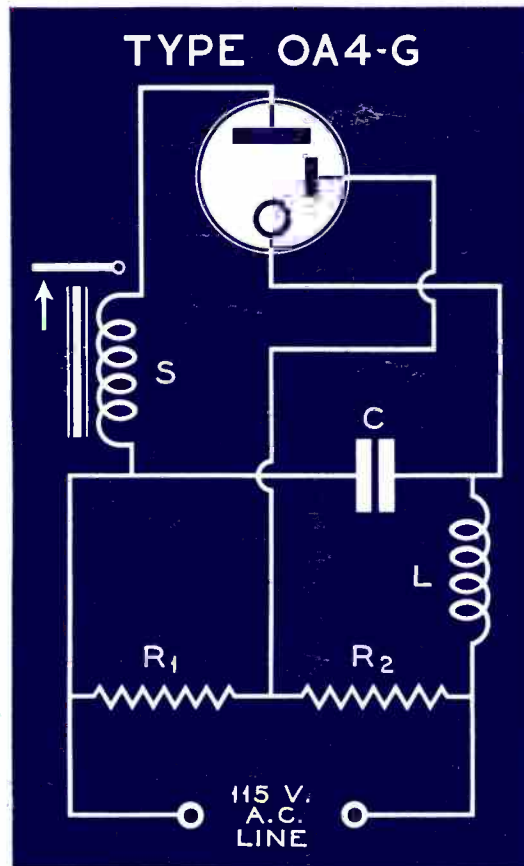


SERVICE

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A Monthly Digest of

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1938

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(See page 11)

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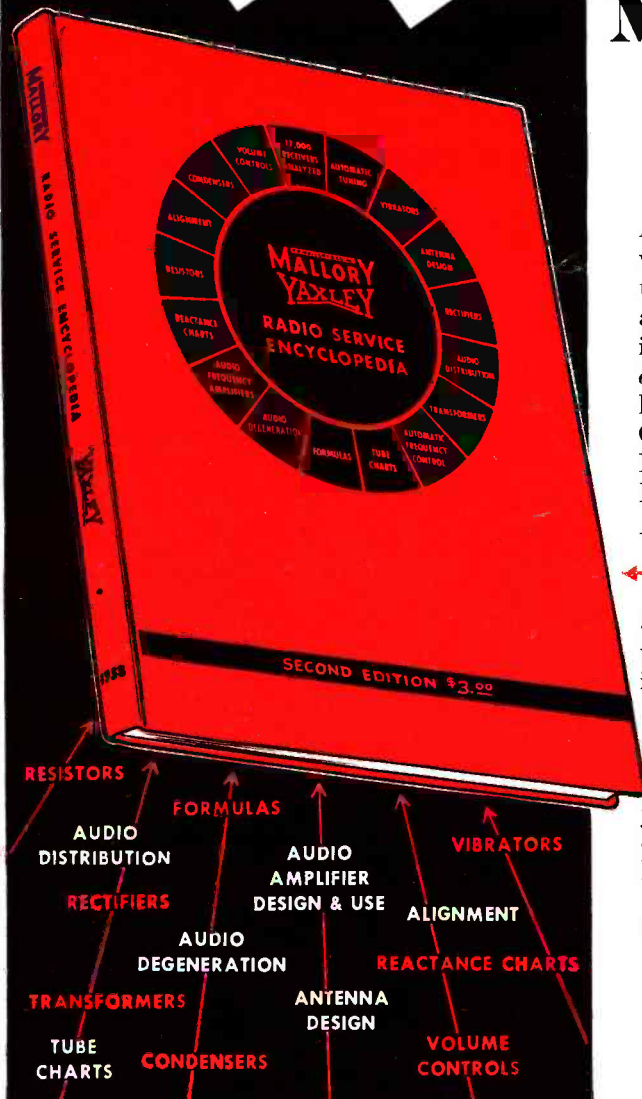
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A Monthly Digest of Radio and Allied Maintenance
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EDITORS

MAY, 1938

Ray D. Rettenmeyer

W. W. Waltz

VOL. 7, NO. 5

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* Indicates that a circuit accompanies the text.

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THE ANTENNA . . .

HOT!

NOT IN THE sense that it is something into which the Service Man should plunge, but something that he should approach with extreme caution, is our thought after seeing several articles recently on the idea of building diathermy and fever equipment for your local physicians. We have received some of these articles and have very promptly returned them.

Here's the reason—think it over well before you do anything.

Artificial fever and diathermic treatments are dangerous; there are many doctors who are not sufficiently well trained to handle the technique, in fact, it has only been within the past few years that this subject was even mentioned in medical schools. Now, most doctors are cautious fellows, but here and there you'll find one who is ready to try anything to bring in a few more dollars. These are the boys who will want to buy any equipment that you might want to sell them, provided it makes their offices look imposing enough.

But, before you sell anything of this sort you'd better ask your District Attorney just how much responsibility will fall on your neck if some patient dies as a result of treatments from your equipment. Maybe you will be technically immune from culpability—your conscience may be something else, though!

. . .

VACATION TIME

NOT SO LONG now before the city dwellers will be packing up and heading for the country—and the country people will be looking over the maps of the roads leading to the so-called bright lights. It seems to be human nature to look for a change of some kind and, regardless of the fact that the change may involve discomfort and even painful experiences, to call it a vacation.

Even the broadcasters make note of this urge for a change—programs become increasingly easier to take as the summer advances. We are, of course, referring to the program material and not to the static which jams things, more or less, from now on until October. But that, after all, is a matter of location, among other things. Those who live near or vacation near high-power broadcasters needn't worry over-much about static.

All of which, in so far as the Service Man is concerned, leads to a couple of pertinent points.

For some reason or other, radio service seems to undergo the usual summer slack, along with the radio industry in general. There isn't much sense to it, once you stop to consider the situation as it is, and as it can be made. We don't profess to know why it is that Mr. and Mrs. American Radio Listener are continually cold to the idea of having their sets gone over in the summer time when listener interest is (theoretically) at a minimum. But there is no doubt about it, it's a tough

job persuading them to have their work done. So, maybe the line of approach has been all wrong.

We mentioned above that many of the summer programs are quite easy to listen to. The percentage of sustaining programs increases, providing a most welcome relief from the blatant commercial plugs, and the general tone of things—music in particular—lightens up.

Possibly, with some kind of a talk about the advantages of summer programs, something can be accomplished. Point out the obvious advantages of summertime reception—and along with that line of talk, the necessity of having a receiver in top-notch condition so that noise originating within the set won't be added to the inevitable static.

From an entirely different angle, the summer should provide at least several other opportunities. Radio equipment—receivers, power-supply devices, phonograph record players—is essential to the vacationing family. They may be vacationing in a mountain cabin, a farm, a trailer, or a motor boat; regardless of where, the Service Man is the logical one to furnish the extra equipment which they will need, and to install it.

Still along vacation lines, how about the men in your locality who belong to a hunting and fishing club? Quite often, these clubs are located miles from civilization and for that reason are "naturals" for radios with either wind-driven or gas-engine power supply. And, the logical time to do jobs of this kind is long before the snow starts to fly next November. Right now seems to be a good time.

. . .

THERE'S A DIFFERENCE

YOU CAN DO a job on a set just sufficient to make it work—or, you can turn out something of which you will be proud and your customer will praise. Maybe not to you, but to his friends when they ask him who fixed his radio so it sounds so well.

That's the kind of advertising that pays dividends many times over, and it costs . . . just the extra care that you take in doing each job well. And, don't forget that you're being paid in cash, too. You charge your time (at least we hope you are working on a sufficiently business-like basis to know just about how much time to charge for on each job) so why not make full use of that time and turn out a real job and collect the extra dividends that word-of-mouth advertising will bring?

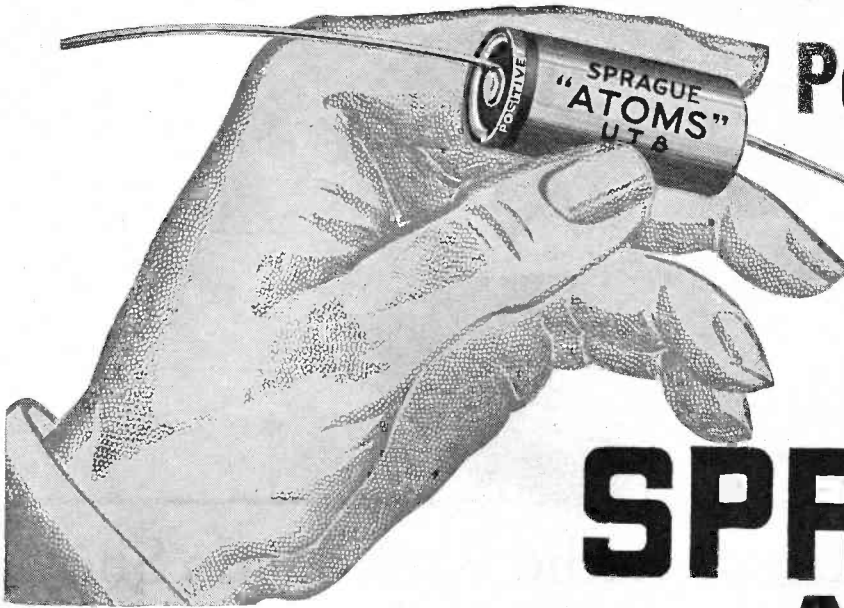
. . .

THE SHOW

SERVICE, along with over a hundred other organizations, will be represented at the Chicago show, June 8-11. Our booth is located at 212 Bell Street. We'll be glad to have you stop and get acquainted.

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- ✓ *The finest, most reliable midget drys on the market, bar none!*

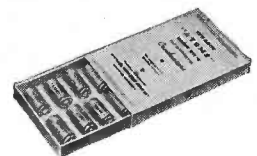
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TA-25	25	25	0.50	9/16"	1-5/8"
TA-525	25	50	0.55	5/8"	1-5/8"
UT-41	4	150	0.40	5/8"	1-5/8"
UT-81	8	150	0.45	5/8"	1-5/8"
UT-121	12	150	0.50	5/8"	1-5/8"
UT-161	16	150	0.55	11/16"	1-5/8"
UT-201	20	150	0.60	3/4"	1-5/8"
UT-401	40	150	0.65	7/8"	1-5/8"
UT-42	4	250	0.45	9/16"	1-5/8"
UT-82	8	250	0.50	5/8"	1-5/8"
UT-122	12	250	0.65	11/16"	1-5/8"
UT-162	16	250	0.75	3/4"	1-5/8"
UT-43	4	350	0.50	5/8"	1-5/8"
UT-83	8	350	0.55	11/16"	1-5/8"
UT-123	12	350	0.70	3/4"	1-5/8"
UT-4	4	450	0.55	5/8"	1-5/8"
UT-8	8	450	0.60	3/4"	1-5/8"
UT-12	12	450	0.75	7/8"	1-5/8"
UT-16	16	450	0.90	13/16"	2-1/8"
UT-20	20	450	1.00	7/8"	2-1/8"

DUAL CARDBOARD TUBULARS, TOO!

TA-100	10-10	50	\$0.65	5/8"	2-3/8"
TA-212	12-12	200	0.95	13/16"	2-3/8"
TA-216	16-16	200	1.05	7/8"	2-3/8"
TA-816	8-16	200	0.95	13/16"	2-3/8"
UT-88	8-8	450	1.00	15/16"	2-3/8"

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SERVICE

A Monthly Digest of Radio and Allied Maintenance

FOR MAY, 1938

LAW NUMBER ONE

By BERNARD H. PORTER

NO RADIO Service Men ply their trade in the Erlangen (Germany) of 1826. Nor is Mrs. Georg Simon Ohm's man Georg a Radio Engineer. He is, in fact, interested neither in soldering irons nor servicing costs. He merely writes a paper and entitles it, for lack of a better name, "Die galvanische Kette mathematisch bearbeitet." When its contents are received coldly, he feels hurt, resigns his professorship in mathematics and earns a precarious livelihood for a few years until another teaching position is available at Nuremberg.

Aside from Georg's later receipt of a few medals there is little left to say. That is nothing more unless one wishes to reconsider the last few paragraphs of his pamphlet. One translated sentence of it reads: "In any wire at uniform temperature the current is directly proportional to the potential difference between its ends."

Without visualizing that there would ever be such an electrical appliance as a radio, Georg Simon Ohm has described thus an equation that will always show how the resistance, current, and voltage of radio circuits are related to one another. His law, as stated originally above, applies equally to the early regenerative receivers, to-day's "radio nurses," and future television circuits. Obviously, then, it is good engineering and efficiency to know the how and why of such a general, but all inclusive, principle. Whether one is measuring a unit's resistance from the amount of current through it and the voltage across it, determining if the measured current agrees with the resistance and voltage values given on the circuit's

diagram, calculating the value of cathode-bias resistance, or measuring the effect of resistance increase by a voltage divider element on a receiver's voltage distribution—the simple statement of Ohm's Law must be known and used. Having once learned that the current through any resistance element of a circuit is equal to the voltage across it divided by its resistance (a restatement of Ohm's original text) one does not have to relearn it every time a manufacturer introduces a new model, Ohm's Law applies basically to all types of circuits, no matter how complicated, antiquated, or new.

Oddly enough, however, this same statement is still received coldly today even by those who could use it daily to best advantage. Admittedly Ohm's Law, so revolutionary in principle during the early days of electricity and magnetism, smacks of theory. Some calculation is also required. Contrary to general beliefs, nevertheless, theoretical facts involving arithmetic and thought still have practical value. Per-

haps when this truth is recognized more widely, greater progress will follow in the servicing industry. After all, theory is the sum total of experience had by thinkers and experimentalists over long periods of time. Their findings have merely been correlated and condensed to a single formula for the convenience of all who follow. By refusing to acknowledge the value of theory and things theoretical one is dismissing simultaneously useful information.

OHM'S LAW

The equation relating current, voltage, and resistance now bears Ohm's name. It shows that for a given metallic circuit a definite ratio exists between the potential across and current through it. If the potential is doubled, the current also increases twofold. This ratio of voltage to current is called the resistance of the circuit and is measured in *ohms*. Thus a network is said to have five ohms resistance when the ratio of the potential to the current is five. That is, five volts will send one ampere through it, while ten volts will send two amperes.

An ohm, then, may be defined as that which permits a current of one ampere to flow through a wire when there is a difference of potential of one volt between its ends.

Hence we have:

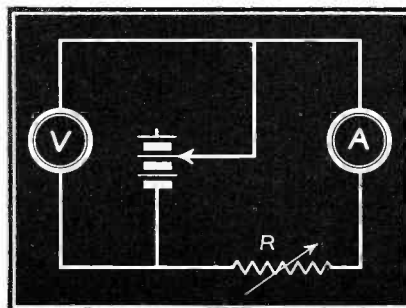
$$\frac{\text{Potential}}{\text{Current}} = \frac{\text{Volts}}{\text{Amperes}} = \text{Ohms,}$$

or

$$R = \frac{E}{I}$$

where R equals the resistance in ohms;

Circuit for demonstrating Ohm's Law.



E equals the electromotive force or potential in volts, and I equals the current in amperes. ("I" comes from the French word "intensite," meaning current.)

In this equation the ampere (1) and the volt (2) are defined legally and the ohm is determined experimentally. A legal definition for the international ohm, however, has been made. (3)

(1) The ampere was defined by an Act of Congress in 1894 as: "The unit of current shall be what is known as the international ampere, which is one-tenth of the unit of current of the centimeter-gram-second system of electromagnetic units and is the practical equivalent of the unvarying current, which when passed through a solution of nitrate of silver in water according to the standard specifications, deposits silver at the rate of one thousand, one hundred and eighteen millionths (0.00111800) of a gram per second.

(2) One volt, as defined by Act of Congress (agreeing with the definitions adopted by other countries) is the 1/1,0183th part of the potential delivered at 20 degrees C by a standard chemical cell, called the Weston Cell. This consists of plates of cadmium and mercury in an electrolyte of mercurous sulphate and cadmium sulphate, the whole cell being made according to certain prescribed conditions.

(3) The ohm is the resistance of a column of mercury 106.3 cm long, 1 mm² in cross-section, at 0 degrees C.

HIGHLY USEFUL

Of the three values, amperes, ohms, and volts, to be determined in any circuit, one can always calculate a factor with Ohm's Law provided the other two are known. If all resistance in a circuit and the applied voltage are known, the current can be computed by this relation. Likewise, if the current is read on a meter, and the voltage is known, the resistance can be determined. Finally, if the resistance and the current are known, the voltage can be found.

GENERAL APPLICATION

These determinations apply to an entire circuit or to any part of it. When the law is applied to the *entire* hook-up, care must be taken that *all* the electromotive force of the circuit is used for the value of E, that *all* the current in the circuit is used for the value of I, and *all* the resistance of the circuit for the value of R.

Similarly in applying the relation to only a *part* of the circuit, one should see that the values for E, I and R include only the voltage, current, and resistance of *that particular part* of the circuit under consideration.

FIRST FORM

$$I = \frac{E}{R}$$

This means the current in amperes equals the potential in volts divided by the resistance in ohms, or

$$\text{Amperes} = \frac{\text{Volts}}{\text{Ohms}}$$

In the above or first form of Ohm's Law the value of the current I is unknown and is to be determined from the known voltage and resistance. The equation states that if the known volts passing through a circuit or portion thereof are divided by the known resistance of those parts, the answer is the current value sought.

It follows from this expression that the higher the resistance (voltage being held constant) the *smaller* the current found, because a small fixed number is being divided by a high factor to give a small result. Similarly, the higher the voltage (resistance held constant) the *higher* the current, because a high number is being divided by a small fixed number to give a higher result.

SECOND FORM

$$E = I R$$

This is the same as saying the potential in volts equals the current in amperes times the resistance in ohms, or

$$\text{Volts} = \text{Amperes} \times \text{Ohms}$$

The second statement for Ohm's Law determines an unknown voltage when the current and resistance values are known. The greater the current, or the resistance, or the higher both are, the greater the voltage found.

THIRD FORM

$$R = \frac{E}{I}$$

Resistance in ohms equals the potential in volts divided by the current in amperes, or

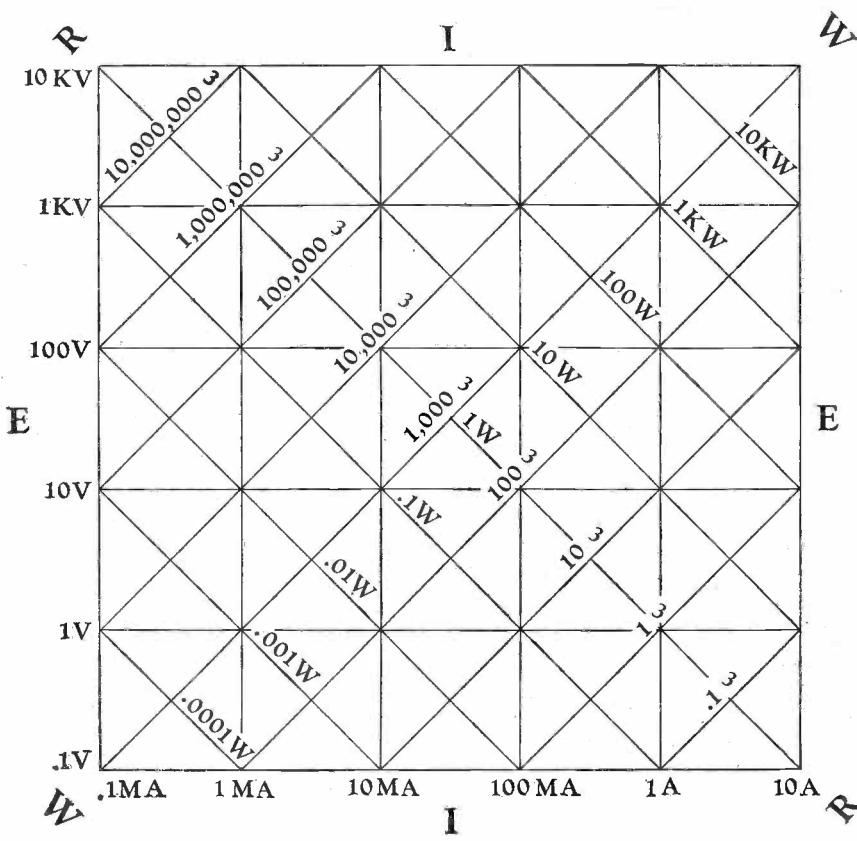
$$\text{Ohms} = \frac{\text{Volts}}{\text{Amperes}}$$

The determination of resistance from the third form of Ohm's Law (voltage and current known), like the solution for the current from the first equation, is made by division. The smaller the current substituted in this relation the higher the resistance because the constant voltage value is being divided by a larger number. Likewise, the smaller the voltage (resistance constant) the smaller the current because a smaller number is being divided by a fixed one.

MEMORY AIDS

It is worth while noting in these three expressions that whenever "the higher, the higher" applies, so also does "the lower, the lower." For example, the higher the current or voltage (or both) the higher the voltage. Also the

THE DECIMAL CHART—"A"



lower the current or resistance (or both) the lower the voltage.

In the two expressions for finding current and resistance, it is the voltage that is divided by something. For current determinations, the voltage is divided by resistance; for resistance, it is divided by current. In other words, if the current is unknown, then the known voltage is divided by the remaining constant. If the resistance is to be found, the known voltage is divided by the third factor, the current in amperes.

The second form ($E = IR$) is the simplest to remember. It is also distinguished by being unlike the other two expressions in form. Learn it first. Memorize preferably the letters and associate unconsciously the proper words with them. Rather than repeating the law as "volts equals current times resistance," say instead "E equals I R," or "E equals I times the third."

Then learn the first form of Ohm's Law. Learn it as "I equals E over R," or "I equals E over the third."

Hence the resistance formula follows as "R equals I over the third." In all there are but three things to remember: amps, volts, and ohms. When one has I and E, the third is R; if R and E, the third is I.

Actually the equations are purely algebraic, so that the mathematically minded may prefer to remember only $E = IR$ and to transpose it mentally at the time of and in accord with the determination at hand. Numerous calculation aids and time-saving devices are available for the Service Man. Facility in the use of charts like those shown here, for example, is helpful. Chart A, the "Decimal Chart," and Chart B, the "Numerical Chart," provide a rapid method for determining current (I), voltage (E), resistance (R) and wattage (W), if any two of these variables are known.

A chart that would cover any range of I, E, R, or W would be complicated and too large to put in a convenient printed form, consequently, the two charts A and B.

The limits of the charts are as follows:

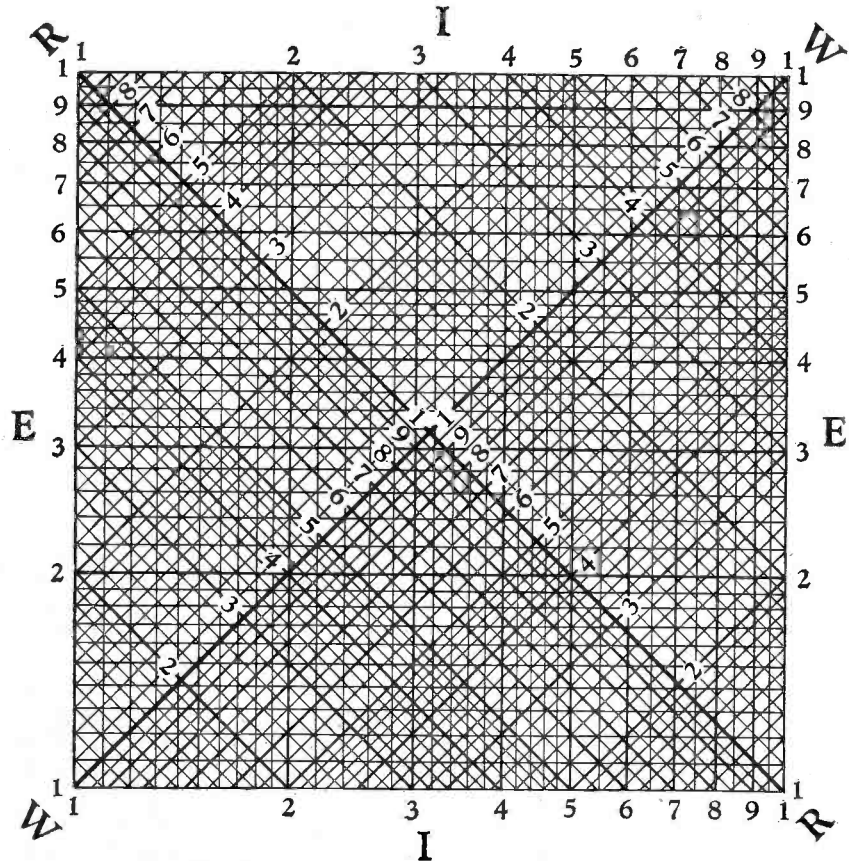
Current—"I"—0.1 ma—10 amperes.
Voltage—"E"—0.1 volts—10,000 volts.
Resistance—"R"—0.1 ohm—10,000,000 ohms.
Wattage—"W"—0.001 watt—10,000 watts.

I, E, R and W are designated on the charts as follows:

Current—"I"—Vertical lines.
Voltage—"E"—Horizontal lines.
Resistance—"R"—Lines slanting up to right and down to left, parallel to WW, the wattage scale.
Wattage—"W"—Lines slanting up to left and down to right, parallel to RR, the resistance scale.

In order that these charts may be

THE NUMERICAL CHART—"B"



Charts and chart data courtesy Shallcross Mfg. Co. (© Shallcross Mfg. Co.)

readily and easily understood, it is important to remember that Chart A is divided by the horizontal lines "E" and the vertical lines "I" into 25 squares.

Chart B is an enlargement of each one of these squares sub-divided in order that fractional values of these variables can be accurately determined. It will be noted that Chart B is divided into four major sections formed by the diagonal lines "R" and "W."

When "R" and "W" are known and it is desired to find "I" and "E" it is advisable to start with Chart A. The point where these lines representing the known value of "R" and "W" intersect will determine the exact section of the square where the other two unknowns will intersect. This also designates the decimal point. As these charts are logarithmic, when interpolating it should be remembered that the scale on Chart A for each square is identical to that on Chart B.

If a point of intersection is not located in the section presupposed, this point will be in the section opposite.

When combinations other than "R" and "W" are given, it is best to start with Chart B. An example or two will best explain.

Example 1

W = 200 watts
R = 500 ohms

Starting with Chart A project along the 500 ohm diagonal line parallel to WW and the 200 watt diagonal line parallel to RR. It will be noted that these lines intersect in the right hand section of the square. This designates the decimal point.

Referring to right hand section or Chart B where R5 line intersects W2 line, read E and I as follows: E 316, I 64. The decimal place has already been fixed from Chart A and I is between 100 ma, and 1 ampere, or I in this case is 640 ma. E is between 100 volts and 1 kv, or in this case E is 316.

Example 2

I = 30 ma
R = 4 ohms

Starting with Chart B project vertically upward from 3 to R4 and the intersection of these two lines determines the values and in what section of the square.

Project along these lines parallel to I until you intersect the E scale. E will then be found to be 12. From the intersection of I and R project along lines parallel to RR until you intersect the WW scale. W will then be found to be 36.

Referring to the decimal Chart A, in (Continued on page 30)

ADDING VARIABLE SELECTIVITY

to stock receivers

By FRANCIS C. WOLVEN

SOME TIME AGO the writer was confronted with the problem of improving the selectivity of a Sonora (Continental No. 11S) which was not living up to its owner's expectations. At an earlier date, Litz-wound high-gain i-f transformers had been installed in an Apex 10-B for the same customer and the increase in selectivity and sensitivity had been well worth while. However, the owner was very slightly deaf, the deafness being entirely in the upper register. This is very annoying since it entirely destroys the intelligibility of speech. Naturally he had to operate the rebuilt Apex at a very high level since the set was too selective to give really good tone. The new Sonora was a little better but still not quite clear enough for him and too broad for the rest of the family. Since automatic tuning was one of its features and the a-f-c system was rather limited in its action, any attempt to make the set highly selective would render the automatic tuning worse than useless as well as ruin the tone for the owner. It was decided that the only solution would be variable selectivity since then the set could be changed to fit most conditions.

Two mica-trimmer type intermediate transformers were used, the discriminator transformer remaining unchanged. This gave rise to some misgivings as mica trimmers are not too reliable in a-f-c applications. Still, it will be a simple matter to substitute transformers using air-type trimmers should it ever become necessary and the job, being more or less an experiment, was undertaken with that understanding. Since these transformers are much larger than the originals, it was necessary to remove the shields from the two i-f 6K7's and to substitute metal tubes for glass. A template was made, the location of the holes punched, and the transformers went into place quickly and easily. A small lamp, 7.5 to 10 watt, placed under the chassis, made it very simple to locate the transformers over the same spot as the originals. The transformers were in place, all connections made, and the shaft used to vary the coupling was

installed by lunch time. No mechanical difficulties were experienced as the frame holding the dial mechanism and the cover over the automatic-tuning disc are conveniently located. Brackets with bearings salvaged from old volume controls were placed in both locations and an old Silver Marshall winding drum served to hold the cord which was to raise and lower the push rods on the transformers.

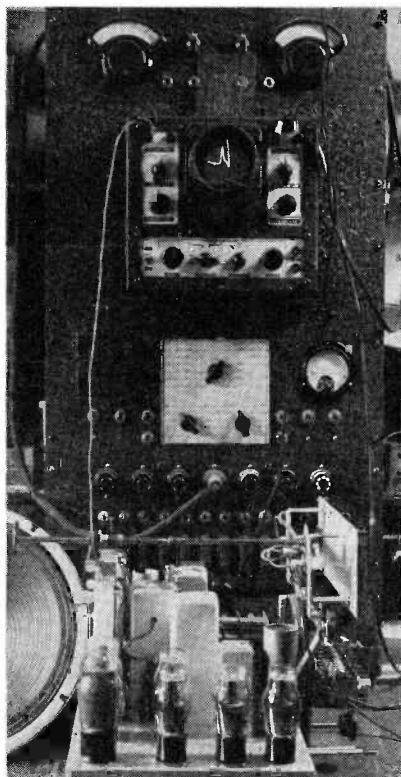
Collars were placed to prevent end-play, stops arranged to prevent unwinding the cord and breaking it, a bakelite wheel and spring added (salvaged from a Magnavox battery set) and a cross-piece fastened across the two push-rods to actuate both at once. The cord was attached to this cross-piece at a slight angle to coincide with the pitch of the winding drum, thus preventing undue wear. The shaft was purposely left long so that it could be cut "on loca-

tion" to bring the control knob in line with the back of the cabinet. The bakelite wheel was notched at various points where desired resonance curves were obtained. However, this was done some time after alignment. A piece of spring steel checks any tendency of the shaft to turn and provides a definite stop for each position.

Alignment was carried out with both output meter and oscillograph connected to the set and used alternately. Alignment was carried out at minimum coupling in accordance with manufacturers' instructions. (See also pages 109 to 111 of Rider's "Automatic Frequency Control Systems.") Contrary to common belief, it seems easier to peak a set at maximum response (when coupling is loose) with an output meter than with an oscillograph. However, when the i-f coils are closely coupled, the oscillograph becomes a necessity and in this case was used as a check when varying the coupling. It was found that even one slightly incorrect adjustment would distort the resonance curve seriously as viewed on the screen, but it was very difficult to make any correction with the help of the oscillograph since throwing one circuit slightly "off" would correct the shape of the pattern, but result in a marked decrease in gain when switching back to the output meter.

Using both oscilloscope and output-meter interchangeably, it took very little time to get excellent resonance curves with maximum gain at loose coupling and well-balanced peaks at close coupling. Desired resonance curves were then selected and the bakelite wheel was scratched at corresponding positions. Upon filing the notches and reassembling, it worked perfectly. The meter used for the galvanometer test, incidentally, was a Weston 10,000-ohm-per-volt job used on the 1/2-volt scale. The discriminator secondary was difficult to peak accurately, but this method provides the most positive check so that no errors are possible if a little care is taken.

The proof of the pudding is, of



Receiver under test on the author's bench.



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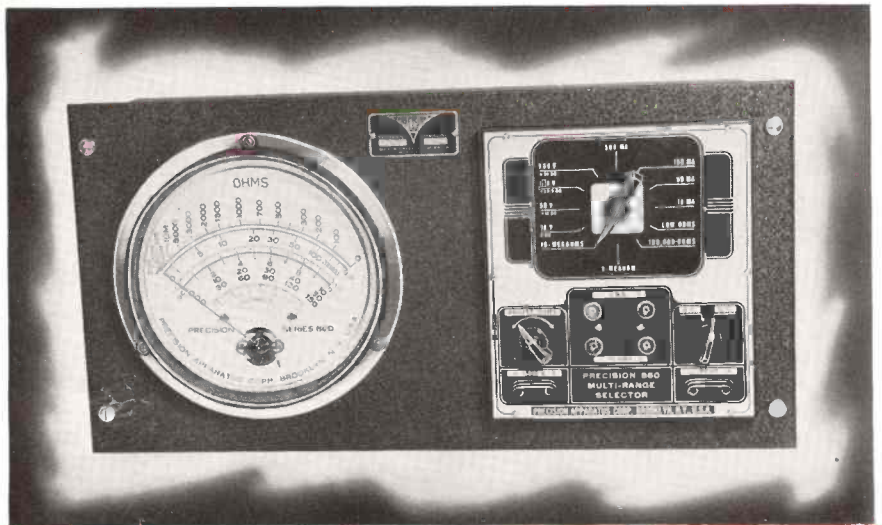


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Size of entire panel 20 x $10\frac{1}{2}$ x 4.

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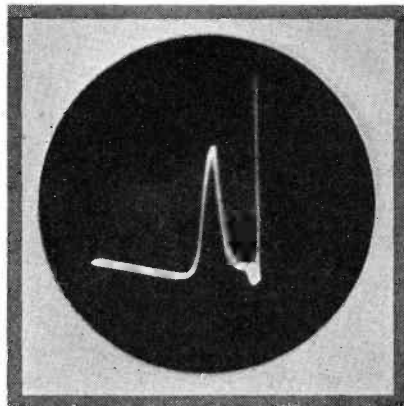
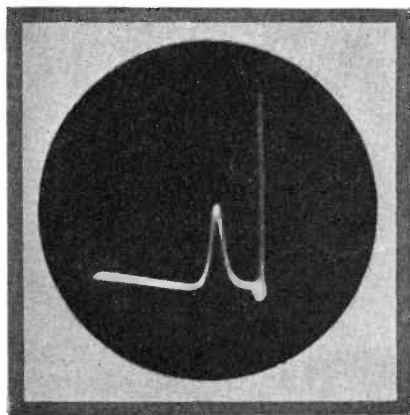
Thousands of favorable comments have convinced us that YOU like the sizeable 9 inch, full vision meter and the fact that the selector unit can be removed from the panel for bench use. This, as you know, preserves the life and accuracy of the meter inasmuch as it entails a minimum of handling, removing the ever present risk of "bouncing around."

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See This and Other "PRECISION" Units at Your Distributor or at the June Show Booth 209, Ampere Street

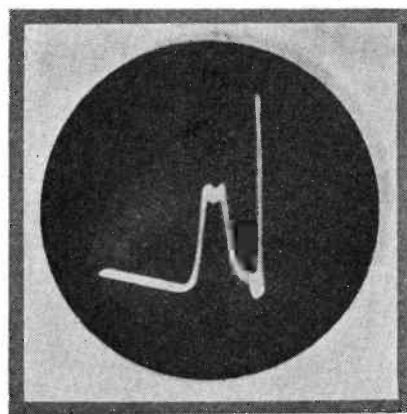
PRECISION Apparatus Corporation
821 EAST NEW YORK AVENUE
BROOKLYN, NEW YORK

An oscillogram of the revamped receiver. This shows the i-f response with the transformers set for minimum coupling.



With the i-f transformers set for optimum coupling, this curve results. Note that the response is still not exactly suitable for high-fidelity response.

Moderately close coupling gives this curve. The transformers are still not greatly over-coupled, but enough so for the desired results.



course, in the eating. The accompanying oscillograms tell the story. All images were taken with the controls set at the same position. The first is larger than it should be because of a-v-c action and represents minimum coupling. The second indicates optimum coupling and the third is typical of moderately close coupling. Maximum coupling was, of course, unsatisfactory. With the selectivity control set at the latter position, the customer could understand speech perfectly at low room volume although he could not use the other set unless it were very loud, to most persons, uncomfortably so. It may be

that this accounts for many more (but not all!) people who demand full volume; they are having trouble with their higher frequencies, and too many sets cannot supply them.

When tested for selectivity, it was possible to get 10 kc selectivity on any of the principal stations—and in the evening at that. Of course the high frequencies were much attenuated but, at any rate, each member of the family could make the radio suit his taste. The knob controlling the selectivity was entirely satisfactory at the rear of the set, since, when the novelty has worn off, it will be used perhaps three or four times

per day. Especially noticeable when changing selectivity was the much greater amount of interference in the high-fidelity position. The difference cannot be appreciated until one makes such a change-over test; another argument for noise-reducing antennae, interference elimination, etc.

To conclude, any shop should be able to handle this or other similar jobs without too much delay and to the satisfaction of both owner and Service Man. This one took about three-fourths of a day, the bill was under twenty dollars, and the customer was entirely satisfied.

REMOTE CONTROL

(See front cover)

THE ANNOUNCEMENT of a new tube, the OA4-G, a cold-cathode glow-discharge type especially applicable to remote control, was recently made. The discharge can be initiated by a very small amount of electrical energy applied to the starter-anode circuit.

The circuit shown on the cover is the fundamental schematic for the use of the OA4-G as a remote control device. This particular circuit is for an a-c line, although the tube may be used with a d-c supply. With d-c, it is necessary to provide some means for interrupting the supply voltage after the signal voltage is removed. If this is not done, the tube will continue to conduct even in the absence of the signal voltage. With a-c operation, the periodic reversal of the supply serves to extinguish the discharge in the OA4-G.

As will be seen, the 115-volt a-c supply is impressed between the anode and cathode. By means of the voltage

divider, R1 and R2, the starting anode is maintained at a potential slightly below that required for breakdown.

Coil L and condenser C constitute a tuned circuit, resonant at the frequency of the controlling signal. When this signal is applied—it is impressed directly upon the 115-volt line—a resonant voltage builds up across L and C. The voltage across C tends to increase the negative potential peaks on the cathode and, hence, to increase the potential between cathode and starter anode. This increase results in the start of a discharge between starter anode and cathode.

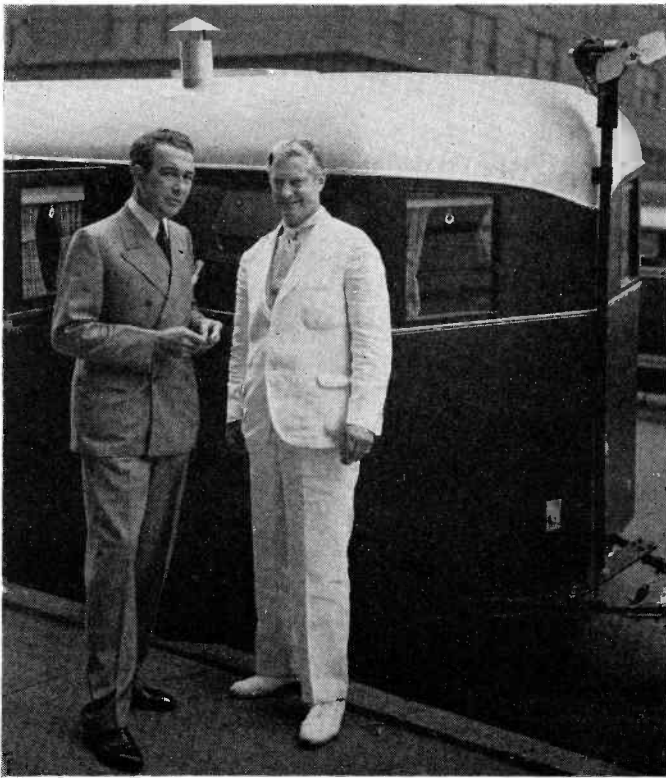
The resulting ionization taking place within the tube causes the discharge to transfer from the starting anode to the anode. With the discharge occurring between anode and cathode, current flows through the winding of a relay, S, closing the circuit of which the relay contact and armature are a part. This

relay then serves to control another circuit.

It is obvious that most of the voltage impressed between the cathode and starter-anode can be supplied by the voltage divider, R1 and R2, necessitating that the tuned circuit, L and C, supply only the difference between the voltage obtained from R1-R2 and that required to start the discharge. Typical operating conditions, with a-c supply, indicate that the *peak* value of voltage on the starter-anode can be 70, maximum (49.5 volts, rms).

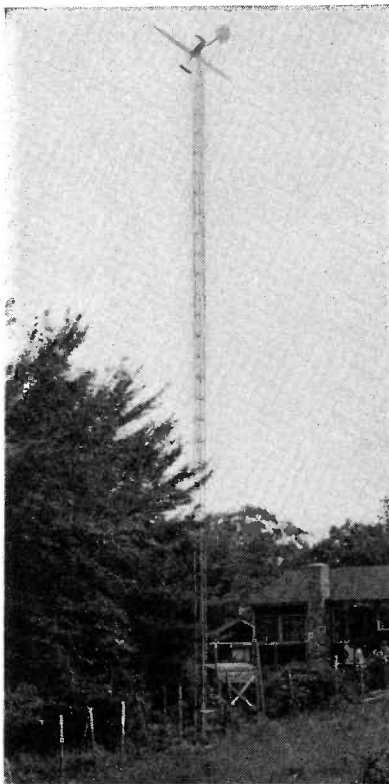
Practical applications for this tube will no doubt occur to many readers. It is suggested that those interested further in the use of this tube, especially as applied to the remote control of radio receivers, consult a paper by C. N. Kimball, "A New System of Remote Control," RCA Review, January 1938; this article describes a system for remote control of a receiver.

Do you know your operating costs? Fair profit is your due.

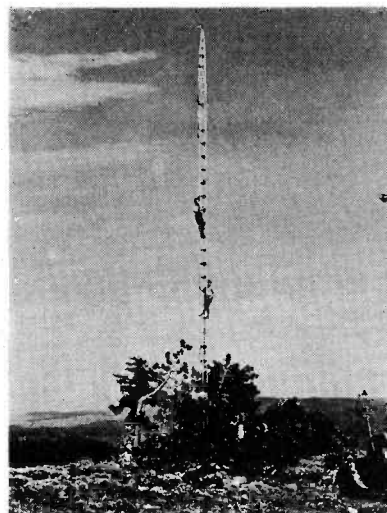


On a trailer! The charger cuts in at a speed of 22 miles per hour with a maximum rate of 20 amperes. Carveth Wells, noted explorer and author, talks with Commander E. F. McDonald, Jr., of Zenith, before starting on a nationwide trailer tour during which radio will play a prominent part.

A high - elevation installation in New England

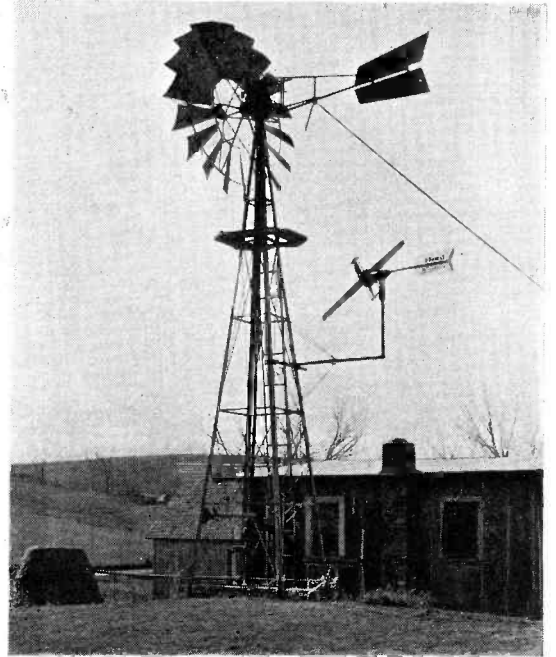


In Ireland.



Nearly a mile above sea level. An Indian reservation in Washington.

Windmill tower provides elevation here.



FREE AS

THE ILLUSTRATIONS on these pages show but a few of the many applications of wind-power charging equipment. Foreign lands, Indian reservations, mountain camps, farms—the list could be extended almost indefinitely.

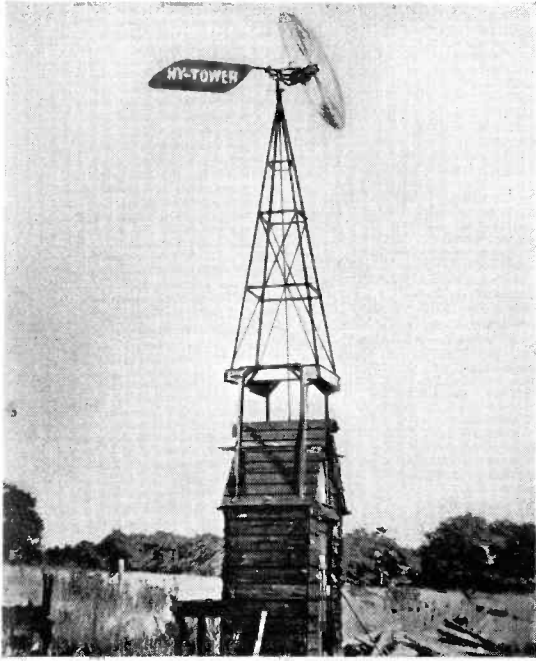
Many Service Men are in an excellent position to take advantage of the opportunities presented by wind chargers. The field is, of course, primarily that of the rural areas not yet reached by power lines; this includes many square miles of "vacation lands," dotted with camps and cabins.

(Photos on this page courtesy Wincharger Corp.)

Illustrating a typical installation.



An installation in England.



THE AIR

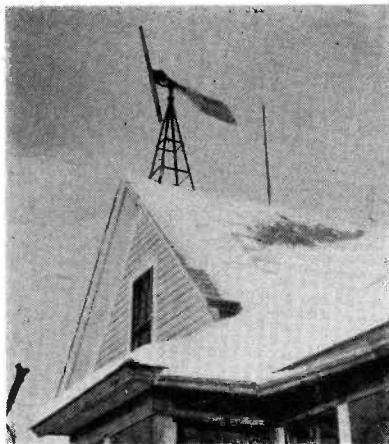
Power for the radio and a few lights, can in most cases be derived from the same breezes that cool the vacationists.

Boats, of a size to be found on many rivers and lakes, are other possible users of this equipment. Frequently, the boats' motors cannot furnish the additional power which would be required to charge an additional battery for a radio.

Trailers, as one of the illustrations shows, are among the possibilities. Service Men in the cities will find trailer owners their best, if not only prospects.

(Photos on this page courtesy Parris-Dunn Corp.)

Another windmill tower put to good use.



Minnesota.



An Iowa barn serves for this mounting.

Palestine investigates the possibilities of wind power. This installation is at Solomon's Pools, just outside of Jerusalem.

Two farm boys take time out from chores to install a wind-power charger. This illustrates a typical installation as recommended for flat country.



General Data . . .

Majestic 870 (Chassis 1870)

Tuning: "Telematic" and manual
 Ranges: 538-1650 kc; 1.67-5.7 mc;
 5.8-18.8mc

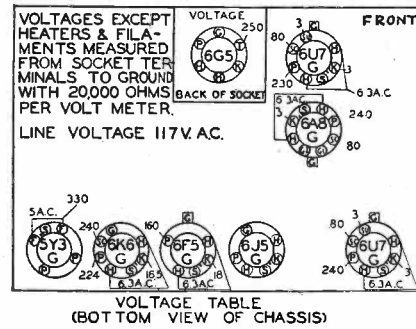
Tubes:
 R-f: 6U7G
 1st Det: } 6A8G
 Osc: }
 I-f: 6U7G
 A-v-c: } 6J5G
 2nd Det: }
 1st A-f: 6F5G
 Pwr Amp: 6K6G
 Rect: 5Y3G
 Tun Ind: 6G5

Power Supply: 105-130 volts, 50-60 cycles

I-f: 455 kc
 Speaker: Electrodynamic
 Field Res: 1300 ohms

TO INDEX DIAL

Select the desired station; tune same accurately with the tuning control. Press firmly on the selector knob located at the edge of the rotating escutcheon being very careful that the pressure applied does not shift the position to right or left and effect detuning of station. Apply a sharp, but not too heavy blow to this knob causing same to make



Socket voltages.

the proper indentation on selector ring. Insert station call letters supplied on chart into space provided for same directly at the end of the pointer in stationary outer ring. Repeat this process for all stations desired. Now the dial is indexed. To tune, grasp the Telematic selector knob, apply a slight forward pressure and rotate same until pointer comes about to the desired frequency or station call letters. (This slight forward pressure causes the "mute" switch to silence the receiver.) Now press the knob with reasonable pressure and rotate until it reaches the index into which it should fall. Release

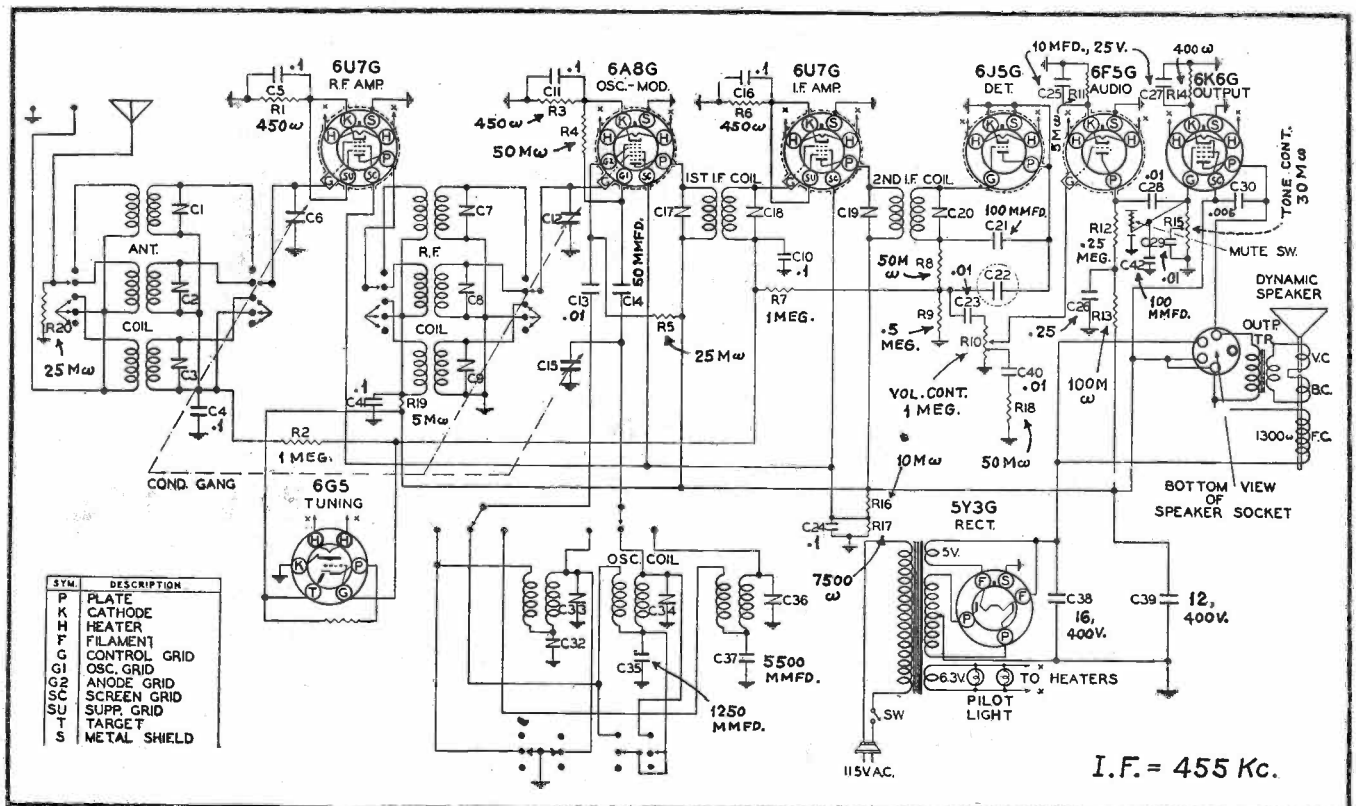
pressure on the knob and the station will be there.

ALIGNMENT PROCEDURE

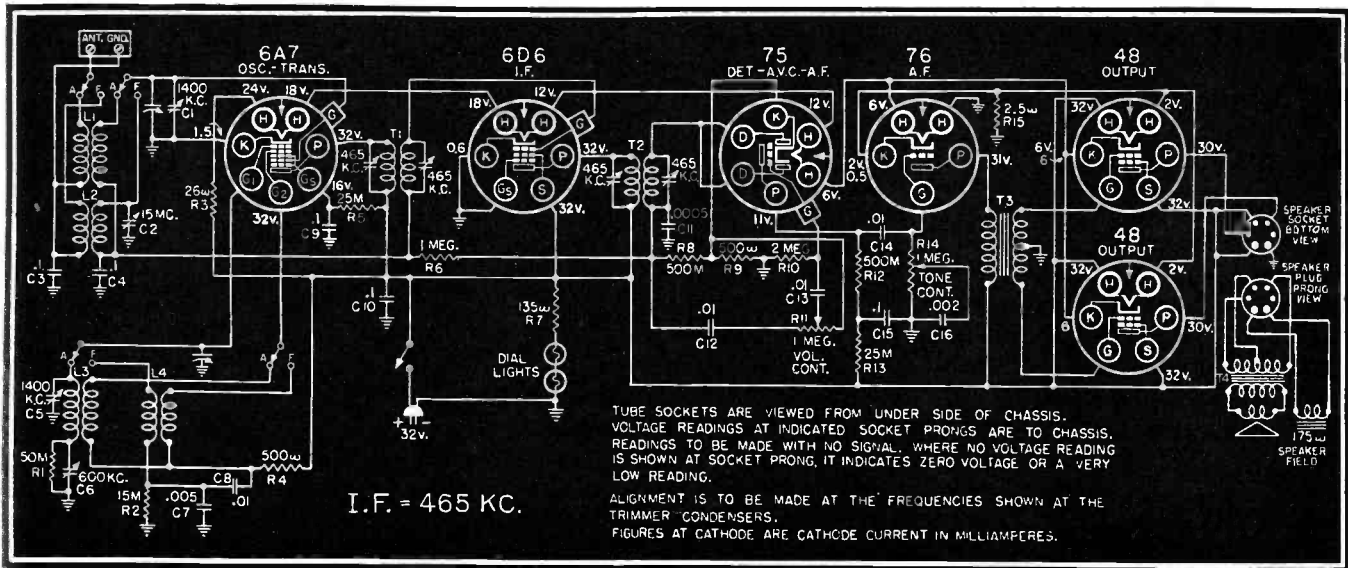
Correct alignment is extremely important. The receiver is properly aligned at the factory and should not be disturbed unless it is absolutely necessary. The procedure is as follows: Turn wave-change switch to broadcast position (full counter-clockwise) and rotate variable condenser until it is about 50 per cent engaged. Apply a 455 kc signal to the grid of 6A8G mixer tube through a tubular condenser on the order of 0.1 mfd. Referring to chassis layout, adjust trimmers marked "Trim 455 kc" for maximum signal using of course some sort of indicating device such as an a-c voltmeter or output meter across the voice coil of the speaker. It may be necessary to apply a very strong signal to "find" the signal until alignment is approached. It is advisable to maintain as low a signal input as conveniently possible in order to minimize the possibility of misalignment resulting from avc and overload effects. If a squeal is heard while tuning, rotate the gang condenser slightly and it should disappear. Naturally, the ground side of the generator should be connected to the chassis either directly or through the 0.1 mfd condenser.

SHORT-WAVE BAND

Rotate the wave-band switch to full clockwise position. Connect high side of generator output to antenna lead



Circuit schematic, Majestic 870.

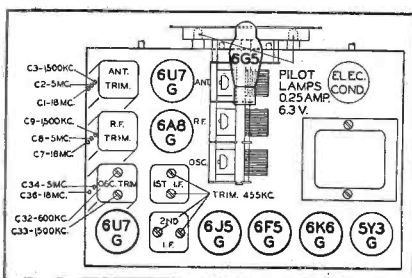


Circuit schematic, Silvertone 4619.

through a 400-ohm dummy antenna. Set dial at 18 mc. Apply 18 mc signal. Unscrew trimmer C36 to a minimum capacity, slowly turn the screw so that the trimmer capacity increases until the signal is heard. Apply 18 mc signal and adjust C7 and C1 for maximum response. It may be found advisable to "rock" generator frequency back and forth through signal to offset detuning effect from interaction between rf and oscillator circuits at high frequencies. Check alignment through medium of sensitivity at 11 mc and 6 mc respectively. When aligning at 18 megacycles, it is well to point out here that the trimmer C7 may indicate 2 maxima. The maxima obtained with the trimmer tighter, is the desired one. This can be checked by leaving the gang condenser set and shifting the generator to a higher frequency viz., 19 megacycles, where the image should appear. If it is properly aligned, it should require about 10 times the signal voltage for the image to give the same output as the real signal.

POLICE BAND

Shift wave-band switch to middle



Chassis layout, Majestic 870.

position. Apply 5 mc signal. Set dial pointer to 5 mc. Adjust trimmer C34 in the same manner as previous band until maximum signal is heard. Apply 5 mc signal and adjust trimmers C8 and C2 until response is maximum. Check for image in same manner as previous band. Check alignment at 3.5 and 2 megacycles respectively.

BROADCAST BAND

Use a 200 mmf mica condenser for dummy antenna on this band. Shift wave-change switch to full counter clockwise position. Adjust trimmers C3 and C9 to medium tight position. Rotate gang until dial pointer indicates 600 kc. Apply 600 kc signal and adjust padder C32 for maximum signal. Set dial to 1500 kc and apply 1500 kc signal; adjust C33 for same. Then adjust trimmers C3 and C9 for maximum response. Shift gang to 600 kc and apply 600 kc signal. "Rock" gang condenser and adjust C4 for maximum signal. Recheck 1500 kc trimming.

Silvertone 4619

Tuning: Manual.
Ranges: 540-1750 kc; 5475-16500 kc.
Tubes:

- 1st Det: } 6A7.
- Osc: } 6A7.
- I-f: 6D6.
- A-v-c: } 75.
- 2nd Det: } 75.
- 1st A-f: } 76.
- 2nd A-f: 76.
- Pwr Amp: 48 (2).

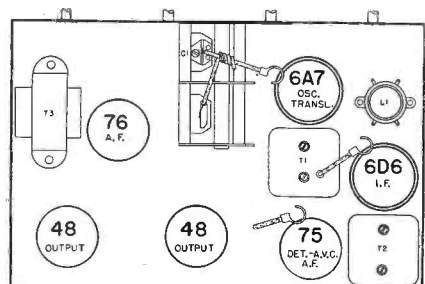
Power Supply: 32 volts d-c: 46 watts
I-f: 465 kc.
Speaker: Electrodynamic.
Field Res: 175 ohms.

GENERAL INFORMATION

Power Supply. These models are to be operated from a 32-volt d-c supply source only. The power supply cord plug must be inserted in its receptacle correctly. If, after waiting a full minute with the receiver turned on, there is no sound from the speaker, turn the power cord plug half way around and re-insert it in its receptacle. When the correct position has been determined, as just described, mark the plug with a notch or by a similar method so that the plug can be correctly re-inserted should it be removed from its receptacle for any reason. No vibrator or generator is used, the 32-volt supply being applied directly to the tube elements.

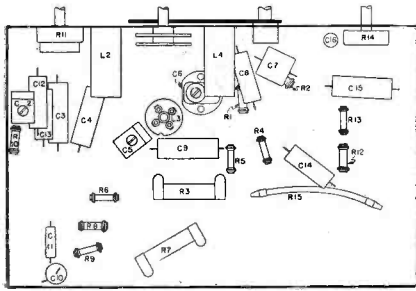
Dial Lights. Two dial lights are used in series with a 135-ohm resistor, R7, across the line. Be sure the same type of lamp is used when replacement becomes necessary, 6.3 volts (Blue Bead).

Noise-Suppression Equipment. Two condensers and a suppressor are supplied for eliminating the electrical interference created by the gasoline engine that drives the 32-volt lighting plant generator.



Location of parts on top of chassis, Silvertone 4619.

GENERAL DATA—continued



Location of parts under chassis, Silvertone 4619.

In single cylinder installations, cut the high tension wire going to the spark plug and screw the suppressor on to the two ends of the wire. In multi-cylinder installations, cut the high tension wire going to the center terminal of the distributor cap and screw the suppressor on to the two ends of the wire.

Connect one of the condensers between the two generator brushes. Ground the generator frame. Connect the other condenser from the battery side of the ignition coil to ground.

A-v-c Circuit. The diode current of the 75 tube, flowing through the 500M-ohm resistor, R8, creates a voltage drop across it. This voltage is applied to the control grids of the 6A7 and 6D6 tubes to provide a-v-c.

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

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

Align the i-f at the new frequency and then realign the rest of the receiver as described under "Alignment Procedure."

ALIGNMENT PROCEDURE

Connect generator to 6A7 grid cap through a 0.1 mfd dummy. Set generator to 465 kc; receiver band switch to "A"; tune receiver to 550 kc. Adjust i-f trimmers T2 and T1.

Connect generator through a 0.0002

mfd dummy to antenna terminal; set generator and receiver to 1400 kc. Adjust oscillator trimmer C5, and detector trimmer C1.

Set generator to 600 kc, generator remaining connected through 0.0002 mfd dummy to antenna terminal; rock receiver gang condenser through 600 kc while adjusting padder C6.

Turn receiver band switch to "F"; use 400-ohm dummy, set generator to 15 mc. Rock receiver gang condenser through 15 mc point while adjusting trimmer C2.

Motorola 12Y and 12Y-1 (Chassis 12-1)

Tuning: Motor

Ranges: 540-1720 kc; 2200-7000 kc;
7000-22000 kc

Tubes:

R-f: 6K7G
1st Det: 6A8G
Osc: 6J5G
1st I-f: 6B8G
2nd I-f: 6K7G
A-f-c control: 6J7G
A-f-c discrim: } 6H6G
2nd Det: }
A-v-c: 6R7G
1st A-f: 6J5G
Pwr Amp: 6V6G
Rect: 5X4G
Tun Ind: 6U5

Power Supply: A-c

I-f: 465 kc

Speaker: Electrodynamic

Field Res: 1000 ohms (cold)

V-c Imp: 14 ohms at 400 cycles

BUTTONS FAIL TO RELEASE

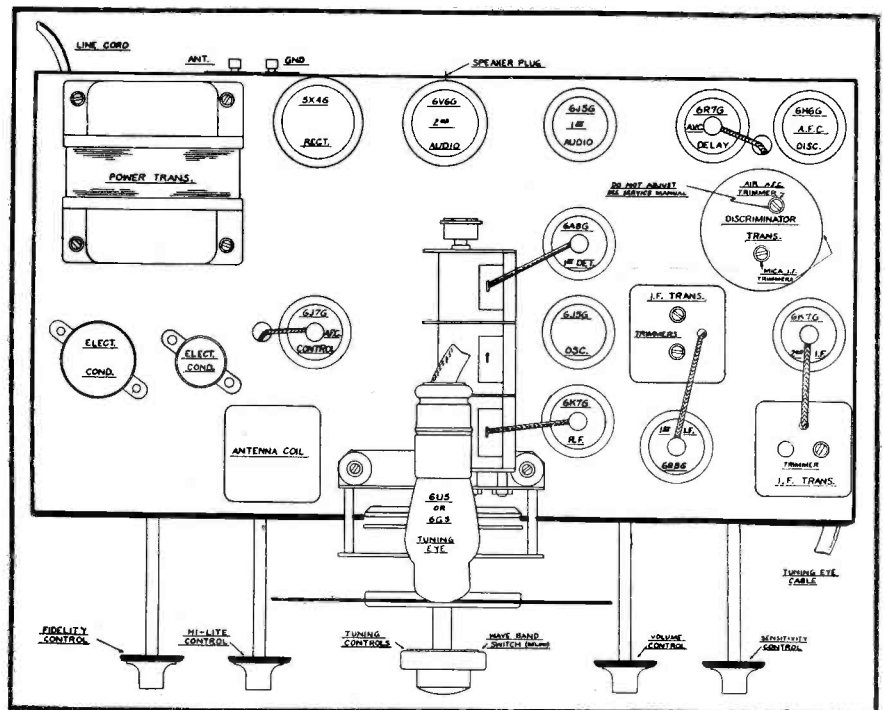
Burr on Button Plunger. To check this, remove the plunger by taking off the lock nut and the washer. To do this it is necessary to press in on another button in order to release the one which you wish to remove. If available, replace the plunger with a new one, and lubricate with several drops of fine oil. If a new plunger is not available, polish the old one with some very fine sand paper or emery paper.

Locking Plate Not Riding on Bearing. This is usually caused by the drum housing being assembled too loosely to the front plate. To determine whether or not the bearing is properly seated, check to see if the locking plate has a circular motion when buttons are pressed. If not, this indicates the plate is off its bearing. To correct this, tap lightly on the front plate around the bushing on which the band spread scale is mounted. For best results, use some circular object that can fit completely around the bushing such as a short section of $\frac{7}{8}$ " pipe.

BUTTONS FAIL TO LOCK IN

Locking Plate Too Tight. Check the locking plate to see that it moves freely when buttons are pressed, but not too freely. In this respect, a happy medium must be found. If too tight it indicates that the drum housing is assembled too tightly to the front plate. Some light oil might ease this a trifle.

Locking Plate Springs Missing. Check



Chassis layout, Motorola 12Y and 12Y-1.

GENERAL DATA—continued

the front of the drum assembly to determine that all three coil springs are present in the locking plate assembly. If any springs are missing, replace them.

Foreign Matter Between Plates. There are three plates in the locking mechanism, the one in the center being the actual locking plate. Dirt or metallic burrs between these plates can prevent freedom of movement. You might try some oil. However, it may be necessary to take the drum apart, which is not ordinarily recommended. If available, change the drum.

Button May be Stuck In. If the button fails to lock in when pressed, it may be because some other button is already locked in and fails to release. (See above notes for proper correction).

Worn Plunger. Remove the plunger as outlined above, and check to see if locking groove and shoulder are intact. If worn, replace with new plunger. If new plunger is not available, turn plunger one-quarter turn from original position and reinstall.

MOTOR FAILS TO START

Button Does Not Release. If, when a button is pressed, the motor does not start, it may be that the previously depressed button has not released, thereby closing the motor switch on the rotor inside the drum. (See previous section on that subject.)

Motor Circuit Open. Check for open motor winding or for open transformer secondary (24 V winding). Check motor switch contacts on front of drum and on the rotor inside of the drum.

Shorted Motor Filter Condenser. Check the 0.5 mf motor noise filter condenser located directly under the motor. If shorted, motor will not run.

MOTOR FAILS TO STOP

Ground In Motor Circuit. Check the white lead from the motor to the switch on the front of the drum. Also check the switch. If ground exists in this circuit, the motor will not stop.

Check Buttons One and Nineteen. If the stop arms on the buttons on either side of the release button are adjusted too close to the release position, the rotor may not reach them in its revolution before the reversing switch is tripped. This makes it impossible to break the motor circuit at the switch on the rotor. To correct this remove lock nut and plunger and with small pointed tool swing stop arm away from release position. Also check reversing switch to see if it reverses at the proper moment.

Rotor Switch Fails To Open. Check the switch on the rotor to see if the contact breaks properly when the button that has been pressed is reached. Setting of rotor switch contacts may be adjusted through inspection hole in back of drum housing. This should be done with exceptional care. The correction can sometimes be accomplished by inserting a thin shim washer under the button plunger. This spaces the station stop arm closer to the rotor.

Drum Switch Fails To Open. Check the switch on the front of the drum to see that it opens properly when the release button is pressed for manual

tuning. If switch fails to break contact properly, motor will continue to run.

FAILS TO STOP AT BUTTON

This condition is a little different from the condition mentioned in the previous discussion. In this type of failure the motor will stop at most of the buttons, but may fail to stop properly on one or two buttons.

Short Plunger. If the plunger is too short the stop arm will be spaced too far back from the rotor. Try a new plunger. If this does not correct the failure, insert one or more thin shim washers under the plunger. This will space the stop arm closer to the rotor.

Skips Several Buttons. If the motor skips several buttons located at different sections of the drum, treat each button as in Step 1 above. If, however, several adjacent buttons fail, then check the assembly of the drum housing to the front plate. It may be too loose along that particular edge of the drum. To correct this,peen the housing more firmly to the front plate.

Too Much Torque. Check the adjustment of the intermediate drive wheel, which can be moved up or down, to see that it releases promptly and freely when the circuit is broken. If it fails to release promptly, it would tend to carry the mechanism beyond the button. Adjust intermediate drive mounting plate if necessary.

Lock Nut Loose. Check all lock nuts to see that they are drawn up firmly. A loose lock nut outside the drum will mean a loose stop arm inside the drum.

MOTOR FAILS TO REVERSE

Defective Reversing Switch. If defective switch is found, replace it.

Reversing Pin Collar Not Properly Set. Check the adjustment of the reversing pin collar which is located directly in front of the flexible coupler, to see that the reversing switch trips exactly at the end of travel of the mechanism. The collar is adjustable, being held by two set screws.

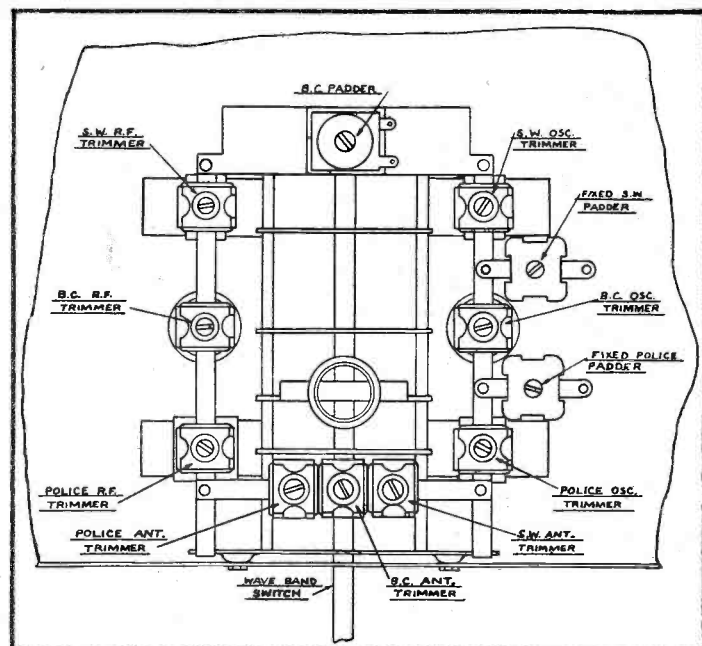
Open Reverse Winding In Motor. Check the reversing field in the motor. If open, the motor will travel in one direction only.

Travel-Lite Stops Not Properly Set. Check the stops on the gear train studs that the travel-lite hits as it reaches either end of the dial. If the travel-lite bracket hits the stop before the reversing switch trips, the motor will not release. Stops may be either of two types: brass clamp or screw and lock nut.

BUTTONS FAIL TO RETAIN

ORIGINAL SETTING

Loose Lock Nut. A loose lock nut



Location of trimmers, Motorola 12Y and 12Y-1.



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YAXLEY MANUFACTURING DIVISION

GENERAL DATA—continued

will permit the stop arm to move from its original setting.

Loose Gear Bushing. Check the gears in the gear train, particularly the split gears to make sure there is no lost motion between the gear and the bushing.

Loose Coupling. Check the flexible rubber coupling between the mechanism and the tuning condenser for loose set screws, loose bushing, or loose rivets.

Loose Drum-Holding Nut. Check the large hex drum-holding nut, to be sure the drum is held firmly in place.

Loose Drum Front Plate. Make sure the front plate is peened firmly to the drum housing.

Loose Set Screws. Check all set screws in the gear train.

Improper Button Setting. Check all button settings, to make sure they are set to the center of the station carrier. This is extremely important. When setting buttons, the release button must be held in firmly to short out afc, otherwise it is impossible to make the setting at the center of the carrier.

A-F-C Switch Grounded. Check the a-f-c switch which is the inside blade of the switch on the front of the drum. If this is grounded while tuning automatically, afc does not operate. No automatic tuning mechanism is accurate enough to operate without afc.

SLIPPAGE

Rubber Drive Cones Worn. Replace if necessary.

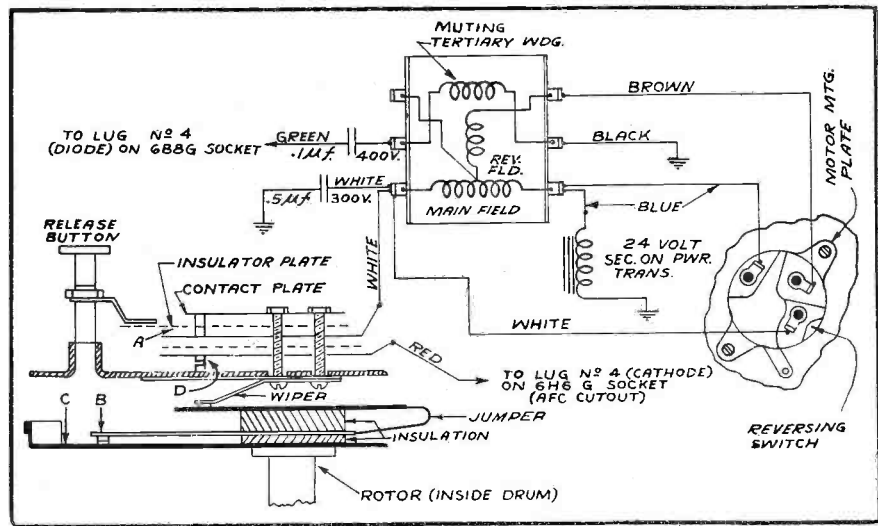
Loose Set Screws in Gear Train. Tighten all set screws firmly.

Improper Adjustment of Intermediate Drive. Check intermediate drive wheel to see that it bears firmly on the flywheel while the motor is running. If necessary, adjust intermediate drive mounting plate.

Binding In Gear Train. Press release button and tune set manually. If binding is noted, attempt to relieve it as follows: Loosen machine screws that extend through the rear mounting plate into the spacing studs that hold the gear train. If tension is relieved, insert shim and retighten machine screw.

Rotor Drags. If the mechanism turns too stiffly, it may be that the rotor inside the drum is dragging. Lubricate rotor bearing and check to see if drum housing is peened too firmly to front plate.

Oil On Driving Surfaces. Make sure that the rubber friction cones, the intermediate drive wheel and the flywheel are free from oil. If necessary, clean



Motor details, Motorola 12Y and 12Y-1

with several drops of carbon tetrachloride (Carbona).

MANUAL CONTROLS TOO STIFF

Intermediate Drive Dragging. Check intermediate drive to see that it falls back away from flywheel when motor is not running. If necessary, readjust intermediate drive mounting bracket.

Motor Armature Fails To Fall Back. The failure in Item 1, may be caused by this. Check the spring in front of the armature, also check lubrication of armature bearings. If motor armature seems to turn too stiffly, see that it is properly aligned and is not dragging at any point on its circumference. The motor bearings are of the self-aligning type and can often be brought into alignment by tapping the laminations of the motor lightly with some heavy tool.

PLANETARY DRIVE (VERNIER) DOES NOT OPERATE CORRECTLY

Weak Planetary Spring. To check this you must be able to visualize the correct assembly of the planetary. The planetary mechanism uses five loose ball bearings in all, three of which are visible through holes in the planetary housing (large tuning shaft) when the drum assembly is removed. The other two ball bearings are located inside the housing with a tension spring in between. A sixth ball bearing is spot-welded to the end of the planetary drive shaft (small tuning shaft). When assembled correctly, the ball on the end of the planetary drive shaft bears against a free ball bearing which in

turn bears against the planetary spring and this spring in turn rests on another ball bearing. A weak planetary spring will cause slippage.

Ball Bearing Missing. If any of the ball bearings in the planetary assembly are lost, and this can easily happen when changing drums, the planetary will not drive satisfactorily.

Race-Way Worn. The drum bearing has a race-way on the inside, around which the three ball bearings revolve. If this is worn the only correction is a new drum.

Improper Lubricant. The planetary must be properly lubricated with a heavy lubricant, preferably vaseline.

Planetary Shaft Bent. This sometimes happens, especially when the instrument has been handled roughly in transportation. Obviously, the only correction is a new planetary assembly.

OFF CALIBRATION

Travel-Lite Improperly Adjusted. Check adjustment of the travel-lite bracket. It is adjustable and can be moved over a considerable range.

Travel-Lite Split Gear. If the calibration is off so far that the adjustment of the travel-lite bracket will not correct it, then the travel-lite split gear has probably slipped in its adjustment on the large brass gear that drives it. It will be necessary to move the split gear several notches in the required direction. In changing this adjustment, be sure you do not lose any of the split gear coil springs, and be sure the split gear is reassembled with proper spring tension.

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GENERAL DATA—continued

MANUAL TUNING BROAD

Set Out of Alignment. Check alignment, following procedure outlined below.

AFC Not Shorted Out. Check the switch on the front of the drum to make sure that the bottom blade grounds against the front plate of the drum when the release button is pressed in for manual tuning. If this bottom blade fails to touch the drum, increase tension of small black steel spring on the release button. Replace this spring if necessary.

ALIGNMENT PROCEDURE

Place chassis on service bench. Remove band spread pointer and dial. Insert a small piece of paper between the front contacts of the switch that is located on the front of the automatic control drum. These contacts break the motor circuit. This is necessary to prevent the motor from running during the alignment.

Connect signal generator to control grid of first detector tube (6A8G) through a 0.05 mf condenser, and to chassis. Do not remove grid cap. Also connect output meter across speaker voice coil. Turn band switch to "American Programs" position. Turn condenser gang completely out of mesh. Press the release button to short out afc.

Set signal generator at 465 kc and carefully adjust the three i-f trimmers in the tops of the two small i-f cans (one i-f can has one trimmer only) to point showing highest reading on output meter.

Adjust the two mica trimmers in the large i-f can to point showing highest readings on output meter. (*Important Note:*—One of these trimmers is located near the bottom of the right hand side of the can, inside the covered hole; the other trimmer is the front trimmer on top of the can. The back

trimmer on top of the can is an air trimmer and must not be adjusted at this time).

Attach a 0-5 high-resistance voltmeter between the cathode (Terminal No. 8) of the 6J7G afc control tube and ground. Turn signal generator up to full output (still set at 465 kc) backing down on receiver volume control, if necessary.

Note cathode voltage reading on voltmeter with afc shorted out (release button pressed in), then note cathode voltage reading with afc operating (press any tuning button, permitting release button to fly out). When afc discriminator is properly balanced, there should be no difference in reading between the two positions. If a variation is noted, it indicates that the adjustment of the air trimmer on top of the i-f is not correct.

Using a non-metallic screw driver, turn the air trimmer just a trifle at a time, checking continually the cathode voltage reading on the voltmeter by pressing alternately on the release button and on one of the tuning buttons (connecting and disconnecting afc). When a position is found where voltage remains the same in both positions, the adjustment is correct.

Note:—While making this adjustment it will be necessary to remove the non-metallic screw driver from its position in order to check the reading accurately since body capacity has considerable effect at this point.

Switch afc off by pushing in the release button and leave it off through the remaining steps of the alignment.

Leave band switch in "American Programs" position. Connect signal generator to antenna and ground terminals, using a 0.0002 mf condenser in antenna lead.

Set signal generator and receiver dial

both at 1700 kc. Adjust BC OSC trimmer until 1700 kc signal is heard.

Set signal generator at 1400 kc and turn condenser gang to the signal at 1400 kc. Adjust BC ANT and BC RF trimmers to point showing highest reading on output meter.

Set signal generator at 600 kc and rock pointer at 600 kc position on dial scale, while adjusting BC padder, until combination is found which gives highest output reading. *Note:*—If there is noise level at 600 kc, padder can be adjusted to maximum noise without rocking gang and without use of signal generator. (Use short wire for pick-up if necessary.)

Turn band switch to "Police and Aircraft" position. Replace 0.0002 mf condenser in signal generator lead with a 400 ohm carbon resistor.

Set signal generator and receiver dial both at 7.0 mc. Adjust POLICE OSC trimmer until 7.0 mc signal is heard.

Set signal generator at 5.8 mc and turn condenser gang to signal at 5.8 mc. Adjust POLICE ANT and POLICE RF trimmers to point giving greatest output reading, while slightly rocking condenser gang.

Turn band switch to "Foreign Programs" position, still using 400 ohm carbon resistor in antenna lead to signal generator.

Set signal generator and receiver dial both at 22.0 mc. Adjust SW OSC trimmer until 22.0 signal is heard.

Set signal generator at 18.7 mc and turn condenser gang to the signal at 18.7 mc. Adjust SW ANT and SW RF trimmers to point giving greatest output reading while slightly rocking condenser gang.

Padders on "Police" and "Foreign" bands are fixed. (No adjustment necessary.)

SOCKET VOLTAGES										
TUBE	POSITION	1	2	3	4	5	6	7	8	9
6K7G	R. F.	0	6.3 AC	210	90	0	X	0	Note A	Note B
6J5G	Osc.	0	0	190	X	-28		6.3 AC	0	
6A8G	1st Det.	0	0	205	95	-14	95	6.3 AC	0	Note B
6B8G	1st I. F.	0	6.3 AC	210	0	0	95	0	0	Note B
6K7G	2nd I. F.	0	0	210	95	6	X	6.3 AC	6	0
6H6G	2nd Det. AFC Disc.	0	6.3 AC	0	0	0		0	0	
6J7G	AFC	0	6.3 AC	180	100	0	X	0	4.5	0
6R7G	AVC	0	6.3 AC	295	Note B	0	X	0	190	0
6J5G	AF	0	6.3 AC	150	0	Note C	X	0	0	
6V6G	Output	0	6.3 AC	275	290	Note D	X	0	0	
5X4G	Rect.			375 AC		375 AC		5.0 AC	5.0 AC	
6U5	Eye	Filament (Brown Wire) 6.3 AC			Plate (Red Wire) 200		Cathode (Black Wire) 0		Grid (Green Wire) 0	

TOP TERMINAL

BOTTOM VIEW OF SOCKET

"X" indicates socket terminals used as dummy tie points.

Note A:—0 to 8.5 V, depending on position of sensitivity control

Note B:—3.5 V, measured point B to ground.

Note C:—6.0 V, measured point C to ground.

Note D:—15.0 V, measured point D to ground

All voltages, except rectifier filaments, measured from socket terminal indicated to chassis ground, using 1000 ohms per volt meter.

Line voltage 115. Current consumption 130. Maximum power output 7.5 watts.

RCA Victor Record Players, R-93B and R-93C

Voltage Ratings

- A-6: 105-125 volts, 60 cycles.
- A-5: 105-125 volts, 50 cycles.
- B-2: 105-125 volts, 25 cycles.
- C-5: 200-250 volts, 50 cycles.

Motor and Pickup

- Type: Synchronous (Manual Starting).
- Turntable Speed: 78 rpm.
- Pickup: Crystal.
- Pickup: Impedance 80,000 ohms at 1000 cycles.

- Average Output Voltage: 1.5 volts at 1000 cycles with 250,000 ohm load.
- Volume Control Res: 250,000 ohms.

CONNECTING RECORD PLAYER TO RADIO RECEIVER

In connecting this player to the radio,

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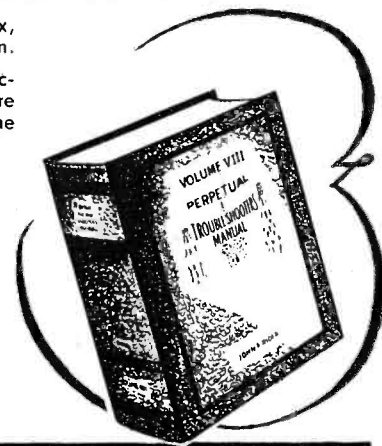
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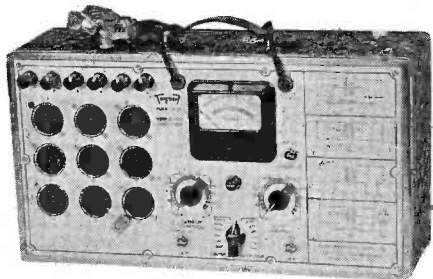
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GENERAL DATA—continued

care must be exercised to connect it at a point where sufficient gain is between it and the speaker to give normal output. Usually two or more stages of audio amplification are required. The radio part must be thoroughly disconnected or "killed" when playing records, else the radio signals will be heard with the record's music. Attention should be given to the possibility of introducing hum and feedback voltage into the radio when connecting the player. A radio-phonograph switch, Stock No. 9824, is recommended for a switching system. Its connections are shown in Fig. 1. With it, radio or phonograph may be selected by simply turning the switch.

When the radio is equipped with a phonograph terminal board, the player is easily connected. One should follow the instructions pertaining to that particular radio. In general, the player's output should be applied to the grid circuit of the first audio tube in the same manner as the second detector is connected. Use a switching arrangement that grounds the radio as it connects the phonograph.

When using the radio phonograph switch Stock No. 9824 on radios using a 6B7 or some similar tube for second detector, the yellow and green leads are connected in series with the grid cap connections of this tube. The green lead is connected to the grid cap.

(Continued on page 28)

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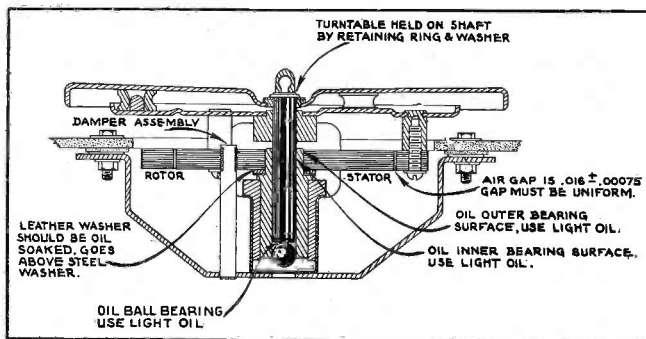
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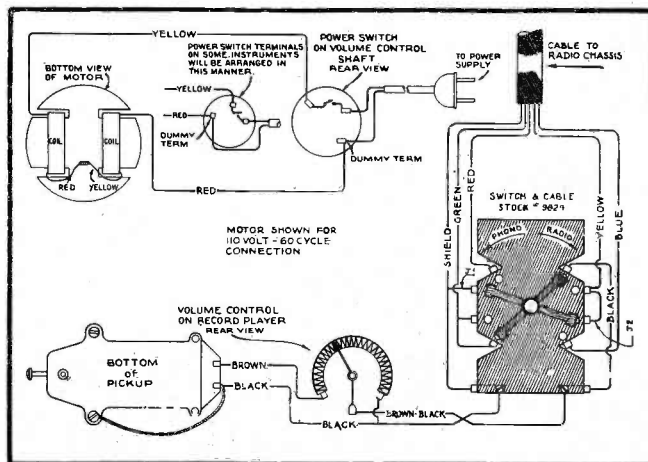
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Test Equipment . . .

AN INFINITE-RESISTANCE VOLTMETER

By G. H. BROWNING, F. J. GAFFNEY and B. THOMPSON*

THE RADIO SERVICE business has advanced from a technical angle by leaps and bounds in the last few years. The voltmeter, tube tester and signal generator are unable in some cases to cope with modern service problems. Additions such as cathode-ray oscilloscopes, condenser analyzers, etc., have been most helpful in analyzing set faults in a short period of time, which is so essential to a profitable business.

It has been only the last year or two that the Service Man has been required to make voltage measurements in the high-resistance networks associated with automatic-volume-control systems, automatic frequency control, phase-inverter circuits and high-fidelity audio circuits. The vacuum-tube voltmeter has been used with considerable success for this purpose. However, vacuum-tube voltmeters cannot be readily combined with the usual volt-ohm-milliammeters to make one complete radio set tester. The problem of obtaining the correct voltage measurements on high-resistance circuits has been appreciated by various manufacturers for the past year or more, for where formerly voltmeters had a resistance of 1,000 ohms per volt, the resistance per volt has been increased up to 20,000 ohms or more in some cases.

The meter to be described is a d-c voltmeter with an infinite resistance for ranges of voltage from approximately 0.2 volt to 250 volts. This instrument uses an old electrical principle put to a new use to obtain a voltmeter which draws no current from the source being

measured and is, therefore, said to possess an infinite resistance. It is of course well known that if a circuit consists of equal and opposite voltages no current will flow in the circuit. Such a circuit is shown in Fig. 1. Here if the voltages E_1 and E_2 are exactly equal to each other, no reading will be obtained on G , the current indicating device.

In order to measure an unknown voltage, therefore, without drawing current from the voltage source it merely becomes necessary to oppose this unknown voltage with an equal and opposite voltage and then to measure the opposing

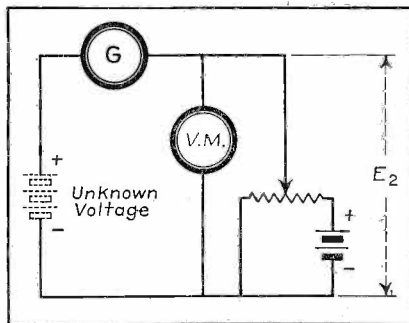


Fig. 2. Measuring an unknown voltage.

voltage. Fig. 2 shows a circuit which accomplishes this end. This circuit consists of a variable voltage E_2 which can be made to oppose the unknown voltage E_1 . When the current instrument G gives zero indication, E_2 will exactly equal E_1 and no current will be drawn from the unknown voltage source. If voltage E_2 is measured with an ordinary voltmeter an accurate determination of E_1 can be made since E_1 equals E_2 .

In order to gain some idea of the magnitude of error introduced by low-resistance meters in measuring voltages across circuits having high internal resistance we shall examine the conditions which prevail in Fig. 3. Here a source of potential E is connected, in series with a high resistance R , to a voltmeter. If no current were then drawn from the voltage source the voltage V_m would be exactly equal to E , the voltage source. However, if the voltmeter has some finite resistance R_m the voltage actually read on the meter will be given by the equation

$$V_m = \frac{E \times R_m}{R + R_m}$$

If R is very large in comparison to R_m this equation reduces to

$$V_m = \frac{E \times R_m}{R}$$

By means of this equation the actual voltage appearing across the high-resistance source may be obtained from the voltmeter reading when the resistance of the voltmeter and the resistance of the voltage source are known. These calculations are bothersome and are eliminated when the infinite-resistance voltmeter is employed as the measuring device.

It would be well to point out here that the accuracy of the zero-current voltmeter depends entirely upon the ability to balance the galvanometer to zero deflection. For this reason, any errors in the indicated voltage may be either plus or minus. These errors will increase as the ratio of voltage to resistance approaches zero. It is impossible to state that the zero-current voltmeter has a definite percentage of accuracy for all ranges of volts in circuits of any resistance. However, it is possible by very carefully balancing the galvanometer to measure voltages as low as 5 volts in series with a resistance as high as 10 megohms with an error of less than 10 percent.

Faulty operation of automatic-volume-control circuits is a frequent source of annoyance to the Service Man. In order to be able to correct any difficulties which occur in this portion of the circuit, it is absolutely necessary to obtain reliable data on the values of the a-v-c voltage applied to the various tubes. Heretofore this data has been extremely difficult to obtain due to the fact that the a-v-c voltages are developed across high-resistance networks so that some voltmeters can not be successfully employed in their measurement. The detector and output circuit of a typical superheterodyne receiver are shown in Fig. 4; the a-v-c voltage is developed between point B and ground. To give a practical illustration of the variances obtained in measuring a-v-c voltage, a radio-frequency signal was applied between the antenna

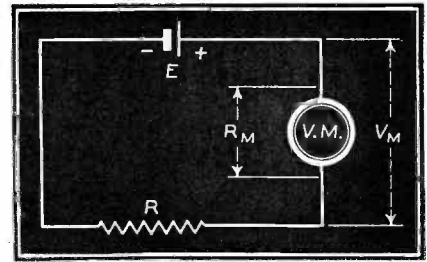


Fig. 3. Sources of error in voltage measurements.

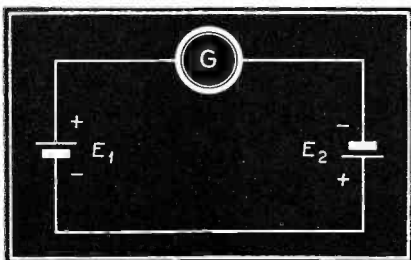
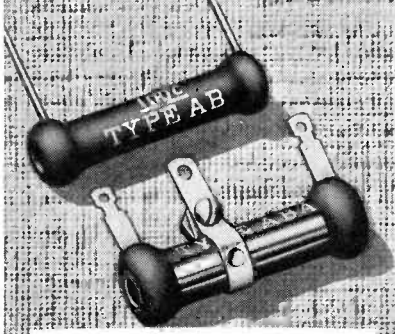


Fig. 1. Principle of the infinite-resistance voltmeter.



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TEST EQUIPMENT—continued

and ground system and measurements were taken of the a-v-c voltage developed between point B and ground, using a low-resistance instrument and the zero-current voltmeter. The results obtained with the different measuring devices are plotted in Fig. 5, which shows the variation of a-v-c bias with input signal. As shown, the values obtained with the zero-current voltmeter when making measurements of voltages developed across a resistance of 1.5 megohms (as is the case in the circuit of Fig. 4) are accurate to within about 5 percent. The curve in Fig. 5 obtained by means of the zero-current voltmeter is, therefore, substantially correct.

One of the main sources of annoyance to the Service Man are those faults which are termed "intermittents." These faults are usually due to one of three causes—a condenser which opens circuits intermittently, a faulty tube, or a resistor whose value changes appreciably with current. The first two of these causes can usually be located without much difficulty. The last cause, however, that of an intermittent resistor, often presents a difficult problem. The common service procedure in such cases is to check the voltage applied to the plate and plus-B end of this resistor and then, with the set turned off, check the resistance of the resistor itself. This procedure is never satisfactory in cases where the value of resistance changes appreciably with current passing through it. Obviously, the correct procedure in this case is to obtain an accurate measurement of the voltage at the plate of the tube in question at the time when the set is operating normally and when the signals begin to fade or have faded out entirely. It will be noted, however, that in practically all resistance-coupled circuits commonly employed in receiver design, the load resistors have rather large values. For this reason, measurements of plate voltage made with some voltmeters may be too inaccurate to show up such faults as the one just cited.

Another frequent cause of faulty or

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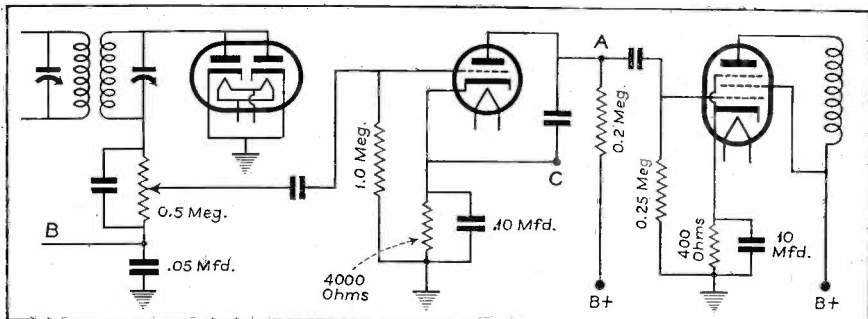
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Fig. 4. A-v-c and a-f circuit of a typical receiver.



TEST EQUIPMENT—continued

intermittent operation is an incorrect value of grid bias in some stage of the circuit. In many such cases, the bypass condensers are at fault, although cases of faulty grid-biasing resistors are not uncommon. These difficulties can be detected readily if an accurate measurement of cathode voltage with respect to ground can be obtained.

The operation of the zero-current voltmeter is extremely simple. The voltage to be measured is connected to the proper terminals and remains connected while the measurement is being taken. A switch on the meter is set to the

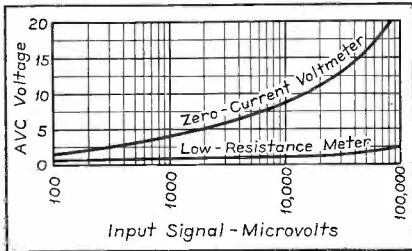


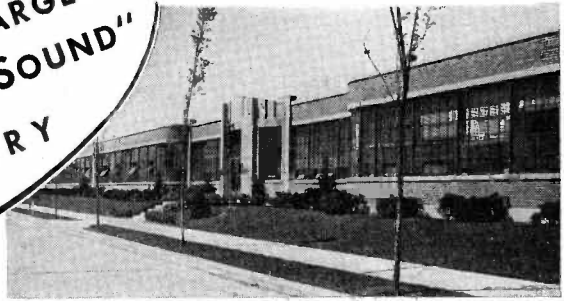
Fig. 5. Results of measurement on an a-v-c circuit.

proper range (0-10, 0-50, or 0-250) and a potentiometer adjusted until the meter deflection is zero. To read the unknown voltage, it is only necessary to press a button which disconnects the unknown voltage from the meter circuit and places a resistance of the proper magnitude in series with the current meter and across the internal power supply voltage. The value of the voltage developed by the meter power supply necessary to just balance the unknown voltage (as indicated by zero meter deflection) is obviously equal to the unknown voltage. The circuit employed is such that even if the meter is connected to an unknown voltage whose value is considerably higher than that indicated by the switch setting, no damage to the meter will ensue.

This zero-current type d-c voltmeter has been incorporated into a set tester which is said to give the Service Man a rather unusual and serviceable combination consisting of an ohmmeter for reading resistances from 0.1 ohm to 10 megohms in 5 ranges, d-c milliamperes from zero to 500 in 3 ranges, 0-500 d-c microamperes, d-c volts at 1000 ohms per volt from zero to 2500 volts in 6 ranges, a-c volts from zero to 2500 volts at 1000 ohms per volt in 6 ranges, a-c milliamperes 0-500 in 3 ranges, and capacity from 100 mmf to 200 mfd in 5 ranges. This is in addition to the zero-current d-c voltmeter the range of which is, as before stated, from 0.2 volts to 250 volts in 3 ranges.

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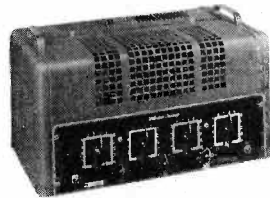
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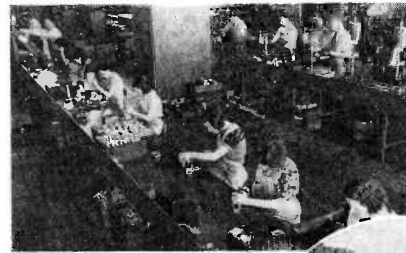


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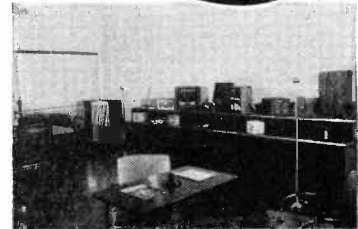


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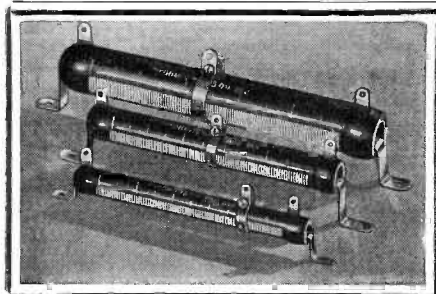
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GENERAL DATA—continued

RECORD PLAYER SWITCH JUMPERS

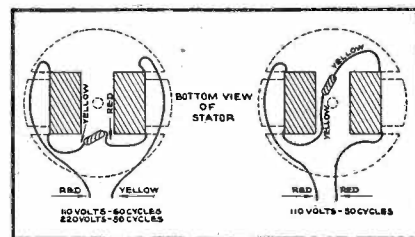
Some record player switches do not have jumpers J1 and J2 attached. When the switch is so connected and turned to phonograph position, the voltage developed by the pickup is fed into the radio receiver through the green wire and shield, and at the same time the yellow wire is connected to shield. The jumpers J1 and J2 permit the yellow lead to kill radio by connection to shield. The jumpers should be removed where the yellow lead connects in such a position as to short bias batteries, etc. Check the switch to be used for the method chosen and use the jumpers accordingly.

PHONOGRAPH MOTOR SERVICE DATA

The synchronous motor used in this instrument is designed to be simple and foolproof. Among its many features are constancy of speed, low power consumption, single moving part, ease of starting, rubber damper, ease of repair, and long life. The parts that may require attention are plainly shown by Fig. 2. The motor is started by turning "on" the power switch and giving the turntable a clockwise spin with the hand. Smooth starting and running will be insured by keeping the bearings well cleaned and oiled.

ROTOR ADJUSTMENT

Use three 16-mil shims, spaced equally around the gap between rotor and stator. When rotor is suitably ad-



Motor coil assembly and connections RCA Victor record players R-93B and R-93C.

justed, securely tighten the three screws which hold the rotor to the turntable. The centering operation is very similar to that done with a dynamic speaker.

If top of rotor lamination assembly is not flush with top of stator laminations, additional steel washers should be inserted beneath the stator until it is raised to the desired level.

HUM AND VIBRATION

A small amount of hum when starting, decreasing to a negligible amount while running, is normal. If excessive vibration occurs either at starting or running, it may be due to one of the following:

- (1) Insufficient lubrication in outer

GENERAL DATA—continued

bearing or any other failure that will cause the stator to bind.

(2) Metal washer above the leather washer at the bottom of the main bearing. It must be below.

(3) Leather washer not oiled. When

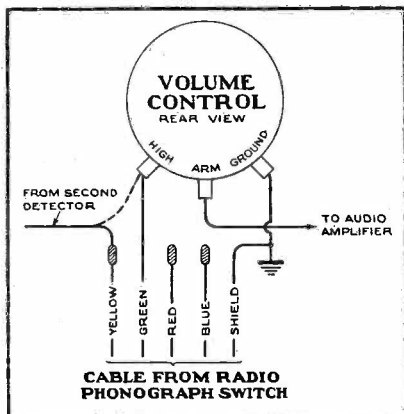


Fig. 4. Typical connections to radio receiver volume control.

replacing the leather washer, make sure that it is thoroughly soaked in oil.

(4) Motor not properly supported from motor board. Unless the motor is properly supported from the motor board, vibration will be excessive.

(5) Burrs on salient poles of rotor or stator. They should be removed with fine emery cloth.

(6) Avoid placing the record player on top of the radio cabinet since acoustic feedback may tend to accentuate mechanical hum.

REMOVING THE ROTOR FROM THE STATOR

The rotor and turntable assembly simply rests on the ball bearing at the bottom of the vertical bearing, and may be removed by lifting out. Don't turn player upside down without holding turntable.

LUBRICATION

Both the rotor and stator have bearing surfaces about the center vertical axis. These bearings and the ball bearing at the bottom of the turntable's shaft should be oiled whenever player is serviced. The leather washer beneath the stator is to be pliable and soaked in light oil.

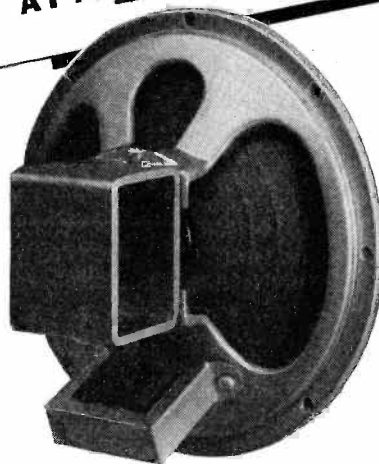
Stromberg-Carlson (Late Models)

Crackling: Crackling can often be traced to the Candohm voltage divider. Replacement is the only sure cure. Pinching the divider at each terminal with a heavy pair of pliers will restore temporary operation, but sooner or later the trouble will return.

Sylvania News

Jensen New Replacement Line of **QUALITY SPEAKERS AT LOW PRICES**
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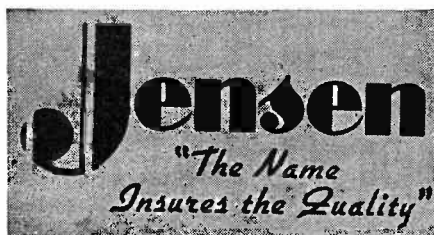
This new Jensen low price line is opening up new opportunities for dealers in service and repair and in many cases for additional speaker or sound outlets.

Write to Jensen or see your distributor for complete information on these new speakers. Remember—it is no longer necessary to jeopardize your reputation by offering an ill-fitting, poorly designed replacement part or a nondescript complete speaker to meet the owner's demand for low price.

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With Permanent Magnets	With Field Coil
PM5-FS ... 2.70 less Transformer	H5-S 2.30 less Transformer
PM6-ES ... 3.30 " " "	H6-S 2.70 " " "
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LAW NUMBER ONE
(Continued from page 7)

130 ma, project vertically upward to R4, where these two lines intersect determines the decimal point. From the intersection you find E between 0.1v and 1v, E therefore is 0.12 volts. Wattage between 0.01 watts and 0.001 watts, therefore W is .0036 watts.

It should be emphasized that Ohm's Law applies to the flow of current through conductors. Their cross-sectional size, metallurgical contents, length, and temperature all affect this flow.

In so far as the type of circuit is concerned (that is, d-c or a-c), we have been proceeding on the assumption that d-c circuits were being considered. Ohm's Law applies equally as well to a-c circuits, but there are other considerations (having to do with the resistance of the circuit) which make it best to consider them in a separate and future article.

All-Wave Antennas

Loss in receiver selectivity: Traced to bad insulation on twisted pair leads allowing wires to short. Dip wires in hot pitch over a length of about 12 inches. This insulates well and obviates the need of taping the leads.

Sylvania News

Philco 38-1, 38-2

Oscillation: To eliminate parasitic oscillations, replace the 6U7G r-f tube with a 6K7G tube, also lengthen the green wire connecting the screen contact of the 6U7G tube and condenser No. 6. Then redress this wire around the 6U7G socket toward the front of the r-f unit and then back to condenser No. 6. Be sure that the wire is as close to the base as possible. Remove 250 mmfd. condenser entirely from 6U7G screen circuit. This change should be performed on all these models up to Run 4.

Sylvania News

Victor Automatic Electrola, Model CE29

Mechanical cycle repeating intermittently: Directly under the turntable and motor board is a round plate with a notch in it. Into this notch fits a narrow arm which when engaging, stops the cycle of the mechanism and allows the record to play through. The plate and arm are both narrow, and if the arm is bent slightly out of position the mechanical cycle will repeat indefinitely. This trouble is often intermittent, making it difficult to run down. The remedy is to bend arm slightly so that it is on exactly the same plane as the plate.

Sylvania News

RADIO TRADE SHOW PROGRAM

Tuesday, June 7

1:00 p.m. Registration, National Radio Parts Trade Show.

Wednesday, June 8

9:00 a.m. Registration, National Radio Parts Trade Show.

10:00 a.m. Board of Directors, Radio Servicemen of America. T. P. Robinson, President, Presiding.

2:00 p.m. 1938 National Radio Parts Trade Show Opens.

6:30 p.m. Annual RMA Banquet.

8:00 p.m. Technical Session, Auspices Radio Servicemen of America. "Push-Button and Remote Tuning" by Charles Herbst, RCA Manufacturing Company.

10:00 p.m. Exhibits Close.

Thursday, June 9

9:00 a.m. Registration Desk Open. RMA Golf Tournament.

10:00 a.m. Meetings:

The Representatives.

Sales Managers Club, Eastern and Western Divisions, jointly with

Radio Parts Manufacturers National Trade Show.

2:00 p.m. Exhibits Open.

7:30 p.m. Technical Session, Auspices Radio Servicemen of America. "New Types of Electrolytic Capacitors and Their Application to Radio Circuits," by J. I. Cornell, Solar Manufacturing Company.

8:00 p.m. Sound Equipment Symposium:

Microphones—Shure Bros.

Amplifiers—Thordarson Elec. Mfg. Co.

Speakers—Jensen Radio Mfg. Co.

8:00 p.m. Engineering Session, Auspices Chicago Section, Institute of Radio Engineers. Engineering Papers, "Facsimile."

10:00 p.m. Exhibits Close.

Friday, June 10

9:00 a.m. Registration Desk Open.

2:00 p.m. Exhibits Open.

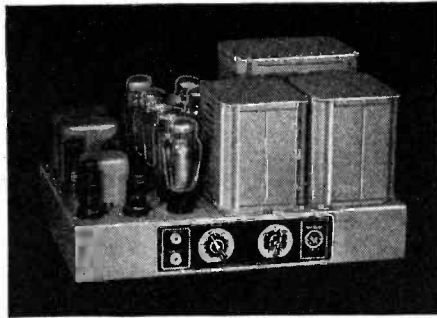
7:30 p.m. Technical Session, Auspices Radio Servicemen of America. "Tubes" by Walter Jones, Hygrade Slyvania Corporation.

8:00 p.m. Engineering Session, Auspices Chicago Section, Institute of Radio Engineers. General Subject: "Facsimile." Social and Economic Aspects. Newspaper Aspects. General Discussion, followed by Demonstration of Apparatus.

10:00 p.m. Exhibits Close.

(Continued on page 55)

New POPULAR PRICED AMPLIFIER KITS



S-100 AUDIO AMPLIFIER

The S-100 audio amplifier is an ideal low priced high power unit. 100 watt output is provided with gain sufficient for crystal mike. Dual input and tone control is provided and universal modulation output transformer. Tubes required are one 6J7, one 6C5, two 6F6's, four 6L6's and three 83's. The kit is supplied completely mounted, ready to wire, including all accessories, less tubes and dust cover. **Net Price..... \$52.50**

Kit as above with PA output transformer for universal voice coil impedance, use kit No. S-100PA. **Net Price..... \$55.00**

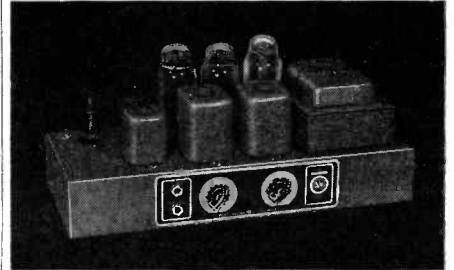
Cabinet for above to match SX-80 and SX-200. No. S-100C. **Net Price.... \$3.75**

S-15A AUDIO AMPLIFIER

The S-15A audio amplifier is an ideal kit for PA and modulator service. The power output is 15 watts and the gain sufficient for crystal mike service. Dual input—high or low gain, and tone control are incorporated. Tubes required are one 6J7, one 6C5, two 6V6G's and one 83. The kit is supplied completely mounted, ready to wire, including accessories, less dust cover and tubes. **Net Price..... \$24.00**

Kit as above but with universal modulation transformer in place of voice coil output, use kit No. S-15M. **Net Price... \$24.00**

Dust cover for above amplifiers, type S-15D. **Net Price..... \$1.50**



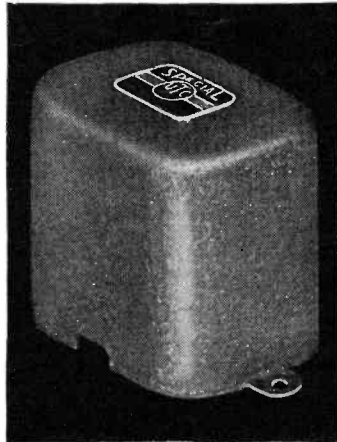
S-25A AUDIO AMPLIFIER

The S-25A audio amplifier has been designed for high power PA and medium power modulator work. 25 watt output is provided with gain sufficient for crystal mike. Dual high impedance input—high or low gain, and tone control are provided. Tubes required are one 6J7, one 6C5, two 6L6's and one 83. The kit is supplied completely mounted and ready to wire, including all accessories and dust cover, less tubes. **Net Price..... \$30.00**

Kit as above but with universal modulation transformer in place of voice coil output, use kit No. S-25M. **Net Price.... \$30.00**

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S-2	1 plate* to 2 grids.....	2:1	1.50
S-3	1 plate* to 1 or 2 grids compact type	4:1 2:1	1.20
S-4	1 plate* to 2 grids wide range response	1:1	2.10
S-5	Single or double button mike or line to 1 grid hum-bucking type	16:1	1.80
S-6	Single or double button mike or line to 1 grid, compact type	16:1	1.20
S-7	Single plate* and carbon mike to one or two grids.....	3:1 16:1	2.10

*Will match tubes like 56, 6C5, 6C6 triode, 77 triode, 37, etc. Can be used with high mu triodes with loss in low frequencies.

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Type No.	Tubes and Pri. Ohms	Sec. Ohms	Power	Net Price
S-14	Single tubes 2500 ohms for 2A3, 6A3, 6A5 G, 6B4 G, 6L6, 6Y6, 25L6 4000 ohms for 2A5, 6F6 triode, 12A5, 25A6, 43, 45, 50, 71A 7000 ohms for 2A5, 6F6, 6K6, 20, 31, 33, 47 10000 ohms for 6G6, 38, 41	2, 8, 15, 500	10 W.	\$1.95
S-15	P.P. tubes: 4000 ohms for 25L6, 6Y6G 5000 ohms for 2A3, 6A3, 6A5G, 6B4G, 45 13000 ohms for 19, 736G, 30, 43, 39, 6Z7G, 6AC5G, 53, 6A6, 6N6, 6N7, 6B5	2, 8, 15, 500	12 W.	2.10
S-16	3000 ohms for 2A3, 6A3A5G, 6B4G, AB 6000-6500 ohms for 2A5-6F6-42 triodes AB, 46, 59, 6L6 10000 ohms for 6B5, 6V6, 2A5-6F6-42 pentodes AB	2, 8, 15, 500	30 W.	2.85
S-17	3300 ohms for 4 6L6's, 4-46's 3300 ohms for 2 6L6's, AB2 5000 ohms for 1008, 809	2, 8, 15, 500	55 W.	3.90

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TEAR OUT AND MAIL TODAY

Sound Service . . .

OUTDOOR-SOUND POWER REQUIREMENTS

By W. L. ROTHENBERGER*

ONE OF the most important questions to consider in any outdoor commercial sound installation is "How much power output will I need?" This question is important to the customer, because the total cost of any installation depends to a large extent upon the power output. And it is doubly important to the sound expert because he frequently stakes his reputation, as well as his financial return, on his ability to render an accurate answer to this question. If the sound man's estimate of power requirements is too low, the installation will be unsatisfactory, the customer will be disgruntled, and the resultant loss of prestige may prove serious. On the other hand, if the sound man is over-cautious, and estimates far more than the actual requirements, he may lose the job to a competitor who can calculate power requirements more closely. Naturally, it is always desirable to provide reserve power to insure good tone quality on peaks.

There has been a dearth of practical information on this subject, and it is therefore the purpose in this short article to present a simple, straightforward method by means of which it is possible to determine approximately the required amount of electrical power output in watts for practically any outdoor sound installation.

The power output that is required for any specific installation can be determined mathematically from formulas that have been substantiated by many years of practical application. In order to avoid tedious calculations, these formulas have been used to prepare the accompanying table of power requirements for various conditions.

*Manager, Commercial Sound Products, RCA Manufacturing Co., Inc.

DETERMINATION OF POWER REQUIRED

In this table, the required power output is specified for two different values of sound pressure or "loudness" at the audience area. For the majority of installations, a pressure of 5 dynes per square centimeter will be more than adequate to over-ride the usual noise levels of from 0.05 to 0.2 dynes per sq cm. But for installations where unusual noise conditions prevail, or where it is desired to have a reserve of power to take care of exceptional noise levels, it is desirable to provide sufficient output to obtain a pressure of 10 dynes per sq cm. To give some idea of what this latter value means in actual sound intensity, it may be pointed out that it is roughly comparable to the level encountered in Photophone theatre installations.

The required power output is given in the table for three common values of

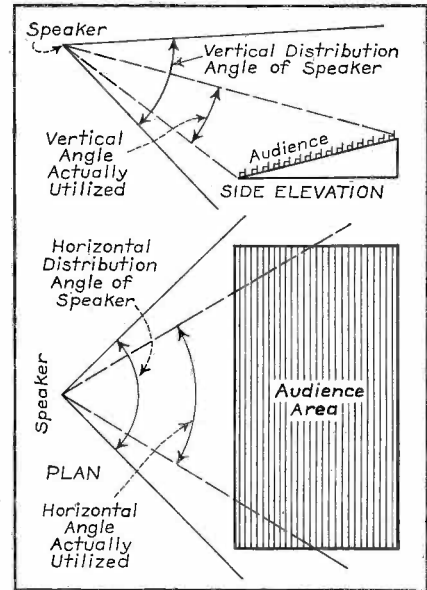


Fig. 1. Illustration to show how "coverage efficiency" is determined.

The application of this table can be most readily understood by considering an example:

Assume an installation where the audience occupies a space of 150 by 80 feet. The "audience area" is 150 x 80, or 12,000 square feet. Also assume that the efficiency of the loudspeaker is 20 percent and that the coverage efficiency is determined to be 25 percent. Re-

AMPLIFIER POWER OUTPUT REQUIREMENTS

Coverage Efficiency	Loudspeaker Efficiency (Acoustic watts output) (Electric watts input)	Approximate Amplifier Power Output in Watts for Each Thousand Square Audience Area	
		For 5 dynes/sq cm	For 10 dynes/sq cm
25 percent	5 percent	4.4	17.6
	10 percent	2.2	8.8
	20 percent	1.1	4.4
	30 percent	0.75	3.0
	40 percent	0.55	2.2
50 percent	50 percent	0.44	1.76
	5 percent	2.2	8.8
	10 percent	1.1	4.4
	20 percent	0.55	2.2
	30 percent	0.37	1.5
75 percent	40 percent	0.27	1.1
	50 percent	0.22	0.9
	5 percent	1.5	6.0
	10 percent	0.75	3.0
	20 percent	0.37	1.5
	30 percent	0.25	1.0
	40 percent	0.18	0.73
	50 percent	0.15	0.6

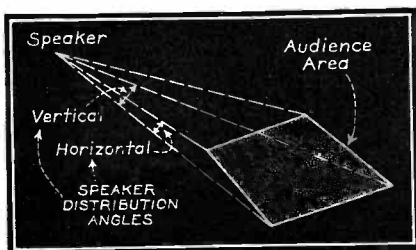


Fig. 2. 100 percent efficiency.

"coverage efficiency," and for various values of loudspeaker efficiency. The rated loudspeaker efficiency can be obtained from the loudspeaker manufacturer, and the coverage efficiency can be determined as described later. Knowing these two factors, reference to the table will immediately give the approximate power output in watts required for each thousand square feet of audience area.

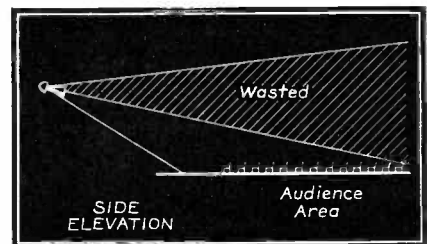


Fig. 3. 50 percent vertical coverage efficiency.

ferring to the table, it is found that for these conditions, and to obtain a pressure of 5 dynes per sq cm, the required power output per thousand square feet is 1.1 watts. Multiply this by 12 (the number of thousand square feet), gives approximately 13 watts as the required power output. This example is based on obtaining a pressure of 5 dynes per sq cm, which, as mentioned previously, is satisfactory for installations where the noise level is low. If it were necessary to provide a sound pressure of 10 dynes per sq cm to override unusual noise conditions, a power output of 4.4 watts per thousand square feet, or a total of approximately 53 watts would be required for this installation.

COVERAGE EFFICIENCY

The term "coverage efficiency" indicates the percentage of sound power from the loudspeakers that actually strikes the audience area. In an ideal installation, the "beam" of sound from the loudspeakers would just cover the audience area, and none of the power would be wasted on unoccupied areas. In such an ideal case, the coverage efficiency would be 1 to 1, or 100 percent. Naturally, it would be difficult to attain this condition in actual practice, but by correct selection, location, and direction of the loudspeakers, it is possible in many cases to attain a coverage efficiency of 25 or 50 percent.

Inspection of the accompanying table shows that the required amplifier power output increases as the coverage efficiency decreases. For example, with 40 percent efficient loudspeakers, and a coverage efficiency of 25 percent, it is necessary to provide 2.2 watts per thousand square feet to secure a sound pressure at the audience area of 10 dynes per sq cm. If the coverage efficiency is doubled, to 50 percent, it is necessary to use only one-half the previous power, or 1.1 watts per thousand square feet. Obviously, for an economical installation it is very desirable to secure the highest possible coverage efficiency.

The coverage efficiency depends on the distribution angle (or angles) of the loudspeakers, the shape and size of the audience area, and the height, distance, and direction of the loudspeakers. To determine the coverage efficiency, it is necessary to ascertain all these factors, and then, by making a scale drawing of the proposed installation, as shown in Fig. 1, it is a simple matter to determine the horizontal and vertical angles that are actually utilized.

The coverage efficiency is then calculated as follows:

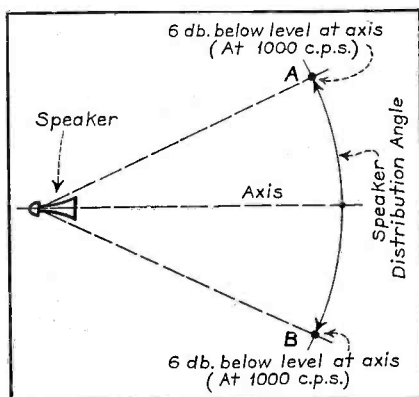


Fig. 4. Loudspeaker distribution angle.

$$\text{Coverage efficiency in percent} = \frac{\text{Vertical angle actually utilized}}{\text{Vertical distribution angle of speaker}} \times \frac{\text{Horizontal angle actually utilized}}{\text{Horizontal distribution angle of speaker}} \times 100$$

For example:

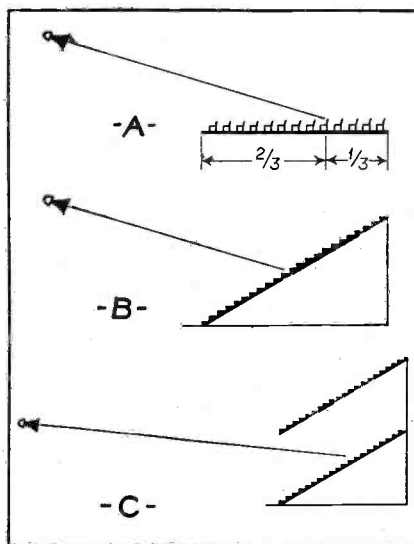
Assume that the loudspeaker has a vertical distribution angle of 50°, and a horizontal distribution angle of 90°. Also that the proposed installation is similar to Fig. 1, where the vertical angle actually utilized is 22°, and the horizontal angle actually utilized is 62°. Substituting these values in the equation:

$$\text{Coverage efficiency in percent} = \frac{22}{50} \times \frac{62}{90} \times 100, \text{ or approximately } 30 \text{ percent.}$$

In determining the utilized horizontal angle, it is satisfactory to consider it as the angle formed by lines drawn from the loudspeaker to points half-way back

Fig. 5A. Horizontal, or slightly-sloping audience area.

Fig. 5B. Inclined audience area. Fig. 5C. With a double-deck stand.



in the audience area, as shown in Fig. 1. In Fig. 1, the coverage efficiency can be increased by moving the loudspeaker closer to the audience area and mounting it higher. If the location of the speaker is fixed by structural limitations, the only alternative is to employ speakers with smaller angles of horizontal and vertical distribution.

In this connection, it may be pointed out that the distribution angle of the loudspeaker is seldom equal to the angle formed by the sides of the horn. It is generally considered as the angle enclosed by points on each side of the center axis where the response at 1000 cps is down 6 db from the level at the same distance along the axis, as shown in Fig. 3. With a square or round horn, the vertical distribution angle is the same as the horizontal distribution angle. If the horn has an oblong opening, the vertical and horizontal distribution angles are different. The loudspeaker manufacturer generally states the distribution angle (or angles) in his technical specifications.

LOUDSPEAKER EFFICIENCY

The required power output of the amplifier for any installation increases as the efficiency of the loudspeaker decreases. The efficiency is defined as the ratio of acoustic watts output to electric watts input. Unfortunately, this figure is not always obtainable, but it is absolutely necessary for even a rough calculation of power requirements.

Sound men have become so accustomed to using p-a speakers with efficiencies as low as 5 percent that it may be a distinct surprise to realize the tremendous difference that the efficiency of the loudspeaker makes in the total power requirements and likewise in the total cost of an installation. For example:

Assume an audience area of 10,000 square feet, a coverage efficiency of 50 percent, and a desired sound pressure of 10 dynes per sq cm. From the accompanying table it is found that with speakers of 5 percent efficiency it is necessary to use amplifiers with a power output of 88 watts. But with speakers of 30 percent efficiency, the amplifier output need be only 15 watts. In each case the sound pressure at the audience area is the same.

This is a striking comparison and emphasizes the necessity of knowing the efficiency of the loudspeakers. It is also obvious, from this comparison, that the use of high-efficiency loudspeakers is

(Continued on page 55)

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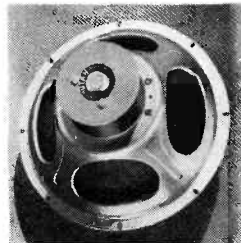


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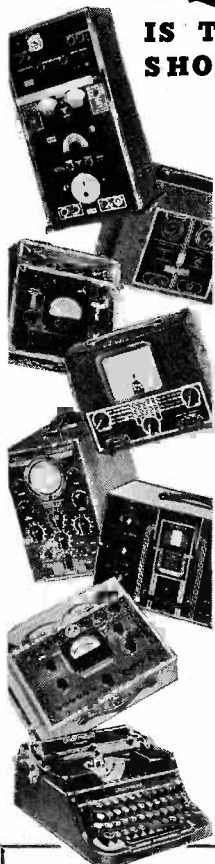
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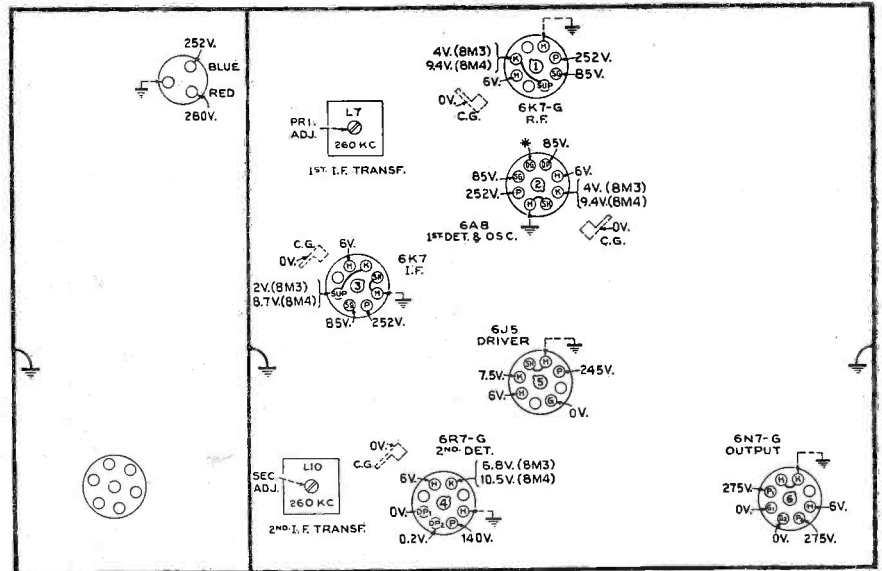
Loudspeaker. Centering of the loudspeaker is made in the usual manner with three, narrow, celluloid or paper

feathers after first removing the front dust cover. This may be removed by softening its cement with a light application of acetone, using care not to allow the acetone to flow into the air gap. The dust cover should be cemented in place with ambroid upon completion of adjustment.

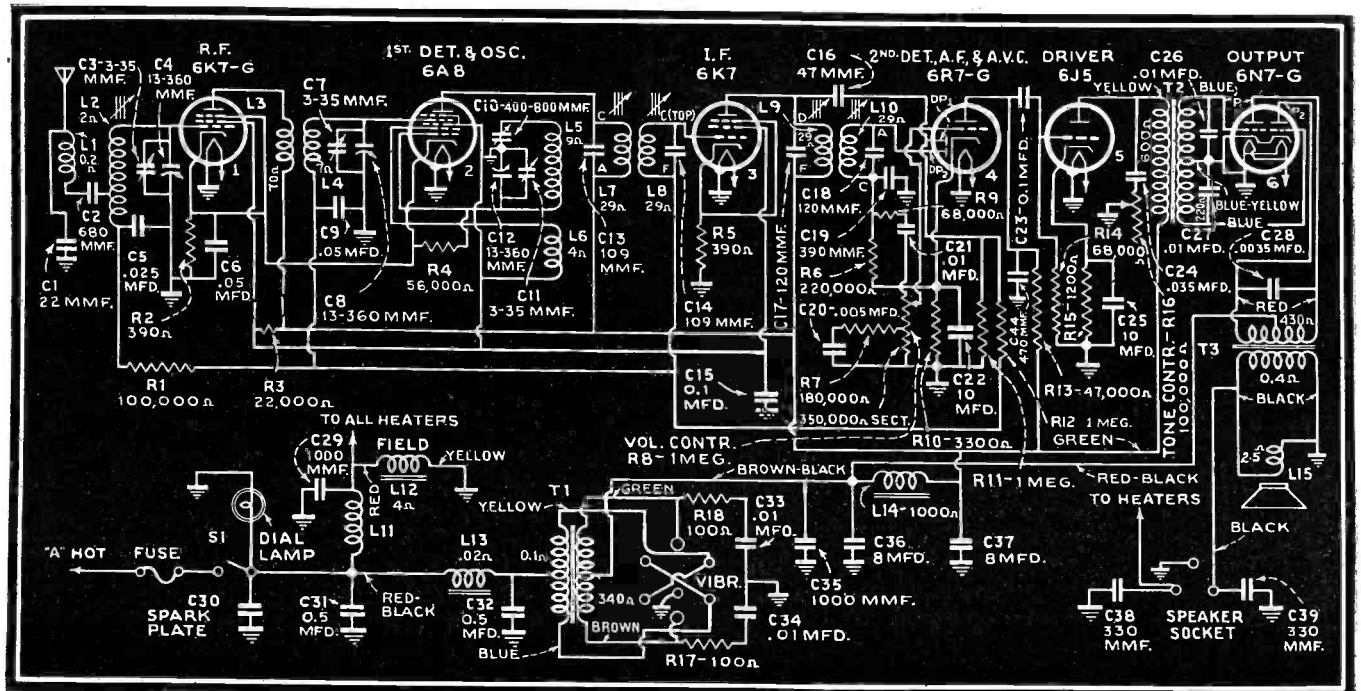
Vibrator. The mechanical vibrator has a plug-in base for easy removal. Its adjustments have been accurately set during manufacture by means of special equipment. In cases of faulty

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Dial Pointer Adjustment. With receiver and control unit properly in-



Socket-terminal voltages and trimmer locations.



Schematic diagram, RCA Victor 8M3.

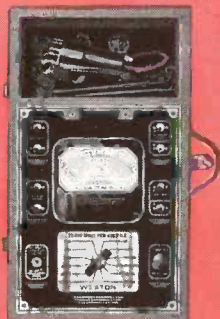
Follow the Crowd...



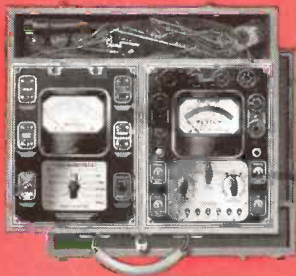
WESTON Model 776
Oscillator



WESTON Model 773
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(also available in portable type)

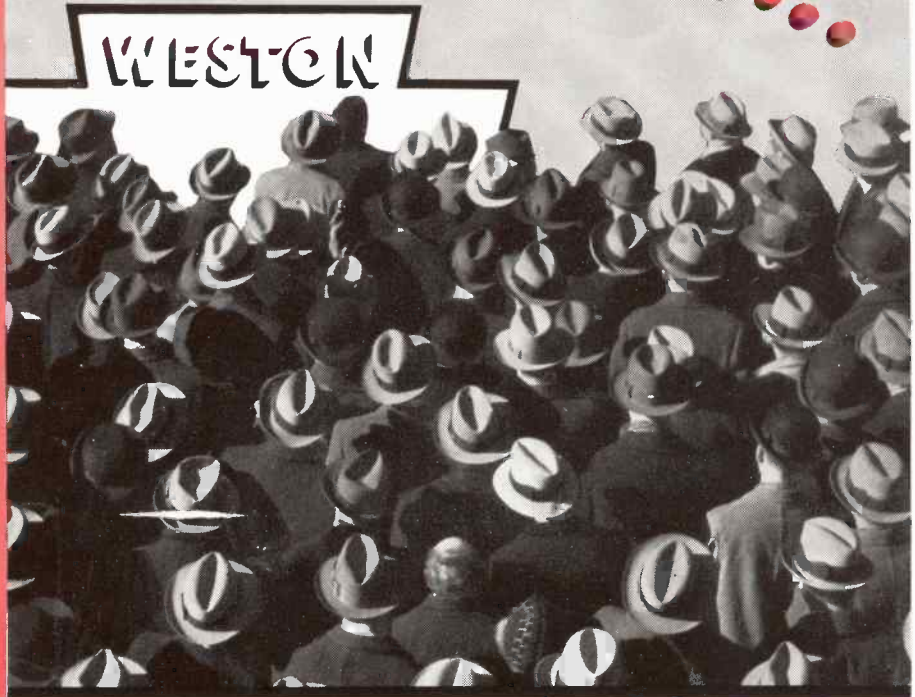


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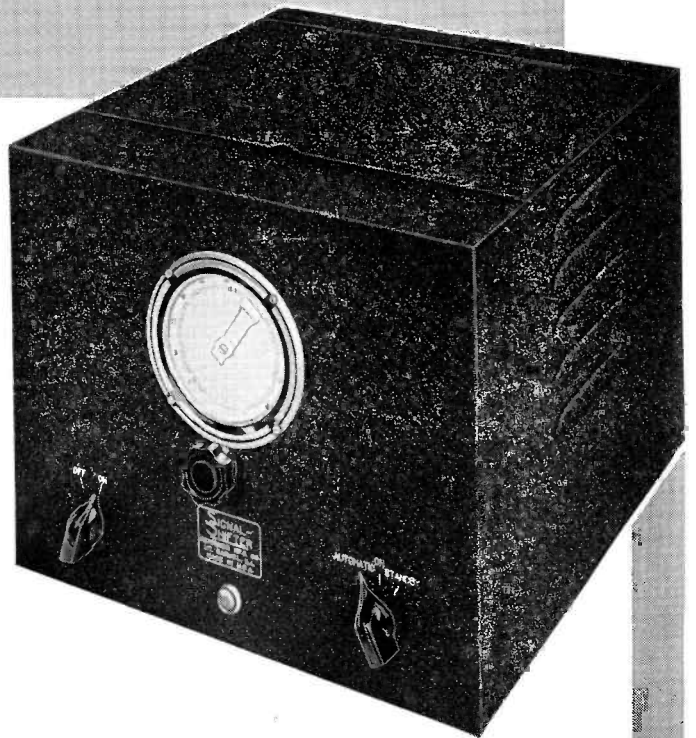
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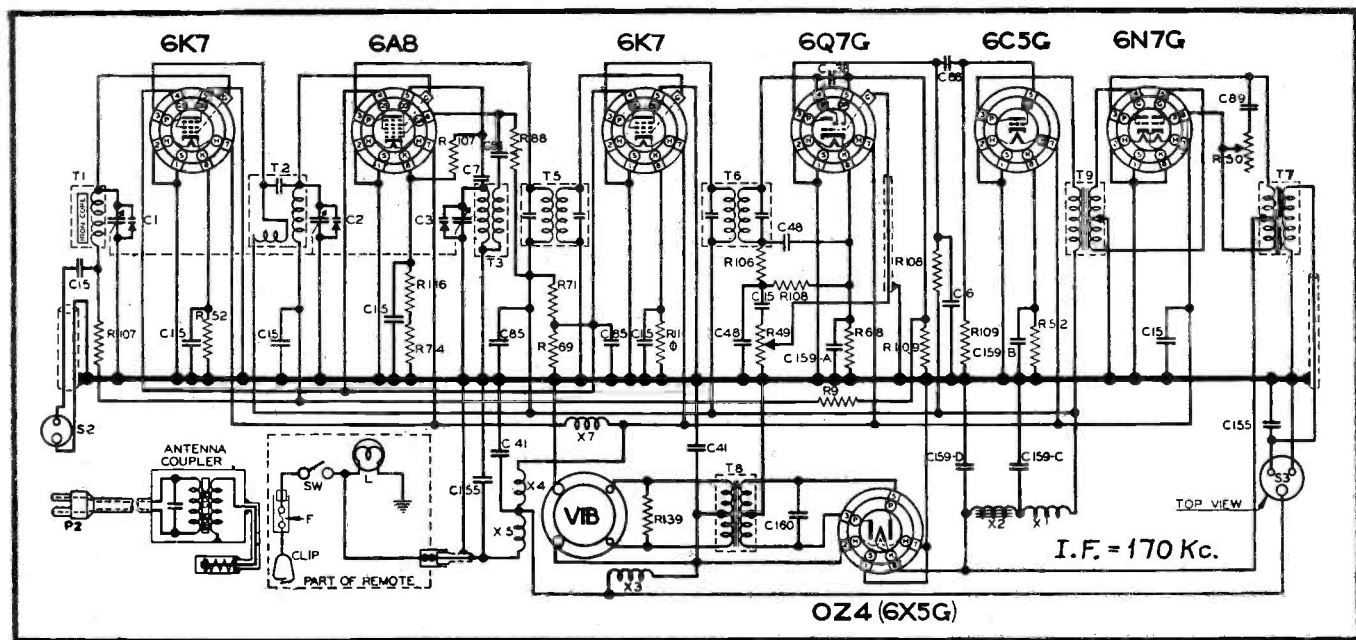
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Schematic diagram, Arvin Model 42.

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(Continued on page 55)

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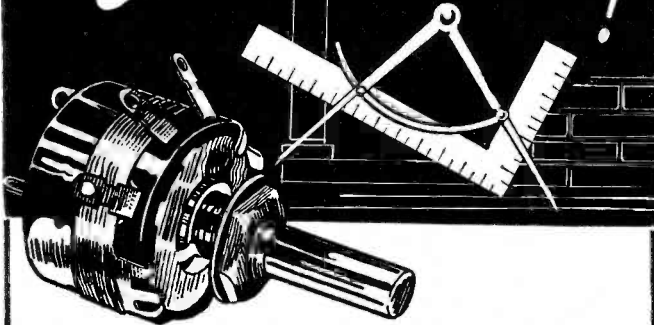
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Everything you need in radio. It's all in this new **RADOLEK RADIO PROFIT GUIDE**. Every repair part for every receiver. Newest radio receivers. New 1938 model public address amplifiers, outputs for 5 to 100 watts. Test instruments. Technical books. Special equipment. Leading standard brands. Every item guaranteed. It must be right or we make it right. And everything under one roof. You get what you want promptly, and exactly what you want. Radolek's immense stock plus Radolek's efficient organization insures you fastest service. 25,000 service men depend on this service and benefit by Radolek's lowest prices. Send now for your copy of Radolek's Radio Profit Guide. It will help you make more money.

..... RADOLEK

600 W. RANDOLPH, CHICAGO, Dept. R19

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

Name

Address

Serviceman? Dealer? Experimenter?

AT THE RADIO PARTS SHOW

Aerovox Corporation, Brooklyn, N. Y.

Condensers, resistors, filters
Booth Address: 206 Coulomb Street
In Charge: Charles Golenpaul

Alliance Mfg. Co., The, Alliance, Ohio

Radio tuning motors, turntable motors
Booth Address: 217A Franklin Avenue
In charge: R. F. Doyle

Alpha Wire Corporation, New York City.

Wire and wire products
Booth Address: 211 Faraday Avenue
In Charge: Peter Bercoe

American Condenser Corp., Chicago, Ill.

Electrolytic condensers
Booth Address: 213 Marconi Boulevard

American Micro. Co., Inc., Los Angeles.

Dynamic, crystal and carbon microphones and accessories
Booth Address: 211A Bell Street
In Charge: F. A. Yarbrough-A. H. Bruning

American Phenolic Corp., Chicago, Ill.

Sockets, plugs and connectors
Booth Address: 204 Steinmetz Avenue
In Charge: Arthur J. Schmitt

American Radio Hdw. Co., Inc., N. Y. C.

Plugs, jacks, radio hardware
Booth Address: 208 Coulomb Street
In Charge: Mac J. Stessin-Ted Mitchell

American Tel. & Radio Co., St. Paul.

Auto and farm radio replacement vibrators, d-c, a-c inverters, "A" battery eliminators, battery chargers and inverter vibrators

Booth Address: 217 Henry Avenue

In Charge: Albert Goffstein

Amperite Company, N. Y. C.

Microphones, stands, regulators
Booth Address: 210 Hertz Avenue
In Charge: S. Rutenberg

Amperex Electronic Prod., Inc., Bklyn, N.Y.

Transmitting tubes
Booth Address: 213 Bell Street
In Charge: S. Norris

Arcturus Radio Tube Co., Newark, N. J.

Receiving tubes
Booth Address: 202 Steinmetz Avenue
In Charge: J. Gearner

Astatic Microphone Lab., Inc., Youngstown, Ohio.

Crystal microphones and crystal pickups
Booth Address: 216 Henry Street
In Charge: R. T. Schottenberg

Atlas Sound Corp., Brooklyn, N. Y.

P-A equipment, loudspeakers, etc.
Booth Address: 209 Franklin Avenue
In Charge: R. C. Reinhardt

Audak Company, N. Y. C.

Sound reproducing apparatus
Booth Address: 211 Franklin Avenue
In Charge: Royal A. Stemm

Barker & Williamson, Ardmore, Penna.

"Air inductors," turrets, swinging links, ceramics and accessories
Booth Address: 212 Marconi Boulevard
In Charge: Barrie R. Barker-John F. Williamson

Belden Mfg. Co., Chicago, Ill.

Wires
Booth Address: 208-210 Franklin Avenue
In Charge: E. K. Butler

Bell Sound Systems, Inc., Columbus, Ohio.

Portable p-a systems, mobile sound systems, amplifiers, accessories, Belfone intercommunication systems
Booth Address: 107 Marconi Boulevard
In Charge: R. E. Potts

Birnbach Radio Co., Inc., N. Y. C.

Standoff insulators, all-wave antenna kits, colored hardware, short-wave parts, aerial wire, mike cable
Booth Address: 217 Steinmetz Avenue
In Charge: Morris Birnbach

Bliley Electric Co., Erie, Penna.

Quartz crystals, holders and temperature control mountings
Booth Address: 105 Bell Street
In Charge: F. D. Bliley

Bogen Co., Inc., David, N. Y. C.

P-A intercommunicating and sound systems
Booth Address: 206 Steinmetz Avenue
In Charge: Haskel A. Blair

Brand & Co., William, N. Y. C.

"Turbo" varnished tubing, saturated sleeving, varnished cloths and papers, mica
Booth Address: 207 Bell Street
In Charge: William Naumburg, Jr.

Bruno Laboratories, Inc., N. Y. C.

Velocity microphones, static velocity microphones, stands
Booth Address: 212 Henry Avenue
In Charge: William A. Bruno

Brush Devel. Co., The, Cleveland, Ohio.

Crystal microphones, crystal headphones, "Hushatones," crystal vibration pickups, crystal phonograph pickups
Booth Address: 216 Hertz Avenue
In Charge: John Altmayer

Bud Radio, Inc., Cleveland, Ohio.

Variable transmitting and receiving condensers, relay racks, panels, chassis, cabinets, r-f chokes, sockets, plugs, etc.
Booth Address: 212 Franklin Avenue
In Charge: Max L. Haas

Cardwell Mfg. Corp., The Allen D., Brooklyn, N. Y.

Fixed and variable air condensers, and accessory products
Booth Address: 207 Marconi Boulevard
In Charge: R. L. Morehouse

Carron Mfg. Co., Chicago, Ill.

Speaker cones
Booth Address: 106 Coulomb Street
In Charge: J. Prince

Centralab, Milwaukee, Wisc.

Variable and fixed resistors, selector switches
Booth Address: 114-116 Bell Street
In Charge: H. E. Osmun

Cinaudagraph Corp., Stamford, Conn.

Loudspeakers and permanent-magnet alloys
Booth Address: 214 Faraday Avenue
In Charge: D. P. O'Brien

Clarostat Mfg. Co., Inc., Brooklyn, N. Y.

Resistors, volume controls, ballasts
Booth Address: 208 Steinmetz Avenue
In Charge: Victor Mucher

Clough-Brengle Co., The, Chicago, Ill.

Test equipment
Booth Address: 106-108 Bell Street
In Charge: Eugene Carrington

Continental Carbon, Inc., Cleveland.

Carbon and wire-wound resistors, auto-radio suppressors, Filternoys, paper dielectric condensers
Booth Address: 115 Ampere Street
In Charge: G. F. Benkelman

Continental Diamond Fibre Co., Wilmington, Del.

Booth Address: 209 Marconi Boulevard

Cornell-Dubilier Electric Corp., So. Plainfield, N. J.

Capacitors for the radio and electrical industries, dry and wet electrolytics, paper, oil, mica, Dykanol
Booth Address: 207 Faraday Avenue
In Charge: Leon L. Adelman

Cornish Wire Co., Inc., N. Y. C.

Radio wires and antenna accessories, "Noise Master" all-wave kits
Booth Address: 204 Marconi Boulevard
In Charge: W. F. Osler, Jr.

Coto-Coil Co., Inc., Providence, R. I.

Parts
Booth Address: 211 Steinmetz Avenue
In Charge: F. C. Henrikson

Crowe Name Plate & Mfg. Co., Chicago.

Tuning dials, escutcheons, auto-radio remote controls, nameplates, etc.
Booth Address: 104-106 Marconi Boulevard
In Charge: J. L. McCarthy

Drake Electric Works, Inc., Chicago, Ill.

Soldering irons and stands, solder pots
Booth Address: 110-112 Bell Street
In Charge: W. A. Kuehl

Eby, Inc., Hugh H., Philadelphia, Penna.

Parts
Booth Address: 213 Hertz Avenue
In Charge: C. N. Wiltbank

Electronic Design Corp., Chicago, Ill.

Vocograph amplifiers, sound systems and accessories
Booth Address: 113 Ampere Street
In Charge: Robert L. Barr-John S. Meck

Electronic Labs., Inc., Indianapolis, Ind.

Vibrators and vibrator type converters
Booth Address: 210 Henry Avenue
In Charge: Norman R. Kevers-Wm. W. Garstang

Electro Motive Mfg. Co., Inc., N. Y. C.

Condensers and resistors
Booth Address: 209 Bell Street
In Charge: L. B. Weyburn

Electro-Voice Mfg. Co., Inc., So. Bend.

Microphones and microphone stands
Booth Address: 206 Marconi Boulevard
In Charge: A. R. Kahn

Garrard Sales Corp., N. Y. C.

Record changers and phonograph motors
Booth Address: 213 Steinmetz Avenue
In Charge: William Carduner

General Cement Mfg. Co., Chicago, Ill.

Booth Address: 107 Edison Street

General Industries Co., The, Elyria, Ohio.

Record changers
Booth Address: 209 Henry Street

General Transformer Corp., Chicago, Ill.

Transformers
Booth Address: 101-103 Ampere Street
In Charge: Henry Shafer

Guthman & Co., Inc., Edwin I., Chicago.

Textile-covered and Litz wire, padder and trimmer condensers, cabinets, coil-winding machinery, antenna and r-f coils, i-f transformers and chokes, condenser banks for automatic push-button tuning
Booth Address: 114 Marconi Boulevard
In Charge: B. J. Funk

Hallicrafters, Inc., The, Chicago, Ill.

Communications receivers and transmitters
Booth Address: 107-109 Bell Street
In Charge: W. J. Halligan

Hammarlund Mfg. Co., Inc., N. Y. C.

Midget variable condensers, micro condensers, plug-in coils, sockets, neutralizing condensers, r-f chokes, i-f transformers, mica trimming and padding condensers, "Super Pro" receiver
Booth Address: 207 Steinmetz Avenue
In Charge: W. W. Jablon-L. A. Hammarlund

Hickok Elec. Inst. Co., Cleveland, Ohio.

Service equipment and meters
Booth Address: 208 Henry Avenue
In Charge: L. C. McCarthy

Howard Radio Co., Chicago, Ill.

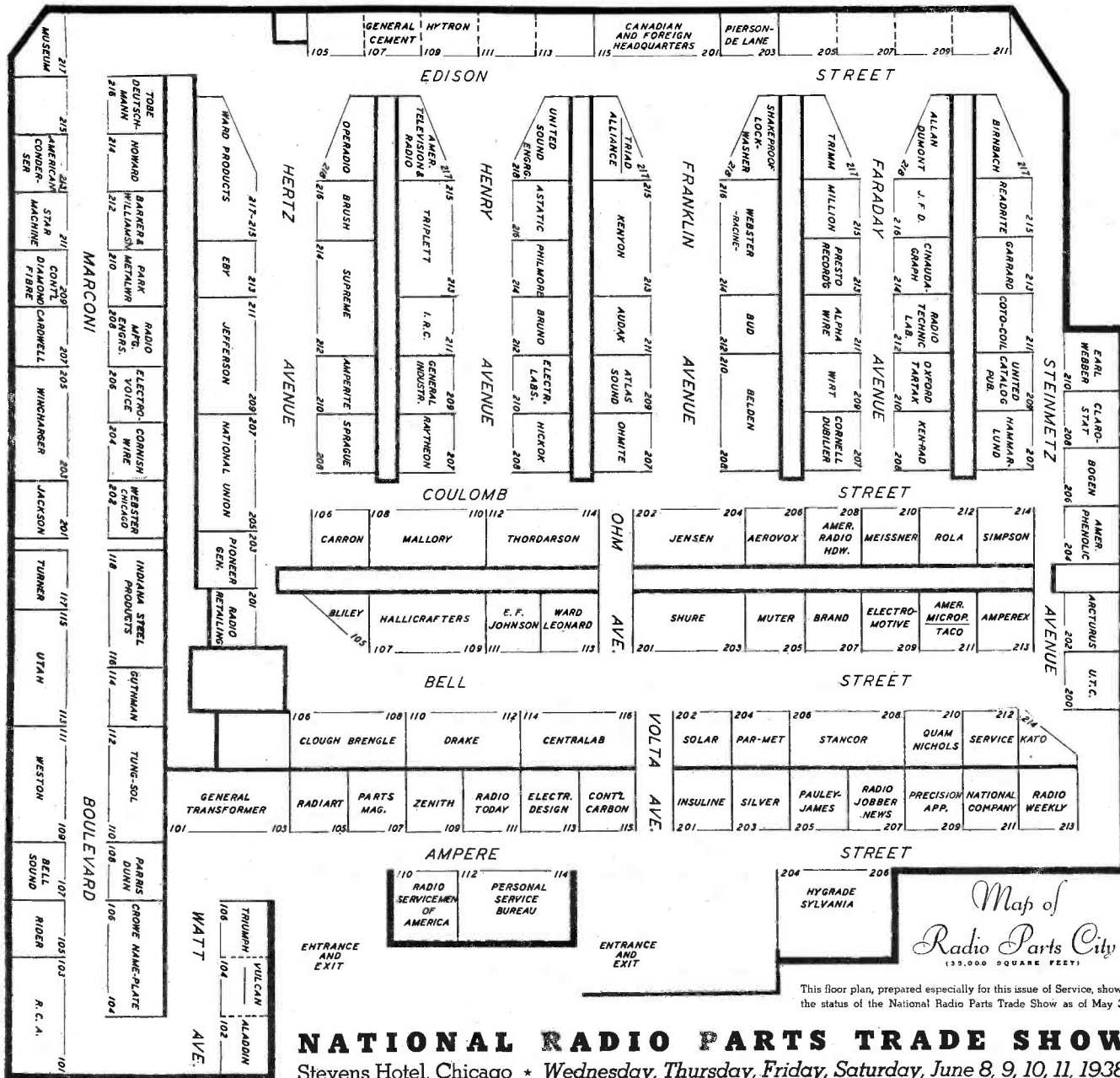
Booth Address: 214 Marconi Boulevard

Hygrade-Sylvania Corp., N. Y. C.

Tubes
Booth Address: 204-206 Ampere Street
In Charge: A. L. Milk

Hytron Corp., Salem, Mass.

Receiving tubes
Booth Address: 109 Edison Street



This floor plan, prepared especially for this issue of Service, shows the status of the National Radio Parts Trade Show as of May 3.

NATIONAL RADIO PARTS TRADE SHOW

Stevens Hotel, Chicago * Wednesday, Thursday, Friday, Saturday, June 8, 9, 10, 11, 1938

Indiana Steel Products Co., The, Chicago.
Permanent magnets
Booth Address: 116-118 Marconi Boulevard
In Charge: A. D. Plamondon, Jr.

Insuline Corp. of America, N. Y. C.
Auto-radio antennas, parts and accessories, soldering irons
Booth Address: 201 Ampere Street
In Charge: S. J. Spector

International Resistance Co., Phila., Pa.
Resistors and volume controls
Booth Address: 211 Henry Avenue
In Charge: Dan Fairbanks

J. F. D. Mfg. Co., Brooklyn, N. Y.
Home and auto-radio accessories
Booth Address: 216 Faraday Avenue
In Charge: J. Finkel

Jackson Elec. Inst. Co., Dayton Ohio.
Test equipment
Booth Address: 201 Marconi Boulevard
In Charge: Paul F. Jackson

Jefferson Electric Co., Bellwood, Ill.
Transformers and chokes
Booth Address: 209-211 Hertz Avenue
In Charge: R. J. Horstman

Jensen Radio Mfg. Co., Chicago, Ill.
Loudspeakers
Booth Address: 202-204 Coulomb Street
In Charge: Ralph T. Sullivan-T. A. White

Johnson Co., E. F., Waseca, Minn.
Transmitting equipment
Booth Address: 111 Bell Avenue
In Charge: E. F. Johnson-Byron E. Hargrove

Kato Engineering Co., Mankato, Minn.
Kato Rotary Converters, a-c lighting plants 6- and 12-volt battery chargers
Booth Address: 214 Bell Street
In Charge: Cecil H. Jones-Wm. A. Cliff

Ken-Rad Tube and Lamp Corp., Owensboro, Ky.
Receiving tubes
Booth Address: 208 Faraday Avenue
In Charge: Geo. E. Phillips

Kenyon Transformer Co., Inc., N. Y. C.
Transformers and reactors, television components
Booth Address: 213-215 Franklin Avenue
In Charge: F. P. Kenyon-W. G. Many-F. Ralph Kenyon

McMurdo Silver Corp., Chicago, Ill.
Receivers, phonograph, p-a equipment
Booth Address: 203 Ampere Street
In Charge: McMurdo Silver

Mallory & Co., P. R., Indianapolis, Ind.
Volume controls, condensers, vibrators, switches, vibrapacks, bias cells, rectifiers, battery chargers and radio hardware

Booth Address: 108-110 Coulomb Street
In Charge: F. Newton Cook

Meissner Mfg. Company, Mt. Carmel, Ill.
Coils, coil kits, etc.
Booth Address: 210 Coulomb Street
In Charge: W. F. Marsh

Million Radio & Television, Chicago, Ill.
Test instruments, sound equipment
Booth Address: 215 Faraday Street
In Charge: John W. Million, Jr.

Muter Co., The, Chicago, Ill.
Resistors, condensers, push-button switches, ballast resistors, thermotrols candohms, spirashields, ceramic condensers, interference eliminators
Booth Address: 205 Bell Street
In Charge: Leslie F. Muter-J. R. Scanlon

National Co., Inc., Malden, Mass.
Communication equipment
Booth Address: 211 Ampere Street
In Charge: James Millen

National Union Radio Corp., Newark, N. J.
Radio tubes and condensers
Booth Address: 205-207 Hertz Avenue
In Charge: R. H. Van Dusen

Ohmite Mfg. Co., Chicago, Ill.
Rheostats, resistors
Booth Address: 207 Franklin Avenue
In Charge: Ralph M. Hill

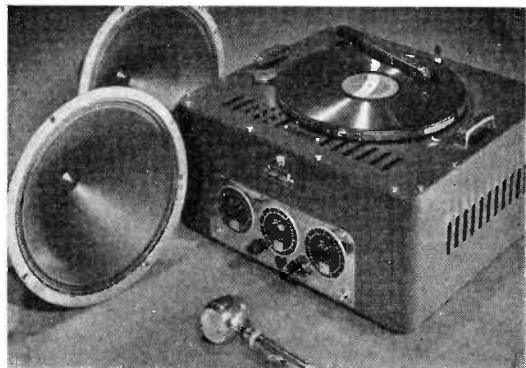
- Operadio Mfg. Co., St. Charles, Ill.**
Amplifiers, portable p-a systems, intercom-
municators, loudspeakers
Booth Address: 218 Hertz Avenue
In Charge: H. A. Wilson
- Oxford-Tartak Radio Corp., Chicago, Ill.**
Loudspeakers
Booth Address: 210 Faraday Avenue
In Charge: Paul Tartak
- Park Metalware Co., Inc., Orchard Park,
N. Y.**
Xcelite screw and nut drives, wrench and
other tools
Booth Address: 210 Marconi Boulevard
In Charge: F. B. Farrington
- Par-Metal Products Corp., L. I. C., N. Y.**
Relay racks, cabinets, panels, chassis
Booth Address: 204 Bell Street
In Charge: Oren H. Smith
- Parris-Dunn Corp., Clarinda, Iowa.**
6-volt wind-driven battery charger
Booth Address: 108 Marconi Boulevard
In Charge: F. E. Brown
- Pauley-James Corp., Chicago, Ill.**
Vibrators
Booth Address: 205 Ampere Street
In Charge: H. M. Pauley
- Philmore Mfg. Co., Inc., N. Y. C.**
Battery and a-c, d-c receivers and kits,
microphones, crystal receivers and elim-
inators
Booth Address: 214 Henry Avenue
In Charge: Gary Granat
- Pierce-Delane, Inc., Los Angeles, Calif.**
Booth Address: 203 Edison Street
- Pioneer Gen-E-Motor Corp., Chicago, Ill.**
Gas-electric plants, dynamotors, Gen-E-
Motors and rotary converters
Booth Address: 203 Hertz Avenue
In Charge: D. E. Bright
- Precision Apparatus Corp., Brooklyn,
N. Y.**
Test Equipment
Booth Address: 209 Ampere Street
In Charge: P. W. Mack
- Presto Recording Corp., N. Y. C.**
Instantaneous sound recording equipment;
recording discs, needles and accessories
Booth Address: 213 Faraday Avenue
In Charge: R. C. Powell
- Quam-Nichols Co., Chicago, Ill.**
Loudspeakers
Booth Address: 210 Bell Street
In Charge: H. A. Staniland
- RCA Mfg. Co., Inc., Camden, N. J.**
Parts, receiving tubes and transmitting
tubes
Booth Address: 101-103 Marconi Boulevard
In Charge: H. P. Kasner
- Radiart Corp., The, Cleveland, Ohio.**
Aerials, vibrators, vibrator testers, vibrator
power supplies
Booth Address: 105 Ampere Street
In Charge: L. K. Wildberg
- Radio Mfg. Engineers, Inc., Peoria, Ill.**
Receivers, preselectors, frequency expand-
ers and associated radio equipment
Booth Address: 208 Marconi Boulevard
In Charge: E. G. Shalkhauser—R. M.
Planck
- Radiotechnic Laboratory, Evanston, Ill.**
Tube testers
Booth Address: 212 Faraday Avenue
In Charge: H. P. Manly
- Raytheon Production Corp., N. Y. C.**
Raytheon tubes
Booth Address: 207 Henry Avenue
In Charge: E. Dietrich
- Readrite Meters Works, Bluffton, Ohio.**
Meters and servicing equipment
Booth Address: 215 Steinmetz Avenue
In Charge: F. E. Wenger—R. L. Triplett
N. A. Triplett
- Rider, John F., New York City**
Publisher
Booth Address: 105 Marconi Boulevard
In Charge: John F. Rider
- Rola Co., Inc., The, Cleveland, Ohio.**
Loudspeakers
Booth Address: 212 Coulomb Street
In Charge: Leon Golder
- SERVICE, New York City**
A Monthly Digest of Radio and Allied
Maintenance.
Booth Address: 212 Bell Street
- Shakeproof Lock Washer Co., Chicago, Ill.**
Booth Address: 218 Franklin Street
- Shure Brothers, Chicago, Ill.**
Microphones, pickups and acoustic devices
Booth Address: 201-203 Bell Street
In Charge: J. B. Albert
- Simpson Electric Co., Chicago, Ill.**
Test equipment and panel meters
Booth Address: 214 Coulomb Street
In Charge: Geo. H. Koch
- Solar Mfg. Corp., N. Y. C.**
Wet and dry electrolytics, paper, mica,
transmitting trimmers and padders
Booth Address: 202 Bell Street
In Charge: W. C. Harter—Arthur Moss
- Sprague Products Co., No. Adams, Mass.**
Fixed condensers of all types
Booth Address: 208 Hertz Avenue
In Charge: Harry Kalker
- Standard Transformer Corp., Chicago, Ill.**
Transformers, packs, chokes
Booth Address: 206-208 Bell Street
In Charge: C. L. Pugh
- Star Machine Mfrs., Inc., N. Y. C.**
Auto-radio controls, escutcheon plates
Booth Address: 211 Marconi Boulevard
In Charge: I. B. Finkel—Edward R. Fish
- Supreme Instruments Co., Greenwood,
Miss.**
Testing instruments
Booth Address: 212-214 Hertz Avenue
In Charge: Dormand S. Hill
- Technical Appliance Corp., N. Y. C.**
Antenna and master antenna systems, line
filters
Booth Address: 211B Bell Street
In Charge: T. Lundahl
- Thordarson Elec. Mfg. Co., Chicago, Ill.**
Transformers and amplifiers
Booth Address: 112-114 Coulomb Street
In Charge: C. P. Cushman
- Tobe Deutschmann Corp., Canton, Mass.**
Service instruments, noise elimination fil-
terettes, electrolytic and paper dielectric
condensers
Booth Address: 216 Marconi Boulevard
In Charge: Tobe Deutschmann
- Triad Mfg. Co., Inc., Pawtucket, R. I.**
Tubes
Booth Address: 217B Franklin Avenue
In Charge: Edward Singer
- Trimm Radio Mfg. Co., Chicago, Ill.**
Headsets, custom-built amplifiers
Booth Address: 217 Faraday Avenue
In Charge: Paul A. Bottorff
- Triplett Elec. Inst. Co., Bluffton, Ohio**
Electrical measuring instruments, testing
equipment
Booth Address: 213-215 Henry Avenue
In Charge: F. E. Wenger, R. L. Triplett—
N. A. Triplett
- Triumph Mfg. Co., Chicago, Ill.**
Test Equipment
Booth Address: 106 Watt Avenue
In Charge: J. P. Kennedy
- Tung-Sol Lamp Works, Inc., Newark, N. J.**
Tubes
Booth Address: 110-112 Marconi Boulevard
In Charge: P. R. Dawson
- Turner Co., The, Cedar Rapids, Iowa.**
Microphones
Booth Address: 117 Marconi Boulevard
In Charge: H. W. Johnson
- United Sound Engineering Co., St. Paul,
Minn.**
P-A and intercommunicating equipment,
instruments, centralized sound systems
Booth Address: 218 Henry Avenue
In Charge: H. M. Richardson
- United Transformer Corp., New York City.**
Transformers
Booth Address: 200 Steinmetz Avenue
In Charge: Sam Baraf.
- Utah Radio Products Co., Chicago, Ill.**
Speakers, vibrators, replacement and ama-
teur transformers, transmitter kits,
Carter parts
Booth Address: 115 and 113 Marconi Boule-
vard
In Charge: L. L. Worner—Olin F. Jester
- Vulcan Electric Co., Lynn, Mass.**
Soldering irons
Booth Address: 104A Watt Avenue
- Ward Leonard Electric Co., Mt. Vernon,**
Resistors, rheostats and relays
Booth Address: 113 Bell Street
In Charge: Kline Gray
- Ward Products Corp., The, Cleveland, O.**
Aerials
Booth Address: 215-17 Hertz Avenue
In Charge: H. R. Wiesenbergl
- Webber Co., Earl, Chicago, Ill.**
Test equipment
Booth Address: 210 Steinmetz Avenue
In Charge: R. M. Krueger
- Webster Co., The, Chicago, Ill.**
P-A systems, sound equipment
Booth Address: 202 Marconi Boulevard
In Charge: F. J. Wessner
- Webster Electric Co., Racine, Wisc.**
Webster Electric sound systems, phono-
graph pickups, "Teletalk" intercommuni-
cation system
Booth Address: 214-216 Franklin Avenue
In Charge: W. H. Johnson
- Weston Electrical Instrument Corp.,
Newark, N. J.**
Servicing equipment, panel instruments,
electrical measuring instruments and their
accessories
Booth Address: 109-111 Marconi Boulevard
In Charge: V. E. Jenkins
- Wincharger Corp., Sioux City, Iowa.**
6- and 32-volt Winchargers, and antenna
towers
Booth Address: 203-205 Marconi Boulevard
In Charge: Bill Herron
- Wirt Company, Philadelphia, Penna.**
Wire-wound and carbon resistors, spark-
plug suppressors, switches, volume con-
trols
Booth Address: 209 Faraday Avenue
In Charge: R. F. Taylor
- Zenith Radio Corp., Chicago, Ill.**
Zenith tubes, replacement parts and acces-
sories
Booth Address: 109 Ampere Street
In Charge: H. W. Blakeslee

The Radio Industry special train carrying jobbers, representatives, and others of the radio trade to the National Radio Parts Trade Show in Chicago, will leave Grand Central Station, New York, at 4:10 p.m. Daylight Time, June 7, and will arrive in Chicago the next morning.

Further details concerning the train may be obtained from Perry Saffler, 53 Park Place, New York City. Telephone REctor 2-5334.

BELL COMBINATION MOBILE P. A. SYSTEMS

MANUFACTURED UNDER
LICENSE ARRANGEMENT
WITH E. R. P. I.



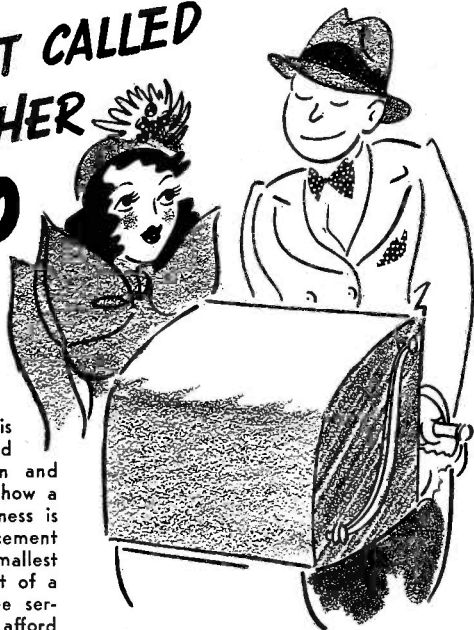
For 6 volt D.C. or 110 volt A.C. operation. No power packs to interchange. 24 watts output. Two 12" auditorium type permanent magnet speakers reduce battery drain when operated on D.C. Three input channels—two for microphones—one for phono. Beam power output tubes. Bass and treble compensating controls reduce feedback to a minimum. Plug-in type crystal microphone permits easy adaptation to pedestal or other type stands. Modern in appearance, easily portable and easy to service and built to Bell's usual high standards of quality. Model M-24 is a truly modern, reasonably priced Mobile System, that's easily portable and easily serviced. Write for details on this and other Bell models.

VISIT OUR BOOTH AT THE NATIONAL TRADE SHOW

BELL SOUND SYSTEMS, INC.

61-62 East Goodale Street, Columbus, Ohio
Export Office: 308 W. Washington St., Chicago, Ill.

HE FIRST CALLED
TO FIX HER
RADIO



SHE liked his work so called him back again and again. That is how a permanent business is built up. Replacement parts are the smallest part of the cost of a service call. The serviceman can't afford to use other than the most dependable. That is why Ward Leonard is enjoying ever increasing demand.

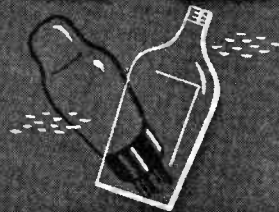
Visit us at Radio Parts Show, Booth 113 Bell Street, Stevens Hotel, Chicago, June 8 to 11.

WARD LEONARD ELECTRIC CO.

36 SOUTH STREET, MOUNT VERNON, N. Y.
Please send me Price List Bulletin 507 A.

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

RADIO TUBES and COD LIVER OIL



The radio service man who finds drug stores, stationery stores and a dozen others featuring tubes might try selling some of their lines—but, we wouldn't advise it. We doubt if he'd make any more money on cod liver oil than they do on cut-price radio tubes.

Here's a better suggestion. Sell the tube that protects the dealer with a sound merchandising plan. The tube proposition that guarantees full profit on every sale—without investment. Under the Tung-Sol Consignment Plan reputable dealers, who can qualify, receive a stock of dependable tubes without paying a cent—they sell the tubes, collect the profits and then remit once a month.

Think of the benefits this practical plan holds—freedom from losses through price reductions and obsolescence—and what is more, you pay no premium for the financing of your tube stock.

Write our nearest sales office for details and necessary qualifications.
Dept. D

TUNG-SOL

Flow Radio Tubes
TUNG-SOL LAMP WORKS, INC.
Radio Tube Division

Sales Offices: Atlanta, Boston, Chicago, Dallas, Kansas City,
Los Angeles, Detroit, New York. Gen'l Offices, Newark, N. J.

ASSOCIATION NEWS . . .

RSA NEWS

RSA continues to show substantial membership gains; local groups in Buffalo, New York; Houston, Texas; Jamestown, New York; and Rockford, Illinois, have affiliated with the RSA in the last thirty days. Thirty-one local associations have affiliated to date.

The RSA is embarking upon the first step of its program to acquaint the public with the desirability of having good radio servicing by sponsoring a Better Radio Reception Week. This program is being run in cooperation with local broadcasting stations in Chicago and the Chicago Chapter of RSA. Accurate tabulations are being kept of results and some very interesting facts will be released to the trade shortly.

Flint Chapter

The Flint Chapter under the leadership of Worden Stiles, Chairman, participated in a regional meeting held in Pontiac, Michigan, at which meeting the Executive Board of Flint, Pontiac and Detroit Chapters formed a regional setup under the direction of Joe Cole, National Director of RSA.

Pontiac Chapter

Acting as hosts to both the Flint and Detroit Executive Boards, Pontiac on Sunday, April 3, took active part in new regional setup for District Nine. A flying squadron was organized to assist any group in District Nine in affiliating with the RSA. The Pontiac Chapter is under the able leadership of John Trick, Chairman.

Oklahoma City Chapter

The Oklahoma City Radio Service Association held a banquet Tuesday evening, April 5, with orchestra and entertainment. The ladies were invited and games and other entertainment were enjoyed. The regular business meeting of April 12th will be devoted to revising the by-laws of the Chapter.

Chicago Chapter

The Chicago Chapter had the pleasure of hearing John F. Rider at which time Mr. Rider took the boys to task for their lack of business ability as well as their failure to take advantage of many aids offered by the industry, in order that they might improve their business. He stressed the fact that regardless how good they were technically, it is necessary to be business men in order that they may succeed in the radio servicing business.

Houston Chapter

The National Radio Service Association of Houston, Texas, voted to affiliate with RSA and join with other groups of servicemen throughout the country who are determined to improve both the business and technical efficiency of radio servicing. T. F. Stephenson, a member of the organizing board of RSA, is a member of this group. The group is under the direction of C. L. Robertson, Chairman, and J. L. Stone, Secretary-Treasurer.

Rockford Chapter

The Rockford, Illinois Chapter was officially established on Thursday, April 7 at

which time all of the radio service dealers in town voted unanimously to form the Rockford Chapter of RSA. This is one of the strongest groups yet to affiliate with RSA. Officers elected were: Frank N. Welden, Chairman; E. S. Ary, Secretary; and A. L. Hissong, Treasurer.

Buffalo Chapter

The Associated Radio Service Engineers of Buffalo, one of the oldest and most progressive groups of servicemen in the country, voted on April 5, 1938, to become affiliated with the RSA. This fine group of servicemen have done much to raise the standards of servicing and servicemen in the Buffalo area, and is under the able leadership of Anthony Schreiber, Chairman; Vincent E. Ball, Treasurer; and Frank Bestine, Secretary.

Jamestown, N. Y., Chapter

The Jamestown Association of Radio Service Engineers, who attended a meeting held in Buffalo on April 5, voted to affiliate with RSA. This able group of men is under the leadership of Lawrence Babcock, Chairman; Richard L. Bonsteel, Treasurer, and C. Leonard Johnson, Secretary.

Detroit Chapter

John Rider spoke to a capacity crowd in Detroit on April 4, at which time he stressed the necessity of strong leadership amongst the servicemen as a means of eliminating some of the evils that beset the industry. The Detroit Chapter had as its guests for the meeting a large delegation from both the Flint and Pontiac, Michigan chapters.

Peoria and Freeport Chapters

The Peoria and Freeport Chapters are planning a get-together of members and their wives at a picnic to be held some time in the near future, at which time members of both chapters as well as their families will become better acquainted. Don Stover of the Freeport Chapter and John Stoll of the Peoria Chapter are in full charge of the details.

Interstate Chapter

The Interstate Chapter is working very closely with the group in Waterloo, Iowa, who have not as yet affiliated with the RSA. Meetings in the near future are being planned with the Davenport and Waterloo groups, looking towards the affiliation of the Waterloo group. Details for the Interstate Chapter are being handled by George Wooley, Chairman.

Johnstown Chapter

The Johnstown Chapter is devoting quite a bit of time to its current meetings for the discussion of noise interference elimination. A thorough check is being made throughout Johnstown area to determine the offenders in this respect, and prompt, vigorous action has been promised in order that radio reception may be aided thereby. K. A. Vaughan, the newly elected director of the RSA is a member of the Johnstown Chapter and is aiding in this work.

Cleveland Chapter

The Cleveland Chapter is arranging for a large number of its members to attend

the National Trade Show in Chicago in a body. These arrangements are under the personal supervision of Al Theriault, the newly elected director from the Cleveland area and L. Vangunten, Chairman of the Cleveland Chapter.

Binghamton Chapter

The Binghamton Chapter, at the request of the radio widows of the Chapter, deemed it advisable to hold a banquet on March 15. In addition to local members there were guests from Scranton, Pennsylvania, and Ithaca, New York. The entertainment consisted of local broadcasting and a Badger fight staged by John Rose, the Director from District Nineteen. At a previous meeting, the local by-laws were completed and finally accepted by the chapter. Meeting ended by expelling those members whose dues were in arrears.

Duluth Chapter

The Duluth Chapter had the pleasure of hearing a fine talk by John Reitan of the Lucker Sales Company of Minneapolis. The talk consisted of the latest kinks in radio and television.

Rio Grande Valley Chapter

The Rio Grande Valley Radio Servicemen's Association hold regular meetings the first and third Wednesdays of each month. The program consists of technical talks and discussions by the members with speakers from manufacturers whenever possible. At the present they are working toward a study course for their members.

RTG

The Radio Technicians' Guild officially opened its new headquarters in Boston on Monday, April 4th, 1938.

J. O'Leary, chairman of the Guild delivered a very interesting address to the group. The address covered important facts regarding the service industry from its commencement to the present day; the various changes it has gone through, the requirements of a serviceman 15 years ago compared with those of today. He also made mention the extra qualifications that will be required by television servicemen. The address was recorded on a Presto Recorder to be kept for posterity.

The oscilloscope played an important part in the opening exercises. Double image features were presented which showed a real X-ray of radio circuits.

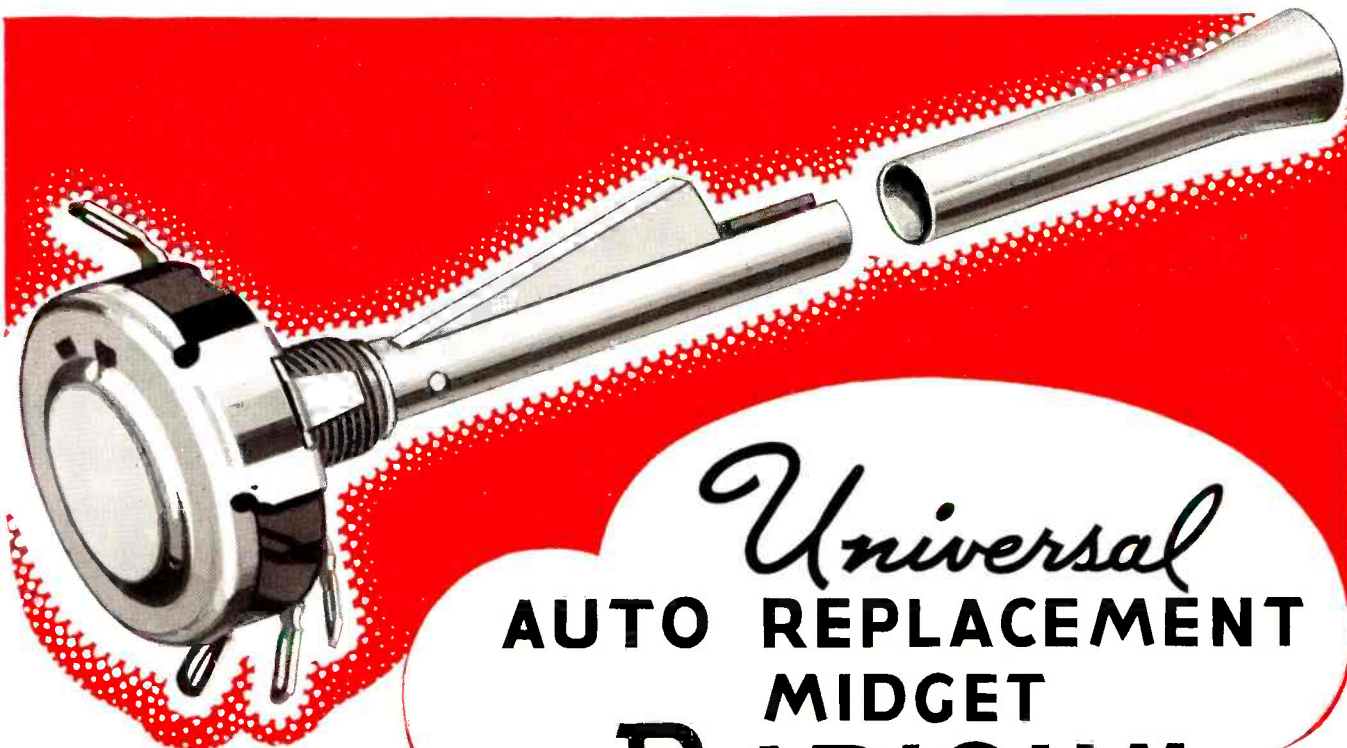
The group has now embarked on a program of study for 52 weeks.

Lectures will be confined to the oscilloscope.

Delegates present discussed the coming classes and the meeting was closed with a rendition by the Guild's trio: A. Haid, S. Di Russo, and W. Staples. This was also recorded. The song was a selection from "Snow White."

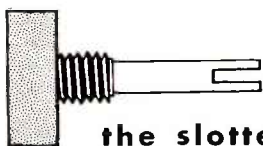
Lawrence Chapter was given two booths in the Lawrence Pageant of Progress which was held in Lawrence, April 4 to 9th. Unfortunately, they were unable to attend the opening ceremonies having to be present for the Pageant.

(Continued on page 53)

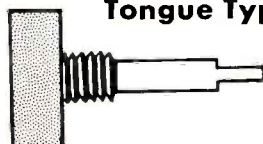


Universal AUTO REPLACEMENT MIDGET RADIOHM

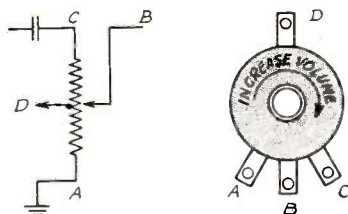
REPLACES



the slotted
type as well
as the
Tongue Type



If the original control has a tap on the resistance strip for tone compensation, connect the wire from this circuit to terminal D on the replacement. Sketch shows how to locate this terminal. If no tone compensation is used, leave this terminal unconnected — it may cut off, if care is used.



All plain units are supplied with the slip clutch. Because of this construction separate switches cannot be attached to plain units. When replacing switch type controls order switch type replacement. D.P.S.T. switch provides for extra heavy duty service.

The hinged shaft tongue may be rotated out of slot and cut off to duplicate either type of original shaft. A guide funnel supplied with all controls keeps the tongue in position.

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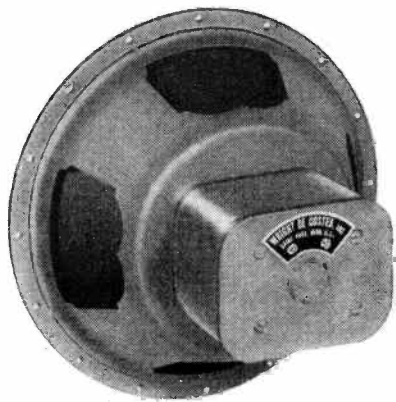
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THE MANUFACTURERS . . .



12" NOKOIL SPEAKER

This Model N 12 HL Speaker will be furnished in 3 different types—low-frequency type covering the range from 50 to 3,500 cps; standard type covering from 60 to 5,000 cps; and the wide-range type covering from 60 to 7,500 cps. All three types will be capable of handling 20 watts continuously. Wright De Coster, Inc., St. Paul, Minnesota, manufacturer, announces this new speaker.—SERVICE.

CENTRALIZED SOUND SYSTEMS

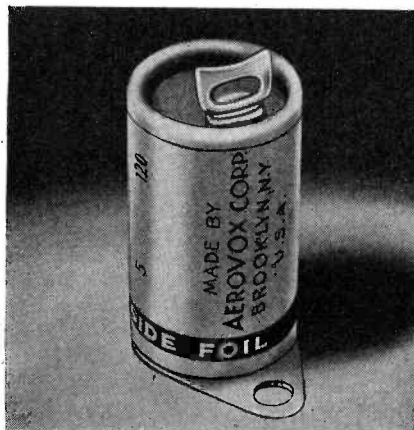
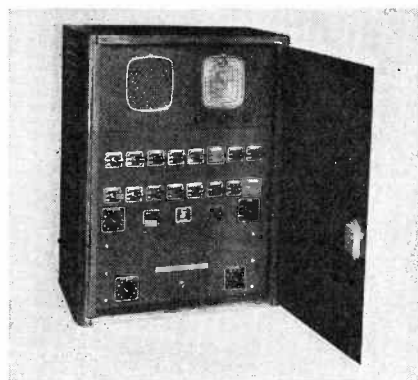
The David Bogen Co. announce a new low priced centralized sound system of extreme flexibility for use in schools, institutions, hospitals, department stores, etc.

The Model S-32 includes a built-in all-wave radio tuner, monitor speaker, master and emergency announcement switch, visual volume-level indicator, special class-A amplifier, tone compensator and provision for up to 32 classroom switches.

These new units incorporate talk-back features permitting two-way communication from the central unit to any or all classrooms or outlying stations. Inputs are available for phono pickup and microphone and additional inputs are provided for expansion.

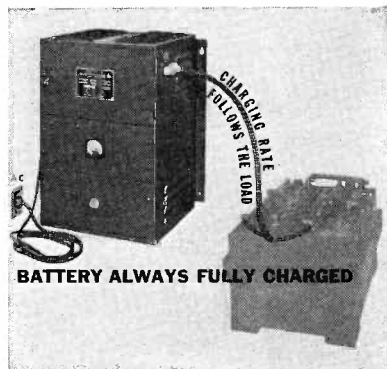
The Model S-32 comes complete with eight classroom switches and 8" p-m speakers housed in walnut finished wall baffles. The S-32 is mounted in a chromium trimmed metal cabinet equipped with a door and lock and handsomely finished in durable shrivel.

For complete details write David Bogen Co., Inc., 663 Broadway, New York City.—SERVICE.



CONDENSER FOR AUTO-RADIO NOISE SUPPRESSION

Another addition to its line of auto-radio condensers is announced by Aerovox Corporation, 70 Washington St., Brooklyn, N. Y. It is the "hash" or generator noise-suppressing condenser—a tubular paper job with grounded bottom bracket and top terminal lug, intended for mounting and connections directly on the car generator. The standard capacity is .5 mfd., but other capacities will be made available if called for. The voltage rating is 100, although the condenser is subjected to little over 6 volts in normal service.—SERVICE.



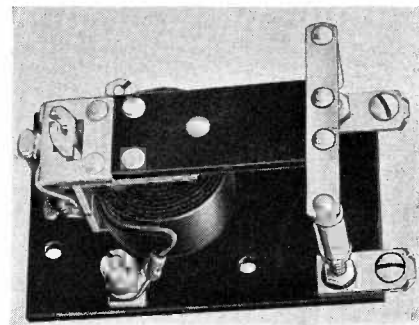
RAYTHEON BATTERY CHARGER

A self-regulating battery charger, so designed that it may be plugged in, connected to a storage battery, and then forgotten, has been made available by Raytheon Mfg. Co., Electrical Equipment Division, 190 Willow Street, Waltham, Mass.

Full details of this charger, which is said to have several advantages over the manually adjusted types, may be obtained from the manufacturer at the address given.—SERVICE.

DUMONT SUPER-VOLT CONDENSERS

A new line of high-voltage electrolytic condensers, said to be especially suitable for applications where excessively high voltages are encountered, has been announced by Dumont Electric Co., Inc., 514-516 Broadway, New York City. The condensers are rated at 700 volts peak, and are available in all sizes.—SERVICE.



HIGH-VOLTAGE RELAY

New grid controlled rectifier tubes for high-powered, one kw or more stations, have necessitated the development of this new Ward Leonard 507-516 Keying Relay.

These relays have single pole, normally open, double break contacts. The base and cross arms are of bakelite. Silver-to-silver contacts are insulated for 5,000 volts to ground. The relay operates on 6 to 8 coil volts, dc.

The armature design, light in weight, provides speed in keying up to 50 words per minute.

Further details may be obtained from the manufacturer, Ward Leonard Electric Co., Mount Vernon, N. Y.—SERVICE.

CLARION 20-28 WATT UNIVERSAL SOUND SYSTEM

Transformer Corp. of America, 69 Wooster Street, New York City, through its national organization, the Clarion Institute of Sound Engineers, announces the addition of a new Universal 6-Volt DC and 110-Volt AC Sound System to the line of Clarion Sound Equipment. Designated as

Model S-32 includes self-contained amplifier, no power packs required (supplied with and without phono attachment), two 12" heavy duty p-m speakers, two parabolic reflectors, military hand mike, and 50 ft of speaker cable—all ready to operate.

Amplifier features four beam power tubes, inverse feedback, standby switch, mixing and fading facilities, two self-contained power supplies and power for phono table operation. Complete details may be had by writing direct to manufacturer.—SERVICE.

MARION INSTRUMENTS

Marion Electrical Instrument Company, Manchester, New Hampshire, announce the release of a new line of meters, popularly priced. All meters feature a D'Arsonval movement of 2 per cent accuracy or better, large clear reading scales, ample torque to allow use in any position, balanced and calibrated for such use with no loss of accuracy. Magnets are aged both naturally and artificially to insure maximum stability. The pivots are the finest obtainable, set in high grade sapphire jewels, eliminating all possible friction in the movement. Completely sealed against dust. One-milliamper meter movements regularly supplied with 50-millivolt drop within 2 per cent. Can also be furnished with any millivolt drop from 50 up.—SERVICE.

Now—DIRECTIONAL CONTROL

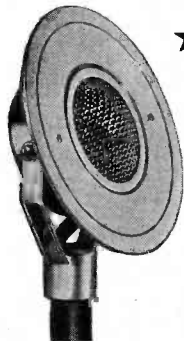


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Noise**

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New removable A90A Directional Baffle for Shure 700A Crystal Microphone. Reduces feedback—cuts down background noise. **\$2.50**
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MANUFACTURERS—continued

MEISSNER PUSH-BUTTON TUNER

A push-button tuner, adaptable to either t-r-f or superhet receivers, has been announced by Meissner Mfg. Co., Mt. Carmel, Ill. Seven buttons permit tuning a receiver to that number of stations, while a "release" button returns control of the set to manual tuning.—SERVICE.

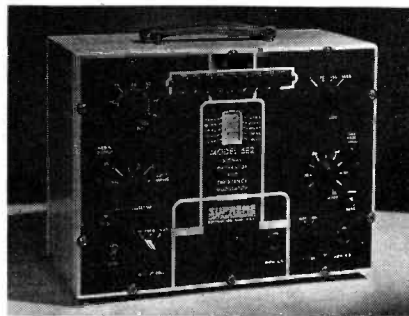
JACKSON SOLDERING TOOL

A one-quarter inch soldering pencil, claimed to do the work of a much larger conventional iron, has been announced by Jackson Electro Corp., 625 Broadway, New York City. The tool consumes only 25 watts; it comes equipped with tips and stand.—SERVICE.

SUPREME PUSH-BUTTON SIGNAL GENERATOR

For the first time on a signal generator, according to an announcement by Supreme, rapid, accurate push-button tuning! The most used r-f and i-f frequencies are laboratory calibrated and are controlled by a series of push-buttons. An exhaustive check-up shows that 90 percent of all receiver models ever made used but five i-f frequencies. Add to this four r-f frequencies and alignment of practically all sets can be made, using push-buttons only.

Using a 'scope connected to the proper output circuit and the 582-A connected to the first i-f stage, all the necessary i-f frequencies are instantly available by pushing the proper button. Either amplitude modulation or frequency modulation is available on the same button. Adjusting for maximum amplification and required selectivity characteristics is made easy. To balance the r-f circuit, connect the 582-A to the receiver input. Check at 1400 kc, 1000 kc



and 600 kc for maximum gain and proper selectivity and the job is done.

Also offers a complete manually tuned band of frequencies from 85 kc to 15 mc on fundamentals and to above 60 mc on harmonics. This dial has over 8 feet of actual translucent scale length, using a hairline shadow indicator (no parallax) with only the wanted frequency spotlighted. Newly developed permeability tuned iron core inductors in the main tuning circuits and air dielectric trimmers throughout result in high Q, freedom from drift and greatly improved accuracy.

The new completely electronic "lock-center-synchronize" Supreme frequency modulator circuit is used.

Further details may be obtained from Supreme Instruments Corp., Greenwood, Miss.—SERVICE.

**What!
NO HUM?**

• • • No sir, not when a set is equipped with

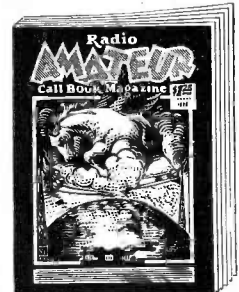
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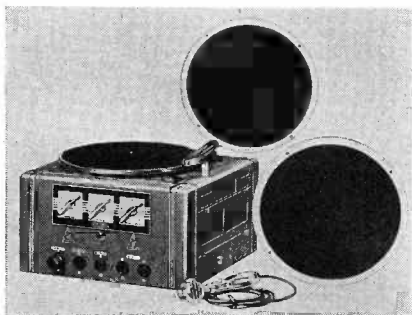
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MANUFACTURERS—continued

OPERADIO MOBILE SYSTEM

Said to be instantly changeable for either a-c or d-c operation, the Operadio model 172 mobile p-a system also makes provision for remote volume control, head-



phone and meter monitoring. The system is equipped with dynamic microphone especially designed for sound-truck work.

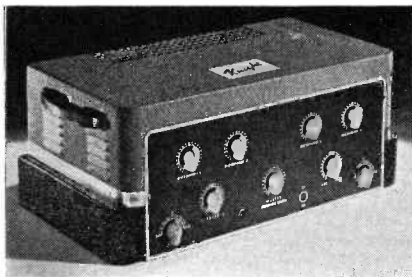
Full details are available from Operadio Mfg. Co., St. Charles, Illinois.—SERVICE.

KNIGHT SOUND EQUIPMENT

Completely new in basic design, operating features, and styling the Knight line of public address equipment for 1938 offers an exceptionally versatile range of sound units from 10 to 60 watts, according to Allied Radio Corporation.

Typical of this new line is the Knight 60 watt amplifier illustrated. Features include: automatic volume control, automatic volume expansion, dual tone control, master gain control, 6 input channels, universal output, 5-channel mixer, inverse feedback, plug-in connections, etc.

This system develops a full 60 watts



undistorted output (70 watts maximum), and is especially suitable for installation in large athletic fields, stadiums, bandshells, and similar outdoor spots.

Other new offerings include: universal sound systems for 6 volts-110 volts operations; new transcription reproducers; recording equipment, and a full selection of microphones, speakers and public address accessories.

Knight Sound Equipment is distributed exclusively by Allied Radio Corporation, 833 West Jackson Boulevard, Chicago.—SERVICE.

FIXED POWER RESISTORS

Wire-wound fixed power resistors with a choice of two coatings are announced by Clarostat Mfg. Co., Inc., 285-7 N. 6th St., Brooklyn, N. Y., after several years of research and engineering development.

For usual applications calling for dependable service even in the face of fre-

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In addition you get the following exclusive features: (1) Wide Frequency Coverage (2) Air Tuned Trimmers and Special Iron-Core Inductors for more Accurate Calibrations (3) Four types of Output (4) Automatic Electronic Frequency Modulation (5) Razor Edged Tuning on Giant Dial (6) Specially Designed Attenuator Circuits, etc.

See the new Model 582-A at your parts jobber or write for literature.

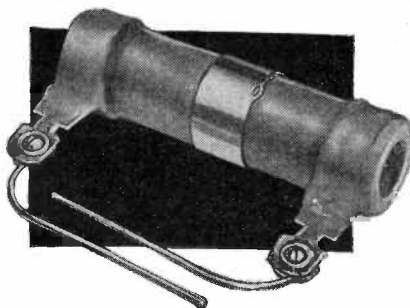
Visit the Supreme booth at the Radio Parts Show, Booths 212 and 214 Hertz Ave., Stevens Hotel, June 8, 9, 10 and 11, Chicago.

SUPREME INSTRUMENTS CORP.

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EXPORT DEPT., ASSOCIATED EXPORTERS CO., 145 W. 45th ST., NEW YORK, N. Y., CABLE ADDRESS: LOPREN, N. Y.

quent overloads, there is the inorganic cement type of Clarostat resistor. The cement used is solidified with a very low heat treatment which cannot cause the slightest damage to the resistance wire winding.

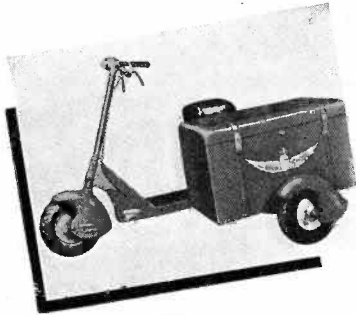


Due to the inorganic nature of this special cement, the resistor may be operated at red heat without blistering, cracking or deterioration.

For applications calling for maximum protection against extreme humidity as well as acid vapors or salt spray, there is the Clarostat varnish-coated type. This coating withstands continuous operation at greater power input than its wattage rating, without the slightest deterioration, according to the manufacturer.

Clarostat fixed power resistors are provided with soldering lug terminals and, for radio service use, with 1½" pigtail leads rivetted thereto. Available in 5 and 10 watt varnished coating, and in 10 and 20 watt cement coating, as well as in resistance values from 1 to 50,000 ohms.—SERVICE.

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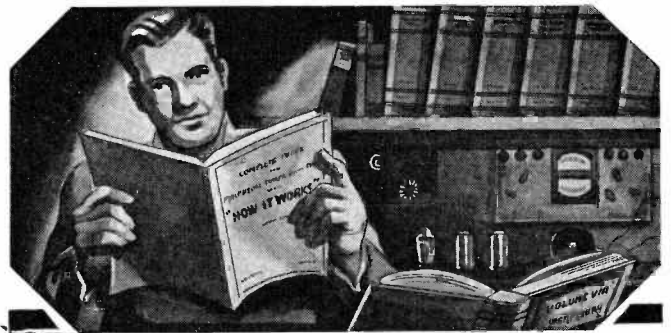
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Vacuum Sealed Transformers

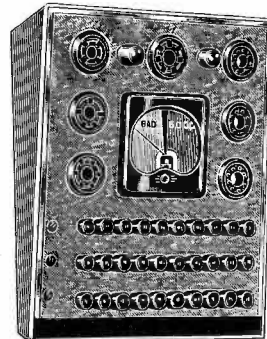
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MILLION RADIO AND TELEVISION LAB.
671 W. OHIO ST. CHICAGO, ILL.

A GOOD NAME GOES A LONG WAY



Ken-Rad Tubes have the confidence of radio set users. The name, Ken-Rad, stands for highest quality and dependable radio reception.

KEN-RAD TUBE & LAMP CORPORATION
OWENSBORO, KY.

KEN-RAD
DEPENDABLE RADIO TUBES

ART—BRITISH COLUMBIA

A little over a year ago the Victoria Branch of the Association was just another idea the boys had for enlarging the scope of the organization. A small group headed by Mr. Lennox made the trip to Victoria and through much groundwork being done by Percy Benson, they were able to start the Victoria section. A few weeks later Mr. McMillan had the pleasure of going to Victoria and presenting them with a charter of their own.

Since then, twelve months have passed and we find them celebrating their first annual meeting. The meeting was held at the Colwood Golf Club on Wednesday, March 23rd. After a very short business session, the directors resigned their positions and the meeting was open for nominations. Results of the election were: E. A. Young, President; F. W. Rose, Vice-President; G. M. Warnock, Secretary; J. R. H. Pearson, Treasurer; C. Murdock, Recording Secretary.

The meeting then adjourned to the dining room to hold the first annual dinner.

The dinner in itself was a huge success. After thoroughly satisfying the inner man with both solid and liquid refreshments, several of the boys took upon themselves to make after-dinner speeches. This was followed by some fine violin solos by H. George. The meeting and dinner impressed us very much. The Victoria section are one hundred percent loyal to the ART and live strictly to the constitution. Enthusiasm and good fellowship prevail. For a group that have only been organized 12 months, they accomplished much and are bound to succeed as an organization.

PRISMA BRIEFS

Don't say that this colyum didn't tell you last month about our future meetings. Last month sure was a honey, given by Radio Electric Service Co., featuring Aero-vox. Guest speaker Mr. Haussman told the boys what makes a condenser condense . . . and Mr. Goldenpaul sure can put them over. Just ask any of the boys who were there!

Sorry to hear that Bob Thorn is sick. Don't let it get you down, Bob. We are all pulling for you and hope to see you bouncing around again.

Glad to see so many of our old members asking to be reinstated again. Always a good sign!

Our closed meetings are as good as the open meetings, with something of importance there at all times besides refreshments.

We wish to thank Mr. Shapiro of Radiart Co. for his talk on auto aeriels. Everybody came away happy.

We also wish to acknowledge our thanks to the following radio companies for the service notes they sent us for our closed meeting:

- Emerson Radio & Phonograph Co.
- International Radio Co. (Kadette)
- Stewart-Warner Corp.
- Wright De Coster Inc.
- Supreme Instrument Co.

Stan Meyers (the watch dog of the treasury) still hanging around the door waiting for the 1938 dues. Put 'em up, says Stan!

FOR TODAY'S BEST BUY...

Get this combination
**VOLT-OHM-MILLIAMMETER
AND TUBE TESTER**

Precision built throughout, yet designed to withstand rough field work. That's why you find Readrite-Ranger testers used by so many leading service organizations. Volt-Ohm-Milliammeters, Tube Testers, Free Point Testers, Oscillators, available in combinations or in single units. No extra cases to buy. Today's biggest values in Precision Testers.

Model 440 Tube Tester checks all tubes speedily and accurately on Direct-Reading GOOD-BAD Triplet Model 221 instrument. Proper load values are applied to tubes under test. Indicates all inter-element shorts and leakages. Has illuminated X dial. A. C. meter for line volts adjustment.

Model 440 Only, Complete in Carrying Case, Dealer Price . . . \$18.90

Model 740 Volt-Ohm-Milliammeter has 3" Square Triplet Precision Instrument. Scale readings: 10-50-250-500-1000 AC and DC Volts at 1000 Ohms per Volt (DC Accuracy 2%, AC 5%); 1-10-50-250 DC M.A.; 0-300 Low Ohms; High Ohms to 250,000 at 1 1/2 Volts. (Rheostat adjustment for 13 1/2 Volts for Ohms readings to 2 1/2 Megohms. Batteries may be added, permitting such readings in 250,000 Ohms steps.) Low Ohms to 1/2 Ohm with 25 Ohms in center of scale. Back-up circuit used. Current draw is only 1 M.A. Batteries, accessories and instructions included.

Also Available in Single Units . . . No Extra Cases to Buy

Model 440-740



PRECISION BUILT
ONLY \$36.90



READRITE METER WORKS
517 College Ave., Bluffton, Ohio
Please send me more information on
 Model 440-740
 I am also interested in . . .
Name
Address State
City

CROWE INTER-CHANGEABLE
ON - THE - PANEL CONTROLS



EASY TO INSTALL
NO-GLARE DIAL

DO you know that over five and one-half million auto radios have been sold in the last six years?

Do you know that nearly four million of these sets were new within the last three years?

Your Opportunity!

Sell Crowe On-the-Panel Controls to reinstall these still-serviceable radios in new cars. Sell them to replace old-fashioned under-dash or steering column controls in owners' present cars.

See Your Jobber

Get a stock of Crowe Controls from your jobber and go after your share of this valuable replacement business.

ASK FOR BULLETIN

CROWE NAME PLATE & MFG. CO.
1775 GRACE STREET CHICAGO
CABLE ADDRESS: CRONAME-CHICAGO

Visit Us
at
**National Radio
Parts Trade Show**
Our Booth
112-114 Coulomb Street
also
**Demonstration of
Equipment in
Room 502
Stevens Hotel**
**THORDARSON
ELECTRIC MFG. CO.**
500 W. Huron St., Chicago, Ill.
Transformer Specialists Since 1895

HIGHLIGHTS . . .

NEW ADDRESS FOR RIDER

John F. Rider Publications are now located at 404 Fourth Avenue, New York City.

QUESTIONNAIRE SIMPLIFIES CATHODE-RAY EQUIPMENT SPECS

In order to base their suggestions and specifications for special-purpose cathode-ray equipment on pertinent data, the Allen B. DuMont Labs., Inc., have evolved a most explicit questionnaire form. This form, sent to anyone who has a special cathode-ray problem to be solved, quite thoroughly analyzes all vital factors of the given problems and, when properly filled out, enables the DuMont engineers to draw up specifications for suitable equipment answering the requirements stated. A copy of this questionnaire may be had on request.

An event of interest to the industry was the removal, on April 18 of the Allen B. DuMont Laboratories, Inc., from Upper Montclair to 2 Main Avenue, Passaic, N. J. All future correspondence should be sent to the new address.

MASTER ANTENNA SYSTEM MANUAL

With many installations already in service, it has become possible to provide practical data for Service Men. Indeed, it is said, the latest edition of the Taco Master Antenna System Manual contains all required information for surveying buildings, estimating, installing, testing and servicing. Many Service Men are making nice money through such installations, while at the same time providing proper operating conditions for new and old sets.

A copy of the Manual is available to any Service Man addressing Technical Appliance Corp., 17 East 16th St., New York City. Likewise an attractive window poster on the master antenna system, for jobber, dealer or Service Man.

CLARION SOUND CATALOG

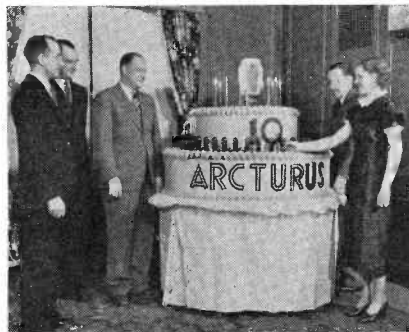
Transformer Corporation of America, through the Clarion Institute of Sound Engineers, have just released their new 1938-1939 catalog of Clarion "Unified" sound systems and associated accessories.

The complete new line, ranging in size from the 5 to 8 watt system to the 70 to 98 watt system, and including portable systems ranging from 5 to 8 watts to 40 to 50 watts, is fully described in this catalog. In addition to the sound systems a complete line of Clarion microphones, speakers and other accessories as well as two new types of inter-communicating systems is also included.

Copies of the new catalog may be obtained from the Clarion Institute of Sound Engineers, 69 Wooster Street, New York City.

ORMONT HEADS FEDERATED PURCHASER

Dave Ormont has taken charge of both the 25 Park Place, New York City, and the Pittsburgh, Pa., stores of Federated Purchaser, Inc.



ARCTURUS CELEBRATES

Gathered around a big cake commemorating the tenth anniversary of the introduction by Arcturus of the first quick-heating a-c tube, are (left to right) A. Feindel, chief engineer; A. E. Lyle, plant superintendent; J. A. Stobbe, vice president and general manager; Jack Geartner, sales manager; and Miss Stella Saunders, who has the distinction of being the first operator to turn out a quick-heating '27 type tube.

CREI TO MOVE

Marking another milestone in its eleven years of growth The Capitol Radio Engineering Institute, Washington, D. C., has announced its removal to its own building on or about July 1. The nationally-known radio institute will occupy the former Breckinridge Long mansion located at 3224 Sixteenth Street N.W. in the Nation's Capital. The new building will contain the entire residence school, laboratories, shops, radio, equipment, classrooms and dormitories. It will also house all the business offices and home-study course departments.

MICROPHONE MATCHING CHART

Transducer Corporation announces from their New York Headquarters this month the completion of a chart showing the decibel equivalent of volts and watts for matching microphones, amplifiers and loudspeakers.

The new Transducer chart provides the answer to a problem which frequently confronts the sound engineer who has to select the proper impedance and transformer ratio or the proper input tube when matching microphone equipment, the output of which is given in decibels, to amplifiers, the gain of which is given in decibels but with the input voltage given in volts.

A copy of the Transducer chart, suitable for framing, is being provided, free of charge, to purchasers of Transducer Bullet microphones or may be had by writing Transducer Corporation at 30 Rockefeller Plaza, New York City.

STANCOR IN NEW BUILDING

Standard Transformer Corp. has announced its removal to a new building at 1500 North Halstead Street, Chicago, Ill.

WALL DISPLAY BOARD

Supplementing the complete kit of sales helps available to dealers handling Ward auto aerials, the Ward Products Corporation, Cleveland, Ohio, has just introduced a new wall hanger point-of-sale display unit.

Attractively lithographed in orange and blue, size 10½" x 30½", these new wall boards can be "spotted" around the service department, shop, showroom or store.

A unique feature of the new boards is that they can be used to display any of 11 different models of Ward aerials. A set of price stickers is furnished with each board. The units are free to Ward dealers.

POTTS NAMED BELL SALES MANAGER

The announcement has just been made by Floyd W. Bell, President of Bell Sound Systems, Inc., 61 E. Goodale Street, Columbus, Ohio, of the appointment of R. E. Potts as Sales Manager, effective May 1. Mr. Potts fills a newly-created position, sales having been previously directed by Mr. Bell.

Potts comes to his new position from Parkersburg, W. Va., where he was associated with the Ideal Corrugated Box Company for the past three years. Prior to that, he was in business organization work in Columbus. He is a graduate of Ohio State University and active in various fraternal groups.

TUNG-SOL DEALERS GET NEW BANNER

A giant canvas banner approximately 3 x 6 feet has just been released to Tung-Sol dealers. In line with Tung Sols' consistent policy of focusing interest on the dealer, the wording stresses in large type, "Radio Service by Radio Technicians." The coloring is very attractive and consists of black and white lettering on yellow, red and blue backgrounds. Substantially made, with adequate grommets for hanging, this banner should be a business getter for Tung-Sol radio tube dealers.

GTC BULLETINS

Two bulletins of interest to the Service Man have just been published by General Transformer Corp., Chicago, Ill. These bulletins, which may be obtained by writing to GTC, are "Amateur Transformers" and "Sale of Sales."

RCA SOUND EQUIPMENT BULLETIN

The Commercial Sound Section of the RCA Mfg. Co., Inc., Camden, N. J., has prepared an attractive promotional bulletin on sound equipment. The bulletin discusses an authorized dealer plan for commercial sound; it includes many tips on prospective users and other information of value to sound men.

FREED TRANSFORMER MOVES

Freed Transformer Company announces the removal of its offices and factory to 72 Spring Street, New York City.

RADIART VIBRATORS
Better than ever
GUARANTEED NOW
1 YEAR NORMAL SERVICE
PRICES now
Lower than ever
\$2.95 and up
ASK YOUR JOBBER
for New Catalog No. 538-A or
write for a copy to
THE RADIART CORPORATION
East Cleveland, Ohio

SALES
of RADIART'S
1938 LINE of
AERIALS, for
only 4 MONTHS
are
9 times
as large as
total sales of
the 1937 line

Now!
A Balanced Assortment of
50 Ten Watt WIRT RESISTORS
Save \$2.00 and get the NEW
FOR ONLY \$10 VALUE '12

Lifetime CABINET absolutely FREE

Resistors are all FIRST QUALITY, WIRT WIRE WOUND, protected from injury by Wirt PHENOCOTE, the non-absorbent, non-hygroscopic coating and laboratory tested for humidity and accuracy.

The cabinet is made of well seasoned bass wood rubbed to a beautiful natural finish—6 drawers of three-ply wood—24 compartments—removable partitions. Order yours NOW from your jobber. If your jobber cannot supply you send in the coupon below, with your jobber's name.

WIRT COMPANY
Makers of DIM-A-LITE 5221 Greene St. Philadelphia, Pa.

Please send me your balanced assortment of 50 TEN-WATT WIRT RESISTORS and your new LIFETIME CABINET. If I decide to keep them I pay only \$10.00 by check or money order. If I am not perfectly satisfied I will return them within 10 days.

Name

Address

Town State

P.S. You may also send me information on carbon composition resistors and Wirt Auto Radio Ignition Suppressors.

SHOW PROGRAM
(Continued from page 31)

Saturday, June 11
10:00 a.m. RMA Service Section, J. N. Golten presiding.
2:00 p.m. Exhibits Open.
7:30 p.m. Technical Session, Auspices Radio Servicemen of America "Organize — Then Standardize" by S. R. Cowan, SERVICE.
8:00 p.m. "The Phasmajector, Source of Video Signals for Use in Demonstrating Television" by Allen B. DuMont Labs.
9:30 p.m. National Radio Parts Trade Show Closes.

SOUND SERVICE—continued

essential for modern economical sound installations.

Permanent-magnet loudspeakers designed especially for commercial sound work, with high efficiencies, have recently been placed on the market. One type has a continuous power-handling capacity of 60 watts; another, of similar type, has a continuous power-handling capacity of 100 watts. These high-efficiency loudspeakers represent one of the most important advancements in commercial sound equipment in several years.

AUTO-RADIO—continued

through a 50-mmf dummy antenna. Ground the oscillator to the Phantom Filter red junction box.

With the oscillator set to 1,575 kc adjust padder No. 1 to resonance.

Reset the oscillator to 1,400 kc; rotate the tuning condenser until this signal is tuned to resonance. Reduce the output of the oscillator until the signal barely deflects the output meter.

Adjust padder Nos. 2 and 3 until a maximum output reading is obtained.

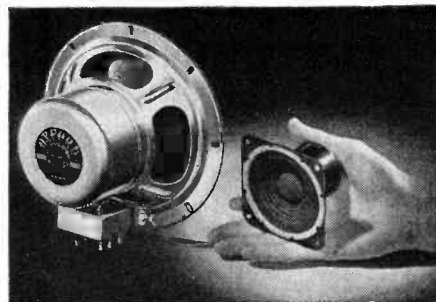
After installation of the radio receiver in an automobile, tune in a very weak station between 1,300 and 1,500 kc and readjust padder No. 3 for maximum output.

The sensitivity of this receiver may be determined by reading the number of microvolts input required to produce 1 watt output. That output is obtained when a reading of 1.7 volts across the voice coil of the speaker is indicated by the output meter.

Emerson 250 (A-c, D-c)

Hum: May be caused by filament resistor, which is mounted on chassis, shorting against metal container. Replace resistor.

RCA Service Tip File



OXFORD

- ★ PERMAG-DYNAMIC
- ★ ELECTRO-DYNAMIC
- ★ MAGNETIC

All Popular Sizes . . . from 3" to 14"

There is an Oxford Speaker to suit your requirement especially well, whether for original installation or replacement. There is the remarkable 3" Permaga which made a sensational hit and solved many sound-application problems—and other popular models up to the 14" Permaga or Electro-Dynamic units—all built right—and priced right!

IN STOCK READY TO SHIP

A complete stock of Replacement and Public Address Speakers carried in stock for your convenience. Standard numbers can be shipped directly upon receipt of order.

See your Jobber or Write Dept. S for complete data and information.

Custom-Built to Specifications

Custom-built speakers carefully and accurately made to manufacturers' specifications.

Visit Our Booth at 210 Faraday Avenue, National Radio Parts Trade Show, Stevens Hotel, Chicago, June 8-11.

New York Office: 27 Park Place



SERVICE MEN

. . . in addition to being our readers, are among our most valued contributors.

Perhaps SERVICE can use an item on that interesting job YOU did yesterday.



Collect that REWARD!

● There's a reward of a dollar or two coming to you on EVERY set that isn't performing up to standard. All you've got to do is talk, demonstrate and sell a TACO Antenna System to every old or new set owner. And that's easy.

Here's the NEW TYPE 600 SYSTEM

- A good noise-reducing antenna system. Efficient in standard broadcast and short-wave bands. Only \$5.00 list.
- Short and long aerial wires, transfer unit, twisted-pair downlead, set coupler, insulators—everything, complete.
- No fuss, bother, headaches. Just string up in an hour or less. Factory soldered.
- Typical of TACO antenna systems. More elaborate systems available for greater noise suppression in most troublesome spots.

Don't Overlook the MASTER ANTENNA

- Just the thing for the multi-set private dwelling. Also for apartment house, club, hospital, etc. One aerial serves up to 25 set outlets.

Ask for DATA . . .

- If you visit the Chicago Parts Show, drop in at our booth. Otherwise, write for latest data.

TACO
TECHNICAL APPLIANCE CORP.
 17 East 16th Street New York City
 Lic. A. A. K., Inc. Patents
 IN CANADA: 414 Bay Street, Toronto



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AMPERITE offers "ADJUSTABLE RESPONSE" *
 ... made possible by
THE ACOUSTIC COMPENSATOR
 (pat. pend.)

*Higher or lower pitch with the same microphone.

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

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

NEW LOW-PRICED CONTACT "MIKE"
 Model SKH (hi-imp); SKL (200 ohms) \$12.00 LIST

MODELS RAH-RAL, excellent for speech and music. Reduce feedback. \$22.00 LIST

Write for Complete Illustrated Bulletins and Valuable Sales Helps.

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

AMPERITE Velocity **MICROPHONE**

JACK GRAND
SAYS:

No Serviceman is better than his Service Equipment.

No matter what your ability, you are seriously handicapped unless you possess the equipment necessary to speed up your work and to do that work accurately.

We can supply you with all leading makes of test equipment . . . the kind that makes YOU valuable to yourself and to your business. Here's a few lines we carry:

- CLOUGH-BREngle
- HICKOK
- RCA
- TRIPLETT
- PRECISION
- SUPREME
- WESTON

All instruments available on time payments excepting Triplett and RCA.

★ Jack Grand, authority on retail radio and radio servicing problems, has written for leading radio journals and has been widely quoted. Jack will be glad to aid you in your servicing or merchandising. No obligation. Just ask him.

SUN RADIO CO.
 212 Fulton Street, New York, N. Y.
 Cable Address: SUNRADIO NEW YORK

STARTLING



SMALLER . . . METAL SEALED

Solar MINICAP *tubular* Dry Electrolytic Capacitors mark more than an advance in an art. They occupy less space, have longer life because of permanent sealing and are more convenient to use. Costing less to produce, they are sold at prices offering new economy . . . in line with the times.

Make use of their

INBUILT QUALITY...OUTSTANDING UTILITY

Details upon Request.

SOLAR MFG. CORP., 599-601 BROADWAY, NEW YORK, N. Y.

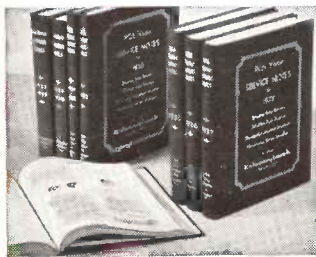
NEW!

RCA Victor MASTER ANTENNA



...the first that's not dependent on location for its remarkable noise-reducing qualities!

Here's an antenna sensation that provides the ultimate in noise-free radio reception. The set coupling transformer included in this kit provides individual adjustment for the reduction of local noise, such as vacuum cleaners, oil burners, etc. Is similar to that included in many de luxe 1939 RCA Victor radios.



Just Out! RCA Victor Service Notes for 1937

Fill out your service note library with this latest addition—now available at all distributors for \$1.25. Covers technical details of 1937 RCA Victor instruments.

Assembly consists of a balanced doublet with a counterpoise parallel to the transmission line. Length of counterpoise is adjustable, with dimensions dependent on transmission line run.

The RCA Victor Master Antenna covers a frequency from 140 to 23,000 kcs. Stock No. 9845 complete with Receiver Coupling Transformer. List price \$6.95. Receiver Coupling Transformer, Stock No. 9846. \$2.45.

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

Meet us at the National Radio Parts Show, 101-103 Marconi Boulevard, Hotel Stevens, Chicago. June 8, 9, 10, 11.



Parts FOR PROFIT

RCA MANUFACTURING CO., INC., CAMDEN, N. J.
A Service of the Radio Corporation of America