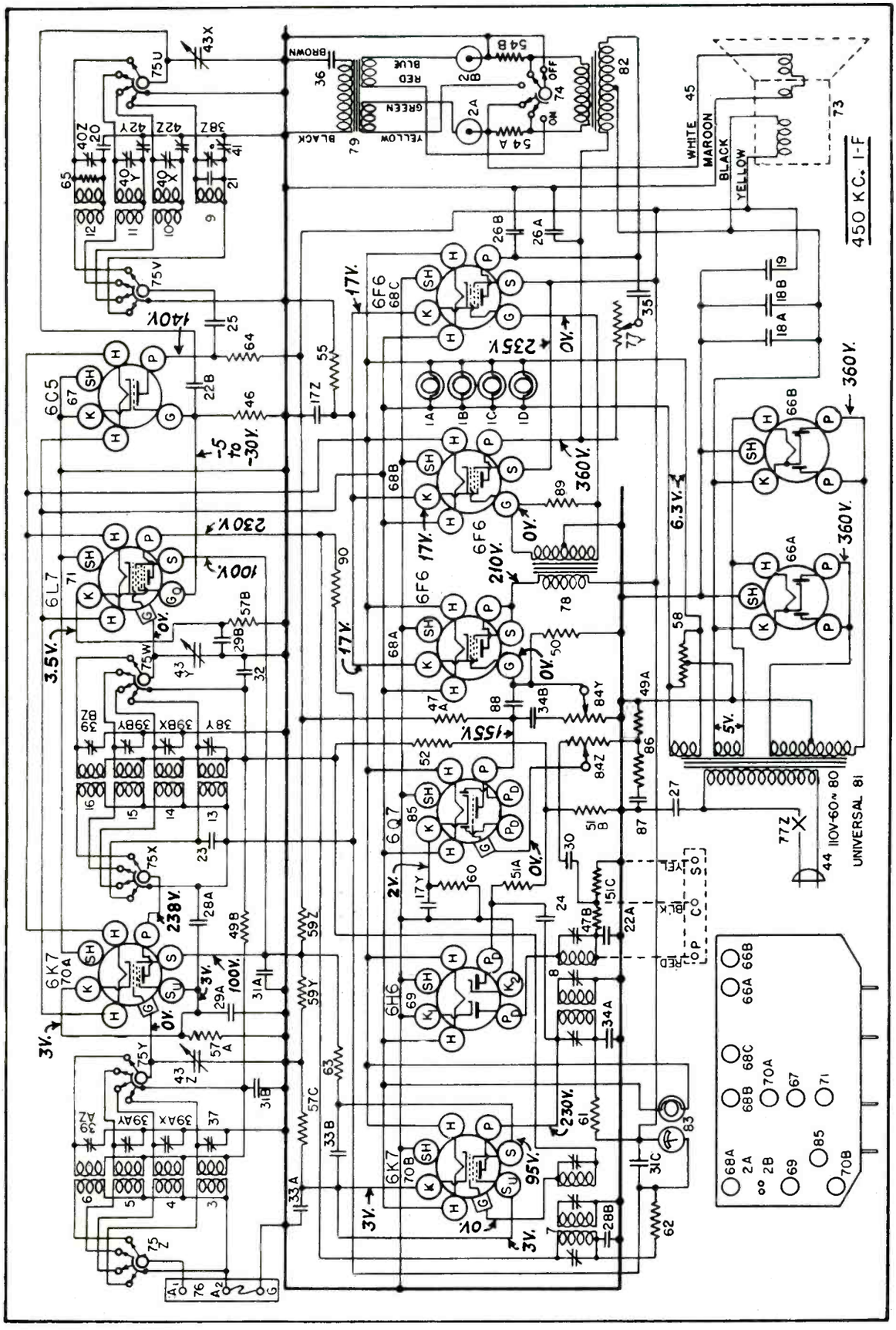


Fig. 1. Complete circuit diagram, Crosley 1155. Note auto-expressionator.

PARTS LIST (SEE FIG. 1)

Condensers		*Resistors*	
No.	*Capacity*	*No.*	*Ohmage*
17Z	25 mfd 25 v	46	40,000 ohms ¼ w
17Y	12 mfd 25 v	47A	100,000 ohms ¼ w
18A	35 mfd 400 v	47B	100,000 ohms ¼ w
18B	35 mfd 400 v	49A	300,000 ohms ¼ w
19	40 mfd 300 v	49B	300,000 ohms ¼ w
20	0.0056 mfd 300 v	49C	300,000 ohms ¼ w
21	0.000025 mfd 200 v	50	400,000 ohms ¼ w
22A	0.0001 mfd 200 v	51A	500,000 ohms ¼ w
22B	0.0001 mfd 200 v	51B	500,000 ohms ¼ w
23	0.00025 mfd 200 v	51C	500,000 ohms ¼ w
24	0.00025 mfd 300 v	52	1. megohm ¼ w
25	0.006 mfd 400 v	54A	1. ohm 1 w
26A	0.004 mfd 400 v	54B	1. ohm 1 w
26B	0.004 mfd 400 v	55	220 ohms 2½ w
27	0.01 mfd 400 v	56	none
28A	0.01 mfd 400 v	57A	350 ohms ½ w
28B	0.01 mfd 400 v	57B	350 ohms ½ w
29A	0.02 mfd 160 v	57C	350 ohms ½ w
29B	0.02 mfd 160 v	58	20 ohms wire-wound
30	0.02 mfd 200 v	59Z	4000 ohms wire-wound
31A	0.05 mfd 200 v	59Y	4000 ohms wire-wound
31B	0.05 mfd 200 v	60	2600 ohms 1½ w
31C	0.05 mfd 200 v	61	1400 ohms ¾ w
32	0.05 mfd 200 v	62	1650 ohms 1¼ w
33A	0.05 mfd 200 v	63	2000 ohms 1¼ w
33B	0.05 mfd 200 v	64	15,000 ohms 1 w
34A	0.05 mfd 400 v	65	10,000 ohms ¼ w
34B	0.05 mfd 400 v	84Z }	Volume control
35	0.05 mfd 400 v	84Y }	
36	0.3 mfd 160 v	86	6400 ohms
87	0.017 mfd 200 v	89	5000 ohms ¼ w
88	0.001 mfd 400 v	90	200,000 ohms ¼ w

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

(f) Transfer the output lead of the signal generator from the 6K7 tube to the top cap of the 6L7 modulator tube leaving the tube's grid clip in place.

(g) Open the middle trimmer of the first i-f transformer three or four turns from the closed position. (Care should be taken that the screw does not become dislodged from the nut.)

(h) Adjust the top and then the bottom trimmers of the first i-f transformer for maximum output.

(i) Transfer the output lead of the signal generator from the 6L7 tube to the "Ant" terminal of the receiver and increase the output of the signal generator, if necessary.

(j) Adjust the middle trimmer of the second i-f transformer by opening condenser until maximum output is obtained. (*Do not readjust the top and bottom trimmers.*)

(k) Adjust the middle trimmer of the first i-f transformer by closing condenser until maximum output is obtained. (*Do not readjust the top and bottom trimmers.*)

Aligning R-F Amplifier

When aligning the r-f amplifier the output lead of the signal generator is connected to the "Ant" terminal of the receiver. For the blue, red and green, bands a 0.00025-mfd condenser must be connected in series with the output lead of the signal generator and for the high-frequency band a 400-ohm carbon resistor should be used in place of the condenser.

Each band should first be shunt aligned and then series aligned where provision is made for series alignment (blue, red and green bands). The band selector switch should be set for the band being aligned and the signal generator should be set to the frequency indicated below for each adjustment.

(a) Adjust the "osc," "r-f" and "ant" parallel trimmers (Figs. 4 and 2) in the order given for maximum output. Rock the station selector slightly around the generator signal and then check the adjustments of the "r-f" (Fig. 4) and "ant" trimmers (Fig. 2) in the order given. *Do not readjust the "osc" trimmer.*

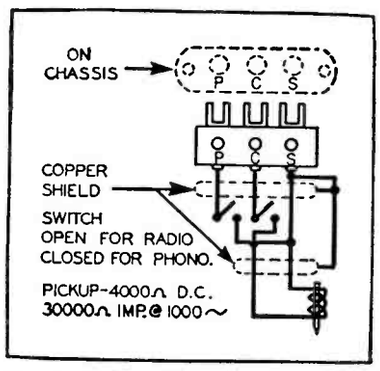


Fig. 5. Phonograph pickup connections.

Note: When shunt aligning the green and violet bands care must be exercised so that the circuits will be aligned on the fundamental frequency rather than on the image frequency which is approximately 900 kc less than the fundamental. To check on this, increase the output of the signal generator approximately ten times and try to tune in the signal both at the generator frequency as indicated on the station selector dial and at approximately 900 kc below the correct frequency. If the circuits have been properly aligned the signal can be tuned in at both positions, but much stronger at the correct position.

(b) To align the "series" trimmers (Fig. 2) set the signal generator to the frequency indicated (c) and then tune-in this signal with the station selector for maximum output. Tune the station selector approximately to the generator output. Adjust the series trimmer while rotating the station selector back and forth slightly until no further improvement in output can be obtained.

(c) Signal input frequencies for alignment follow: blue-band shunt alignment, 400 kc; series, 150 kc; red-band shunt, 1700 kc; series 600 kc; green-band shunt 6000 kc; series 2500 kc; violet-band shunt 18000 kc; no series alignment.

Phonograph Pickup

Chassis equipped with a universal power transformer also have three terminals on the back for connecting a phonograph pickup. These terminals are marked P C S and the pickup is connected through a double pole—single throw switch to these terminals as shown in Fig. 5.

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G.E. Model A-54

The G. E. A-54 is an a-c, d-c metal-tube, two-band, five-tube superheterodyne. It has a tuning range from 540 to 1720 kc on the broadcast band, and from 2300 to 7000 kc on the short-wave band.

The Circuit

The complete circuit diagram, showing the tubes and their functions, is given in Fig. 1. For additional con-

venience an underchassis view is given (Fig. 2) showing the location of the trimmers and the voltages encountered at the various socket prongs, etc. These voltages are measured with the antenna disconnected and the volume control on full. A 1000 ohms-per-volt voltmeter was used.

The signal from the antenna is applied to the control grid of the 6A8 tube through the r-f transformer, the secondary of which is tuned to the incoming signal by the rear section of the main tuning condenser. The local signal is generated by the oscillator section of the 6A8, and the proper frequency difference is maintained throughout the tuning range by the front section of the tuning condenser, oscillator coils, and padding capacitors.

The combination of the two signals produces the intermediate frequency of 465 kc. The intermediate frequency amplifier consists of a 6K7 tube and two transformers, both of which have tuned primaries and secondaries.

The output of the i-f amplifier is rectified by the diode section of the 6Q7 tube, providing avc bias as well as detection. The a-f voltage developed across R-7 is applied through C-18 to the grid of the triode section of this tube from the variable arm of R-7 which constitutes the volume control of the receiver. The d-c voltage developed across R-7 is applied to the control grids of the 6A8 and 6K7 tubes for avc.

The output of the 6Q7 amplifier section is resistance coupled to the grid of the 25A6 power amplifier pentode. The plate circuit of the 25A6 is suitably

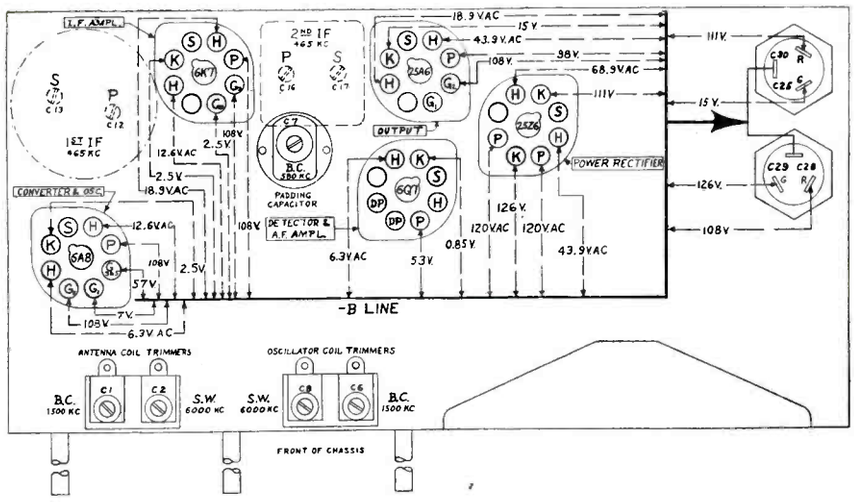

Fig. 2. Underchassis view with voltages encountered.

matched to the loudspeaker by means of an output transformer.

The tone control circuit consists of an 0.05 mfd capacitor which is connected from the plate of the 25A6 tube to B-lead through the tone control switch.

When the receiver is used on a-c, plate and grid voltages and loudspeaker field current are supplied by a 25Z6 rectifier tube and its associated filter circuits.

When the receiver is used on a d-c supply the 25Z6 rectifier tube remains in the circuit and serves two purposes. If the power cord should be plugged in with incorrect polarity, the 25Z6 tube protects the filter condensers from damage. On correct d-c polarity the 25Z6 tube aids the filter circuits in smoothing the supply, thus minimizing the line noise.

The heaters of all tubes and the dial light with its shunt ballast resistor (the 30-ohm section of R12) are all in series and are furnished current from the power line through a dropping resistor (the 150-ohm section of R12).

Note that the chassis is not connected directly to either the ground lead or to the power supply, but is by-passed to the B-lead by various condensers.

I-F Alignment

The i-f amplifier should be tuned to 465 kc; set the test oscillator dial at

(*Continued on page 221*)

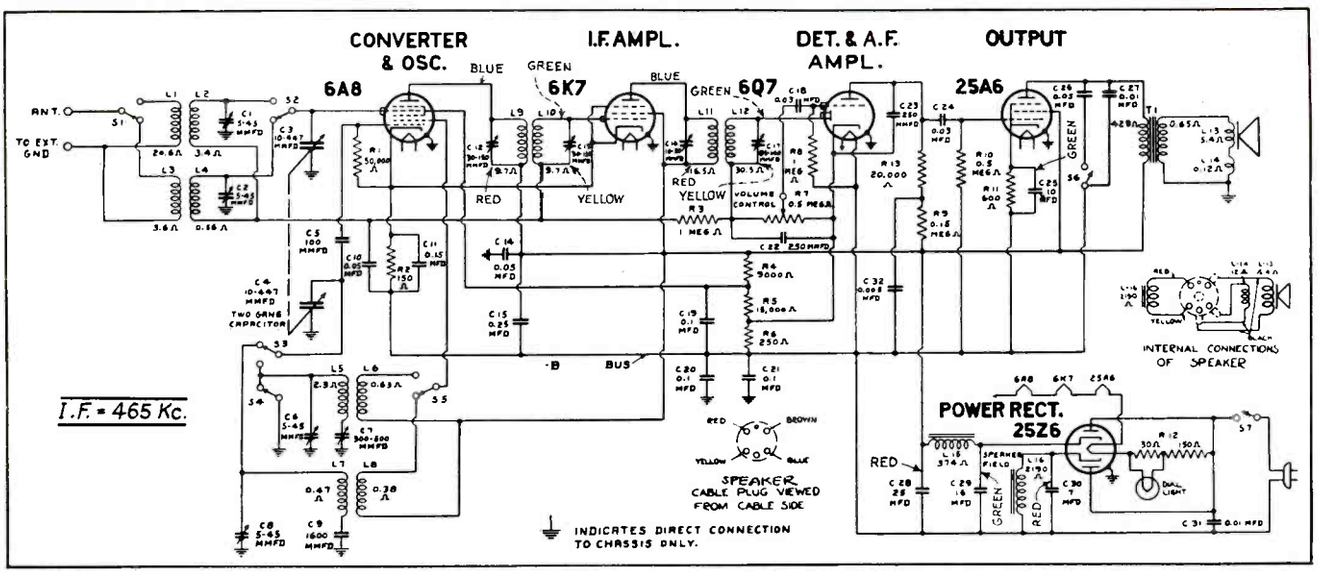

Fig. 1. Complete circuit diagram G.E. A-54.

Auto-Radio . . .

Emerson Model 6A

The Emerson Model 6A is a 6-tube superheterodyne of the conventional type, completely powered from a 6-volt storage battery supply. The complete circuit diagram is shown in Fig. 1.

The Circuit

An r-f stage using a 78-type tube is employed ahead of the 6A7 combination first-detector-oscillator. A special cut for the oscillator section of the tuning condenser maintains the frequency difference between the incoming signal and the local set oscillator. A single i-f stage is employed, using a 78 tube and a doubly tuned i-f transformer. The type 85 tube used as second-detector avc and first audio stage is fed from a primary tuned i-f transformer. A 41 tube is used in the output stage.

I-F Alignment

To align the i-f transformers, use a good modulated oscillator set for 172½ kc. Set the volume control for maximum volume and turn the dial to a point where little or no signal is received; then ground the antenna.

Connect the oscillator output between the grid of the 6A7 tube and ground. Connect an output meter across the primary of the speaker transformer, or across the voice coil. Using the smallest output from the test oscillator that will give a reading on the meter, adjust the trimmers on the two i-f transformers for the largest reading obtainable. Use a non-metallic screw driver if possible.

R-F Alignment

To align the r-f and oscillator sections, couple the oscillator through a standard dummy antenna to the antenna lead and ground the receiver. Set the test oscillator to some frequency near 1400 kc. Set the dial to the frequency selected. Adjust trimmers on the variable condenser, beginning with the oscillator trimmer. Reduce the output of the test oscillator and repeat. If an output meter is not available, adjust for maximum volume, then reduce the input and repeat.

Voltage Analysis

The voltages lettered on the circuit diagram, Fig. 1, were measured from ground to the points indicated. A 1000-ohm-per-volt voltmeter was used. The volume control was advanced to maximum and the antenna lead was connected to the chassis during all readings. The voltage at the storage battery was 6.3 volts, at the heaters: 5.5 volts, at the field: 5.5 volts.

A 10-ampere fuse is located in a small tubular holder in the battery lead. To replace the fuse, remove the cap, insert the fuse and replace the cap. The fuse is intended to protect the receiver, and in no case should one larger than 10 amperes be used.

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Fada 266, 266SD, 266SG

These are 6-tube auto receivers available with combined or separate speaker. The circuit is of the superheterodyne type using a combination of glass and metal tubes. The complete schematic is shown in Fig. 1 with the tubes used, their functions and the voltages encountered throughout lettered on the diagram. The voltages were taken with a 1,000-ohm-per-volt voltmeter while the antenna was shorted to the chassis, the volume control on full and the battery

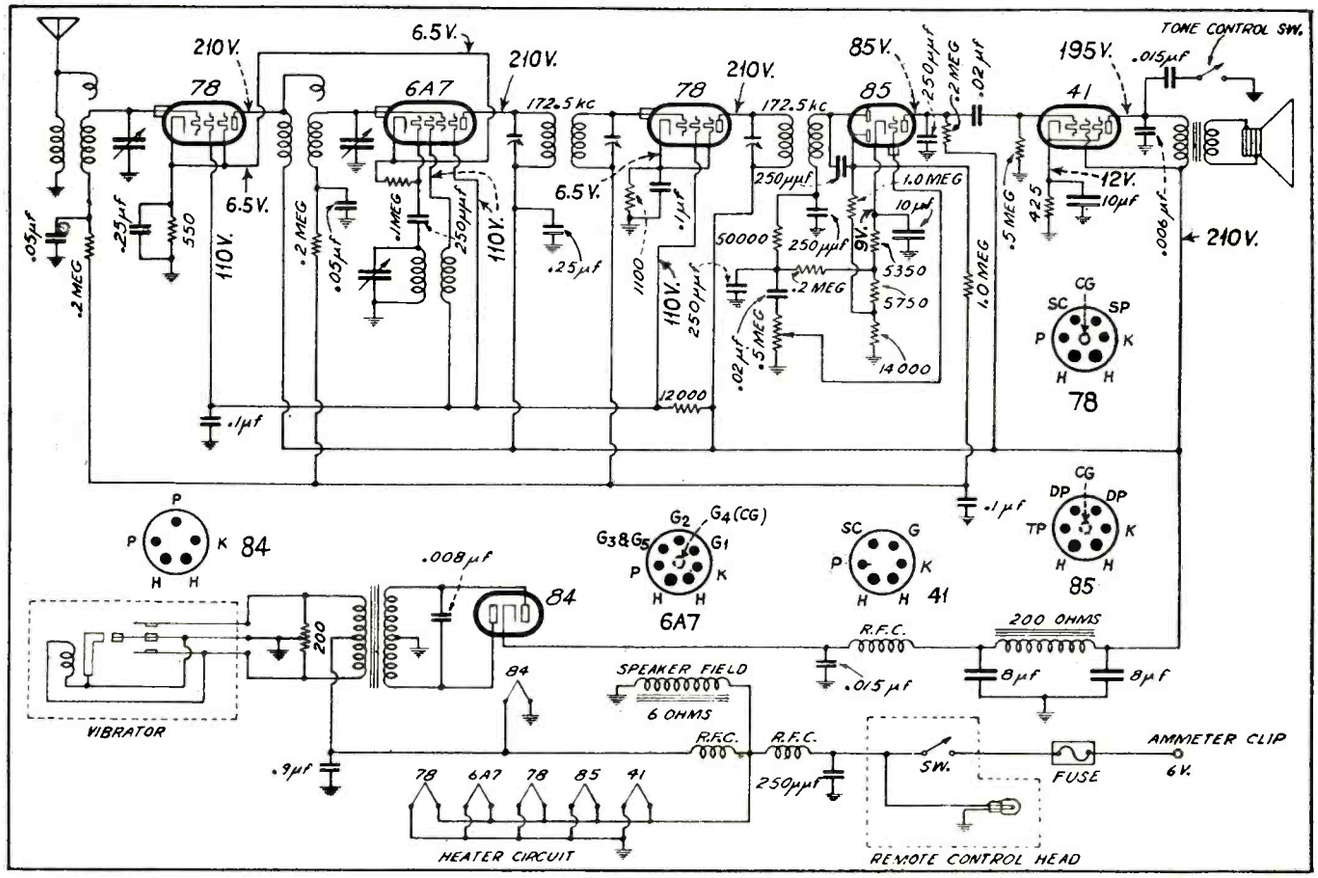


Fig. 1. Complete circuit diagram, Emerson 6A.

WATCH MORLEN IN JUNE

Next month, on this page, we will make an announcement which will be of vital importance and great interest to owners, installers and operators of public address equipment.

Make certain that you are on our mailing list to receive all notices and bulletins.

MORLEN ELECTRIC COMPANY, INC.
60 W. 15TH ST. - NEW YORK, N. Y.

voltage at 6.3-volt. The sensitivity is rated at better than one microvolt with low background noise. This is attributed to the introduction of an iron-core antenna coil.

Alignment Procedure

The output meter is connected across the primary of the speaker transformer. Turn on both the receiver and the signal generator. Short out the oscillator section of the tuning condenser. Set the volume control at the maximum position.

I-F Alignment

Connect the antenna lead of the signal generator through a .05-mfd condenser to the grid of the 6A7 tube.

Connect the ground lead of the signal generator to the chassis ground. Set the signal generator to 175 kc.

Attenuate the signal from the generator so that the output meter reads in the center of the scale. The signal in the speaker should be audible but not loud.

Adjust the three i-f trimmers until maximum output is obtained, keeping the signal low at the signal generator. Repeat this adjustment.

R-F Alignment

Set the signal generator for 1,500 kc. Turn the rotor of the tuning condenser to the full open position. Remove the short from the oscillator section.

Connect the shielded antenna lead from the chassis through a 150-mmfd condenser to the antenna post of the signal generator.

Adjust the trimmer of the oscillator section of the three gang condenser until maximum output is obtained, keeping the signal low by means of the attenuator on the signal generator.

Adjust the first-detector and antenna trimmers for maximum output. Repeat the adjustment.

Calibrating the Dial

Another adjustment required after the receiver is installed in the car is the calibration of the dial. Tune in a nearby station of known frequency at about the center of the dial. Loosen the screws on the remote control, and rotate the dial to correspond with the frequency of the station.

•

RCA Model 5M

Model 5M is a single-unit receiver containing the radio chassis, power conversion system, and loudspeaker all in one housing. A convenient three-contact loudspeaker receptacle installed on the chassis case permits the addition of a remote dynamic loudspeaker if desired. The circuit diagram is shown in Fig. 1, with the tubes and their functions indicated. The average current drain at 6.3 volts is 6.5 amp. The frequency range is from 540 to 1600 kc.

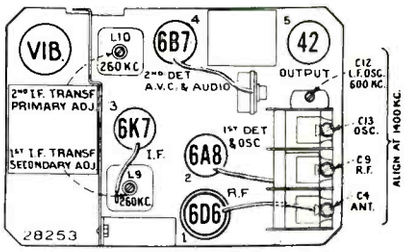


Fig. 2. Chassis view, RCA 5M.

Engineering Features

Engineering features incorporated in this instrument are: the inclusion of ignition suppression means within the circuits of the receiver; reduction of power line modulation in antenna circuit; improved high-gain molded core antenna coil; permeability-tuned i-f transformers; continuously variable high-frequency tone control; and a plug-in type of synchronous rectifier-vibrator for obtaining high-voltage supply. Correct arrangement of parts, adequate shielding, and the insertion of filters at proper points in the circuit insure minimum disturbances from apparatus associated with the electrical circuits of the automobile and from adjacent power lines.

(*Continued on page 219*)

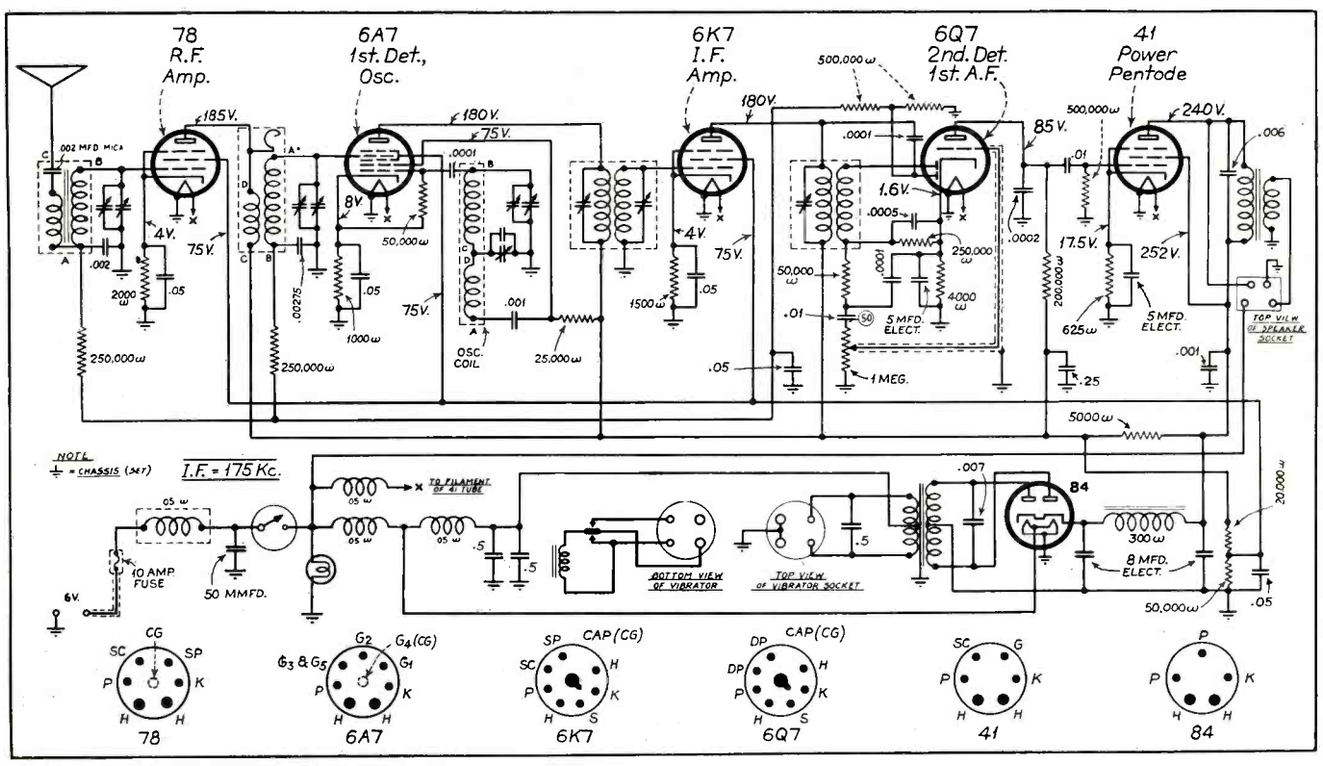


Fig. 1. Complete circuit diagram, Fada 266, 266SD, 266SG.

Technical Features of 1936 Auto-Radio Receivers

	G.E.	HOWARD	MOTOROLA				PHILCO			RCA			REMLER	SPARTON			STEWART WARNER	TIFFANY TONE	TRAV-LER			TROY	WARWICK		WELLS GARDNER	WESTINGHOUSE		ZENITH			
Model No.	N-60	HA6	50	60	80	Golden Voice	817	818	819	5M	6M	6M2	37	D-686	H-686	S-676	1601	537 538	54A	542	642	68	550	660 686	6R	WR 502	WR 503	5M90	6M90	6M91	6M92
Number of Units	1	1	1	2	2	2	1	2	2	1	1	2	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	–	–	–
Total Current Drain	7	6.8*	6	6.5	8	9	–	–	–	6.5*	7.3*	7.3	7	6		6	6.5	4.5*	5.7	5.9	6.7	.5	5.6	6.2	6.5	6		5.6	6.5		6
Frequency Range	530 to 1650	540 to 1500	535 - 1600				540 - 1600			540 - 1600			550 to 6000	–	–	–	530 to 1600	550 to 1600	535 - 1500			550 to 1550	530 - 1550		530 to 1650	540 - 1600		–	–	–	–
Maximum Audio Power	4	3.5	–	–	–	–	–	–	–	4	9	9	3.4	–	–	–	3	2	3.1	4		2	2.5	3	3	3.5		–	–	–	–
I-F. Peaks	175	465	262				260			260			250	172.5			177.5	469	456			465	456	262.5	175	175		456	252.5		
Speaker	6	6	5	6	8	10	–	2 SPKRS	2 SPKRS	6	6	$8\frac{1}{4}$	6	$8\frac{3}{4}$	9	6	$6\frac{1}{2}$	5	5	$5\frac{1}{2}$†	$6\frac{1}{2}$†	5	5	6	6	6		5	6	Choice	6
I-F. Adjustments	3	4	4				4			4			4	–	–	–	3	4	4			4	4	3	3	3	4	–	–	–	–
R-F. Shunt Adjustments	3	3	3				3			3			3	–	–	–	3	2	2		3	2	2	3	3	3		–	–	–	–
R-F. Series Adjustments		3	4				2			1			1	–	–	–						1		2		1		–	–	–	–
R-F.	6K7	6D6	78		6K7		78			6D6			6K7	6K7			6D6				6D6			6D6	6D6	77	6J7		6K7		
First Detector	6J7	6L7G	6A7		6A8		6A7			6A8			6A8	6A8			77	6A7	6C6		6A7	6A8	6C6		6C6	77	6A8	6A7	6A8		
Oscillator		76																													
First I-F.	6K7	6D6	78		6K7		78			6K7			6K7	6K7			6D6	6D6	6D6			6K7	6D6		6D6	78	6K7	6D6	6K7		
Second Det., A.V.C.	6Q7	75	75		6H6		75			6B7	85		6Q7	6Q7			75	75	75			6Q7	75		75	75	6H6	75	6Q7		
First Audio					6C5																						6F5				
Second Audio											6C5		6C5																		
Output	6F6	6B5	41	6B5	PP 6N6	PP 6F6	41		PP 41	42	6A6		6F6	6F6			41	42	42	6B5		6F6	42		41	42	6F6	41	6F6		
Rectifier	6X5		84			6H6 0Z4	84							84			84	84	84		0Z4	84	84		84	84	0Z4	84	6X5		

* Add 1 Amp. for extra speaker

† Curvilinear cone

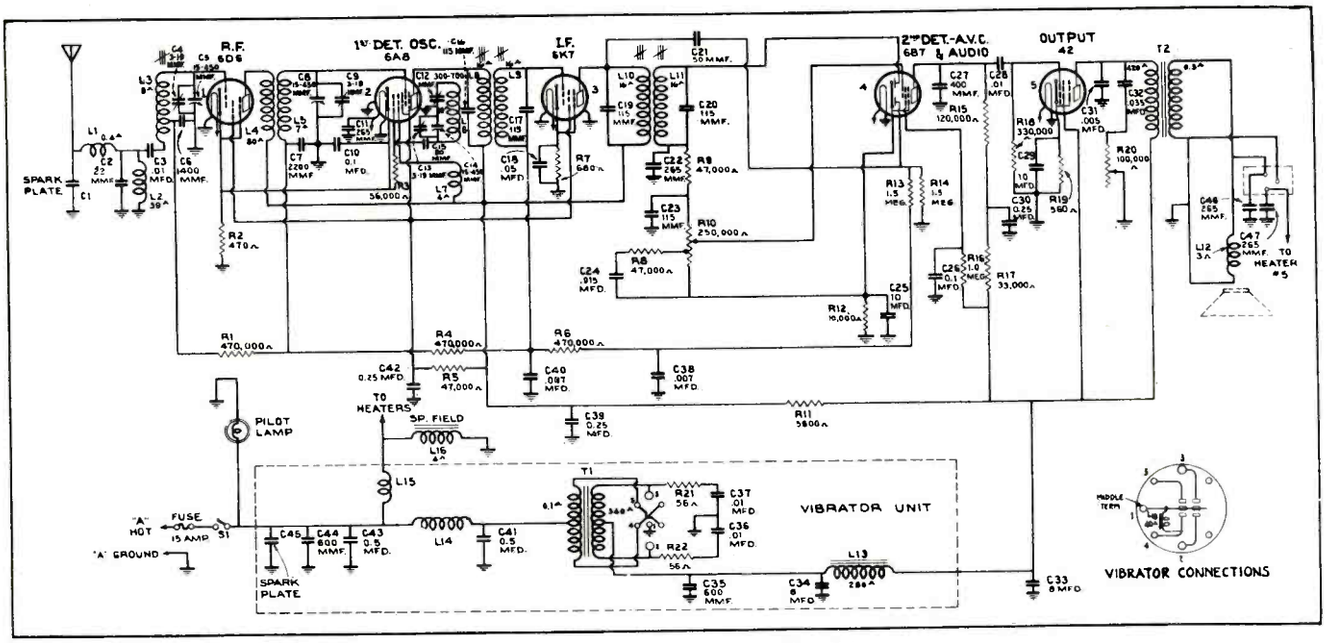


Fig. 1. Complete circuit diagram, RCA 5M.

Alignment Procedure

There are four alignment trimmers provided in the antenna-, detector-, and oscillator-coil tuned circuits. The i-f transformer adjustments are made by means of four screws attached to molded cores.

Note: The antenna coil has a molded core which is adjusted at the factory for the correct inductance. This adjustment should not be disturbed.

Place the receiver in operation with its two covers removed. Attach the output indicator across the loudspeaker voice-coil circuit or across the output transformer primary. Advance the receiver volume control to its maximum position, letting it remain in such position for all adjustments. For each adjusting operation, regulate the test oscillator output control so that the signal level is as low as possible and still observable at the receiver output. Use of such small signal will obviate broadness of tuning which would otherwise result from avc action on a stronger one.

I-F Adjustments

(a) Connect the output of the test oscillator to the control grid cap of the i-f tube (6K7) through a 0.25-mfd capacitor and connect the ground of the oscillator to the receiver chassis. Tune the oscillator to 260 kc, place its modulation switch to "On" and its output range switch to "Hi."

(b) Adjust the 2 screws (attached to the moulded cores) of the second i-f transformer, one on top and one on bottom, for maximum output.

(c) Remove the test oscillator from the i-f tube input and connect it between the control grid cap of the first detector tube (6A8) and chassis-ground, using the 0.25 mfd capacitor as previously. Allow its tuning to remain at 260 kc.

(d) Adjust the two screws of the first i-f transformer for maximum (peak) receiver output. The indication for this adjustment will be broad, due to the "flat-top" characteristic of the i-f system. The two screws should, therefore, be very carefully adjusted so that the indicator remains fixed at maximum as the oscillator is shifted through a range 2 kc above and below its normal setting of 260 kc. An irregular double-peaked indication is to be avoided.

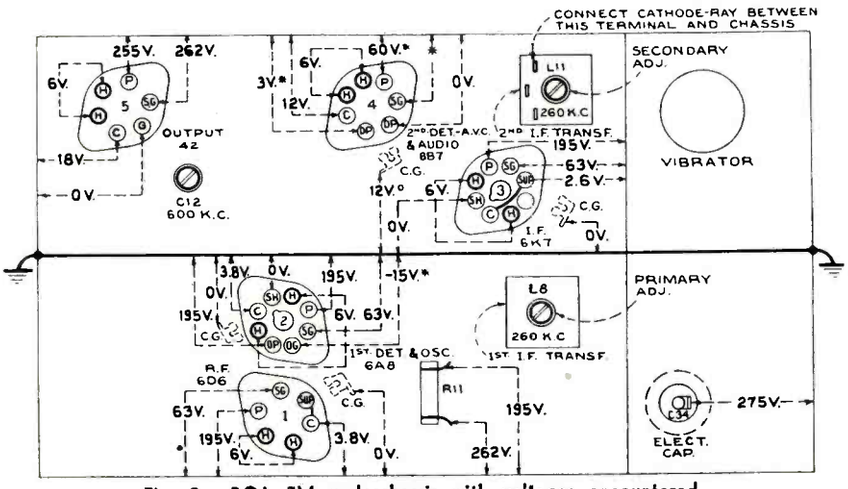


Fig. 3. RCA 5M underchassis with voltages encountered.

R-F Adjustments

Note: Before making r-f adjustments, it may be advisable to replace the bottom cover to eliminate vibrator interference.

(a) Adjust the dial pointer on the remote control head by the following procedure. Rotate tuning knob to its extreme clockwise position irrespective of location of pointer on dial. Now turn the pointer adjusting screw in the center of the back of the control unit until the pointer is at the end of calibration mark beyond the 55 on dial scale.

(b) Connect the output of the test oscillator to the antenna ground terminals of the receiver with a 175-mmfd capacitor in series with the antenna lead.

Note: For r-f alignment of receivers in which the tubular paper condenser C-3 (.01 mfd) has been replaced by the

Technical Features of 1936 Auto-Radio Receivers

	ARVIN			ATWATER-KENT					AUTO-CRAT		BOSCH			CHAMPION		CONTINENTAL	CROSLEY		CORONA	DELCO					DE WALD			EMERSON	FADA			FISCHER & SMITH	
Model No.	18	28	33	126	136	556	416	446	505	618	736	737	738	501	601	U6	A-156	A-166	130	631	632	633	634	635	517	517R	617 605R	E128	266	266 SO	266 SF	72	74
Number of Units	1 or 2			1	2	1	1	2	1	1	1	2	2	1	1	2	1	2	1	1	1	2	2	1	1	1	1	1	1	2	2	1	2
Total Current Drain	5.5 *			6.8 *			6.8 *		5	6	6.5			4.7	5	-	6.3	6.2	5.25	6.5	7	7	7.25	7.25 *	6.25	5.25	6	6.3	5.8			6	8
Frequency Range	535-1600			540-1600			540-1600		550 to 1500	550 to 1500	540-1600			550 to 1500	550 to 1500	550 to 1550	-	-	540 to 1550	-	-	-	-	-	540-1600			540 to 1530	540-1600			550 to 1600	550 to 1600
Maximum Audio Power	3.5			4	4	3	4		2.5	3	4			3	3.5	3.5	4	6	3	-	-	-	-	-	3.5	3	4	3	3			3	6
I-F. Peaks	177.5			264			264		456	175	175			456	175	175	172.5		456	262					456		175	172.5	175			262	
Speaker	6			$6\frac{1}{2}$	$6\frac{1}{2}$ or $8\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{2}$ or $8\frac{1}{2}$	5	6	6	5	8	5	6	-	-	9	5	6	6	5	8	5 and 8	5	5	6	5	$6\frac{1}{2}$	8	$5\frac{3}{8}$	5	6
I-F. Adjustments	4			4			4		4		4			4		-	-		4	-	-	-	-	-	3			3	3			4	
R-F. Shunt Adjustments	3			2			2			1	3			2	3	-	-	-	2	-	-	-	-	-	2	2	3	3	3			3	
R-F. Series Adjustments				2			2									-	-	-	1	-	-	-	-	-			1		1			1	
R-F.	78			6K7G			6K7			78	6K7				6K7	6D6		6D6									6D6	78	78			6D6	
First Detector / Oscillator	6A7			6A8G			6A8		6A7		6A8			6A7	6A8	6A7	6A7		6A7	6A7					6A7			6A7	6A7			6A7	
First I-F.	78			6K7G			6K7		6D6	78	6K7			6D6	6K7	6K7	6B7		6D6	6B7		6D6			6D6			6B7	6K7			6D6	
Second Det., A.V.C. / First Audio	75			6Q7G			6Q7		75		6H6 / 6F5			75	6Q7	75	6B7 / 6D6	76	75	6B7 / 6D6		85			75			6B7 / 76	6Q7			75	
Second Audio																																	
Output	42			6F6G			6F6		41		6F6			41	6F6	6F6	42	PP 41	41	6B5			PP 41	PP 6F6	41			41	41			42	PP 41
Rectifier	84			6X5G			6X5		84		0Z4			0Z4		84	84		84	84					84	0Z4	84	84	84			84	

* Add 1 Amp. for extra speaker

small molded condenser, 500 mmfd, use a .001-mfd capacitor instead of the 175 mmfd capacitor in series with the antenna lead and test oscillator.

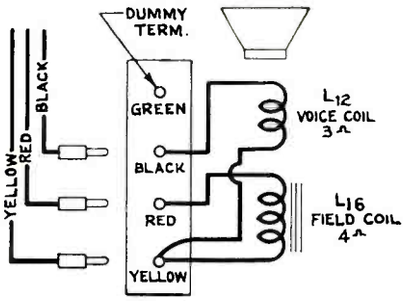


Fig. 4—External speaker connections.

There should be a shunt capacitor of 50 or 60 mmfd from the antenna lead at the receiver to ground. Tune the oscillator to 1,400 kc. Allow the output indicator to remain attached to the receiver output.

(c) Tune the receiver so that the dial reading is 1,400 kc. Then adjust the oscillator, detector, and antenna-coil trimmers, C-13, C-9, and C-4, respecing maximum indicated receiver output.

(d) Shift the oscillator frequency to 600 kc and tune the receiver to pick up this signal, disregarding the dial reading at which it is best received. The oscillator series trimmer, C-12, should then be adjusted, simultaneously rocking the receiver tuning control backward and forward through the signal until maximum (peak) receiver output results from the combined operations. The adjustment of C-13, C-9, and C-4 should be repeated as in (c) to correct for any change in its alignment due to the adjustment of C-12.

Final Dial Adjustment

Final adjustment of the dial pointer may be made during operation after the receiver is installed in automobile. To do this tune in a station of known frequency (say 760 kc—approximately 76 on the dial) as accurately as possible. Now reset the dial pointer to exactly 76 on the dial by means of the adjusting screw at center rear of operating head.

(b) Short-wave Band

With the frequency band-switch in the counterclockwise position, set the receiver dial at 6.0 mc. Set the test oscillator at 6000 kc and adjust the short-wave oscillator trimmer for maximum output. Next, set the short-wave r-f trimmer for maximum output. Repeat these adjustments a second time. After aligning the s-w band, turn the test oscillator to approximately 6930 kc with the receiver dial still at 6.0 mc. Increase the test oscillator output until a signal is heard in the neighborhood of 6930 kc. This is the image frequency and if the set has been properly aligned the sensitivity at this point will be much less than at 6000 kc. In the event the image frequency cannot be found, the alignment should be rechecked at 6.0 mc. It will be noticed that the oscillator trimmer will have two positions at which the signal will give maximum output. The position which gives the lower trimmer capacitance obtained by turning the trimmer screw counterlockwise is the proper adjustment.

When these adjustments have been completed the receiver will be in alignment.

•

GENERAL DATA—continued

this frequency. Set the volume control at maximum and short-circuit the antenna and ground leads. Tune the receiver to a point where no signal comes in.

Connect the test oscillator output between the 6A8 converter tube grid (with the grid cap on) and the chassis. Connect the output meter across the cone coil of the speaker and adjust the oscillator output until a small deflection is observed in the output meter.

The four i-f trimmers are adjusted in the following sequence:

1. Secondary trimmer on second i-f transformer. (See Fig. 2.)
2. Primary trimmer on second i-f transformer.
3. Secondary trimmer on first i-f transformer.
4. Primary trimmer on first i-f transformer.

Throughout all adjustments the output should be maintained at a low level by decreasing the test oscillator output as the various stages are brought in line. After these adjustments have been made, the same procedure should be repeated as a final check. The i-f alignment will then be complete.

R-F Alignment

The r-f and oscillator transformers are aligned at 580, 1500, and 6000 kc. With the tuning condenser plates fully meshed, line up the pointer and dial by adjusting the dial set screws so that the line at the extreme end of the dial is indicated.

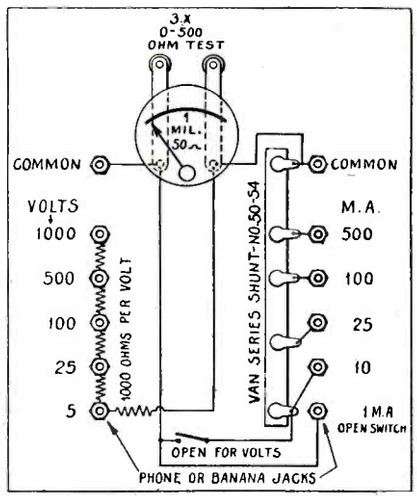
(a) Broadcast Band

With the band switch in the clockwise position, set the tuning dial to 1500 kc. Set the test oscillator at 1500 kc and adjust the oscillator trimmer for the broadcast band for maximum output. Next, set the r-f trimmer for maximum output, taking care that the output from the test oscillator is not high enough to overload any part of the set. After these adjustments, tune the set and the test oscillator to 580 kc. Adjust the broadcast padding capacitor for maximum output while rocking the tuning condenser back and forth until maximum output is obtained. The dial setting after this adjustment may not agree exactly with the frequency, but this is not important.

To complete the broadcast-band lineup, repeat the adjustment at 1500 kc, as before.

Series Shunts

A series shunt is a combination of meter shunts connected end to end and the complete assembly connected across the meter terminals. In the type shown



the shunt is connected directly across the meter terminals and the external circuit is connected to different points on the shunt.

D. L. Van Leuven

Public Address . . .

MATCHING TRANSFORMERS TO SPECIAL PURPOSES

By I. A. MITCHELL*

A transformer does not represent a device having definite impedances but rather, a power or voltage transfer device which has an impedance ratio. That is, the impedance measured on the primary bears a definite relationship to the load on the secondary. This impedance on the primary is called the *reflected* impedance.

In other words, a transformer having a step-down ratio of 2 (total primary to total secondary) with 1000 ohms on the secondary, 2000 ohms would be reflected on the primary. Similarly, with 2000 ohms on the secondary, 4000 ohms would be reflected on the primary.

Due to limitations in commercial transformers a given unit cannot be used for a wide range of impedances, other than that for which it was originally designed, or frequency discrimination and loss of power transfer will result. Analysis of the equivalent T circuit will show the cause of this loss.

In addition to the power transfer characteristics of the simple transformer (as shown in Fig. 1A) a primary inductance shunts the source impedance, a leakage reactance, in effect, operates in series with the load, and a distributed capacitance can be lumped to shunt the load. This simplified form is indicated in Fig. 1B. As the frequency feeding the transformer is reduced the impedance of the primary inductance decreases. This decrease may reach a point where some of the power, which normally would be transferred from primary to secondary, is shunted through this inductance. Similarly, as the frequency increases the impedance of the distributed capacitance decreases and shunts some of the power which would normally pass through the load.

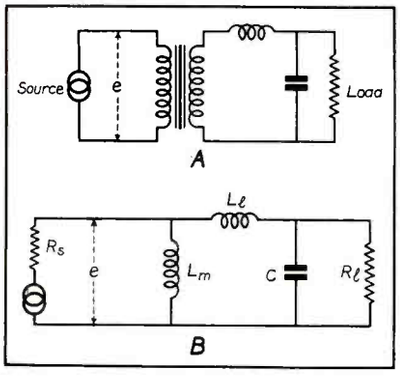


Fig. 1

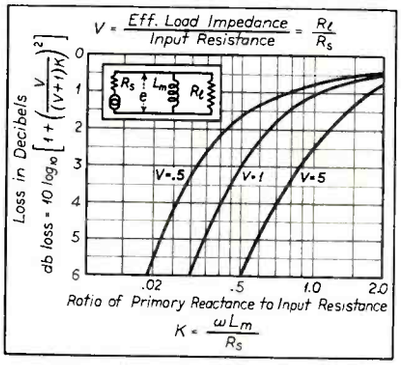


Fig. 2

The third element to be considered is the leakage reactance whose impedance increases with the frequency and produces a strong series loss at the higher frequencies. The effects of primary inductance, distributed capacitance, and leakage reactance, since they are all related with primary and secondary impedances, become variable depending upon these impedances. This is illustrated in the curves of Figs. 2 and 3. Fig. 2 illustrates the loss in low-frequency response caused by the primary inductance with the source and load impedances considered. It can be seen that as the source impedance increases the low-frequency loss increases; and as the ratio of the load impedance to the source impedance is increased the loss decreases. A similar effect, due to the distributed capacitance is illustrated in Fig. 3. Examination of these effects shows that an improvement in frequency response will be obtained if the source impedance is reduced, while the load remains constant. Conversely, a loss will result from an increased source impedance. This is illustrated in Fig. 4, where the operation of a typical line-to-grid transformer is shown with various source impedances.

Where special impedance matching is required several interesting and useful possibilities can be considered, as indicated above. These may be summarized as follows:

1. The primary impedance of a transformer depends on the secondary load.

2. A transformer may be used for impedances other than those for which it is rated without appreciable loss provided the variation is not too far from the manufacturer's rating; the original impedance ratio will still apply.

3. A transformer operating with a lower source impedance than normal will generally give a better frequency response.

The above-mentioned possibilities can be applied to actual cases. For example, an output transformer is required to match a pair of 46's in class B to a 6-ohm voice coil. Catalogs show standard transformers available for most tube combinations, but with secondary impedances of 5 ohms. The use of 6 ohms matched to a 5-ohm output usually would have no noticable effect, but 46's in class B are critical to load. Catalogs show, however, a transformer for 2A3's with a primary of 5000 ohms

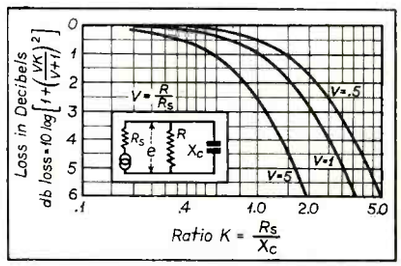


Fig. 3

and the 5-ohm secondary tap. Since the impedance ratio of this transformer is 1000 to 1, by loading the 6-ohm voice coil on the 5-ohm tap, a reflected impedance of 6000 ohms is obtained, instead of the original 5000 ohms. This matches the 46's and the standard transformer will suit our special requirements. In this case the variation from manufacturer's rating is only 20% and the use will still be within the range of the transformer. Greater variations from ratings, however, are not recommended.

It is desired to match a 30-ohm dynamic microphone to the grid of a tube. The nearest standard transformer available has a split primary with which 50 ohms can be obtained. Since operating this transformer from a lower source impedance than that for which it is rated will improve its frequency characteristic (see Fig. 3), this tap will be satisfactory.

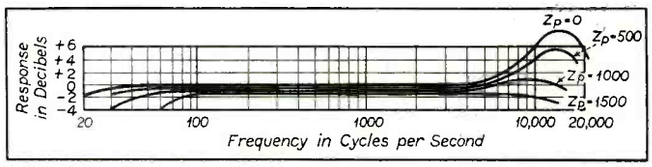
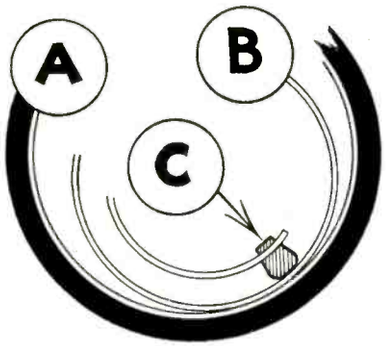


Fig. 4

*Chief Engineer, United Transformer Corp.



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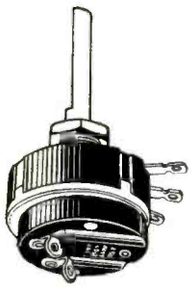
A. Resistor strip on inner circumference of Bakelite case has longest possible length to insure smooth volume control and low noise level.

B. Highly polished non-rotating metal band contacts the resistor over a large area. Result, low contact resistance with light pressure, low noise level, no resistance change or wear.

C. Oilless wood bearing provides the contact pressure and glides over the polished metal band when control is rotated. Permanently quiet and smooth turning.



These exclusive Centralab contact features are covered by U. S. A. patent Nos. 1653745, 1660879, 1704154.

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The economical system for the radio service dealer. This system can be used on either 6 V. D.C. or 110 V. A.C. by simply plugging in the right power pack. Thus you have two complete systems. It can be used for any kind of rental and has many distinct applications for sales where this type is most ideal.

This system is complete and has all the latest refinements; Hand Type Crystal Microphone, two 12" Permanent Magnet Speakers with dustproof voice coil construction. Mixes microphone and phonograph, tone control also incorporated, phonograph unit has high fidelity pickup and Universal electric turntable motor.

The plug-in type power pack is an exclusive WEBSTER-CHICAGO development (patent pending). The use of the phonograph turntable and pickup as an integral part of the system reduces size and cost. Excellent frequency response and low hum level.

Amplifier uses 1—6C6, 3—6A6, 1—6E6. For A.C. operation additional tube No. 83 is used. All tubes furnished with system.

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TEST EQUIPMENT . . .

Display Value of Test Equipment

SERVICE Men are today faced with the necessity of investing in modern and complete equipment in order to give competent service to the customer. When making an investment in new equipment it is to his advantage to consider not only the quality and utility of that equipment but also to make certain that he can take advantage of its display value. In so doing he is taking proper steps to insure a reasonable return on his investment.

The Service-Lab

As an example of the foregoing comment this article illustrates and describes the complete "Service-Lab" suggested by one manufacturer of test equipment. A full illustration of this complete unit is shown in Fig. 1. Although quite impressive at first glance, the unit reveals the following facts:

1. The foundation unit is a standard 19-in. wide relay rack 34 in. high. Individual instruments (with panels designed for relay rack installation) have been assembled on this relay rack and so arranged for a maximum of convenience and utility.

2. The lower unit consists of a dynamic analyzer for the purpose of complete tube testing and also for complete receiver testing, including point-to-point tests and component tests. The instrument panel is 19 in. long and 10½ in. high. The panel is cast aluminum with suitable openings for control panel, socket panels, meter, etc.

3. The central unit in the assembly is a complete frequency modulated signal generator. This instrument may be used for any purpose where a test oscillator is required.

Fig. 1. The complete Service Lab.

4. The upper unit in the illustration is a complete cathode-ray oscillograph incorporating the features required in modern service work. This instrument contains separate amplifiers for the vertical and for the horizontal deflecting plates (right- and left-hand panels). The oscillograph is also provided with complete linear timing controls for securing a steady image (lower control panel).

Convenience and Utility

A careful consideration of the equipment described reveals advantages both in display value and in utility. In many shops bench space must be carefully conserved to give adequate working room. An assembly such as the "Service-Lab" occupies bench space of approximately 20 by 25 inches as compared to many times this space if the instruments were individually placed on the service bench.

All instruments are centralized at one point, and this facilitates circuit analysis and receiver alignment.

The complete equipment installation is ruggedly assembled and installed; therefore individual instruments are less liable to damage through accident.

If the test unit which the Service Man wishes to adapt for the relay rack happens to have a height which is an exact multiple of 1¾ in., the Service Man can easily make two right-angle brackets from sheet metal and attach them to the instrument.

Many optional arrangements will suggest themselves to the reader depending on the exact nature of the equipment to be mounted. It is well to remember several points about the installation setup.

1. Seldom used or obsolete equipment will only occupy space that could better be used by a modern, regularly used instrument.

2. Arrange each instrument for a maximum of convenience. If two intruments are associated in practical use, such as a signal generator as unit number one, and a cathode-ray oscillograph as unit number two, mount these two units adjacent to each other on the relay rack.

3. Keep in mind the display value of the entire assembly and make plans carefully to achieve this valuable commercial feature.

4. If the service shop has a display window facing the street, consider the suggestion that the service bench be moved up near this display window and the "Service-Lab" installation placed prominently in view.

P. F. Jackson, President, Jackson Electrical Instrument Co.

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The Set-Tested Radio Tube

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Emporium, Pa.

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The most important WIDE-RANGE development since the first appearance of the pickup in 1926

Winners in the name contest for this revolutionary new AUDAX pickup are

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Yvan de Seve, Station CKCV, Canada
T. R. Stretton, London England
M. L. Perusquia, Mexico, D. F.
Keith La Bor, Los Angeles, Cal.

●

Among the thousands of letters received, many wrote: "Why give a new name to a product already bearing one of the proudest names in the world of fine tonal equipment—AUDAX."

Very well then: AUDAX-MICRODYNE it shall be. AUDAX—a name synonomous with quality and performance for over 20 years.

Details on AUDAX-MICRODYNE, the new pickup employing a radically new principle, will be released in the next issue. Watch for this history-making announcement . . . the story of MICRODYNE, the pickup in which the bug-a-boo of moving-mass, has, at last, been conquered and eliminated.

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ON THE JOB . . .

The 6E5 as a Service Tool

THE 6E5 is a tube of divers uses—designed originally as a tuning meter for higher priced sets. More recently, it has come to the attention of the experimenter and Service Man as a worthwhile addition to his test equipment. Properly placed in a simple circuit, the 6E5 can be used instead of the vacuum-tube voltmeter or as an output meter. The same device will also measure a-c and d-c voltages.

THE CIRCUIT

Power for the 6E5 is obtained from a 25Z6 in a voltage doubler circuit, with two 2-mfd *paper* filters. It is essential at this point to use paper condensers to prevent the interconnection between the test prods and the a-c line which would be caused by the use of electrolytics. If the voltage to be measured is a-c, it will be rectified by the 6H6 which will then supply d-c bias voltage to the grid of the 6E5. Small condensers in series with each a-c input prod eliminate any undesired d-c components. No switching is required, since rectifying the d-c will not affect the calibration. A 1-megohm potentiometer is provided in the diode return, and grid voltage for the 6E5 is tapped from it.

OPERATION AS A VOLTMETER

At first it was considered advisable to read the voltages as indicated by the angle of shadow on the eye. However, the scale is rather small and as only one-half the angle can be used in actual measurement, another more effective means of reading voltage had to be devised.

We know that the eye will close when the grid is biased minus 8 volts. Let us say that the voltage to be measured is 100 volts d-c. The drop through the 6H6 is about 20 volts, with 80 volts across the potentiometer (which is one megohm) 8 volts would be obtained when the arm of the pot is 100,000 from ground. No matter how often 100 volts d-c is measured, the same position of the potentiometer arm will always just close the eye. A similar condition holds for any voltage—and it follows that the scale on the potentiometer can be calibrated directly in volts. Then for any

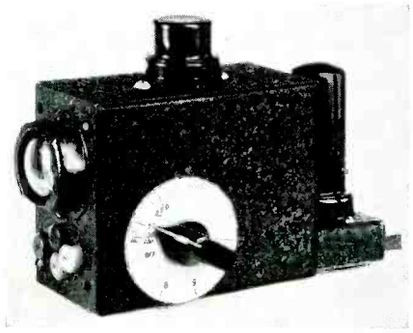

Fig. 2. Photograph of the device.

unknown voltage, it is just necessary to turn the pointer until the eye closes (or leaves a fine hairline of shadow) and then read the voltage from the potentiometer scale. The same is true of a-c voltages, although the calibration will be somewhat different.

Due to the high resistance of the circuit used (1 megohm and up) bias and avc voltages can be safely measured without disturbing the operation of a set.

USE AS AN OUTPUT INDICATOR

Using unmodulated i-f and r-f signals the various elements of a super can be correctly tuned using the arrangement shown, by connecting the avc voltage to the d-c input of this device. Similarly the a-c, r-f voltages taken from the detector grid of a t-r-f tuner can be used effectively. If it is desired to note the effect of modulation, or if it is not possible to hook into the avc or detector circuits, connect the a-c input to the speaker terminals. Maximum output is indicated by maximum closure, i. e., minimum shadow. The potentiometer will adjust the device to any desired sensitivity.

HUM LEVEL

As a hum level indicator, the magic eye is invaluable to the trouble-shooter on p-a and similar installations as well as radio sets. Any increase or decrease in hum level as the Service Man probes with his condenser leads is clearly shown by the unwinking green eye on his bench (connected across the primary of the speaker transformer), simplifying the work of comparing results "with and without."

Joseph Schoenbaum

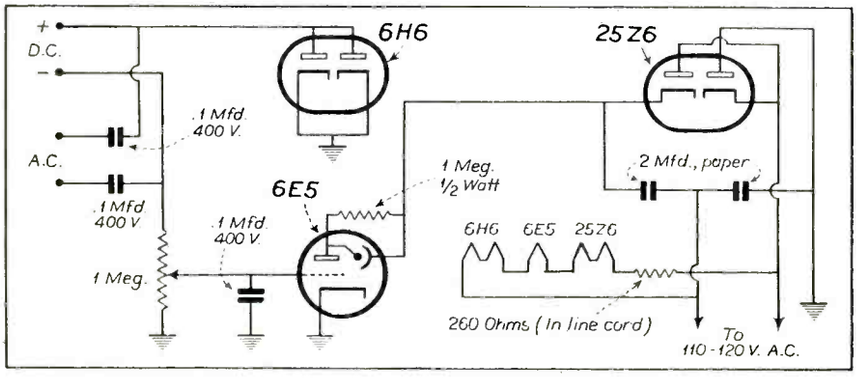

Fig. 1. Circuit of 6E5 service tool.

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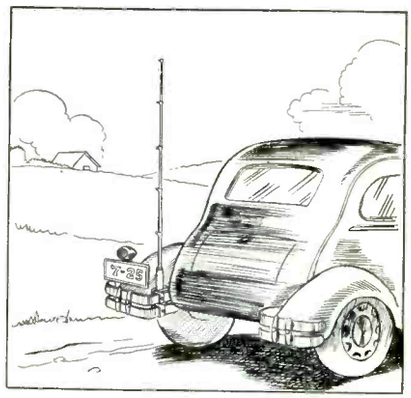
Novel Auto Antenna

The antenna shown in the illustration can be made from a brass rod, an old fishing rod, or any similar segmented metal rod. A strip of rubber cut from an inner tube and wrapped about the bottom can be used to insulate the rod from the bracket. The



bracket can then be firmly secured under the bumperette bolts. Longer bolts can be substituted if necessary.

•

Soldering Resistance Wire

When winding special resistors, using resistance wire from discarded resistors, difficulty is usually encountered in soldering the wire to lugs. The same trouble is often found in repairing breaks in wire-wound units. A perfect joint can be made by using Kester aluminum solder, and soldering in the conventional manner with a clean iron. Flux should always be removed with alcohol.

E. M. Prentke

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Just remember this:

Exclaimed Julius Caesar whenever he waxed enthusiastic about something PERFECT . . . and if you spoke Latin, that's the way you would describe the Index to Rider's Manuals.

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The Ward Leonard line of resistors for the service man is complete. Bulletin 507A gives the complete line of wire wound replacement resistors with list prices. Ward Leonard Resistors stand up so you keep your job profits because you don't have to make good for resistor failures. Fill in the coupon and mail it today to get your copy of this bulletin.

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RECEIVER CASE HISTORIES

A.K. 126, 136, 556

Service note: After the set and control unit have been installed and connected, fasten the cables securely to prevent motion when car is in operation, then loosen the two chucks on set container, push the cable sheathing into the chucks, then withdraw 1/32" to prevent binding, and tighten the chucks. Again rotate the control knobs to determine that the controls are functioning properly.

•

Arvin 27

Lacks normal volume: If the set has a 6B7 tube as second detector and amplifier try changing the 200,000-ohm plate resistor, R-4, to a 300,000-ohm resistor. This change usually increases sensitivity and volume. This does not apply to those Model 27's using a 75 tube in place of the 6B7 tube.

Cuts out or oscillates occasionally: Besides an actual defective condenser this trouble can sometimes be traced to the body of this type of condenser used in these sets working loose slightly from its mounting flange, and therefore occasionally making a poor ground. Bonding the condenser bodies to their respective flanges with solder will eliminate this possible cause of trouble.

Paul D. Shields

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Bosch 536, 636, 637

Adjusting vibrator: After the vibrator has been in use for some time, it may refuse to start operating. This is an indication of worn tungsten contact points; but, as a reserve supply of tungsten has been provided, a simple adjustment can be made to prolong the life of the vibrator.

1. Remove the vibrator unit from its housing by removing the tension spring with a pair of round-nose pliers.

2. Remove the rubber sock, being careful not to bend the wires at the soldered connection.

3. Lay the vibrator on a piece of white paper so that when viewed from above it appears exactly as shown in Fig. 1.

4. Loosen lock nut A and turn screw B clockwise until .005" of light can be seen between contacts C and D. If the contact points are somewhat roughened, light cannot be seen across their entire diameter, even though they are correctly re-spaced, that is, within .005" of touching each other.

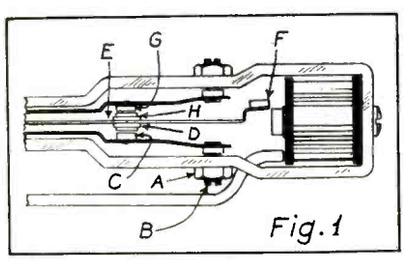

Fig. 1

5. A simple check on the correctness of the spacing adjustment is obtained by pressing lightly against the center of the reed with a small nail in the direction and location shown by arrow E. When the reed is thus moved so as to close contacts C and D, the weight F on the free end of the reed should move 1/64" from its at rest position. This check should be made after lock nut A has been firmly retightened.

6. Do not readjust the spacing between contacts G and H unless the tungsten is nearly all worn away. In this case, readjustment may be made in the same manner as for contacts C and D.

7. In re-inserting the vibrator into its rubber sock, be very careful to turn the flats of the sock hole so that they are parallel to the flat side of the vibrator frame. This provides ample space in the sock for the free movement of the reed. Make certain that the slot in the prong terminal plate engages the small projection on the inside edge of the housing. Then replace the tension spring. These instructions do not apply to any other types of vibrators.

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Emerson 5A, 6A

Service note: If it becomes necessary to remove the chassis from the housing, the speaker and tone control leads, as well as the strips bonding the variable condenser to the case, must first be unsoldered.

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G.E. N-60

Motor noise: In extreme cases of motor noise it is advisable to peen the distributor rotor arm, that is, increase the length of the arm by using a small machinist's hammer. This will lessen the gap between the rotor arm and the stationary contacts, reducing the spark.

•

Majestic 66

Weak, noisy, or no reception: Check the rectifier socket for carbonization or breakdown.

Insulate the i-f coil frame from its shield.

A source of trouble in this model, is a peculiar electrolysis which takes place on the red colored lead connected to the B choke. This electrolysis opens the soldered joint inside the choke where the lead connects to the fine wire of the choke winding. The symptom of this condition is a high voltage on the control grid of the 89 output tube. By placing the fingers across the control grid and the chassis one may feel a slight shock. The choke need not be replaced, if the winding itself is not open. Cut away the first layer of insulation until the two wires are exposed. Clean and resolder. After resoldering wash the connection with alcohol or a dilute solution of ammonia to prevent a recurrence of the electrolysis.

When volume is low or fades inspect the 0.03-mfd condensers which couple the grid returns of the first and second r-f coils to ground, and the 0.03-mfd coupling in the diode and triode sections of the 6C7. The pigtail leads of these condensers are wound in a flat spiral, within the cartridge, and make contact to the foil by means of a butt joint. If the case has not been completely filled with insulating compound it will make a bad contact.

Hygrade Sylvania Auto-Radio Manual

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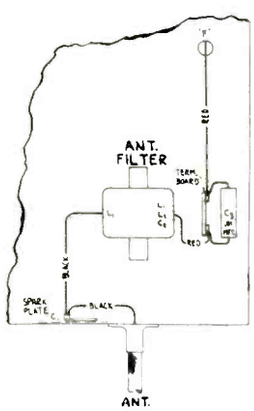
RCA Victor 6M, 6M2, and 5M

Service note: Certain 1936 automobiles are equipped with high capacitance type (400-mmfd or greater) built in antennas. The 1936 Dodge, DeSoto, and Chrysler are examples of automobiles so equipped. Installations in automobiles



having such antennas require the following modification of the antenna circuit of the receiver to suit the characteristics of the high capacity installation: Remove the tubular condenser C-3, 0.01-mfd as shown in the accompanying illustration, and replace with a molded type having a capacity of 0.0005-mfd.

ASSOCIATION NEWS . . .

NEWARK CHAPTER IRSM

It is a long time since the Newark Chapter has appeared on this page. During 1935 the chapter became like a ship without a rudder and drifted on reefs of despair. The year ended with but the name remaining of the derelict.

There were a few, however, who still had hopes for the future but the outlook was black. We were without a meeting place, without funds, and were forgotten by the Chicago headquarters. After holding meetings at their own expense, these few worked out plans for reorganization of the Newark Chapter. A reorganization rally was set for February 4, 1936.

The results of the rally were disheartening. Besides the original few, about 5 Service Men showed up, making a total of 15 for the entire attendance. This from a mailing of 400 notices. In spite of this poor showing, another meeting was scheduled and held with greater success.

Officers for 1936 were elected and from then on the Newark Chapter has held regular meetings at the Hotel Douglas, the second and fourth Tuesday of each month. Attendance is now in the neighborhood of 100, and shows every sign of increasing.

Mr. N. V. Rotolo, the new chairman, and Mr. T. W. Macdowell, secretary, promise their utmost to make the Newark Chapter greater than ever.

A. S. Cooke, Director of Publicity.

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THE C. R. T. OF CALIFORNIA

At each of the four regular meetings held during the last month the Certified Radio Technicians Association presented an interesting speaker.

The meeting of March 26 was devoted to a study of audio amplification, the second lecture in the series conducted by Mr. R. G. Leitner. In this lecture Mr. Leitner gave a more comprehensive explanation of the decibel.

On April Second Mr. Drake of the National Radio School gave a lecture entitled "Improving the Response Curves of Amplifiers." Mr. C. Parker, of the Associated Wholesale Electric Co., spoke on the reconditioning of A. K. receivers at the April Ninth meeting. At the close of the lecture the Question Box was opened. Mr. Orme directed the round table discussion of the problems presented for solution.

Mr. C. A. Nichols, Service Engineer for Packard-Bell, was the speaker at the meeting of April 16. Mr. Nichols gave helpful suggestions on the troubles encountered and methods of correction in Packard Bell receivers and also a very interesting talk on overcoming ignition noise in auto radio installations.

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NEW HAVEN SERVICEMEN'S BANQUET

The New Haven Radio Servicemen's Association held their First Annual Banquet at the Hotel Garde in New Haven on April 23.

An attendance of 147 was reported, delegations coming from all the surrounding cities in Connecticut. Door prizes were given away lavishly and entertainment was provided.

THE R. T. G. OF NEW ENGLAND

The Radio Technicians Guild held their First Annual Equipment and Parts Exposition at the Hotel Lenox in Boston on April 29.

The exposition was a huge success. A few of the local jobbers who refused to exhibit, claiming "it is the wrong time of the year for a show," were greatly surprised when Service Men from all sections of New England came to the exposition in droves. The actual attendance (those registered) was 750, which is a good turnout for any show, and proves that the Radio Technicians Guild has the power and strength to break the "bugaboo."

The Equipment & Parts Exposition will be a yearly institution of the R. T. G. Next year a much larger hall will be required to handle the crowd and exhibitors. We have already signed up several exhibitors for next year.

George Feldman, Secretary.

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PRSMA NEWS

At the opening meeting in April Mr. L. S. Fox of the National Carbon Co., delivered an exhaustive lecture on air cells and layer-bilt batteries.

At the special meeting on April 14, Mr. Shaw of G. E., explained the function of each part of a superheterodyne receiver from a practical standpoint. The information given by Mr. Shaw did not concern any specific make or model, but was applicable to practically any present-day super. The G-E meeting on April 14th was one of the best ever presented by any manufacturer. Servicing was the key note—and it was a *real service talk!*

A-K will be present at our May meeting with their New Noise Rejector Circuit. If it's as good as it sounds we had better all be there.

Right at the peak of the auto-radio season comes Radiart—at our June meeting. The talk is short but the odds are long that you fellows will surely need the information Radiart will present. We will have no meetings during July and August unless a special meeting is called, and if we do—it will be because the biggest and best service meeting of the year will be held. The Committee is now negotiating.

Al Feldstein has been elected to the "Factory Men Who Talk Our Language Club."

If you want to be able to service the new sets—attend the May meeting.

Ed Ward has been tearing his hair over the vice-presidency and the mag. But wait until he finds out that he is now "judiciary chairman."

The new constitution (if the secretary doesn't forget!) will be at the door for your inspection at the next meeting.

If (quote) the secretary does forget—there will be a new secretary at the door for your inspection at the following meeting (end quote)—Simons.

J. T. Gallagher in PRSMA NEWS

NRIAA BALTIMORE LOCAL

A new milestone in the history of the Baltimore bulletin has been attained. As volume three comes off the press, the editor feels the Baltimore bulletin has kept step with the local chapter in its successful forward march. Without peradventure we have proven our slogan "watch us grow" to be an aggressive battle-cry, religiously adhered to and not just an empty, meaningless boast.

As the Baltimore local steadily continues its ascendancy amidst the ranks of Radio Service Mens' Associations, we are saddened by the spectacle of many service organizations which have flourished and prospered in previous years; suddenly enter into a period of stagnation and slow disintegration. They falter on for a brief time fighting a losing battle, members straying from the ranks never to return, until eventually unity can no longer be maintained and the organization is a defunct issue.

Analyzing this situation we find we must indict the officers of these organizations as responsible for the collapse, not the membership. Yes, we have witnessed organizations prosper and expand under the able administration of one group of officers only to wither and die when these officers step down and a newly elected group take over the reins of leadership.

Egotism has ruined more official careers and wrecked more organizations than any other factor. The officer in his proper performance of duty has no place for vanity. To be a success he must realize he represents the will of a hundred or more men and not just his own whims and desires. He must temper his actions with the oil of cooperation, not the spleen of obstinacy. Unpleasant tasks must be met face to face and boldly surmounted, the issue should never be evaded by the easier method—silence.

The outstanding success of the Baltimore local may be attributed to calibre of men, not luck. The men comprising the ranks of the National Radio Institute Alumni Association are trained men, trained for leadership. With this abundant supply ever present from which to elect officers how can we do other than succeed in our endeavors. To the skeptical may we merely suggest a look at the record of the officers of the Baltimore local, both past and present.

With a vote of confidence, we join hands with the present officers of the local. May they travel far and accomplish even greater achievements.

W. B. Giese, Editor Baltimore Bulletin

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A.R.T. OF BRITISH COLUMBIA

The Associated Radio Technicians of British Columbia, organized in 1928, boasts a membership of over 70 Service Men. The association has its headquarters at Hastings and Homer Street, in Vancouver, B. C. Meetings are held the second and fourth Tuesday of each month. The March 24 meeting was taken up with the nomination of officers. On April 14, at a combination business meeting and banquet, held in the York room of the Hotel Georgia, officers for the coming year were elected.

HIGHLIGHTS . . .

PRESTO CATALOGS

Two new catalogs describing developments in equipment, discs, and parts, for the instantaneous recording and transcription fields, is announced by the Presto Recording Corp. Copies furnished upon request to the company at 139 W. 19 St., New York City. A special article on instantaneous recording is also available.

•

WESTON FOLDER

Tube base diagrams showing more than 60 different prong arrangements and connections are shown in a new folder just issued by the Weston Electrical Instrument Corporation, Newark, N. J. Base connection diagrams for octal base tubes, both metal and glass, are included. More than 300 makes are classified in a convenient table.

The folder is available to Service Men without charge.

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MAC-ADAMS G. E. AUTO-RADIO DISTRIBUTOR

M. B. McCullough, president of the Mac-Adams Equipment Co., Inc., has completed arrangements to distribute G. E. auto-radios in the New York area. This concern operates salons at 503 W. 56th St., New York City.

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LOOSE LEAF TUBE CHART

The Arcturus Tube Company, Newark, N. J., has published a broadcast receiving tube list. Every tube is identified by showing filament voltage and current, whether filamentary or cathode type, description, and number of useful elements.

The chart is made up in a 10-page booklet, letterhead size, to fit into a standard binder. The addition of new tube types has been anticipated for years to come, and space is provided in the chart so that such new tubes can be entered in numerical order.

Periodic notices of additions and changes to the chart will be sent to subscribers.

Copies are available direct from the factory at the nominal cost of ten cents each including addition service.

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CORNELL-DUBILIER CATALOG

A catalog listing of the more important electrolytic condensers recently developed by their laboratories for the radio servicing field, is announced by the Cornell-Dubilier Corp. Catalog No. 131A furnished on request at the Cornell-Dubilier Corp., 4377 Bronx Blvd., New York City.

•

AUDAK PICKUPS SELECTED

The Audak Co., 500 Fifth Avenue, New York City, has just been awarded a contract for 5,000 Audax magnetic pickups by the U. S. government. These units are to be distributed to libraries throughout the country to be used in conjunction with reading machines for the blind.

•

CINAUDAGRAPH SALES MANAGER

R. W. Augustine, formerly with the Utah Radio Products Co., will be the mid-western district sales manager for the Cinaudagraph Corp., with offices in Chicago.

SPRAGUE CONDENSER CATALOG

Service Men who have not yet fully acquainted themselves with interference elimination in their locality are missing a real bet according to information contained in the 1936 Sprague condenser catalog just issued by the Sprague Products Co., North Adams, Mass.; available free upon request.

•

KEN-RAD BULLETIN

An 8-page engineering bulletin telling of pentagrid converter oscillator considerations has just been issued by The Ken-Rad Corp., Owensboro, Kentucky.

Those wishing a free copy of "Pentagrid Converter Oscillator Considerations" write to the Ken-Rad Corp., Owensboro., Ky.

•

WEBSTER SALES MEETING

During the recent IRSM show, Webster-Chicago held a sales meeting at the Hotel Graemore, Chicago. Mr. John Erwood, vice-president, conducted the meeting; Mr. R. F. Blash, president, discussed the growth of the company during the last 20 years.

Mr. John Erwood

•

GHIRARDI SURVEY

The results of surveys recently conducted under the direction of Alfred A. Ghirardi, author of "Modern Radio Servicing," and his publishers, Radio and Technical Publishing Co., New York City, show that Service Men are not content to accept uncritically every instrument placed on the market. In one representative survey, less than 25% stated that they were using bought equipment alone. The other 75% either build all their own equipment or purchase some of it and build the rest. Service Men today, according to these surveys, have very definite ideas of their own, not only as to what instruments they need in their work, but as to just how specifically those instruments should be made.

RCA INSTITUTES QUARTERLY

A new quarterly publication devoted primarily to technical papers on communication, broadcasting, television and the electronic and audio arts will make its initial appearance in June, under the title of RCA Review. It will be published and distributed through the RCA Institutes Technical Press, a department of RCA Institutes, Inc., 75 Varrick Street, New York.

•

ATLAS WEST COAST REPRESENTATIVES

The Atlas Sound Corp., Brooklyn, New York, manufacturers of p-a equipment, announce the appointments of A. A. Sinai, 26 9th St., San Francisco, and Northwestern Agencies, 2603 3d Ave., Seattle, to act as Atlas representatives for their respective areas.

•

RADIO SERVICE COURSE

The University of Florida will give a short course for Service Men under the direction of the General Extension Division and the Engineering Experiment Station.

Registration will be held from 10 o'clock to 12 o'clock Monday morning, June 8, in the dynamo lab of the College of Engineering. Instruction begins 1:30 P. M. Monday and lasts until 5 P. M. Friday, June 12.

The program of the course as well as any additional information desired can be obtained from the Registrar.

•

FERRANTI BULLETIN

Ferranti Electric, Inc., 130 W. 42d St., New York City, have just released a bulletin illustrating 90 new high-fidelity, self-shielding transformers. Copies may be obtained upon request.

•

WARD LEONARD ENLARGES

The Ward Leonard Electric Company's Chicago office, under the management of Kline Gray, has taken larger quarters in the Monadnock Block at 53 Jackson Blvd. This has necessitated moving their office from Room 1257 to Room 1450.

•

WINCHARGER SALES SERVICE

Announcement of a sales plan to aid dealers in selling farm radios has been made by the Wincharger Corporation, Sioux City, Iowa.

Wincharger will send 50 prospective customers illustrated folders showing advantages of wind-powered charging units and a combination offer of radio and Wincharger.

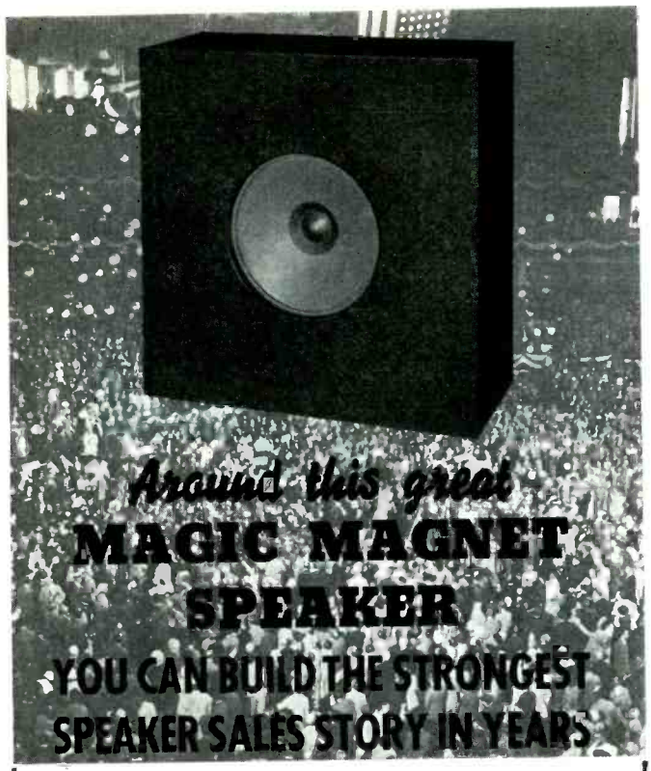
Dealers can obtain this service by ordering one DeLuxe Wincharger and sending in the 50 names to the factory.

•

TECHNOLOGY EMPLOYMENT SERVICE

The Engineering Alumni of the College of the City of New York have established an employment service to assist the Engineering Graduates in obtaining employment. No charge will be made to either the employer or the employee.

Great success has already been reported as employers everywhere are notifying the service of their employment needs in radio, electrical, mechanical, and chemical engineering.



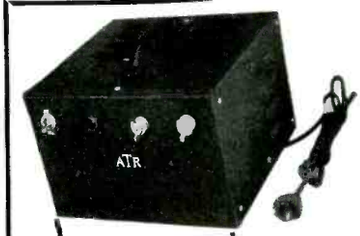
Write today for complete details on the Magic Magnet Speaker line!

CINAUDAGRAPH CORP. ● STAMFORD, CONN.
Speaker Div. Dept. "T"

CINAUDAGRAPH

FLASH

ANOTHER NATURAL ! !



ATR

Auto Radio

"A" BATTERY ELIMINATOR

SPECIALLY DESIGNED FOR DEMONSTRATING AND TESTING AUTO RADIO SETS ON REGULAR A.C. LINES, 105-125 VOLTS 50 - 60 CYCLES

DEALERS PRICE
$12.95 NET
COMPLETE
10% higher west of the Rockies—Higher in Canada. Packed one to a carton.

EQUIPPED WITH:

On-Off Switch
Pilot Light Indicator
10 Ampere Fuse
Rubber Mounting Feet
6-Ft. All-Rubber Cord Set
Cabinet is of heavy gauge metal having attractive black wrinkled finish.
Size: 7½" x 7½" x 5".
Shipping weight: 20 lbs.

OUTSTANDING FEATURES

- Eliminates Storage Batteries and Battery Chargers.
- Prevents the Possibility of Spoiling a Sale Because of a Run-own Battery.
- Operates the Set at Maximum Efficiency at All Times.
- Delivers Pure Direct Current at the Correct Voltage for the Proper Operation of Any Auto Radio Set.
- Equipped with Full-Wave Dry-Disc Type Rectifier Assuring Noiseless, Interference-Free Operation and Extreme Long Life and Reliability.
- Fully Automatic and Fool-Proof.

Write or Wire for Further Particulars.

Sold by Leading Jobbers Everywhere

AMERICAN TELEVISION & RADIO CO.
St. Paul, Minnesota, U.S.A. Cable address: "LIKEX" New York

POLITICS PAYS P.A. PROFITS

It's Free

Sound trucks . . . portable P.A. systems . . . permanent P.A. installations . . . are all in greater demand this year because it is a presidential campaign year.

Political organizations of all parties are going to rent, or purchase outright, various types of public address equipment. Lafayette has prepared a special LIST PRICE catalog to help YOU sell P.A. equipment. And most important of all Lafayette engineers have spent months in the development of new, finer P.A. equipment. Send for your FREE copy of Lafayette's complete P.A. list price catalog No. 64. Get on the political band wagon with Lafayette for profits in P.A.! Simply address Dept. LE 5D.

LAFAYETTE RADIO MFG. CO., INC.
100 SIXTH AVENUE ••• NEW YORK, N.Y.

C-D

Types BB and DT Tubular Condensers

Cornell-Dubilier has supplied the majority of tubular condensers in use today. The finest of raw materials, careful inspection and supervision, patented construction and continuous engineering effort makes C-D condensers world famous.

The TYPE "BB" tubulars, wound on a permanent core, embody the most advanced engineering design and construction. Made to stand up under severe conditions of circuit voltage fluctuations, atmospheric changes and continuous operation.

TYPE "DT" tubulars, non-inductively wound, wax impregnated and oil cooled, are triply sealed in sturdy moisture proof containers. Small, efficient, low power factor, high equivalent series resistance — these dwarf tigers ARE condensers.

Catalog No. 128 fully illustrates and lists these handy tubulars. Your copy sent free upon request.

CORNELL-DUBILIER
C O R P O R A T I O N
4375 BRONX BOULEVARD
NEW YORK

THE MANUFACTURERS . . .

ATR A BATTERY ELIMINATOR

The American Television & Radio Corp., St. Paul, Minn., developed a unit that is

designed for demonstrating and testing auto-radios on the regular a-c lines.

•

TACO JUNIOR ANTENNA

The Technical Appliance Corp., 17 E. 16 St., New York City, have designed a modern all-wave antenna system completely soldered at the factory for easy installation.

•

KADETTE BATTERY SET

From Ann Arbor, Michigan, comes the announcement of a unique battery-operated receiver. A Perm-O-Flux dynamic speaker and a patented "battery saver" reduces battery expense.

The Kadette Battery Superheterodyne Model 400, is completely portable with aerial attached and batteries entirely self-contained, weighing approximately 25 lbs. Uses three 1½ volt dry cells for A supply. Three portable size B batteries are used, supplying 135 volts.

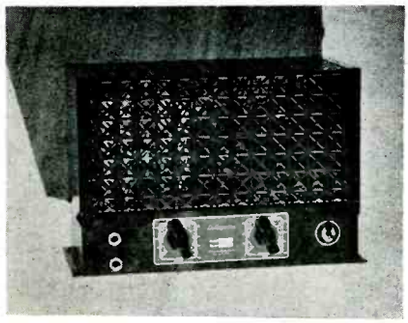
Two distinct tuning ranges cover both Standard Broadcast and Short Wave.

A superheterodyne circuit is employed, using the following tubes: one 106, one 34, and 1B5, and one 950.

•

NEW LAFAYETTE FIVE-WATT AMPLIFIER

The Lafayette Radio Mfg. Co., of 100 Sixth Avenue, New York, New York, announces the addition of a new five-watt amplifier to its 1936 line. This new amplifier, known as the Model 236-A, has the



unusually high gain of 116 db, making possible the use of a velocity microphone. Two input jacks are provided. One of these is for use with input devices having a high output level, such as a phonograph pickup, radio tuner, etc., and consequently uses only a portion of the total gain available. The other input jack, which is used for low-level input devices such as a velocity microphone, provides the total gain of 116 db.

MALLORY BIAS CELL

The Mallory grid bias cell, a potential cell to furnish grid bias for various tubes in the radio receiver, is now available. This cell, used for several years by radio manufacturers, is a small acorn-shaped, self-contained device, ⅝ in. in diameter and 11/32-in. deep. Its principal use is to furnish bias for the first audio amplifier tube in high-gain avc receivers and p-a units—such tubes as 75, 2A6, 6F5 and others.

Both the cells and mounting devices are now carried by leading radio parts distributors. Complete information may be obtained by writing to P. R. Mallory & Company, Inc., Indianapolis, Indiana.

•

KATOLIGHT JR.

A 50-pound, 300-watt, fully portable power- and lighting plant furnishing standard 110-volt, 60-cycle a-c, is announced by the addition of the Katolight, Jr., to the line of the Kato Engineering Company.

•

SOLAR CAPACITY BRIDGE

Ten advantages are claimed for the analyzer until from Solar Mfg. Corp., 299 Broadway, New York City. This is a capacitor-analyzer and resistance-bridge, planned to suit the needs of engineers and Service Men. All readings are secured direct from a color-coded panel.

Descriptive literature on this and other Solar products will be sent to Service Men who address the Solar Mfg. Co., on their business letterheads.

•

RCA OSCILLOGRAPHS

RCA Parts Division has announced the addition of two new types of oscillograph instruments to its standard line of test equipment. These are: a model operating on 25-cycles and a special sweep model.

Both are identical to the standard RCA oscillograph except that one operates on the 25-cycle a-c in use in some areas, and the other has a special sweep oscillator which extends from 4 cycles to 18,000 cycles.

•

FLEXIBLE-SHAFT SCREWDRIVER

The Commonwealth Products Co., 401 Broadway, New York City, are marketing a laminated-steel flexible-shaft screwdriver for working around the corner and in awkward places. Complete information may be obtained from the manufacturer.

SCOTCH TAPE

The Minnesota Mining & Mfg. Co., St. Paul, Minn., are marketing Scotch Tape in 10-yard rolls as a Service Man's item.

Scotch electrical tape is composed of a neutral paper backing known for its freedom from corrosion. The pressure sensitive adhesive used is non-corrosive. Requiring no water, Scotch tape seals by slight pressure. Unlike friction tapes, which are corrosive and will not adhere satisfactorily to any surface other than itself, Scotch tape adheres to any surface, flat or irregular.

•

RCA 6L6

RCA Radiotron Division has recently announced a new all-metal beam power amplifier designated as the RCA-6L6.

The 6L6 is a distinctly new design of power output tube with high sensitivity, high efficiency, high power output, low third and negligible high-order harmonic distortion.

The 6L6 is intended especially for use in the output stage of those radio receivers which are designed to have ample reserve of power-delivering ability.

•

TRIAD BALLAST RESISTORS

The Triad Mfg. Co., Pawtucket, R. I., manufactures a complete line of ballast resistors in the shape of metal, metal glass, and glass tubes. The ballasts have a tap for the pilot light supply. Ballasts for any combination of tubes and pilot lights may be obtained. The marking of the ballast indicates its internal construction.

•

AMPLIVOX NOISE BUCKER

The Amplivox Radio & Sound Labs., 227 Fulton St., New York City, are marketing a noise silencing device built along the lines suggested by Mr. Lamb in his recent article in *Q.S.T.* The device uses

three metal tubes and derives power for its operation from the receiver to which it is connected.

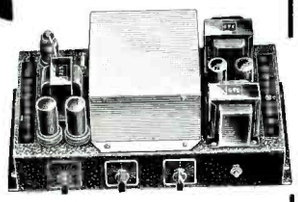
•

GIANT UNIT AND HORN

The Atlas Sound Corp., 1449-39 St., Brooklyn, New York, has added to their line a driver unit, Model GU-3; and a 6-ft. trumpet, Model KD-6. Complete information may be obtained from the manufacturer.

MOBILE

REMEMBER! — Build STENTORIAN way — for powerful, clear volume and lowest cost.



10 Watt Amplifier Nucleus

Matched transformers for better sound reproduction over a wide tonal range.

MOBILE—for Political or Publicity motor cars, sound trucks, motor boats, etc.

MOBILE STENTORIAN NUCLEUS Includes genuine "Pull-Push" moisture-proofed matched transformer, chokes, audios, and outputs. The beautiful chassis has lettered terminal strips and marked tube sockets installed—ready for wiring. Full directions with each NUCLEUS.

Free for the Asking!

Send for Free Illustrated Bulletin on MOBILE and 6, 10, 15 and 30 watt STENTORIAN Sound Amplifier Nuclei and the name of our nearest distributor.

GENERAL TRANSFORMER CORP., 502 South Throop Street, Chicago
Manufacturers of Replacement Units

Volume Controls Condensers

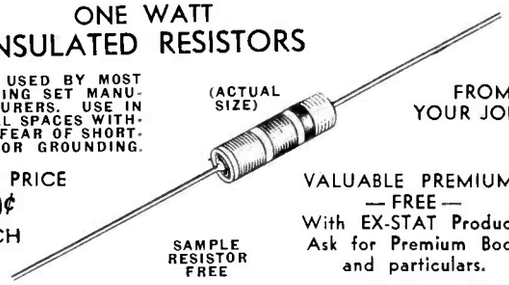
EX-STAT

Carbon & Wire Wound Resistors

ONE WATT
INSULATED RESISTORS

NOW USED BY MOST LEADING SET MANUFACTURERS. USE IN SMALL SPACES WITHOUT FEAR OF SHORTING OR GROUNDING.

(ACTUAL SIZE)



FROM YOUR JOBBER

LIST PRICE 20¢ EACH

SAMPLE RESISTOR FREE

VALUABLE PREMIUMS — FREE — With EX-STAT Products Ask for Premium Book and particulars.

TILTON ELECTRIC CORP., 15 E. 26TH ST., NEW YORK

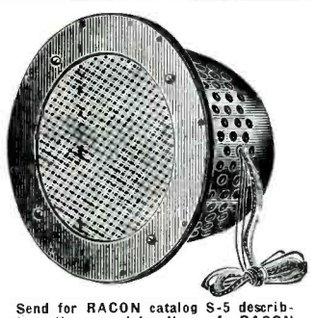
Ken-Rad
Radio Tubes

Ken-Rad Radio Tubes are made to give clear, dependable reception. They satisfy customers and build good will for dealers. Write for full information.

Genuine Glass or Metal Radio Tubes

THE KEN-RAD CORPORATION, Inc., Owensboro, Ky.
Division of The Ken-Rad Tube and Lamp Corporation
Also Mfrs. of Ken-Rad Incandescent Electric Lamps

RACON
BROAD-BAND
BULLET
SPEAKER



RACON'S new BULLET SPEAKER, a small, compact speaker assembly, permits concentration of sound within limited areas without effecting the tone quality. Equipped with RACON BROAD-BAND cone speakers, these extremely rugged units are suitable for indoor or outdoor use.

Send for RACON catalog S-5 describing the complete line of RACON Horns, Electro-dynamic Units, and Acoustical Sound Projectors.

RACON ELECTRIC MFG. COMPANY
52 EAST 19TH STREET NEW YORK CITY

Small — but Good!

Note midget (8 mfd. 450 v.) electrolytic at left compared with usual type of same capacity and voltage rating. ● New GLS series (250 and 450° v.) means smaller units for better filtering. ● Hermetically sealed for longest life. Several capacities. Inverted mounting. Color-coded leads. ● Write for catalog.

AEROVOX

CORPORATION
80 Washington St. Brooklyn, N. Y.

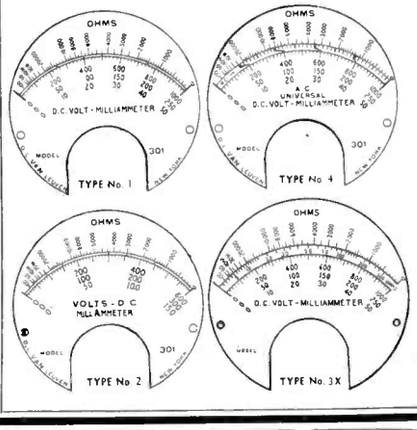
AMAZING NEW SERVICE TOOL THE HANDIPROBE

THE POCKET ANALYZER FOR RADIO DIAGNOSIS AND TROUBLE SHOOTING

For fast, accurate testing for open or short circuited condensers—any type. In shooting trouble for low volume or no volume, excessive oscillation or distortion. Also tests: Presence or lack of voltage on filament, plate or screen arteries. Open or shorted bleeder or cathode resistors. Continuity of any receiver circuit.

Made of highly polished fibre tubing, 8¼" long—just right for hard-to-get-at places. Equipped with ¼ watt G.E. Neon Lamp. Special oil processed 2000 volt D.C. condenser is sealed and baked for long life. Test lead is 20 inches long with insulated Muller alligator clip. Service men—send $2.25 for the Handiprobe postpaid, or see your jobber.

BURTON-ROGERS CO.
755 BOYLSTON STREET, BOSTON, MASS.



SILVERED Etched Dials
on brass

Types 1, 2, 3X and 4 for Weston Jewell, Triplett models 301, 88, 54, 199, 321. Type 3X excepted in models 54 to 199.

Shunts D.C.

5, 10, 25, 50, 100, 500 M.A. for meters having 27, 30, 50, 100 M.V. Also series Shunts.

At Better Retail and Wholesale Dealers or write direct.

D. L. VAN Leuven
410 E. 15th ST.
New York, N. Y.

Insist Upon

EXACT DUPLICATE

Radiart

REPLACEMENT VIBRATORS

This Label

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

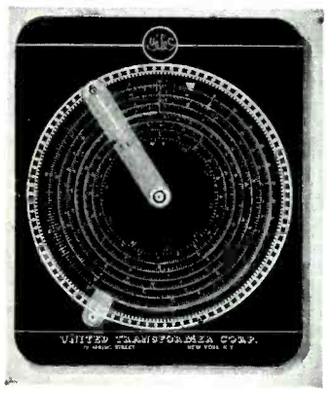
OXFORD MAGNETIC SPEAKERS

Oxford-Tartak, Chicago, Ill., announce a series of cabinet speakers for extension use on radio and p-a installations. Illustrated catalog sheets giving full details are available on request.

•

UTC SLIDE RULE

The United Transformer Corp., 72 Spring St., New York City, offers to Service Men (for the nominal sum of 25c)



their circular slide rule together with other valuable information. UTC also has available their latest 48-page technical bulletin and catalog.

•

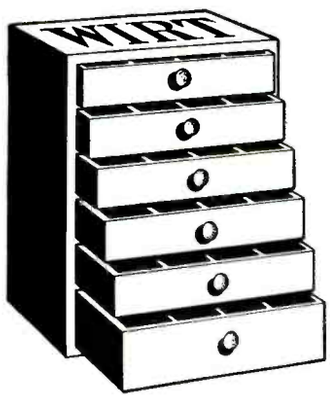
NEW WEBBER TEST OSCILLATOR

A new, low priced Test Oscillator with a direct reading, full-vision dial has just been released by the engineering department of the Earl Webber Co., 1217 W. Washington Blvd., Chicago, Ill. This new Oscillator, known as the 1936 Improved Model 20, is powered by one 4½-volt "C" and one 22½-volt "B" battery; therefore, it can be used equally well for aligning the home receiver in the service laboratory or the auto set in the car.

•

WIRT ALL-WOOD RESISTOR CABINET

The cabinet illustrated is made of seasoned bass wood, varnished and rubbed. It has six drawers with four compartments in each drawer, and all partitions are removable.



Wirt Co., 5221 Greene St., Philadelphia, Pa., is offering this cabinet free on the purchase of an assortment of resistors.

NEW HIGH-WATTAGE ATTENUATORS

For controlling the volume of high-powered amplifiers and public-address systems, the Ohmite Manufacturing Company, 4835 W. Flournoy Street, Chicago, has recently brought out a new line of High Wattage T-Pads and L-Pads. These units offer for the first time almost stepless control of the high-power amplifiers. The resistance elements used in these pads are Ohmite, all-porcelain, vitreous enameled rheostats which are not affected by weather or temperature conditions. There are two lines, rated at 25 watts, and 50 watts. Because the contacts ride directly upon the resistance elements, constant, smooth graduation is obtained. These attenuators were designed to control the volume of individual speakers or groups of speakers, and are connected between the speakers and amplifier. Units are enclosed in black metal housings and are furnished complete with bakelite knobs and etched dial plates. Attenuators to match all standard line impedances are carried in stock.

•

G.E. MODEL A-88

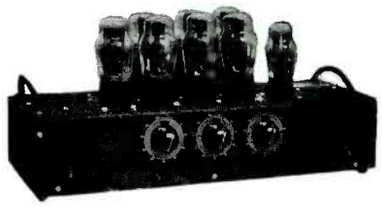
Model A-88 is now equipped with a single-speed synchronous motor, operating at a speed of 78 revolutions per minute. Practically all phonograph records are now recorded on the standard 78-rpm record.

G-E radio dealers are asked to make the necessary corrections, regarding the single-speed operation, in any sales promotion literature they may have on hand.

•

SOUND SYSTEMS MIXERS

Sound Systems, Inc., 6545 Carnegie Ave., Cleveland, Ohio, manufacture 2, 3, and 4 position electronic mixers for separate control of sound cells, crystal microphones and



crystal pickups when used with a single amplifier. Complete information can be obtained by requesting bulletin No. 14.

•

AMER MICROPHONE LICENSED

The American Microphone Co., 1915 South Western Ave., Los Angeles, Cal., have been granted a license by the Brush Development Co., to manufacture crystal microphones under the patents controlled by the latter company.

•

TECH ATTENUATOR

A new attenuator of improved design is announced by the Tech Laboratories, 703 Newark Avenue, Jersey City, N. J. This new unit is said to be especially designed for broadcast and high grade sound recording purposes. It has a larger number of steps, lower noise level, better frequency characteristics, better terminals, easier wiring and smoother operation.

NATIONAL UNION CABINET

National Union Radio Corp. of N. Y. announced that they are making available to Service Men, steel cabinets for storage of small radio parts.

The cabinets are provided in three sizes, a 27-drawer style, a 100-drawer style and a 50-drawer style.

•

READRITE TUBE TESTER

The model 430 Readrite tube tester tests tubes for value and shorts under actual

load conditions. A shadow type meter indicates proper line voltage adjustment. The unit is equipped with an English reading Triplett meter.

Complete information may be had from the Readrite Meter Works, Bluffton, O.

•

OPERADIO PORTABLE P-A SYSTEM

The Operadio Model 110-R portable p-a system features 2 speakers operating on the "acousti-reflex" principle. The rated power output is 20 watts in class A. It comes complete with microphone, speakers, tubes and carrying cases.

Specifications and further details may be had by writing Operadio Mfg. Co., St. Charles, Ill., for catalog 10-A.

•

AMPERITE BANQUET STAND

The new Amperite stand incorporates a ball-bearing clutch which requires only ⅛ turn to tighten. The bearing permits the microphone to be rotated without loosening the clutch. By removing the rod

the base can be used as a desk stand. The stand can be obtained in either gunmetal or chrome.

INDEX TO ADVERTISERS

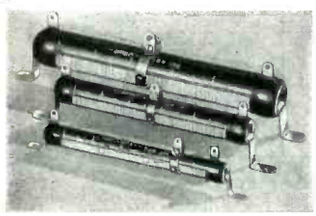
"DIVIDOHM DOES IT!"

says Bill Fixit

"Have you ever seen an Ohmite Dividohm? It's the most useful part I've *ever* come across. I certainly wouldn't make a stop without a few DIVIDOHMS in my kit."

When you want an odd resistance value, or a voltage divider—especially in repairing discontinued models—use "Dividohm" the time-saver. This semi-variable resistor saves scouring the town or writing the factory for a replacement part.

The famed OHMITE vitreous enamel coating is marked with a patented "percentage of resistance" scale which makes it easy to determine values. Any practical number of lugs may be used without shorting out much resistance. 6 sizes: 25 thru 200 watts; resistance values thru 100,000 ohms. Ask your jobber.



OHMITE
MANUFACTURING COMPANY
Makers of Resistors of all types.
4827 Flournoy Street
CHICAGO, ILL.
Write for Catalog 14.

UTAH RADIO PRODUCTS CO.

Utah FEATHERWEIGHT

ORLEANS ST. CHICAGO, ILL.

USE UTAH THE GUARANTEED VIBRATOR AND GUARANTEE YOUR WORK.

URPC 820 S5 CHICAGO, ILL.

UTAH RADIO PRODUCTS CO.
CARRINGTON

TEAR OUT THIS AD—PIN TO YOUR LETTERHEAD AND MAIL TO DEPT. S.
FOR COMPLETE DETAILS AND FREE CATALOG

TOBE

EXACT DUPLICATE

ELECTROLYTIC CONDENSERS

Cut Your Servicing Time

Each label bears complete color code information permitting fast installation! Basic stocks of these TOBE Condensers are available at leading jobbers everywhere.

Coming! Coming!

A new sensation . . . the newest form of Bridge and Component Part Tester . . . Be sure to get the dope.

TOBE DEUTSCHMANN CORP.
CANTON, MASSACHUSETTS

ACRATONE SOUND SYSTEMS

Get In The Money!

There's a STEADILY GROWING MARKET for Acratone public address equipment for political rallies, hotels, churches, theatres, dance halls, musicians, amusement park, schools and police work.

YOU make more money with ACRATONE equipment—a complete line covering every type of installation. Use our FREE ADVISORY SERVICE—we will help you as we have aided thousands of Federated customers. Also our entire sales organization is at your service to help you "land" contracts. No installation too large—none too small!

FREE

Catalog No. A-56 showing complete line of sound amplification systems, also latest developments in radio receivers and parts.

FEDERATED PURCHASER INC.

NEW YORK CITY, 25 Park Place — ATLANTA, GA., 546 Spring St., N.W. — JAMAICA, L. I., 92-26 Merrick Road
CHICAGO, ILL., 1331 S. Michigan Av. — NEWARK, N. J., 230 Central Avenue — 166th Street off Jamaica Ave.
PITTSBURGH, PA., 343 Blvd. of the Allies

to merit your continued confidence . . . .

SOLAR

introduces

"DOMINO"

Bakelite-molded

PAPER CAPACITORS

A STARTLING new achievement in the manufacture of paper bypass condensers! No longer need a radio chassis suffer in appearance because of unsightly paper tubulars. No more worries about the protection offered by paper covers. Here are permanent paper di-electric units molded into Bakelite. They are non-inductive, with best r.f. characteristics; leads are rigidly anchored; mechanical and moisture protection are definitely superior. Test results are phenomenal in their excellence.

Values to .1 mfd. 400 volts

Available in standard packages of 10

through our jobbers everywhere

Ask for the new SOLAR Dominoes

THE Eyes HAVE IT

YOUR eyes and the MAGIC TUBE see all, know all . . . QUICK AS A WINK!

SOLAR Precision

CAPACITOR ANALYZER and RESISTANCE BRIDGE

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Capacity, power factor, leakage, resistance, all read directly on the panel. The highly sensitive No. 6E5 Cathode Ray Tube is used for balancing. Dials are color-coded to match settings. A refined and extended Wien bridge built into instantly useful form for laboratory, shop and field work. A new and advanced necessity, obtainable from our jobbers everywhere.

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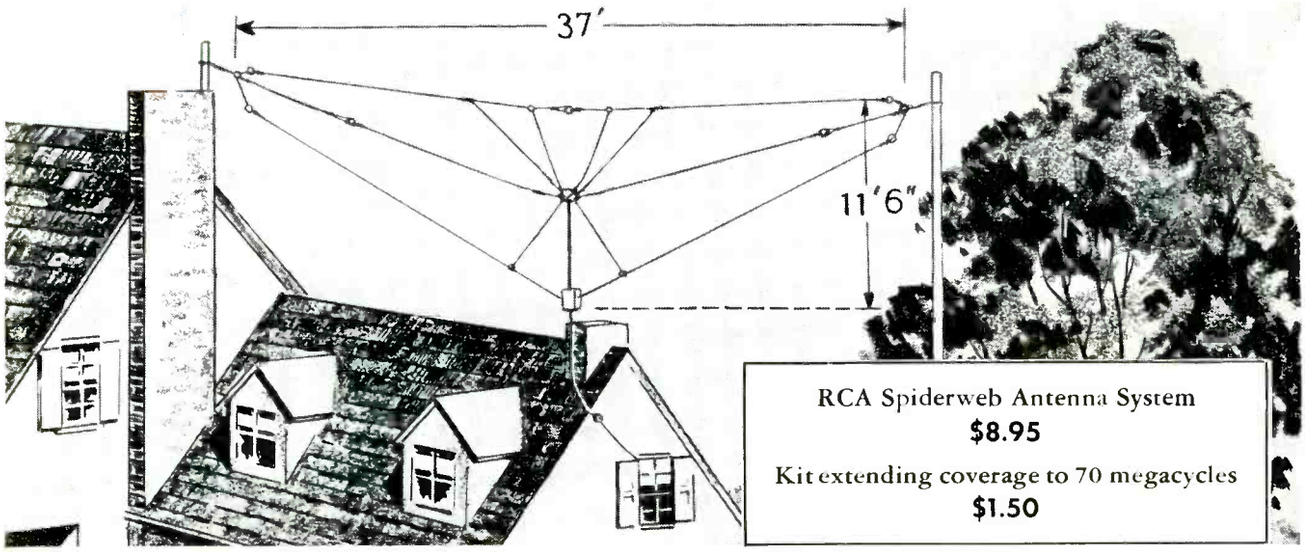

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