April 28
1928

WIRING FOR NOVICES

15
CENTS

RADIO WORLD
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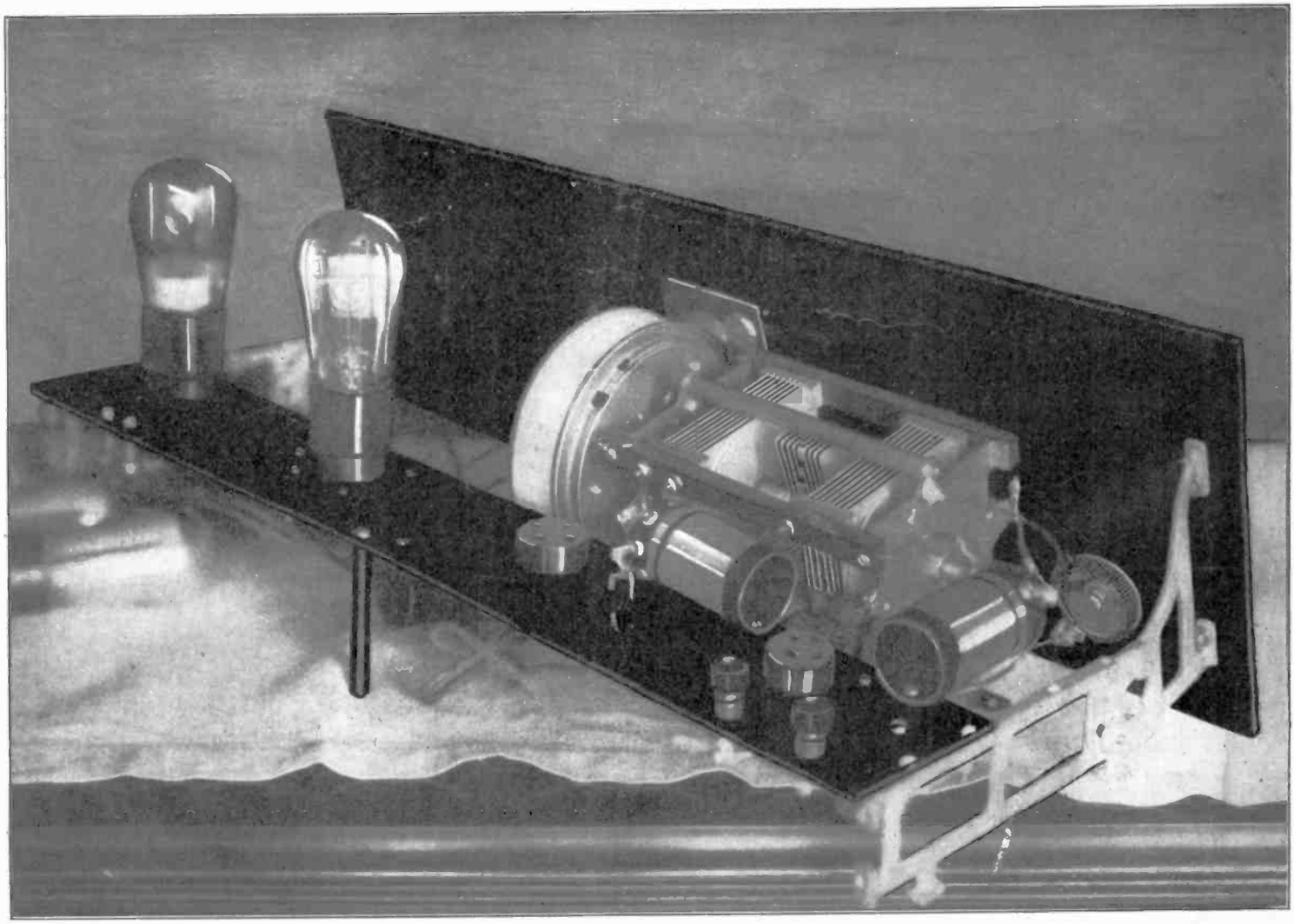
The First and Only National Radio Weekly

THEORY OF BIAS THROUGH RESISTORS

METAL HOUSING AIDS AC SETS

FURORE OVER EQUALIZATION PLANS

HOW TO GET SINGLE CONTROL RESULTS



Single control, without trimmers, presents problems that challenge ingenuity, if high gain is to be preserved. How excellent results were obtained is explained in the article beginning on page 3.

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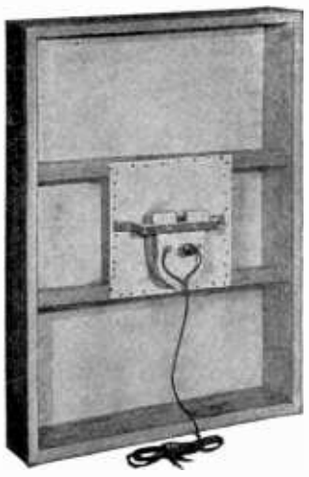

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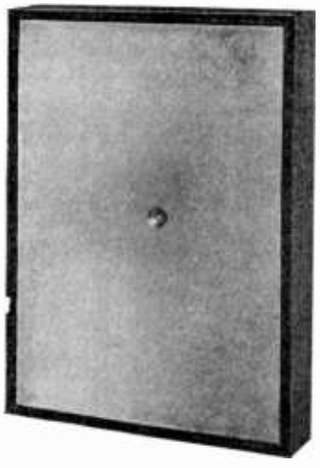

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How to Make Single Control Work Well

By Herman Bernard

ALL too often in the exposition of how to build a circuit that embodies single control you find a glowing description of the performance of the circuit, without adequate explanation of the all-important problem of balancing, both for tuning and for suppression of undesired self-oscillation.

The author may have been an expert who found no difficulty in obtaining the results he describes, but when the general run of experimenters, home constructors and the like attempt to duplicate the result, they may run into trouble.

There is one fundamental proposition about the tuning of multiple circuits by the rotation of a single dial without any minor tuning adjustments, and that is, the efficiency can not exceed that attained if each circuit were separately tuned.

A Method of Convenience

In actual practice the sensitivity may be somewhat less than if individual tuning were employed. But where you have two or more stages of tuned radio frequency amplification you must have three or more dials, to tune each circuit separately, or have just one main dial and a separate knob to actuate each adjustable compensating device, such as a midget condenser or inductive trimmer. Hence when one resorts to strictly single dial tuning he adopts a convenient method, but may have to sacrifice a little amplification to enjoy the convenience.

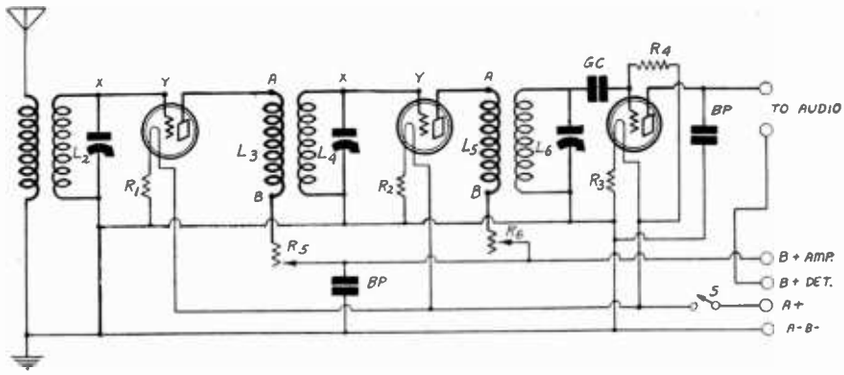
Several factors make single dial tuning more difficult of accurate attainment than the individually-tuned-circuit method. First, a ganged condenser is most frequently used, and this must be of excellent manufacture, so that the plates are nearly the same thickness at all points, and the separation between plates, as well as the cut of the plates, that is, their shape, must be the same.

Use of Midgets

In actual practice it is not possible to produce such condensers with plates of exactly the same constant thickness and separation, particularly since metal will warp, if even a trifle. But there is a permissible tolerance, and all one asks is care in manufacture. It is assumed that such sacrifice as tiny disparities of capacity in the circuits will be tolerated as part of the price one pays for the convenience of single dial tuning.

It is common practice to place a midget condenser across each section of the ganged condensers, and to adjust these small compensators until resonance is achieved at some frequency in about the middle of the scale, say the geometric mean of 910,000 cycles 330 meters.

Another method often used is to adjust at a higher frequency, since the midget capacity is then a greater percentage of the total capacity, and if the circuits acquire differences of capacity as the lower frequencies are tuned in, that difference is a smaller percentage of the total capacity, hence likely to have a smaller damping effect.



A SINGLE TUNING CONTROL RECEIVER THAT PRESENTS TWO FUNDAMENTAL PROBLEMS—SYNCHRONIZATION OF TUNING WITH SOLITARY MOTION, AND SUPPRESSION OF SELF-OSCILLATION WITHOUT TOO GREAT LOSSES. THESE PROBLEMS ARE ANALYZED IN THE ACCOMPANYING ARTICLE, PARTICULARLY RELATIVE TO THE IMPEDANCE EFFECT OF R5 AND R6.

The Larger Aspect

The use of these extra balancing condensers, where they are adjusted once and left thus, is simple and often gives good results, but the condensers perhaps would have to be readjusted if new tubes were used, since the inter-electrode capacity of new tube might differ sufficiently from that of its predecessor to upset the balance.

A variant of the same method is to place a midget or larger condenser across the primary (points A and B in Fig. 1). Larger capacity may be used because the effect is smaller on the secondary than if the addition were made directly across the secondary.

In general, besides the condenser manufacture problem, the reflected capacity of the antenna circuit as a function of the first RF grid circuit raises the natural period of the secondary, L2 in Fig. 1, assuming equal inductance and capacity (reactance) in the two other circuits. Hence, if dials are used that increase in numerical reading as the capacity is increased, a lower dial setting would obtain for resonance, as compared with the two other circuits. This is why, in two-dial sets using two stages of TRF, the antenna input circuit is usually separately tuned, while the second RF stage and detector input are ganged.

Must Not Trust to Luck

Even the succeeding stages are not identical, independent of any possible difference in elemental capacity of the tubes themselves, for the detector circuit usually has a grid condenser in series with part of the tuned grid circuit, while a leak is in parallel with that circuit.

The grid condenser, being of smaller capacity than the tuning condenser, slightly reduces the impedance in the tuned circuit, while the grid leak has a tendency to increase it, being a parallel resistive load, and if the increase and decrease are equal, one is fortunate. But one must not rely on luck.

By the way, with a positive bias used on the detector grid, it is impossible to connect the leak any other way than in Fig.

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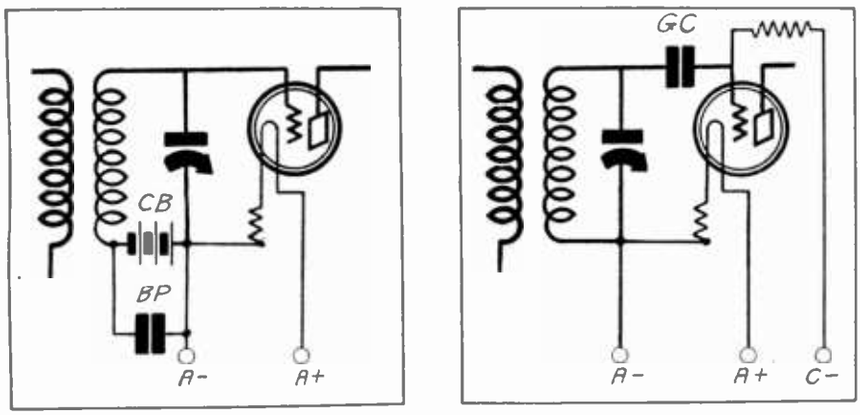

A B

FIG. 2

GRID BIAS DETECTION MAY BE USED AS SHOWN IN A, ALTHOUGH THE COMMON SHAFT OF A MULTIPLE CONDENSER IS RETURNED TO A MINUS. THIS METHOD AFFORDS CHOICE OF C BIAS DETECTOR VOLTAGE INDEPENDENT OF ANY OTHER C BIAS, IT DOESN'T REQUIRE A SEPARATE BATTERY. IN B THE LEAKY CONDENSER METHOD FOR SINGLE CONTROL TUNING IS SHOWN, WITH OPTIONAL BIAS. THE RETURN MAY BE TO C—, AS SHOWN, OR TO A MINUS OR A+.

(*Continued from preceding page*)

1, since there is only one rotor connection for the ganged condenser, and the TRF stage or stages require a negative bias. This they get through the drop in the filament resistors, R1 and R2, the rotor going to A minus.

Grid Condenser Stops DC

While the detector secondary, L6, is connected to the same point, this is done without giving any bias, because direct connection to grid is stopped by the grid condenser, and the only bias is obtained through the leak. As the leak has a very high resistance, 2 meg. or more, it does not short circuit the secondary, even though it is in parallel with that coil, only the A battery intervening. It is well indeed to bypass the A battery in that instance with a condenser of .001 or higher capacity.

Excellent account may be taken of the kind of tubes to insert in the respective sockets, so that fine balance may be attained.

If the first RF tube is an -O1A, and the second tube is a 112A, there will be a slightly higher self-capacity due to the higher elemental capacity of the 112A, and this often is enough to counterbalance the antenna capacity effect introduced ih the secondary L2.

Unknown Quantities

But that method is no cure-all, since to most experimenters the reflected capacity in L2 is an unknown quantity, and indeed so is the inter-electrode capacity of the tubes, so in addition to this method one employs a series resistor in the plate circuit (e. g., R5, R6 in Fig. 1).

The effect of the two series resistors in Fig. 1 (R5 and R6) is to reduce the plate voltage, introduce a resistive load that has a damping effect, and, most important for our purpose, to increase the inductance of the plate circuit load, as well as resistance. Hence a wire-wound resistor is used, for that has lumped resistance and distributed capacity and inductance.

A point not often brought out is the combination in the impedance reflected in the secondary L2, since it consists of inductance, capacity and resistance. We have similar inductance in the succeeding circuits—smaller capacity and smaller resistance—so the series rheostats R5 and R6 help us to duplicate in succeeding stages the condition found in the first stage

An adequate value of these resistors is 400 ohms each. Since they are used also as dampers to overcome self-oscillation at the higher frequencies, there is no sense in bypassing them, but it is well to bypass the B supply as shown.

Another easy method of suppressing oscillations is to open the leads between X and Y and insert a grid suppressor in each, the resistance of which depends on a variety of factors, but a fair average resistance for the first is 700 ohms, and the second 900 ohms. Always use the least amount of resistance here that permits stable operation at the high broadcast frequencies (low wavelengths).

There is an advantage in using the grid bias method of detection, since no leak or condenser is necessary, and two points of tuning uncertainty are thus eliminated.

The method may be made almost as sensitive as leaky-condenser rectification, and has the distinct advantage of handling about twice as much input without producing a distorted power output.

Purer Tone Quality

As two stages of TRF feeding a leaky-condenser detector will cause overloading of the detector on locals that are nearby, grid bias detection is not without its attractiveness. The tone quality is purer, because the response is more nearly flat, the higher frequencies being given a far fairer chance. Listen to a piano solo on grid bias detection and you discern the difference. In many things acoustical, even experts can not detect the difference aurally, so it may not be amiss to emphasize to lovers of true quality the value of resorting to grid bias detection, since one's own ear can tell the difference.

Even when the condenser is ganged, a biasing battery may be introduced as in Fig. 2A, where CB is the C battery and BP is a .001 mfd. mica fixed condenser for bypassing. What this bias should be will depend on the plate load and plate voltage, as well as on the type of tube. Splendid detection operation of the 112A by the grid bias method commends its use, even when the load is resistive. A high mu, with a resistor load, detects better, but overloads more readily than the 112A.

When a Circuit Is Wrong

Therefore grid bias detection not only functions well on a quality basis, but gives good volume, although usually not so much volume as does the leaky-condenser method.

Some who try grid bias detection and notice lessened volume try to make up for it by increasing the plate voltage on the RF tubes, with resultant self-oscillation on the higher frequencies, and even perhaps upsetting of a balance previously obtained by the grid suppressor method of squeal killing. This is unfortunate, since it proves a fundamental error in the design of the receiver, where the RF is built up to high amplitudes for the sole purpose of obtaining a great degree of volume that the audio channel should have been called upon to furnish.

If you place earphones in the detector circuit and lay them on a table, you should not be able to hear the signals when the phones are three feet from your ear. That is a fair average test, for if you hear the signals, more than likely you're overloading the detector.

Rely on Audio for Volume

Not so much should be imposed on the radio frequency channel as to make neutralization difficult, but the volume should be built up to desired levels in the audio channel, and volume controlled at the radio input or as soon thereafter as possible, always preferably ahead of the detector.

The restriction of the amplification at radio frequencies to some safe and modest level also helps quality, since the self-regenerative effect does not set in so severely as to impair sidebands on the higher radio frequencies.

The embodiment of these considerations in a practical receiver is shown in Fig. 3, and the views of the constructed circuit are shown in Figs. 4, 5 and 6.

It is obvious from the preceding dis-

LIST OF PARTS

Constants Refer to Fig. 3.

L1L2, L3L4, L5L6—Three RF transformers of small diameter, the enamel-wire type for .00035 mfd. tuning being suitable.

C1, C2, C3—One three-section .00035 mfd. tuning condenser.

C4—One Electrad 1 mfd. bypass condenser.

R1, R4, R6, R9—Four 1A Amperites, with mountings.

R2—One Frost 15-ohm rheostat.

R3, R5—Two Electrad Royalty adjustable resistors, 400 ohms each.

R10—One standard Clarostat.

BP1—One Aerovox .006 mfd. mica fixed condenser.

BP2—One Aerovox. .001 mfd. mica fixed condenser.

BP3—One Electrad bypass condenser, 1 mfd.

R7—One Lynch .1 to 1.0 meg. metallized resistor.

R8—One Lynch 5 meg. metallized resistor.

S—One Yaxley No. 10 switch.

Two Eby binding posts (Ant. Gnd.).

One Lynch double mounting.

One 7x21 inch front panel.

One 3x20 inch subpanel.

One pair of Bruno or Benjamin adjustable brackets.

Four Frost sockets (1), (2), (3), (4).

One National Velvet Vernier Drum Dial, with pilot light DL.

Two Lynch grid suppressors, S1, 800 ohms or less, S2 400 ohms, with mountings.

One five-lead battery cable.

Two brass strips, about 4 inches long, to be bent into Z shape to support center of subpanel, front and back.

ACCESSORIES

One 4½ volt C battery, with taps at 1½, 3 and 4½ volts (Burgess).

One CeCo type A+ tube, socket (1); three CeCo type 12A tubes (sockets, 2), (3) and (4).

One cabinet for 7x21 inch front panel, at least 8½ inches deep.

One roll of Acme flexible Celatsite.

Solder, flux, nuts, screws, hardware.

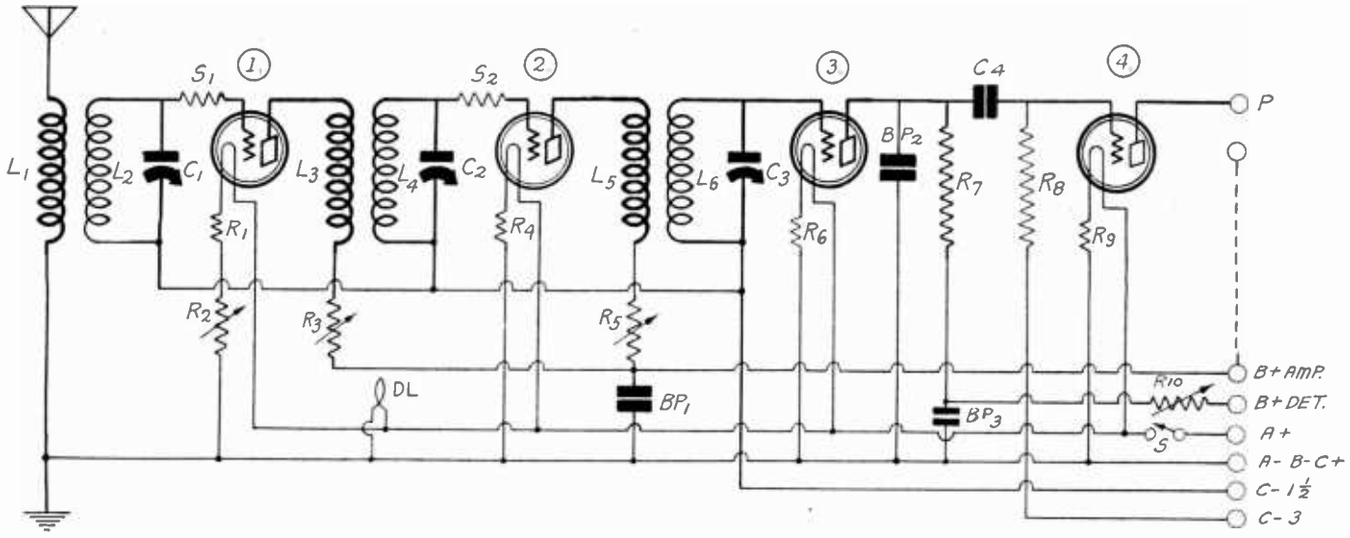

FIG. 3

THE SINGLE CONTROL RECEIVER THAT THE AUTHOR DEVELOPED TO A HIGH POINT OF SATISFACTION, BY USING WIRE-WOUND VARIABLE PLATE RESISTORS FOR THEIR HELPFUL RESISTIVE AND INDUCTIVE EFFECT. A SPECIAL CHOICE OF TUBES WAS MADE, BASED LARGELY ON THEIR ELEMENTAL CAPACITY. THE LIST OF PARTS REFERS TO CONSTANTS DESIGNATED IN THIS DIAGRAM. B+ AMP. SHOULD BE 100 VOLTS OR A LITTLE MORE.

cussion, as well as from Fig. 3, that single tuning is accomplished, without trimming condensers or the like, and the circuit is balanced as to impedance and also against self-oscillation at radio frequencies.

The possibility that self-regeneration may set in is taken care of by the grid suppressors, S1 and S2, which, for B+ Amp. voltages of 100 or so may be 800 ohms for S1 and 400 for S2, if the coils and leads are so placed that the first tube is the one most likely to oscillate. The higher the resistance of the suppressor the greater the damping or suppression.

Use Minimum Resistance

But in many instances self-oscillation will be completely avoided without them since R3 and R5 will likely take care of this problem adequately. Also it is possible that a suppressor is needed only in one circuit, which would be S1, affecting tube (1). Using both the grid suppression and the plate suppression methods, quiet operation is assured.

The grid suppressors reduce the selectivity a little, and this helps toward easier unification of tuning, since the tuning curve is broader, not requiring such very great precision of tuning. Nevertheless the amplification is plentiful, unless too high resistance suppressors are used.

The receiver consists of two stages of tuned RF, grid bias detector and one stage of resistance coupled audio. The output works into a power pack of any type you prefer. However, it is recommended that the power pack include two stages of transformer coupled audio, instead of the usual one, feeding a -10 tube or preferably a —50 tube, although the 40-volt maximum swing of a —71 tube is adequate to handle the volume if the control R2 is properly adjusted for given high levels of signal.

Distortion Always Possible

It is of course a fact that nearly all receivers distort pretty badly on powerful locals nearby, because to obtain adequate volume on a distant station it is necessary to have a thousand times as much amplification as is necessary for comfortable reception of such a local. This defines the necessity of a volume control in all receivers excepting simple crystal sets and recommends, also, the placement of the volume control as near the input as possible.

It will be observed that C bias is used on the RF tubes, and that this bias is the same as for the detector tube. The question may arise: How does the same bias afford amplification in one instance and rectification in the other, especially as the type tube used in sockets (2) and (3) is a 112A? The effective plate volt-

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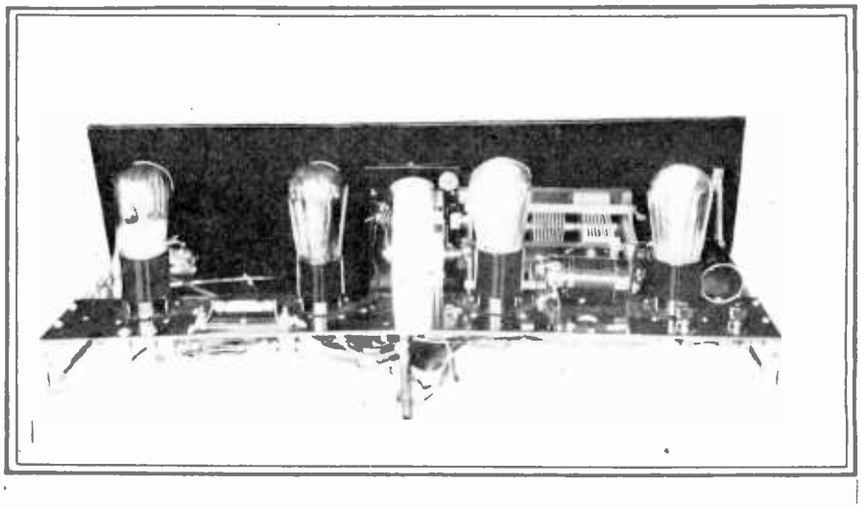
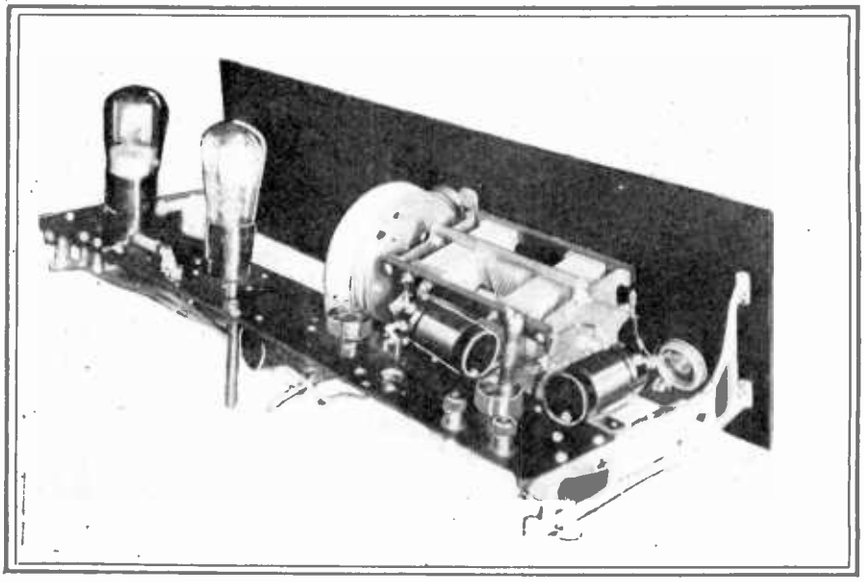




FIGS. 4 AND 5

IF A GRID LEAK IS USED IT MAY BE MOUNTED AS SHOWN, AT LEFT IN BOTH THE REAR VIEW (TOP) AND THE ANGULAR VIEW.

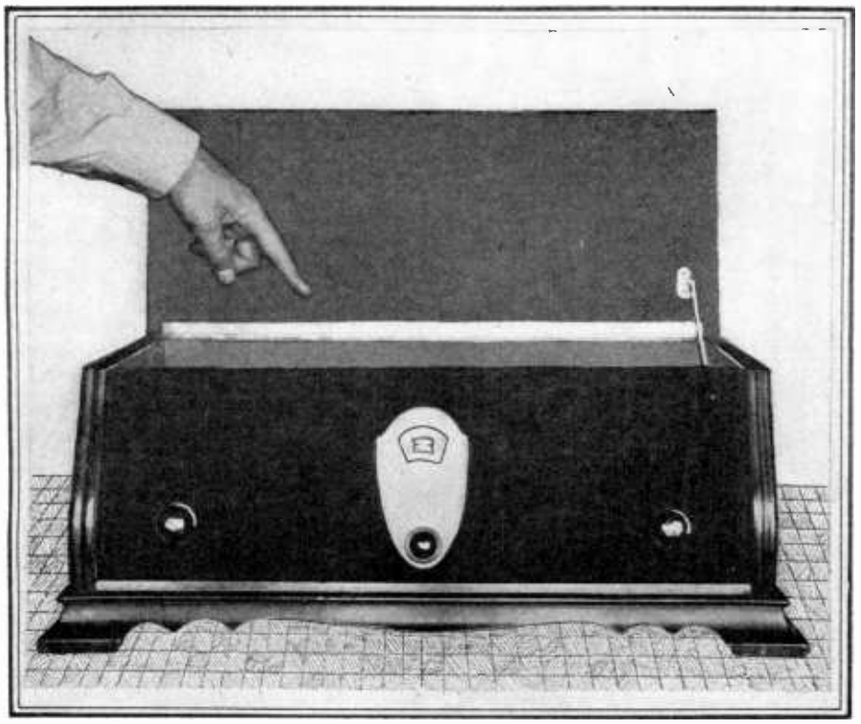


FIG. 6
THE FRONT VIEW OF THE SINGLE CONTROL SET IN A CABINET. THE SUBJECT IS EMPHASIZING THE FACT HE HAS A PIANO HINGE CABINET. HOW THE NATIONAL B SUPPLY IS CONNECTED TO THE RECEIVER.

(*Continued from preceding page*)
ages differ. The resistor R7 drops the applied voltage to an effective voltage normally about half that of the other, sometimes considerably less than half, depending, of course, on the value of the plate resistor, R7. On the other hand, the RF tubes have a higher applied plate voltage (B+ Amp. as compared with B+ Det.) as the voltage drop in the resistors R3 and R5 and in the primaries L3 and L5 is negligible, compared to the drop in R7.

As the plate voltage or grid bias voltage for bias detection is critical, a simple method is to use a variable resistor in the plate circuit of the detector to control the voltage applied to the plate resistor. This is R10 in Fig. 3, but if a B supply is used that has a variable detector voltage control, this suffices, and R10 may be omitted. If B batteries are used, R10 is necessary, because the B battery taps alone do not afford sufficiently fine gradations of voltage, and neither do the C battery taps.

Looking over the circuit broadly, from input to output, we find that equal coils are used for RF, these being for .0005 mfd. or .00035 mfd. tuning, depending on the capacity of the sections of the tuning condensers; that volume control is obtained by a rheostat in series with a fixed resistor in the negative leg of the first RF tube, that electrical balance is attained by choice of tubes and adjustment of plate resistors R3 and R5, aided, if need be, by suppressors S1 and S2, and that the two stages of TRF feed into a detector tube operated as a grid bias detector, followed by a resistance coupled audio stage.

There are three bypass condensers, BP1, of .006 mfd., BP2, of .001 mfd., and BP3 of 1 mfd. Only R2 among the adjustable resistors is placed on the front panel, the tuning dial and the switch S constituting the only other panel-mounted instrument.

The dial light DL is a part of the drum dial equipment and is mounted on the dial frame with rubber gripper.

There is a dotted line in Fig. 3 connecting a binding post to B+ Amp. This connection is not made to the receiver, if you're using a power pack, but is made in the pack itself, B+ Amp. being connected to the B post of the audio transformer that receives the detector output. Hence only the P lead is carried from the receiver to the transformer, and a single phone jack at this point in the receiver is enough. If the B post of the transformer in the pack is not so connected, then the dotted line connection should be made.

In any event, there is only one objection to making the connection at both places. By accident you might connect the receiver B+ output post to a different B+ terminal of the pack, which simply would short out the resistor that drops the voltage drop in the pack.

The cable has only four leads: B+ Amp., B+ Det., A+, and P., A—. The B— lead is connected from B supply (minus) to A minus, at battery, C+ is a 6-inch flexible lead taken off the A— lead in the set, while the two C minus leads are also of short flexible wire, carried directly to the C battery, which fits in the open space behind the front panel, resting on the cabinet floor.

The bypass condensers, isolating condenser (C4), double mounting, resistors R7 and R8, and coil L5 L6 are mounted under the subpanel. The knobs of R3 and R5 are atop the subpanel, while R10 may be outside the set.

The receiver is free from motorboating, unless the C bias voltage is made too high for the detector tube. The lead marked C—1½ in Fig. 3 gives —2½, because the 1-volt drop in the Ampente R6 adds that much. So it is possible to connect the C—1½ lead to A minus direct, instead of as shown, if it proves advisable to reduce the detector bias. Also, remember that R7 may be increased resistance, up to 2 meg., to reduce the voltage effective on the plate.

[The adjustment of the resistors, B voltages and other balancing operations will be detailed next week, issue of May 5.

How to Kill Squeals With Grid Suppressor

The usual tuned radio-frequency amplifier, due to coupling between the input and output circuits, has a tendency to oscillate at a frequency to which the set may be tuned. Various forms of neutralization, such as that devised by Hazeltine, minimize this tendency to oscillate. Many sets, however, are being built in which no scheme of neutralization is employed, and it is usually necessary to provide some means to prevent these troublesome oscillations.

The grid-suppressor method is an easy one. A non-inductive resistance is placed in series with the grid of an RF vacuum tube ahead of the tuning condenser and coil.

The grid suppressor slightly reduces sharpness of tuning and amplification. However, tuning is usually sharper with the grid suppressor method than with the potentiometer stabilizer method. Furthermore, extreme sharpness of tuning is not desirable, since it involves sacrificing the full benefit of the transmitted sidebands. Therefore the grid-suppressor has a definite purpose and is frequently an economical solution to a difficult problem.

It has the advantage that its effect is more pronounced at the lower wavelengths than at the higher, thus tending to keep the amplification more nearly even over the entire wavelength band.

Use Least Resistance Possible

As to the choice of grid suppressors for particular cases, the rule is simple. Always choose a grid suppressor which has the minimum value of resistance that will prevent oscillation in any part of the broadcast range. There is no really satisfactory way to compute the value of these suppressors, as too many factors of an indeterminate nature are involved. The general practice is to determine these values by trial. Grid suppressors range from 50 ohms to 3,000 ohms, with a definite preference for about 600 ohms.

More basic than the precise resistance to employ, however, is the matter of inductance. For satisfactory results in radio-frequency circuits, the resistance must be as near pure resistance as possible, without inherent inductance and capacity.

While good wire-wound grid suppressors have been in use for some time past, utilizing an ingenious double winding for cancelling as much of the inductance as possible, it is found on critical test that there is some residual inductance which in certain types of circuits might possibly tend to affect radio results.

Good for AC Sets, Too

Lately, however, with the introduction of metallized resistors, such as the Durham grid suppressors, of values as low as 250 ohms, it is possible to obtain non-inductive and non-capacitative grid suppressors.

The grid suppressor method suggests itself as the oscillation control means for the old set as well as the new set. It is highly popular in many of the AC tube receivers of the manufactured type and may help reduce hum at high frequencies.

The Novice's Corner

SEQUENCE IN WIRING A SET

By Herbert E. Hayden

The novice views the wiring of a new receiver as a very complex job. But it only appears complex to him because he looks at the wiring as a whole and does not analyze the job. If the work is done systematically it becomes very simple.

Many experienced circuit builders begin the wiring with the filament circuit. Usually the grounded line is run first. It is connected to every point it is supposed to pick up. The grounded line in most cases is the negative side of the A battery circuit. The beginning is made at the minus A binding post. If the filament switch is in this line the minus A post is connected to one side of the switch.

On the opposite side of the switch the line is picked up again and made to touch all the points to which it is to be connected.

In most cases this line touches filament rheostats and ballasts, the ground and B— binding posts and many of the by-pass and tuning condensers. When this line has been run, complete the negative side of the filament circuit by connecting the A— posts on the sockets to the proper rheostats or ballasts. Before passing to the positive side of the circuit the negative side should be checked over to make sure that every part touching it has been properly connected.

The Positive Side Connected

Now start a line from the A plus binding post and run it to the positive binding post on every socket in the tube, if the circuit diagram calls for that construction, as it usually does. If the switch is in the positive lead run the line from the A plus post to one side of the switch and then pick up the other side of the switch and run the wire to every binding post on the tube sockets. Before leaving the positive side of the filament circuit check over the circuit diagram to make sure that the line touches all points it should touch.

Test the filament circuit by connecting a battery across the A plus and A minus binding posts and by connecting a voltmeter across the A plus and A minus posts on every socket in the receiver. Almost the entire filament voltage of the battery should be obtained on the meter.

Grid Circuits Wired Next

Next in order are the grid circuits. Begin at the grid of the first tube and make the connections as directed by the circuit diagram until the grid return lead has been tied to the negative side of the filament battery or to some other point having the required negative or positive bias. Make sure that every grid circuit is continuous from the grid to the point of connection to the filament, and that there is no short in the circuit. The time to test the grid circuit for continuity and freedom from shorts is immediately after it has been wired.

A simple test for continuity is to connect a voltmeter and a battery in series with the grid circuit. For example, the negative of the battery may be tied to the grid binding post, the positive of the battery to the positive on the meter, the negative of the meter to the negative binding post on the socket. There should be a deflection on the meter. If not there is an open. If the filament battery is not connected and if the filament switch is not closed this test might be negative. Don't mistake this for an open grid circuit. It would not be open in operation.

The Plate Circuit

Detecting a short circuit is more difficult in some cases. In other cases it can be determined by inspection of the wiring. It rarely occurs.

When the grid circuits have been wired and checked the plate circuits should be tackled. Again one should be wired and tested at a time, just as in the case of the grid circuits. The tests for continuity and shorts are the same as for the grid circuit.

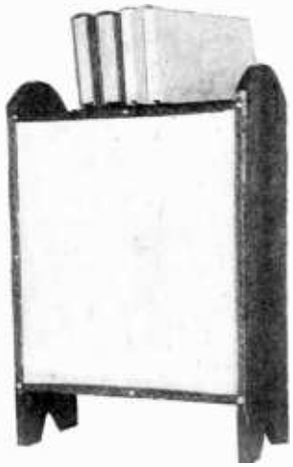
When the filament circuit and all the grid and plate circuits have been wired and tested the circuit is electrically complete, unless it should contain one or more screen grid tubes. In that event the screen grid circuits have to be attended just as the others.

Mistakes in the wiring account for nearly all troubles reported by beginners. And when a circuit fails to work from the start the perplexed novice attributes the failure to everything except the probable cause. The wiring is always excluded as a possibility in the reports, for, it is asserted, that has been checked and rechecked many times, not only by the builder himself, but by the expert friend. Nevertheless, in most cases of these thoroughly checked circuits it is an error in the wiring which accounts for the trouble. Perhaps not always the error of the builder, but usually so.

There are many ways in which errors can arise. For example, leads may be reversed because the actual work is done on the set upside down while the builder has the set in mind right side up. In the same way stages may be reversed partially. It only takes one wrong connection to upset the entire receiver. It is easier to avoid making this connection than to find it and correct it after the circuit has otherwise been completed.

Book-End Model Speaker Announced

The A. E. F. Laboratories have brought out a new model Airplane Cloth Speaker which also serves as a useful and attractive piece of furniture. It can be used as a book-end, flower stand, or for other ornamental or useful purpose. Even the radio receiver may be placed on it. The bookcase houses a speaker of fine tone quality with the low notes brought out distinctly and with a richness made possible by the floor helping to act as a sounding board. Genuine Airplane Cloth is used, stiffened with U. S. specification dope. It is actuated by a specially designed unit developed by the A. E. F. engineers to give the best possible tone in a speaker of this type and to give long service.



Full information on this speaker may be had by mentioning RADIO WORLD and addressing the A. E. F. Laboratories, 57 Murray Street, New York City.—J. H. C.

RAYTHEON BH TIPLESS

The Raytheon BH rectifier is now being supplied with a tipless bulb.

Few Radios on Trains In U.S. Unlike Canada

That the American railroads are delinquent in their failure to equip their trains with radio, although the Canadian National Railways of Canada has provided such equipment, has aroused comment. An inquiry directed to the American Railway Association resulted in a response from G. T. Stanton, chairman of the radio and wire carrier systems committee of the telephone and telegraph section of the association.

It was pointed out by Mr. Stanton that the radio equipment of the Canadian National trains, which permits the traveller to listen to broadcast concerts and to receive market reports and news of the day, is operated in conjunction with the eleven broadcasting stations of the company placed in cities as far east as Halifax and as far west as Vancouver. The fitting out of the trains followed as a logical consequence of the previous expenditure.

As a means of communication between trains and between the ends of long trains, radio is regarded in the United States as highly valuable. This system has already been applied in a limited way and experiments are continuing.

Inquiry showed that few roads in the United States furnish radio entertainment to their passengers. Many private cars have radio installed, notably the cars used by railroad officials themselves. Mr. Stanton said that in the present state of development of the American roads radio would be in advance of the needs of the situation.

The Canadian National have found the loop aerial to be unsuited for railroad work. Instead, they use a box antenna, extending the length of the observation car, supported on glass insulators about six inches above the roof.

This brings in signals well.

Acme Has Regulator for all AC Receivers

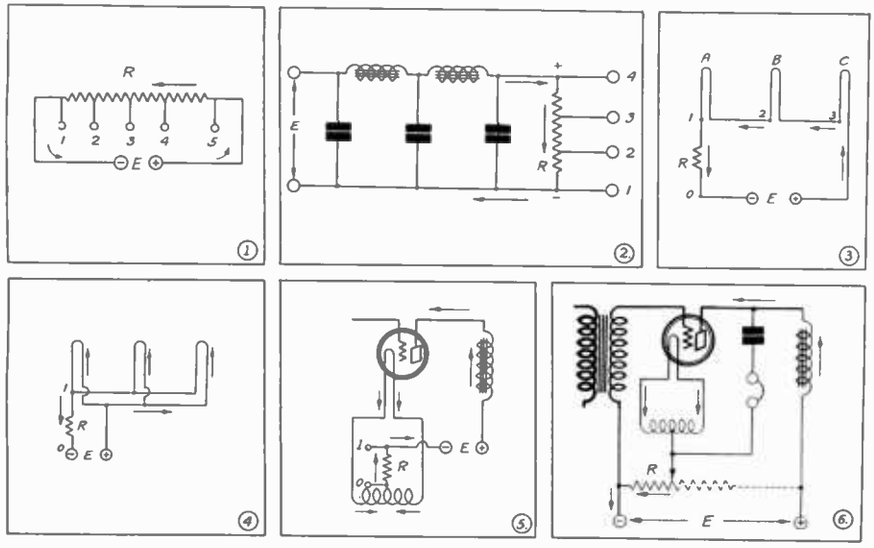
Claude Cairns, president of the Acme Apparatus Company, Cambridge, Mass., has perfected the Acme Automatic Voltage Regulator, which is now on the market. This device, small, compact and sturdy, once installed in any AC receiver, automatically maintains the voltage thereafter at 110 volts, regardless of whether the line potential surges up to 130 or drops down to 90 volts.

The unit is complete in itself, is easily and quickly installed and there are no tubes, liquids nor moving parts. It overcomes the troubles engendered by wavering line voltage and insures the lives of all AC tubes, particularly the heater type. Pearcy W. Mack, at the New York Acme offices, showed commendations and tests from leading engineers. Mr. Mack was leaving for Detroit to be a passenger together with Milton Sleeper, of Pilot, on the Stinson plane purchased by the Pilot Manufacturing Co., of Brooklyn, on a trial trip to New York. Full information on the Acme unit may be had by addressing Pearcy W. Mack, 122 Greenwich Street, New York City.

—J. H. C.

How Bias Voltages Are O

By J. E. Anderson



FIGS. 1 TO 6

A simple electric circuit having an emf E and a resistor R in series is shown in Fig. 1. The emf pumps electricity up to the plus terminal and then the electricity falls back through R to the negative. The numbered points on R indicate various heights or potentials above the minus end.

In Fig. 2 is a circuit similar to that in Fig. 1 except that the source of emf is supposed to be a rectifier. The filter is interposed between the source and the load R and the ends of R are considered as the highest and lowest potential points in the circuit.

Fig. 3 is a series connected filament circuit which is essentially the same as the circuit in Fig. 1. Electricity falls through the filaments and the ballast resistor R from the positive end to the negative. Each filament occupies a different potential altitude. Grid bias for any one of the tubes can be obtained by connecting the grid return of that tube to a point down stream from its zero point.

A filament circuit in which the filaments are all connected in parallel is shown in Fig. 4. The circuit is essentially the same as that in Fig. 1. Grid bias can be obtained for these tubes by connecting the grid return leads below the ballast resistor R.

Grid bias can be obtained also by making use of the plate current (Fig. 5). The grid return is connected to the lowest point and the filament is lifted up stream by means of a resistor R connected as shown in this circuit. The bias is the amount the filament is lifted up stream, and that is equal to the product of the plate current and the resistance R.

Fig. 6 indicates how the grid bias resistor lifts the filament up stream. The DC resistance of the plate circuit of the tube and of the choke coil is represented by the dotted portion of the potentiometer connected across the emf source. As the grid bias resistor is increased the zero point and the filament are moved up stream together.

GRID bias is obtained from voltage drops in resistors more frequently now than ever. And resistors are inserted in so many places for this purpose that it seems to the uninitiated that no method is used. And even those who have considerable experience in radio sometimes have to stop to consider just why a certain resistor gives a negative bias to a tube, or to a number of tubes.

For the purpose of elucidation we shall liken an electric circuit to a channel in which water can flow. Voltage drop, or potential difference, in the circuit we shall liken to altitude drop, or difference in level. Electric current then will have to be likened to the rate of flow of water in the channel. This must not be taken to mean that the current is the velocity of the water at any point in the channels, for the current is the same at every point in the channel or circuit no matter how swiftly it may flow at any given point.

Up Stream. Down Stream

Up stream will be considered positive and down stream negative. The water flows from positive to negative in the channel. Similarly the electric current flows from the positive direction to the negative in the circuit. In other words, the electric current flows down hill in the circuit, and the positive end of the battery or its equivalent is the highest point in that circuit.

The direction of the flow of current will be indicated by arrows pointing down hill or toward the lowest point in the circuit.

A heavy conductor such as a bus bar is analogous in an electric circuit to a water channel in which the change in altitude is very small, where the stream is sluggish. A resistor is analogous to a steep portion in a water channel where the stream is swift, or even to a waterfall where the change in level is abrupt. Where resistors and heavy conductors alternate the circuit is like a cascade.

Pumping Electric Current

A source of electromotive force (emf), such as a battery or a B battery eliminator, is analogous to a water pump which lifts the water from one level to another. Any DC emf lifts the electricity from the lowest potential point in the circuit to the highest, and it is only by virtue of this action that a current can circulate in a closed circuit.

In the various diagrams used to illustrate the methods of obtaining grid bias from resistors the source of emf is indicated by E. The plus sign indicates the highest point in the circuit, that is highest level or highest potential, and the minus sign indicates the lowest.

These highest and lowest points are not always absolute but often only the highest and lowest points in the circuit which are conveniently accessible.

The Basic Circuit

In Fig. 1 is illustrated an electric circuit which might be called basic for it is stripped down as far as possible. It contains an emf E, which pumps the electricity up to a certain potential or level, and a single return channel through which the electricity falls back to the lowest point (—), whence the emf pumps it up again.

The section of the channel between plus and (5) is a heavy conductor and may be compared with a nearly horizontal flume in which there is practically no drop. But between (5) and (1) there is a nearly vertical drop in which almost the entire change in level takes place. Between (1) and minus is another heavy conductor in which there is practically no drop. But the total drop between plus and minus through the channel is just equal to the height to which the emf lifts the electricity.

When the voltage of a battery is measured with a voltmeter, use is made of this equality. The meter actually measures the voltage drop in the external circuit, which is the meter itself, and then it is said this is equal to the apparent emf of the battery.

If the resistance R is uniform, the voltage drop in it is also uniform. That is, if the resistance between (1) and (2) is the same as that between (3) and (4) the voltage drops in these two sections are equal.

Potential Is Relative

Positive or negative potential has no meaning except in relation to some other potential. Thus (1) is negative with respect to (2) and (2) is negative with respect to (3) and so on. But (2) is positive with respect to (1). This is obvious when we think of potential in terms of altitude for (1) is lower than any other point on the resistance R.

We may take any point we choose as zero potential or level. If we choose the lowest point in the circuit all potentials have to be expressed in positive terms. If we choose the highest point in the circuit as zero all potentials have to be expressed in negative terms.

And if we choose some intermediate point as zero some will be negative and some positive. This is the case in nearly all radio circuits.

Battery Substitute Circuit

Fig. 2 shows a modification of Fig. 1. The source of emf E is supposed to be a rectifier. The highest potential point is on the positive plate of the rectifier and the lowest is the negative plate, or the cathode. But these points are not accessible, for the output current has to be filtered before it can be used. Hence we put the plus sign at the top of resistance R, as this is the highest accessible point. Likewise the minus sign is placed at the foot of the resistance, as this is the lowest accessible point. Points (2) and (3) are intermediate potentials.

Another modification of Fig. 1 is shown in Fig. 3. This represents a filament circuit in which the filaments of three tubes are connected in series. There is also a ballast resistor in the series so that the voltage drops in four steps. The circuit is thus a cascade.

When the filaments are connected in

btained Through Resistors

Technical Editor

this manner grid bias can be obtained for any tube by connecting its grid return to a suitable step in the cascade. For negative bias the grid return must be connected to a step lower than that which the tube itself occupies in the series. But before continuing with grid bias let us establish the zero points, the points from which grid and plate voltages are measured.

Zero Points

In a tube heated with direct current the zero point is taken as the negative end of the filament. Thus in Fig. 3 there are three zero points, (1), (2) and (3), one for each tube. Any one zero point is zero for one tube only.

In a tube heated with alternating current the zero point is taken at the midpoint of the filament. This point is not accessible but an artificial midpoint can be arranged outside the tube. In a tube of the heater type in which the cathode is independent of the filament, the cathode is taken as the zero point.

Now let us return to the grid bias as applied to the series circuit in Fig. 3. Suppose the grid return of tube C is returned to point (3). The bias on that tube will be zero.

But if it is returned to point (2) the bias on the grid of tube C will be equal to the voltage drop in the filament of tube B, because point (2) is down stream from (3). If tube B requires a filament voltage of 3.3, volts the negative grid bias for tube (C) will be that. If tube A is also of the 3.3 volt type and the grid return of tube C is connected to point (1) the bias on the grid of tube C will be 6.6 volts, for (1) is 6.6 volts down stream from (3). Point (0) is still farther down stream and if the grid return of C is connected to that point the grid bias will be 6.6 volts plus the drop in R. That drop may be one volt, for example, making the total bias on tube C equal to 7.6 volts.

Tube B is 3.3 volts down stream from tube C and hence to get a 3.3 volt bias on the grid of B the grid return of that tube must be connected to point (1). If the grid return is connected to point (0) the bias will be 4.3 volts, assuming that the voltage drop in R is one volt.

Tube A is lowest in the series and therefore the grid bias on that tube can only be zero or 1 volt negative, depending on whether the grid return of A is connected to (1) or to (0).

Positive Bias Obtainable

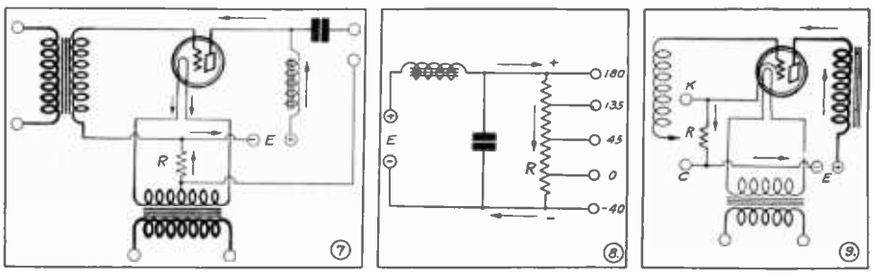
It is of course possible to make the bias on the grid of any tube positive by connecting the grid return to a point up stream. Connecting the grid return of any tube to the positive end of the filament of that tube makes the bias 3.3 volts for this type of tube. It is only in a detector where a positive bias is used and it is usually not desirable to make the positive bias greater than that obtained by connecting the grid return to the positive end of the tube used as detector.

In a series connected circuit like that in Fig. 3 the detector should be the tube lowest in the circuit, that is, tube A in this case.

Then a greater choice of negative bias is available for the amplifier tubes.

Parallel Connected Circuit

In Fig. 4 three tubes are shown with their filaments connected in parallel, the usual connection. Now there is only one zero point, for the negative ends of all the filaments are connected together. This zero point is indicated by (1). If the grid returns of all the tubes are connected to this point the bias on all is zero. But a small negative bias can be obtained by connecting the returns to point (0), which is farther down the stream than (1) by the amount of drop in R. If the three tubes are of the —99 type, each drawing a current of 60 milliamperes, and the value of R is 15 ohms, the drop in R is 2.7 volts. This would be the maximum bias obtainable. A six volt battery would have to be used to supply the total voltage E.



FIGS. 7, 8 AND 9

A typical audio amplifier stage in which a resistor R is used to obtain grid bias.

(Fig. 7) The direction of the steady plate current is clearly indicated by the arrows. The loudspeaker return is connected to the zero point in order to minimize the fluctuations in the voltage drop in R, that is to minimize feed back.

Fig. 8 shows output end of a typical B battery eliminator drawn so as to show how the total voltage output is divded between plate voltage and grid bias. A suitable point is chosen for zero and all the voltages are measured from that point.

When the amplifier tube is of the heater type (Fig. 9) a resistor R can be used for obtaining a negative grid bias by connecting the resistor between the cathode and the lowest potential point and then connecting the grid return to the lowest pont.

Bias from Plate Circuit Drop

In Fig. 5 is shown the most common method of obtaining a bias for a tube heated with AC. The arrows indicate the direction of the steady plate current. Inside the tube the current jumps from the plate to the filament.

The midpoint on the filament transformer winding is used as the zero point, since this is the artificial midpoint of the filament. The plate current flows down both legs of the filament toward the midpoint of the winding and then it flows through the resistor R to the lowest point in the circuit.

From the direction of the current through R it is clear that point (1) is down stream from point (0). If the grid return is connected to point (0) the bias on the grid will be zero. But if it is connected to point (1) the bias will be equal to the voltage drop in R. And the value of this bias will depend on the current flowing through R and the value of R itself. If R is zero points (0) and (1) coincide and the bias is zero.

It is not at first clear what the effect of R is, but a little thought will show that R simply moves the zero point between the positive and negative points of the voltage supply. Increasing R moves the zero point toward plus, decreasing it, toward minus.

Another Viewpoint

The effect might be illustrated by the aid of Fig. 1. The zero point of the filament might be connected to point (2), and this point might then be moved along R either toward plus or minus. The voltage drop to the right of (2) becomes the plate voltage and the drop to the left of (2) becomes the grid bias. In Fig. 5 only the grid bias portion of the resistance R is shown.

Perhaps this explanation is not as clear as it might be. Let us try again. Suppose the grid return is tied to point (1) Fig. 5, the lowest point in the circuit. The plate return is tied to plus, the highest point in the circuit. Now the filament, or point (0), may be tied to any desired point between these two. As R is increased the entire filament, including the zero point, is moved up stream by the amount of drop in R. This drop becomes the bias on the grid.

Since the total voltage between plus and minus is fixed, whatever bias is given to the grid just so much is substracted from the plate voltage. . This is more clearly shown in Fig. 6 in which the zero point on the tube slides on a potentiometer connected across the voltage source. The dotted portion of this potentiometer represents the plate to filament DC resistance of the tube and the DC resistance of the choke coil. The full portion is the actual grid bias resistor.

In Fig. 7 the complete circuit of a power amplifier is shown drawn in the conventional manner. The plus and minus terminals are for the conventional B— and B plus terminals on the B battery eliminator. R is the grid bias resistor.

The Output Voltage Divider

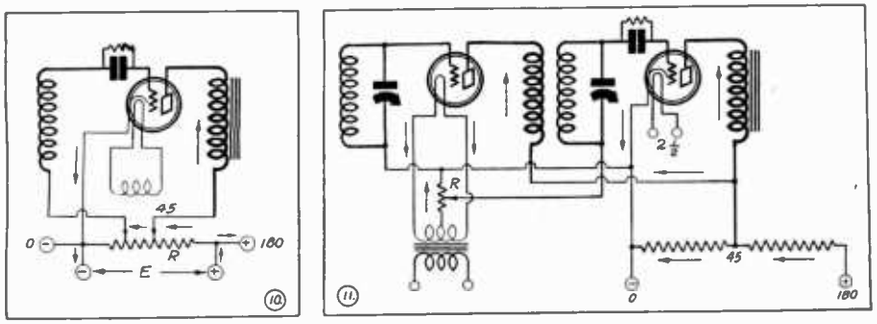
Fig. 8 shows the output voltage divider on a standard B supply. Only one choke coil and one condenser are shown of the filter because the resistance strip is of main interest just now. Taps are shown on the resistance R for —40, 0, 45, 135 and 180 volts.

The negative ends of the filaments of the tubes in the receiver are supposed to be connected to point (0). When that is done the voltage distribution will be as shown. The total voltage drop in R is 220 volts. The "pump" must be able to maintain a pressure of that value when each tube in the receiver is taking its full quota of plate current.

It is obvious that if point (0) is moved up and down that the negative and positive voltages will vary. If it is moved up the plate voltage is decreased and the grid voltage is increased. The reverse takes place when the zero point is moved down. But the voltage across the entire R remains at 220 volts, with only small variations due to poor regulation of the supply.

If the distribution is as shown in Fig. 8, conditions are right for the operation of a —71A power tube, provided the grid return is connected to minus and the plate return to plus. But this does not pre-

(*Continued on next page*)



FIGS. 10 AND 11

When a positive grid bias (Fig. 10) is required for the heater type detector tube it can be obtained in this manner. The cathode is tied to the lowest potential point and the grid return to some other point, which necessarily must be positive with respect to the cathode.

(*Continued from preceding page*)

clude the possibility of obtaining lower grid bias values for other tubes used in the circuit. The portion of the resistor between minus and zero can be tapped at any desired place. The closer to zero the tap is taken, the lower will be the grid bias on the tubes connected to the tap.

Bias in Heater Type Tube

Fig. 9 shows plate and grid circuits of a heater type tube. A resistor R is inserted between the cathode and the lowest potential point in the plate circuit. Since the plate current through R flows from K to C it is clear that C is negative with respect to K, or that it is down stream from K.

If the grid return is connected to K the bias on the grid will be zero. If it is connected to C the bias will be equal to the voltage drop in R. This drop is equal to the product of the plate current and the resistance. If resistance R is a potentiometer and the grid return is connected to the slider, intermediate grid bias values can be obtained.

Note that the heating circuit has no connection with the cathode. Its only object is to heat the cathode.

Heater Tube with Positive Bias

It is customary when using the heater type tube as detector to use zero grid bias. But sometimes better results will be obtained when the grid is made slightly positive with respect to the cathode.

Fig. 10 shows one way of obtaining a positive bias for the grid. The cathode is connected to the lowest potential point in the circuit. When that is done the grid cannot be given a bias lower than zero. If the grid return is connected to some other point than the cathode the bias must be positive. And the higher up stream it is connected the more positive is the bias. R in Fig. 10 is the output resistor of the B supply or a potentiometer connected in parallel with either all or with a part of this resistor.

In Fig. 11 is shown a practical illustration of a method of obtaining a positive grid bias for the detector by connecting the grid return lead to a point up stream from B—. Use is made of the resistor which is also employed for giving a negative bias to the radio frequency tube which precedes the detector.

Every point on R is either higher than the cathode or on the same potential level. Hence any positive bias within the limits of the voltage drop in R can be obtained for the detector by connecting the grid return suitably. There is no essential difference between the methods employed in Figs. 10 and 11.

How to Determine Drop

The amount of voltage drop between two points in a circuit is not always easily determined. Sometimes the resistance is not known and at other times the current flowing is not known. Then the same current may not flow at all points in the conductor between the two points. However, the drop is equal to the product of the current flowing and the resistance between the points. If the current is not the same at all points account has to be taken of this fact. Each section has to be treated separately by obtaining the drop in it and then all the other drops have to be added together to get the total drop.

The meaning of this can be illustrated with the aid of Fig. 10. Resistance R is divided into two sections by the 45 volt return. In the portion of R to the right of the top the plate current of the detector flows in addition to the current which flows through the resistance as a whole.

Hence the voltage drop in the right portion for a given amount of resistance will be greater than it will be in the same amount of resistance to the left of the tap.

Vacuum Tube Voltmeter

The best way of measuring the voltage drop in a resistor is by means of an electro-static voltmeter, for which a vacuum tube may be used. A very high resistance voltmeter is the next best thing. The measurement should be made from the zero point to the grid of the tube, or from the zero point to the grid return point. An ordinary voltmeter is of no value for this purpose because it will not indicate the actual grid bias.

If a first-rate meter is not available the resistance and current can be multiplied together to get the bias. But in that case the actual current and the actual resistance between the two points in question must be used. It is not accurate enough to use rated resistance and current values. For example, the rated plate current in a —71A with 40.5 volts bias and 180 volts on the plate is 20 milliamperes. The grid bias resistor should then be 2,025 ohms.

A resistance rated at 2,000 ohms would be used. But its value may actually be 1,800 ohms. And the plate current originally may actually be 15 milliamperes. The bias in that case would not be 40.5 volts but 27 volts.

Judson Heads List as Independent Producer

With sixteen weekly radio productions under his care, Arthur Judson, through his newly organized Judson Radio Program Corporation, has risen within a few months to rank as the largest independent producer of radio programs. He is also one of the few radio producers presenting programs from all of the great national networks, as well as from separate stations.

Unlike some of the other independent producers, Arthur Judson has not confined himself to one type of radio presentation. In his concert management, Mr. Judson has been noted for the fact that he has specialized in classical soloists and instrumentalists, as well as larger organizations of vocalists and instrumentalists.

Must Be Good

Upon his entry into the radio broadcast field he realized that the radio audience demanded really good entertainment in both the popular and classical fields, and therefore the scope of the Judson Radio Program Corporation includes both types.

Among recent broadcasts under his charge were the New York Philharmonic Orchestra Concerts and the Barbizon Recitals, offered weekly through WOR, and a series of five special concerts for White Rock through WJZ and ten stations of the Blue Network. The efforts of the Judson Radio Program Corporation have been heard by the radio audience in most of the Columbia Broadcasting System's productions. In addition to the complete programs produced by Judson, he has frequently been called upon to furnish vocal and instrumental soloists and ensembles for broadcast features under the production of other persons.

Features Listed

A complete list of Judson Radio Program Corporation features heard this winter follows:

New York Philharmonic Orchestra (WOR); Barbizon Recital Series (WOR); White Rock Concerts, special series, (WJZ and 10 Blue Network stations); Symphonic Hour (WOR); Cathedral Hour (WOR); Operetta in Miniature (WOR); American Singers (WOR); Spur Tie Hour (WOR); Don Vorhees Concert Orchestra WOR); The Pioneers (WOR); The Captivators (WOR); Kolster Radio Hour (WOR); Sunset Dytinters (WOR); La Palina Smoker (WOR); and At Home with the Masters (WOR).

Big Input Required By the New -50 Tube

The use of power audio amplifiers has increased in number and popularity so rapidly that several important facts pertaining to these units have been overlooked in the general rush construction.

It is imperative that the correct amount of signal grid voltage be applied to the output power tube if its full power rating is to be obtained. Since the power output of a tube is proportional to the square of the input voltage, an input signal of half the rated voltage specified for the full power output will result in the reduction of the tube output to one-quarter of its full rated value. This means that present day power amplifiers utilizing —10 or —71 tubes cannot be improved by the simple insertion of type 250 tubes in place of the —71s or —10s. If this is done the power output of the —50s will not be any greater than that of the —71 tubes to realize the full benefits of the —50s it is necessary to increase the signal grid voltage to a value approximating 59 volts (.7 times the maximum grid bias voltage of 84 volts), when 450 volts are applied to the plate.

This can be accomplished by the addition of a stage of Hiler tuned double impedance amplification, between the regular amplifier and the —250 output tubes.

Metal Housing Advantage

In An AC Receiver Cited by Concertrola Designer

By Leo Fenway

PART I

IN the Spring a set builder's fancy turns to set building. It is the time to make better gardens and better radio sets. As everyone who plants a garden knows, a deep spading bring new richness to the soil. As everyone who plants a radio set knows, a deep digging for facts adds new fertility to the set. Seed catalogues are not nearly as plentiful this year, however, as are radio catalogues. And yet, that is the way to make better gardens and better radio sets—use the selected seeds from this year's harvest to improve the next year's planting. That is the way the Electric Concertrola, Model F-5, has been co-operating with about 5,000 RADIO WORLD readers, which is something of a record.

According to the letters received from these readers and set builders, the Concertrola must be the Golden Spade. There is something about this new all-electric receiver that appeals. What is it? What is that elusive something that by some strange attraction touches a business—touches a radio set—and lo, Success!

Reduced to its simplest terms, the radio receiver that succeeds is simply the one that brings something good, something better, into the lives of the people—that renders an honest service at an honest price. The Electric Concertrola has proved itself to thousands of RADIO WORLD readers—has told and continues to tell these readers that it faithfully reproduces the broadcasts of a nation, without trouble, without batteries, without muss and fuss.

Radio From the Light Socket

Dreams of yesterday's radio fans come true. Back in the old days, when fans asked "how long will this battery run my radio?" they had visions of better days in radio . . . receivers which operated directly from the light socket. Today those dreams are an actuality. The fact that the current as it comes from the light socket has to be rectified, filtered, smoothed-out, is of no consequence. What is important is that batteries are no longer necessary. Perfect radio reception is the harvest you reap from sowing A. C. tubes in your radio garden.

The cost of charging storage A and B batteries at home is supposed to be much less than taking them to a service station. As a matter of fact, home charging has never been economical. As often as not the home charged battery is connected in the line with polarities reversed. A waste of current, since the battery must go back in the line for a length of time equal to that spent in charging it "backwards." Naturally, this "backward charging" doesn't do the battery any good.

Then, too, in charging the battery it either has to be brought out of the kitchen sink, or charged in the cabinet or console, under the table. Dangerous business, as any woman knows, who has had acid spilled over a costly rug.

Woman's Demand

Beyond all reasonable doubt, it is the woman of the house who is now demanding the all-electric set. Moreover, she isn't particular as to whether or not it is more selective or more sensitive than the battery operated kind, she only knows that the all electric set has less "loose wires" hanging around and creates less trouble and less dirt than the other kind. The wide-awake family man senses all this and right now he is either building an electric set or getting ready to build one.

LEO FENWAY

Most of the manufacturers, jobbers and dealers are agreed that the electric set is here to stay and are diligently trying to perfect its minor defects. In the interim, however, a goodly number of RADIO WORLD readers are building the Concertrola. They have selected this particular set because, while it has not shattered any special DX record, it at least brings in stations up to about 1,500 miles, with marvelous quality, ample volume and without even the slightest trace of hum or other line noises.

The construction of the Concertrola hinges around the special triple-shielded metal case. One object of this special metal case is to provide a housing for a radio receiver which is exceptionally efficient in operation in comparison with present type metal housings or cabinets.

Advantages of Shielded Case

Other objects of the triple-shielded metal case are to provide a cabinet which operates to prevent radiation of energy from the receiving set; operates to prevent local and foreign disturbing electrical waves from interfering with the functioning of the radio apparatus; operates to reduce the outside magnetic field around various instruments and thus reduce, if not entirely eliminate, undesired coupling with other units of the receiving system; and operates to provide a suitable shield tending to stabilize the action of the apparatus and to increase the range and signal strength.

Another object of the triple-shielded metal case is to provide a simple fire-proof container for the electric radio apparatus, which operates similar to the "magazines" on a moving picture machine, i.e., should a fire start anywhere in the set it will be confined within the metal case. This is a feature of the case that is not to be ignored; not that electric sets are likely to burn up any more than battery operated sets, but sooner or later the Fire Underwriters may gently "hint" that all electric sets must be housed in a fireproof metal box.

Still another object of the triple-shielded case is to provide within the case a built-in metal support, or supports, for the assembling of various radio parts, such as sockets, transformers, coils, condensers, etc. Various other objects and advantages of this special case will be apparent from the description of a preferred example of the Concertrola, Model F-5, and will be evidenced through the use or practice of the set.

Data on Coils

The circuit diagram of the Model F-5, which will be published soon, contains several novel features. One of these is a new and better way of connecting the loudspeaker to the power amplifier.

Another point of interest is the way the simple solenoid-wound coils are made and mounted upon the metal shelf of the case.

In mounting these coils everything depends upon their position in relation to the position of the power transformers in the eliminator. That is to say, if the coils are mounted so that the axis of the R.F. transformers are at right angles to the axis of the power compact the set will function without the slightest trace of hum, or similar line noises.

To illustrate the construction of these coils, specific details will be described. These coils are particularly designed to absorb maximum signal energy from the antenna, designed to provide exceptional sharp tuning, and so made that in operation they tend to reduce outside magnetic field and eliminate coupling with other units of the set.

Simple and Good

The same high quality of parts, as was used in the portable model F-4, described in RADIO WORLD on December 5, 12, 19, etc., will be shown in the Model F-5, including the Thordarson power supply. One thing, however, should interest all those who contemplate building an electric set: the Model F-5 is perhaps the simplest all-electric set made today that brings in stations over 1,500 miles away, with tremendous power and almost perfect quality. Moreover, it is one of the few electric sets which can be constructed with practically no electrical or radio knowledge, and at a cost much below one hundred dollars.

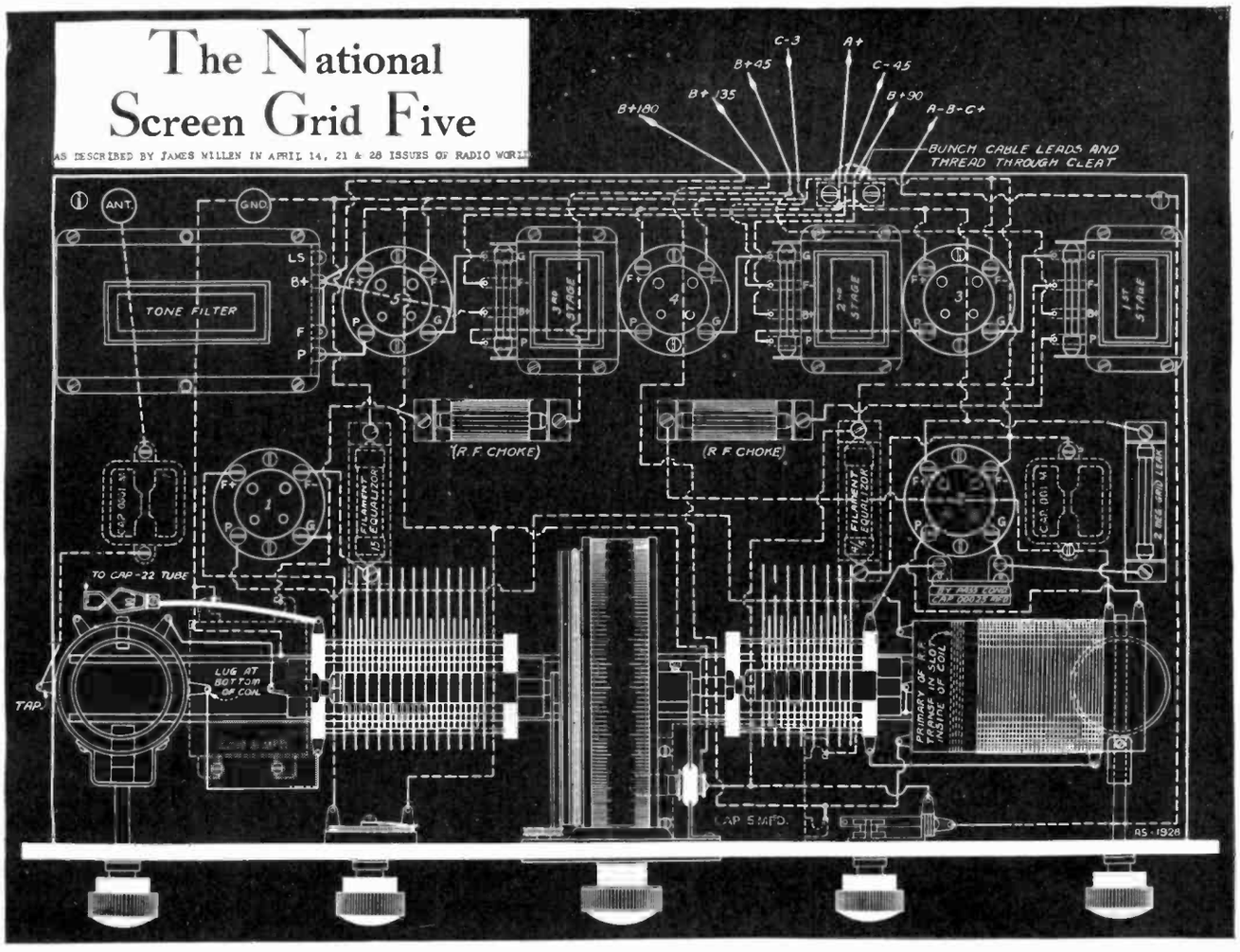
Truvolt Resistors Calibrated in Ohms

H. G. Richter, chief engineer of Electrad Inc., 175 Varick Street, New York City, announces that the Truvolt line of power resistances can be considered as calibrated power resistances, since each effective turn between the end contacts, is equal in resistance to the total resistance divided by the number of turns. This information should be of great interest to persons who desire to obtain various resistance values, but have no means of measuring the exact resistance. An example of the above is the following:

The 25 watt Truvolt has 30 effective turns, and assuming a 3,000 ohm resistance unit, each turn would be equal to 100 ohms. The 50 watt units have 66 effective turns and the 75 watt units have 98 effective turns.

The National Screen Grid Five

AS DESCRIBED BY JAMES MILLEN IN APRIL 14, 21 & 28 ISSUES OF RADIO WORLD



By James Millen

PART 3

ONE of the outstanding advantages of the National Screen Grid-Five Receiver is the ease with which it may be constructed. There is no shielding nor neutralizing required. The parts all mount directly on the sub-panel and when mounted may be completely wired before mounting the front panel.

Not only does this procedure simplify the wiring process, but it also prevents any possibility of scratching or otherwise marring the front panel while the wiring is being done.

When the various parts have been carefully mounted on the subpanel, as indicated in the diagram, the wiring may be started. To obtain a neat looking job, as much as possible of the wiring should be run underneath the subpanel. In the diagram, dotted lines are used to indicate wires under the sub-panel and full lines are used to indicate wires located above.

Be Systematic

If the wiring is done in a systematic manner, first the filament circuit, then the dial light, then all the grid leads, then the plate leads and finally the grid (—C) and the plate (+B) return leads, the work will be found to progress rapidly and with much less chance of error than if just a hit and miss method of putting in a lead here and there is followed.

There is only one long lead carrying any RF current—the one from the plate of the 222 to the primary of the RF transformer. This lead should be run underneath the subpanel in as direct a line as possible.

Although best results are generally obtained when this plate lead is connected to the primary terminal nearest the front panel and the plus B 135 volt lead to the remaining primary terminal, it is well to try interchanging these two leads. With some sets, the reversed connections give considerably better performance.

LIST OF PARTS

L1, L2L3L4, C1, C2, PL—One National Single Dial Tuning Unit BD No. 222 with No. 28 Illuminator (unit consists of drum dial, antenna and detector coils, two knobs, two tuning condensers, mounted on frame).

AF1—One National First Stage Impedaformer.

AF2—One National Second Stage Impedaformer.

AF3—One National Third Stage Impedaformer.

TF—One National Tone Filter.

C, OC—Two Aerovox .0001 mfd. moulded mica condensers.

C3—One Aerovox .00025 mfd. moulded mica condenser.

C6—One Aerovox .001 mfd. moulded mica condenser.

C4, C5—Two Tobe .5 mfd. bypass condensers.

1, 2, 3, 4, 5—Five General Radio sockets.

S—One Yaxley Switch.

R2—One Carter 20 ohm Rheostat.

L5, L6—Two National RF chokes, with two Lynch Equalizor mountings.

R3—One Lynch 2 meg. grid leak with single mounting.

R4—One Lynch No. 4/5 Filament Equalizor with single mounting.

R1—One Lynch 15 ohm Filament Equalizor with single mounting.

One—Bakelite front panel, 7 x 18 inches.

One—Bakelite subpanel, 10 x 17 inches.

Two extra knobs to match those on coil shafts, and to be affixed to rheostat and switch shafts.

One fuse clip or No. 45 Universal Pee-wee clip for cap of 222 tube.

Offers Complimentary Blueprint

The wiring process is quite simple, and the full-sized blueprint is employed there is little chance for even the inexperienced constructor to go wrong. Any reader desiring this blueprint may obtain one, with my compliments, by addressing me as follows: James Millen, c/o Radio World, 145 West 45th Street, New York, N. Y.

Perhaps some constructors may find it advantageous to mark out each line as soon as the corresponding lead has been connected in the set. If so, this may be done on the diagram on this page and the blueprint left intact.

The final step in the wiring is to connect on the leads that form the cable. These wires should be No. 18 stranded rubber covered and should be carefully labelled before being bunched together in the form of a cable. If preferred, a standard battery cable may be used.

Screen Grid Data

A short length of flexible rubber-covered hookup wire with a fuse clip, No. 45 Universal Pee-Wee or other suitable connector at one end, is fastened to the stator plates of the antenna condenser, as shown in the diagram. This is the contact to the cap or control grid of the 222 tube.

When a short indoor antenna or the piano hinge of the cabinet cover is to be used as the antenna, it should be connected to this same clip.

When the receiver has been completely assembled on the sub-panel, and wired,

the front panel may be prepared and mounted in place. In drilling the front panel, it will be noted that a "trick" shape hole is not required. The large round hole shown, is easily made with one of the special panel cutters to be found in most experimenter's tool kits. No mounting screws are necessary for holding the panel in place, as it is well supported by the dial, the front plate of which is fastened to both the sub-panel and the front panel.

Full data on the proper tubes to use and the method of putting the receiver into operation already have been given (April 14th and 21st issues) and it is strongly recommended that the constructor carefully reread the articles before putting the receiver into operation.

Keep Circuits In Unison

One point that cannot be overemphasized is the necessity for properly "lining" the two tuned circuits. If this is not done, the set will tune broadly and lack volume.

Perhaps the most obvious indication of an improperly tuned set is the fact that many stations will seem to come in at two different points on the dial. To correct this difficulty, all that is generally necessary is to vary simultaneously the tuning dial and the antenna variometer knob until the two points on the dial at which the station is heard seem to move together and then finally merge into a single point with greatly increased volume.

Should the above process not give the proper results, then it will be necessary to loosen one of the condensers from its shaft (there is a small set-screw provided for this purpose) and slightly advance or retard its position relative to that of the other condenser. When such a process is necessary, then the adjustment should be made with the antenna variometer set in mid-position.

Prefers Impedaformer Audio

While the receiver, as described, uses impedance coupled amplification, either transformer or resistance coupled systems may be employed, if preferred. When moderate for cost, tone quality, ease of construction and stability of operation is considered, it is doubtful if any other system will prove more desirable.

When large volume with the best of tone quality is the object, the use of a separate combination power amplifier and B-supply, such as the National Amplifier is recommended. This amplifier readily may be connected to the set, as diagrammed. The input, or plate lead, is connected to the lead formerly connected to the terminal marked "P" on the first stage impedaformer. Only the UX222 and the detector tube should be left in the sockets in the set. The No. 45 filament Equalizor must also be replaced with a No. 2 equalizor to place the proper filament voltage on the two remaining tubes.

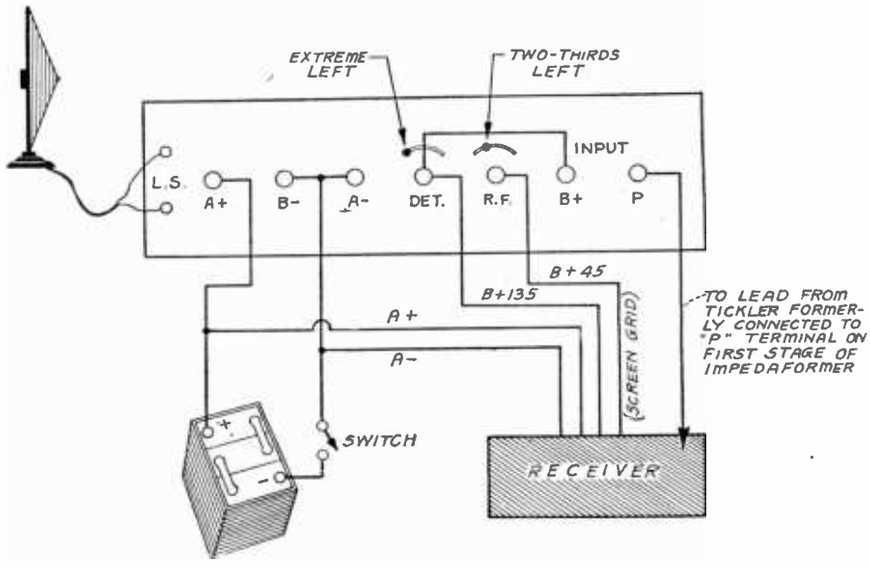
[*This is the third and last of a series of constructional articles on the National Screen Grid Five, by James Millen. Readers of* RADIO WORLD *are at full liberty to request that a complimentary blueprint be sent.*]

WABC ON SHORT WAVE, TOO

The daily programs of WABC, 920 kc, 325.9 meters, are being sent out simultaneously by the new Grebe Short wave station, 2XE, located at Richmond Hill, New York, on a frequency of 5,121.6 kilocycles, about 58.5 meters.

PETTINGELL APPOINTED

Roger V. Pettingell, 1101 Statler Bldg., Boston, Mass., was appointed representative of the Acme Elec. & Mfg. Company of Cleveland, Ohio, large manufacturers of numerous radio products to cover the entire New England territory.



HOW THE NATIONAL B SUPPLY IS CONNECTED TO JAMES MILLEN'S CIRCUIT.

Karas Short Wave Set May Use Dry Cell Tubes

Can the Karas short wave receiver described in the March 31 issue of RADIO WORLD be adapted to dry cell tube operation? That question has been asked by many who have expressed an intention of building the short wave receiver if it can be used with the small tubes.

There is no reason at all why the circuit can not be built around dry cell tubes such as —99s, R215-As, and WD-12s. These tubes are good amplifiers and detectors, and their only limitation is power output. Any one of them can only handle a small fraction of the undistorted power out of the —71A or even of the —01A tube.. But where sensitivity and selectivity are concerned there is no practical difference. Hence if a high volume output is not desired it is entirely practical to build the Karas short wave receiver around dry cell tubes.

Small Tubes Make Compact Set

If portability and compactness are of greater importance than great output volume the dry cell tubes are particularly suitable. The entire receiver can be tucked away in a very small package and yet be ready for operation by the mere turning of a switch.

In adapting the Karas short wave set to dry cell tubes there are no basic changes in the circuit diagram. Only a few operating values have to be changed to suit the working conditions of the small tubes.

Let us assume that the circuit is to be built for —99 tubes and the filament voltage source is to be three No. 6 dry cells. The voltage of these cells will be about 4.5 volts. It will be slightly in excess of that when the cells are new and considerably below it when the cells are exhausted.

The Filament Circuit Adjustment

The filament terminal voltage on the —99 tubes should be 3.3 volts or somewhat less. The value of rheostat Rh1 may remain at 20 ohms and a Yaxley No. 810 resistance put in series with it.

The ballast R2 should be of such value that 1.5 volts drops in in when the current flowing through it is 120 milliamperes. That is, the resistance should be between 10 and 15 ohms. A No. 120 Amperite is suitable for the two amplifiers, i.e., one No. 120 for the two tubes.

The plate voltage on the —99 tubes should not exceed 90 volts. A higher plate voltage will needlessly shorten the life of a tube. A higher voltage would also require additional blocks of B batteries, which would add considerable weight to the circuit in case it is made portable.

With 90 volts on the plates of the two 99s the grid bias should be —4½ volts on both grids. This should be supplied by a small flashlight dry cell battery.

To avoid hand capacity effects from the tuner both of the rotors should be connected to ground. The stator of one condenser should be connected toward the grid of the detector and the stator of the other should be connected to the low side of coil L3.

[*The construction of the Karas Short Wave Receiver was described in the March 31st, April 7th, 14th and 21st issues, A complimentary blueprint may be obtained by addressing* RADIO WORLD, 145 *West 45th Street, New York, N. Y.*]

LIST OF PARTS
for dry cell model.

C1—One Karas .00014 mfd. variable condenser.
2—One Karas .00025 mfd. variable condenser.
C3—One Sangamo .0002 mfd. fixed condenser with clips.
C4—One Sangamo .001 mfd. condenser (across sec. of T2).
T1, T2—Two Karas Harmonik audio frequency transformers.
R1—One 4 megohm Durham grid leak.
R2—One No. 120 Amperite with mounting.
Rh1—One Yaxley 20 ohm rheostat.
S—One Yaxley No. 10 filament switch.
L1, L2, L3—One set of Aero short wave coils.
L4—One Aero radio frequency No. 60 choke coil.
One Yaxley No. 810 10 ohm resistor.
Two Yaxley phone tip jacks.
Two Karas Micrometric dials.
Two Karas sub-panel brackets.
Three Benjamin sockets.
Eight X-L binding posts.
One Formica 7x18x3/16 inch panel.
One Formica 8x17x3/16 inch sub-panel.

Conference Resolution Extols Equalization

Washington.

The resolution adopted by a conference of radio engineers, called by the Federal Radio Commission, making recommendations for allocation of radio channels for broadcasting, has been submitted to Congress by the Chairman of the conference, Dr. J. H. Dellinger, of the Bureau of Standards. At this conference the Board and the Institute of Radio Engineers submitted plans, so did others. The full text of the conference resolution follows:

It is the opinion of the engineers in attendance that from a radio engineering standpoint, under the provisions of the 1928 law requiring equality between zones, Plan A. submitted for discussion by the Commission, modified as follows, represents the maximum obtainable radio service from the available broadcasting channels in the present state of the art:

Class C, 5,000 to 50,000 watts, channels, per zone, 10; United States, 50. Full time assignments, per zone, 10; United States, 50.

Class B, 300 to 1,000 watts: channels, per zone, 18; United States, 36. Full time assignments, per zone, 18; United States, 90.

Class A, up to 250 watts: channels, per zone, 4; United States, 4. Full time assignments, per zone, 40; United States, 200.

"Far Superior Service"

The readjustment of station allocations required by the 1928 Radio Law gives the Radio Commission an opportunity to provide the radio listeners of the United States with a grade of radio broadcasting service far superior to that furnished under the present allocation of stations.

A redistribution of broadcasting stations among the States will, if the proposed classification of service be established, result in the satisfactory reception of more programs at higher signal strengths by a greater number of listeners in a larger total area than at present, and will do this with less interference than now exists.

The fundamental change required to bring about any material improvement is to provide a considerable number of channels upon which only one station operates. The reason for this is a purely physical fact.

Distance Apart Is Important

Since heterodyne interference extends to many times the distance to which actual program service from a broadcasting station extends, operation of two or more stations on a channel results in an area of destructive interference much greater than the area on which program service is provided. Program service, free from interference, can be furnished at great distances from a station only when the station has exclusive use of its channel.

Since there are only 90 channels available for broadcasting in the United States, 90 is the upper limit of the possible number of stations giving service at considerable distances.

When two or more stations operate simultaneously on a channel, program service can be furnished at short distances from each station without destructive heterodyne interference within that distance, provided the stations are located at proper distances apart corresponding to the power used.

Many Stations Per Channel

Under these conditions many stations can be operated for short distance local service on a single channel. Outside the local service areas heterodyne interference will prevent satisfactory reception.

Sections of the country remote from centers of population can not be given service except by the stations first mentioned, which have exclusive use of their channels (Class C.)

It follows that the country as a whole can be given the service it demands, only by having more than one class of stations: (1) Long-distance stations, operating on exclusive channels; (2) Shorter-distance stations, operating on shared channels.

Considering the broadcasting needs and development in this country, it is apparent that the second class can advantageously be subdivided into stations of moderate distance range (Class B), and small stations of very small distance range: (Class A).

The number of channels, 50, indicated for Class C stations, is the minimum that should be provided, in view of the far greater service, both distant and local, that will be rendered by such channels, owing to the absence of heterodyne interference and the consequent possibility of the use of greater power.

Further Study Recommended

The distribution of the remaining 40 channels between classes B and A represents the best judgment of the engineers from present information. A further study should be made of this point on the basis of service requirements of various areas of the country. It is believed that the final answer on this point will not depart widely from the figures given.

It is clear that the stations depended upon for service over large areas must operate on heterodyne-free channels and that therefore there must be only one assignment to each Class C channel.

The moderate-distance (Class B) and short-distance (Class A) channels may each be used by a number of stations in simultaneous operation, since the only desideratum is good service within the local service range of each station.

Duplication Defined

The power required for moderate-distance service (Class B) will not permit as much duplication of stations on one channel as will the smaller power required for short-distance service (Class A).

The amount of duplication recommended is: For each Class B channel, on the average two and a half assignments in the United States (i e., the assignment of every other channel in each zone); and for each Class C channel, 50 assignments in the United States (10 in each zone).

The limitation to two and a half assignments for each Class B channel is determined by the geographical circumstances of the two smallest zones (1 and 2), together with the requirement of the law of equality between zones. Points in zones 1 and 2 average less than 500 miles apart, a distance too small to permit the assignment of any one channel in both zones with the recommended power.

Separate Application

The provisions of the law requiring equal distribution among the zones, and, according to population, among the States, of station licenses, frequencies, time, and power, must be applied separately in each of the three classes of stations mentioned. This results from the inclusion of the number of licenses as one of the elements of equal distribution.

In order to merit the use of a Class C channel a station must be competent to serve a large area. It follows that no Class C station should be allowed to operate with less than 5,000 watts power. The only upper limit for this class need be that fixed by the production of inter-channel interference, and, in consideration of the geographical distribution possible, may be 50,000 watts at the present time

Effect of Increased Power

For the moderate distance (Class B) channels of powers of 300 to 1000 watts will give satisfactory service, and for the short distance (Class A) channels power should not exceed 250 watts per station because of the extensive duplication permitted.

As an exception to these general recommendations for Classes B and A, it is noted that where two or more stations operating on the same channel are all increased to power by the same factor, their heterodyne-free service ranges will be substantially unaffected and a better signal (with respect to noise interference) will be delivered within each service area. This will be at the expense of producing a stronger heterodyne whistle outside the service areas of the two stations concerned.

The expedient of time division does not in general lead to superior service to the listener. It is inherently uneconomic.

Time Sharing Just Tolerable

Where several stations in an area are now dividing time, the duplication of plant and overhead necessarily results in poorer service than would result were these stations to be consolidated into a single station using all the time.

For the Class C stations particularly, time division should not be allowed. An exclusive (Class C) channel is capable of delivering such excellent service over large areas that care should be taken not to restrict the possible service from these channels by an uneconomic arrangement such as time division.

For the class B and class A channels there will doubtless be local conditions demanding, and perhaps justifying, time division in spite of its inherently uneconomic nature. However, the application of time division has been made difficult under the terms of the new law.

Equality Results

Since the law requires equality of the number of hours and licenses among the zones, and according to population, among the States within each zone, if time is divided on a given channel among several stations in any one State, this division must be duplicated on some channel in every other zone and proportionally in every State.

The same difficulty will exist in any attempt to divide time between stations located in different zones, as might be sought, e. g., to take advantage of the time difference between the east and west coasts.

Time division between stations in widely separated localities is subject to the further objection of seriously complicating the maintenance of the proper frequency separation between stations in each of the localities to minimize inter-channel interference.

Next Week

Issue of May 5

Quality Aspects of Audio Transformers, by James H. Carroll.

A New Plan for Standard Frequency, by J. E. Anderson

25 Cleared Channels Held Ruinously Small

Washington.

Allocations to which the respective radio zones and the several States would be entitled in compliance with the equalization clause of the radio law, if the suggestion of Representative Davis (Dem.), of Tullahoma, Tenn., that there be only 25 cleared channels is carried out, are set forth in a letter sent by O. H. Caldwell, Federal Radio Commissioner. Mr. Caldwell represents the first zone. He wrote the letter to President McCanne, of the Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y. The company operates WHAM.

The letter contains a tabulation made by Commissioner Caldwell showing the channels and powers that would be available under an engineering plan proposing only 25 cleared channels. The informal conference of the Radio Commission with engineers recently proposed 50 cleared channels.

Text of Letter

Following is the full text of Mr. Caldwell's letter, and of the tabulation he has prepared:

"Dear Mr. McCanne: In answer to your letter regarding a future cleared channel for your station WHAM:

"Radio engineers and radio men have unanimously approved the conclusions of the recent conference of radio engineers at Washington, recommending 50 cleared channels and the proper spacing of smaller stations on the remaining 40 channels, as affording the best arrangement for good radio reception to the great listening public under the restriction of the recent Davis-Dill 'equalization' amendment (which the Commission is endeavoring to carry out faithfully).

"The engineers' recommendations in this respect have, however, been seriously criticized by a few laymen who insist that 25 cleared channels would be ample. The Commissioners desire to give careful consideration to every point of view, and these comments by laymen, members of Congress, and interested radio listeners are always very helpful.

"However, to show my fellow-Commissioners the situation which would obtain with 25 cleared channels, allotted among the States, according to population, as the 1928 law requires, I have compiled the enclosed rough figures.

"With 25 cleared channels, you will note that in New York State two and a fraction cleared wavelengths have to be divided among your 5,000 watt WHAM, and the following stations of 5,000 watts or above: WEAF, WJZ, WLWL, WABC, WBKW, WGY, leaving a very small amount of time for each station.

Division Compelled

"In New Jersey, WOR and WPG would have to divide between them the five nights a week (five-sevenths time) on a clear channel assigned to that State, allowing WOR and WPG each only two and one-half nights a week to operate.

"In Maine where a new 5,000 watt station is being erected at Portland, this transmitter can be permanently authorized to operate only one night a week (one-seventh time) if 25 cleared channels are to be the limit for the country.

"In Maryland, WBAL would have only two nights a week (two-sevenths) to operate, except by 'borrowing' time from some other zone (with the condition that such time 'loan' might be cancelled any time within 90 days). While at the beginning it was felt that such 'borrowing' of unused power could be carried on between zones, it now becomes apparent that there will be indeed little unused time, power or channels to be drawn upon by other zones, and that the 'permanent' allotment under the 'equitable distribution' clause will shortly be about the extent of any State's working quota.

"A little study of the enclosed tabulation by any one familiar with radio conditions in each State, and the many great and important local stations now serving the listening public in those States, will show the hardship which local listeners and their favorite stations will suffer if the number of cleared channels is limited to only twenty-five.

"Listeners particularly affected will be those in and around such states as Ohio, Michigan, Illinois, Iowa, Minnesota, Missouri, Tennessee, and Florida, as you will note from the fractional clear channels allotted those States.

"Thus, you will see that WHAM is not the only station which will undoubtedly be required to share time under the new allocation. Personally, I have been a great believer in the capacities for public service of your WHAM, with its magnificent artistic and studio facilities through the $7,000,000 Eastern School of Music endowment, and its fine technical and transmitter equipment representing $175,000 in investment.

"It is my feeling that the Radio Commission should do everything possible to preserve the usefulness of such facilities for the service, education and pleasure of the listening public, while at the same time bringing the broadcasting set-up into strict compliance with the requirements imposed by Congress last month in enacting the Davis-Dill equalization amendment."

Following are the permanent allotments of channels, power and time to the States, under the 1928 Davis-Dill clause. With 25 cleared channels, as determined by Commissioner Caldwell.

Based on total United States power of 1,123,000 watts (or 224,000 watts per zone). Full-time stations per zone; 5 on exclusive or "clear" (C) channels; 31 500-to-1,000-watt stations on regional (B) channels, and 40 250-watt stations on local (A) channels. Total full-time stations per zone, 76. Total full-time stations for the United States, 380.

Hardship Tabulated If "25 Channels" Wins

Number of full-time stations clear for 5,000 watts and over is shown in column A and total number of stations in column B. Column C shows the power on cleared channels and column D the total wattage for State.

	A.	B.	C.	D.
ZONE I.				
Maine	1 7	2 2/7	5,540	6,540
N. H.	1/14	1 2/7	2,990	3,740
Vermont	1/14	1	2,150	2,900
Mass.	6/7	12	30,750	35,000
Conn.	2/7	5 4/7	10,730	13,730
R. I.	1/7	2	4,150	5,900
N. Y.	2 1/7	32 1/7	84,250	95,000
N. J.	5/7	10 4/7	27,400	31,400
Dela.	1/14	5/7	1,250	2,000
Md.	2/7	4 2/7	11,520	13,270
D. C.	1/7	1 4/7	3,790	4,540
Porto Rico	2/7	3 5/7	9,500	11,000
	5	75 1/2		
ZONE II.				
Pa.	1 5/7	26 2/7	70,000	79,000
Va.	4/7	6 6/7	18,100	20,600
Ohio	1 2/7	18 3/7	48,100	54,600
Mich.	6/7	12 3/7	32,550	36,800
Ky.	4/7	6 6/7	18,100	20,600
W. Va.	2/7	4 4/7	12,050	13,800
	5	75 1/2		
ZONE III.				
N. C.	4/7	8	20,500	23,500
S. C.	3/7	5	13,250	15,000
Ga.	4/7	8 4/7	22,350	25,600
Fla.	2/7	3 6/7	9,900	11,400
Ala.	3/7	6 6/7	18,100	20,600
Miss.	2/7	4 6/7	12,550	14,300
Tenn.	3/7	6 5/7	17,600	20,100
Ark.	3/7	5 2/7	13,350	15,600
La.	3/7	5 2/7	13,350	15,600
Tex.	1	14 5/7	39,000	44,000
Okla.	3/7	6 3/7	16,900	19,400
	5	75 1/2		
ZONE IV.				
Ind.	4/7	8 6/7	23,450	26,700
Ill.	1 3/7	20 6/7	55,250	62,500
Wis.	4/7	8 4/7	22,350	25,600
N. Dak.	1/7	1 6/7	4,630	5,380
S. Dak.	1/7	1 6/7	5,150	5,900
Iowa	3/7	6 6/7	18,100	20,600
Nebr.	2/7	4	10,050	11,800
Kans.	2/7	5 1/7	13,150	15,400
Mo.	4/7	9 6/7	26,200	29,700
Minn.	4/7	7 5/7	20,000	23,000
	5	75 1/2		
ZONE V.				
Mont.	2/7	3 6/7	9,500	11,000
Idaho	2/7	2 6/7	9,400	10,900
Wyo.	1/7	1 6/7	4,170	4,920
Colo.	3/7	7 2/7	19,200	21,700
N. Mex.	1/7	2 4/7	7,800	7,900
Ariz.	1/7	3 1/7	8,000	9,500
Utah	2/7	3 4/7	9,000	10,500
Nev.	...	3/7	790	1,540
Wash.	5/7	10 4/7	27,800	31,800
Oreg.	3/7	5 1/7	16,200	18,200
Calif.	2	....	81,350	92,100
Hawaii	1/7	1 6/7	4,350	5,100
Alaska	...	2/7	....	....
	5	75 1/2		

10,000 WATTS MAXIMUM IS DAVIS' IDEA

By Edwin L. Davis

Introducer of the Equalization Amendment in the House of Representatives

The harmful effects of any power in excess of 10,000 watts far outweigh the benefits accruing to the station employing the higher power.

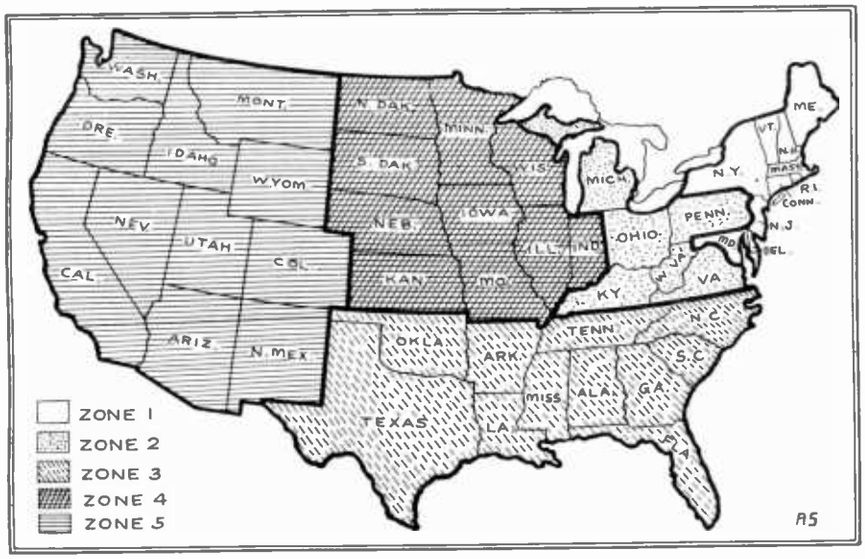
Furthermore, I suggest that the tentative plan is overloaded with so-called national stations, to which it is proposed to assign not only the most of the wavelengths, but of the aggregate power as well.

It occurs to me that it would be much preferable and prove more satisfactory as a whole to provide for twenty-five stations authorized to employ not exceeding 10,000 watts power, and each assigned exclusively a single full time wavelength, and have twenty-five stations authorized to use 1,000 watt power and whatever number and division that might be deemed advisable of stations authorized to employ 500 watts, 100 watts or 50 watts or less, this number, of course, being made to conform to the number of stations and the aggregate station power which the commission may determine to be proper for the broadcast structure.

Chain programs should undoubtedly be made available so far as practicable to those who desire to hear them, and yet they should not be given such assignments of wavelengths and power as will prevent the satisfactory broadcasting and reception of independent programs.

Even from the standpoint of getting the National Broadcasting Company's chain programs to the various sections of the country, there is no occasion for granting such stations a monopoly of power or desirable and cleared channels.

THE FIVE ZONES



HOW THE UNITED STATES IS DIVIDED INTO FIVE RADIO ZONES.

Home Talking Movies Are Promised by R.C.A.

Formation of a new company to be known as "RCA Photophone, Inc." was announced by Major General James G. Harbord, president of the Radio Corporation of America, who will act as chairman of the Board of Directors of the new subsidiary company. The enterprise has been entirely financed by the Radio Corporation and the General Electric and Westinghouse Companies and there is no public offering of its securities.

The RCA Photophone, an apparatus for synchronizing motion pictures with voice and music, will be sold to motion picture theatres, schools, churches and other institutions.

Engineers of the Radio Group are now at work in their laboratories on a simplified photophone device suitable for use in the home, which will make it possible to reproduce talking movies in the home very much as the ordinary radio broadcast programs are now being received in more than eight million homes.

Personnel Selected

General Harbord announced that the other members of the Board of Directors would be Owen D. Young, Gerard Swope, Paul D. Cravath, E. M. Herr, E. W. Harden, Cornelius N. Bliss, James R. Sheffield and David Sarnoff.

The president of the new company will be David Sarnoff. Elmer E. Bucher will be vice-president, in charge of commercial activities. Dr. Alfred N. Goldsmith will be vice-president in charge of technical matters. The other officers of the company will be George S. De Sousa, treasurer; Lewis MacConnach, secretary, and Charles J. Ross, comptroller. A board of consulting engineers has been created and its members are Dr. Goldsmith, C. W. Stone and S. M. Kintner.

Sound Recorded on Film

In discussing the formation of the new company, Mr. Sarnoff pointed out that although the Radio Corporation, General Electric and Westinghouse had been preparing for several years to market apparatus synchronizing voice and music with motion pictures, public introduction of the apparatus had been delayed until the engineers had achieved "complete practicability" so that it would be as simple to operate as a radio set, and, at the same time, highly perfected.

"The Photophone," said Mr. Sarnoff, "is both simple and practical. The essential principle is the recording of pictures and sound on one film. While various methods have been devised for talking movies, experience has shown that the most practical is that of recording pictures and sound on the same film. This is the method employed by the Photophone.

"Ladies and Gentlemen, the President!"

"It is now possible to photograph the President of the United States—voice as well as action—and to distribute films reproducing the event throughout the country.

"Easily operated reproducing apparatus for use in theatres, schools and churches will be nationally available. An entire opera, musical comedy or drama can be electrically recorded on the film, just as it is seen and heard, and then reproduced from the same film. Whatever can be seen or heard, whether it is a nightingale singing or an army in battle, can now be recorded and reproduced for both the eye and the ear. Moving picture dramas with complete orchestral accompaniment, or with music and speech, will be available for nationwide use.

New Acoustical Features

"Standard films without the sound can be used without any change in the machine. The only thing the operator has to do is to close one switch when he is projecting pictures with sound, and open it when he does not want the sound. Any type of talking film can be used in the machine. The type of sound reproducer to be used will vary with the size of the room in which the pictures are to be shown. The reproducer embodies some remarkable new developments in acoustics.

"It is entirely possible, and I may say probable, that the new device will be used to stage debates on great national issues. Presidential candidates, photographed while speaking, can be shown the same evening on the same film, one earnestly presenting one side of a national question, the other eloquently presenting the other side."

Mr. Sarnoff stated that the new company would make its products available to the entire motion picture industry, as well as to individual home-users. Through the National Broadcasting Company, another Radio Corporation associate, it will be able to obtain programs and artists which can be recorded and reproduced by the R.C.A. Photophone.

Experimental motion picture laboratories at 411 Fifth Avenue have been established by the Photophone Company for the development of "talking movie" technique. With 20,000 motion picture houses, 150,000 churches and 270,000 schools in the United States, the new company expects to develop a very large market for its apparatus.

NEW CHANNEL DISTRIBUTION BEING MADE

Washington

The Federal Radio Commission is compiling a new allocation of broadcasting stations to become effective as soon as possible, according to a statement made public by the Commission. Meanwhile, the Commission has extended all broadcasting station licenses for 30 days from April 1.

The statement in full text follows:

"To bring the status of broadcasting station licenses into strict compliance with the new legislation by Congress, providing equal and equitable distribution of licenses, powers, frequencies, and time of operation the Federal Radio Commission is compiling a new allocation of broadcasting stations and powers, to be put into effect at the earliest possible date."

AC Voltage Regulators Operate on All Frequencies

Radio receiver and power amplifier owners who contemplate the purchase of an AC voltage regulator, for use in the power line circuit, to reduce the line voltage to the correct value so as to preclude the possibility of excessive filament voltage, should bear in mind that these units operate with equal facility on all frequencies.

A resistance which does not possess capacity or inductance functions in like manner in DC or AC circuits, that is as a pure resistance and has no capacitative or inductive effect upon the circuit and is therefore independent of frequency. Because of the prevalent use of wire wound resistances as the voltage control devices, and because these resistances are wound upon a form, the enginering department of the DeJur Products Co. has carried out experiments upon their voltage regulator, and have conclusively determined that the inductive and capacitative effects at frequencies from 25 to 133 cycles are so small that the resistance can be considered as a pure noninductive and capacitative resistor.

A full page of Definitions for Novices will be published next week, May 5 issue; also articles on Ferranti Push-Pull Amplifier; Choice of Audio Transformers; New Standard Frequency Plan.

Amateurs Rejoice on Spurned 10-Meter Wave

Hartford, Conn.—Continuing their reputation for developing radio wavelengths commercially regarded as worthless, the amateur operators of the world are now attacking the problem of transmission and reception on a wavelength of ten meters with favorable indications for success, according to information given out by the American Radio Relay League, the national organization of amateurs and experimenters with headquarters in this city.

When the nations of the world met at the International Radiotelegraph Convention at Washington recently to allocate all useful wavelengths in the radio spectrum, engineers pointed out that the lowest useful wave was in the neighborhood of thirteen meters, and that waves below that must be regarded as valueless and impractical for communication purposes. The amateurs, who for several years have been working experimentally on five meters, immediately petitioned for a band in the vicinity of ten meters for their exclusive use.

Request Granted

The band was given them, and, through the action of the Federal Radio Commission of this country, was made available to American amateurs a few weeks ago.

Since that time an increasing number of American amateurs has been constructing apparatus for transmitting and receiving on these extremely high frequencies.

Tests are being organized between stations in this country as well as between amateurs of the United States and foreign countries. Judging by the increasing range of shorter waves, it is believed that the ten-meter band will be useful chiefly for international contacts, over long distances, although tests will be made with various types of antennas and reflectors to secure operation over storter distances.

Success Expected

With many highly enthusiastic and persistent experimenters working on the problem, it is believed only a matter of time before the possibilities of ten-meter communication are ascertained, according to Kenneth B. Warner, secretary of the American Radio Relay League.

"It has always been the lot of the amateur to explore and develop new territory," stated Mr. Warner. "When we asked for the ten-meter band we did so with a full knowledge of adverse technical opinion and expert judgment which states that such wavelengths are worthless for practical communicating purposes. We have a great deal of faith, however, in the ability of the amateur to exhaust every possibility of a given wave band.

"Amateurs as a group have shown the greatest interest in the ten-meter band, and already many of them are working on it. We do not expect too much in the way of success, but at least, if there are any possibilities in this wavelength, we will soon find it out."

LOW WAVES, ONE POWER, ADD TO DX

Hartford, Conn.

When a broadcast station wants to increase its range, it increases its power. When an amateur short-wave operator wants to increase the range of his station, he changes wavelength and does not increase power at all.

Several years ago, when short waves were first being investigated, the amateur found out that increases or decreases of the power of his transmitter meant very little, but that the particular wavelength used meant much. An eighty-meter wave, for instance, was found good for ranges of 50 to 1,500 miles at night, more or less regardless of the power used, and a forty-meter wave for distances of 1,500 to 5,000 miles.

Consequently, if an East Coast amateur using a low-power transmitter on eighty meters for communicating with stations in the midwest wishes to communicate instead with the Pacific Coast, or Europe or Australia, he does not put in a larger transmitter, but merely changes to forty meters, confident that his low-power set will be just as effective over the long distances on 40 meters as it was at the shorter distances on eighty.

For extreme distances at night, and moderate long-distance work in day-light, 20 meters is used.

RADIO PACT IS RATIFIED BY SENATE

Washington.

The International Radiotelegraph Convention, drawn up by representatives of about eighty countries meeting in Washington last October and November, has been ratified by the Senate.

The text of the convention and the general and supplementary regulations regarding the international uses of radio was made public December 17, 1927. It bears the signatures of practically every nation in the world employing wireless communications, with the notable exception of Russia. That country was not invited to participate in the conferences because the host government, the United States, is not on diplomatic terms with Russia.

The American delegates, at the final plenary session, signed the convention and a set of regulations which conform with the principle of private operation of communications facilities in this country. Most of the other delegations signed a second set of regulations applying to countries which operate wireless as a government monopoly or government-controlled enterprise.

Ratification of the convention by a vote of the Senate will put it into effect for the United States January 1, 1929. It is binding only upon the countries whose legislatures ratify.

Under article 22, the convention will remain in force for an indeterminate period and until one year from the day on which a denunciation shall have been made. A second conference looking toward possible revision will take place in Madrid in 1932.

CeCo's Capitalization Raised to $1,000,000

The C. E. Manufacturing Co., Inc., of Providence, R. I., makers of the well-known CeCo radio tubes, has just completed the most successful and profitable year in its history.

The sales increased approximately 40% during 1927 over the year 1926, and its business during the first three months of 1928 has been 100% more than for the corresponding months of 1927.

The future business now on order reaches a total of approximately 400,000.

The capitalization of the C. E. Manufacturing Co., Inc., has recently been increased to $1,000,000, and it is understood that a large special stock dividend will be declared.

The progress of this company is reflected also in the acquisition of 30,000 additional feet of floor space, which will be devoted to research work, laboratory and experimental purposes.

The engineering department personnel has been strengthened by the addition of several well-known radio engineers.

The successful manufacturing of tubes today requires the maintenance of elaborate technical equipment, and the employment of engineering brains of the highest calibre.

The C. E. Manufacturing Co., Inc., by means of its augumented technical staff and increased laboratory equipment, is now able to render to the radio trade and radio public a quality of service second to none in the industry.

From a modest beginning in 1923, the C. E. Manufacturing Co., Inc., has developed to its present position as one of the three outstanding successes in radio tube manufacture, growing from a small plant five years ago, employing only 20 persons to the present large plant employing 200 skilled tube makers.

From the making of only 3 types of tubes the CeCo line has developed to its present output of 20 distinctive types of CeCo tubes for the domestic market, and 8 special types for export market.

Ernest Kauer, head of the enginering staff, said that several new types of CeCo tubes are in preparation, and their production will shortly be announced.

The aggressive advertising of CeCo tubes has worked hand in hand with the quality of the tube themselves to build consumer approval for CeCo radio tubes.

The officers of the company are: president, George Coby; treasurer, Eli Egnatoff; vice-president and chief engineer, Ernest Kauer; secretary, Wm. Cepek; director of sales, Harry H. Steinle; assistant director of sales, Edward R. Fiske.

Engineer Goes Abroad to Get Television Data

To obtain the most exacting data with reference to the possibilities of radio television and other new radio products that are in the process of development abroad, C. H. Bunch, chief engineer of the Acme Electric & Manufacturing Company of Cleveland, Ohio, large manufacturers of radio products and pioneers in the radio industry, will tour cities of Europe.

He will consult with the most prominent radio engineering authorities abroad and expects to return with sufficient valuable information that will enable The Acme Elec. & Mfg. Company to develop and market a commercial television device. Mr. Bunch will return to attend the Radio Manufacturers' Association show at Chicago.

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The First and Only National Radio Weekly

Radio World's Slogan: "A radio set for every home."

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Receipt by new subscribers of the first copy of RADIO WORLD mailed to them after sending in their order, is automatic acknowledgment of their subscription order. Changes of address should be received at this office two weeks before date of publication. Always give old address; also state whether subscription is new or a renewal

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1 Page, 7¼" x 11"	462 lines	$300.00
½ Page, 7¼" x 5½"	231 lines	150.00
½ Page, 8¼" D. C.	231 lines	150.00
¼ Page, 4½" D. C.	115 lines	75.00
⅛ Page, 4½" S. C.	57 lines	37.50
1 Column, 2¼" x 11"	154 lines	100.00
1 Inch		10.00
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Time Discount

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WEEKLY, dated each Saturday, published Wednesday. Advertising forms close Tuesday, eleven days in advance of date of issue.

CLASSIFIED ADVERTISEMENTS

Ten cents per word. Minimum 10 words. Cash with order. Business Opportunities, ten cents per word. $1.00 minimum.

Entered as second-class matter March 23, 1922, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

So Far and Yet So Near

Three brave men took off in an airplane from Ireland to make the east to west ocean trip from continent to continent. Others had attempted this and all had failed.

The world was enthralled by the possibilities of this adventure. Came two days of anxious waiting, until finally it seemed that these two courageous Germans and their Irish companion had paid the toll..

Then as all civilization, with frayed nerves and almost bankrupt in hope, waited to hear the worst, word was speeded around the world that those indomitable spirits had triumphed—and radio was the medium through which the joyful tidings came. . And for many long days after that landing in bleak Labrador, the only news that reached the outside world was in the form of radio messages. Thus again radio was first and foremost in its help and encouragement and was the means that made the three airmen know that succor was near and told the world all was well, confirming the fact that, after all, the remotest of those we love and admire are only a thought and a flash away from us

Television in 5 Years, Not Now, Says Trade

"Debunking" of some widespread misconceptions regarding television and other new radio developments, far from ready for general public use, was the subject of a statement from the Radio Manufacturers' Association.

Television is far off, probably five years at least, in the best opinion of radio engineers, and only then as a separate, distinct and costly apparatus, and not as an attachment to a radio broadcasting receiving set, said the statement. In advising the public against waiting now for television and that it is a separate device. H. B. Richmond, of the General Radio Co., Cambridge, Mass., director of the Engineering Division of the Radio Manufacturers' Association, said that erroneous ideas regarding new radio apparatus were a new menace to the radio industry.

"Unfortunately," said Mr. Richmond, "statements have been made by men high in radio which are true enough when discussed in engineering circles, where all realize the commercial limitations, but when taken up by the public at large, and through the general press, have become so emphasized that they are the equivalent to misstatements.

Appeals to Imagination

"Television! What a wealth of material for the imagination. Today television, and particularly its simpler counterpart, telephotography, is in a limited way a practical reality commercially and also for the more experienced amateur.

"What will tomorrow's developments in television bring forth? Is today's radio set junk? Most emphatically not! Why? Television is not an attachment to a radio set. It is a separate and distinct piece of equipment, and elaborate and very costly equipment at that.

"Fully ten years ago," Mr. Richmond continued, "we read in the daily press about the possibility of television being attached to the home telephone set, so that one might see the person with whom he was talking. How many of us have television attachments with our phones? It is perfectly practical, but not commercially.

Groundless Fear Cited

"Why, then, should it be any more practical commercially, with all the added intricacies of radio?

"It is evident that it is not and, therefore, one is safe in assuming that his set will not be replaced by tomorrow, or for many tomorrows, by one embodying television possibilities.

"Television is new. It is something added. It, therefore, excites the imagination of all. Television and telephotography are going to be reasonably practical as additional items of radio for which the listener may hope. He will have two sets instead of one. Under any of the present methods, there is nothing in his regular broadcast set that may be used simultaneously with television, as part of the television receiver.

"You may say that it is all right to dismiss such a complicated subject as television without further discussion, but what about the host of devices being brought out every day? Will not some of them make your set obsolete tomorrow?

The Automobile Case

"The best answer for this is to look into other industries, for example, the automotive industry. In the past decade many new devices have become practical realities, for example, balloon tires and four-wheel brakes. When these two items appeared, did they make every automobile obsolete? Of course not. It took several years for them to become generally accepted and even today you will find hundreds of thousands of cars, probably millions, on the road without either balloon tires or four-wheel brakes.

"Radio is not a new or mystic art. It is a new application of old phenomena. Its development is slow and steady. Naturally, where there is progress, there is obsolesence. But clothes are just as warm, regardless of the style; in fact, many old style clothes are far warmer and more serviceable than many modern garments.

"Just so with a radio set. The earlier sets operated entirely from a crystal. The vacuum tube, with its associated circuits, was a real improvement.

DC Set May Be Better

"Going a step farther, the lighting of the filaments without a battery, but directly from the light socket, is a convenience. It is not an improvement in the circuit iself. Accordingly, a battery set is by no means obsolete. Like the clothing example just referred to, many of the battery sets are just as good, and some better, from a radio viewpoint, than some of the newer all-electric sets.

"In buying a set, or in considering whether or not one's set is ready to be discarded in favor of a new model, one should apply just exactly the same types of tests that are applied to an automobile, to clothing, to a thousand and one other things.

"Do not be misled by extravagant claims, just because they are radio.

The Ridiculous Arrow

"Just a word or two may be added regarding some radio accessories. Not long ago an item shaped something like an arrow made of copper was sold to be attached to aerials. It was the idea to have the arrow pointing toward the set in the belief that it would draw the radio waves into the set, very much the same as water is carried down a rainspout. Any electrical engineer realizes the absurdity of such a device. First of all, a radio antenna does not collect radio waves the way water is collected in a spout. It acts in a very complicated manner, somewhat similar, perhaps, to a straw following the impulses of a breeze. Further than this, the waves are of a varying nature, so that in their rise and fall half of the time the device referred to would be a hindrance instead of an aid.

"This particular arrow-like device is only representative of a vast number of other aerial devices. Cages looking like rat traps are in the same class, balls on the top of masts, aerials buried under the ground, and a host of similar contraptions. To be sure, the rat trap aerial acts satisfactorily, but not because of its shape. It gives a certain effective capacity to the whole antenna system. A less elaborate device would do the same thing.

Entitled to Money's Worth

"The American Medical Society has available a vast amount of information regarding prepared medicines. This information is not to restrict the sales of medicine, but simply to let the public know that it is getting its money's worth. If one is willing to pay $5.00 for a nickel's worth of disinfectant, there is nothing to stop the transaction. The purchaser, however, is entitled to know what he is really getting for his money.

"Radio listeners are entitled to purchase whatever they desire and at whatever price they care to part with. It has been the intent, however, in these remarks to give the listener a few facts that will enable him to get real value out of his radio purchases, and once having made them, to dispel the somewhat prevalent fear of having them become obsolete tomorrow."

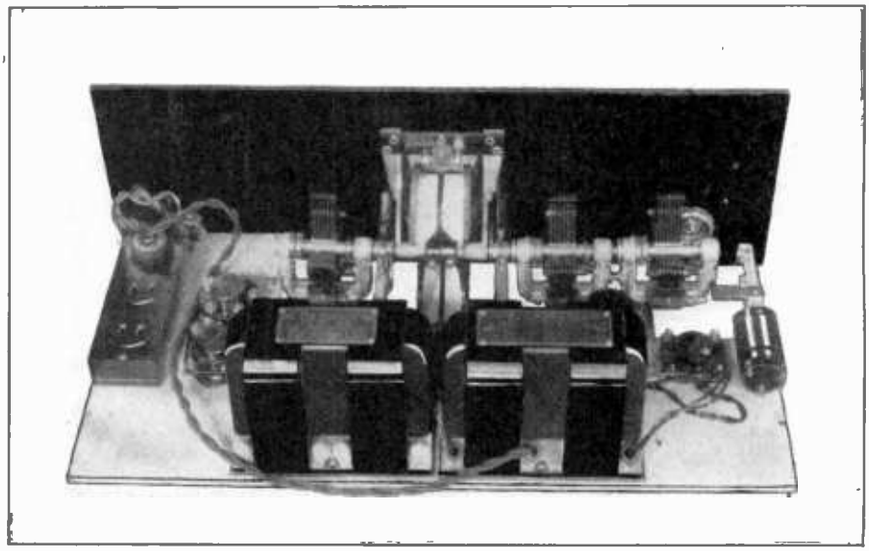
5-Tube Set for A C Fits Convenience

A very handy feature of the AC5-tube TRF receiver described last week (April 21) is the Victoreen socket block. One line switch, which is placed on the panel, is connected in the primary of the supply line. When this switch is opened the power is shut off from all the transformers and tubes in the receiver. When it is closed all the power is on. The socket block is provided with a standard chord and plug for insertion in the nearest convenience outlet.

On the receiver side of the line switch are three outlet sockets connected in parallel for the insertion of the primaries of the filament transformer, power transformer, chargers if necessary, and other devices.

This device takes little space, yet it is thoroughly efficient. And it is a great convenience.

It will be observed that although the filament and the audio transformers are of large dimensions and that not less than three tuning condensers are used, with a drum dial, the set does not take much more room than an ordinary receiver. Yet it conntains everything but the loud speaker and the B battery eliminator. This compactness is due to the choice of parts and the ingenious layout. The condensers are placed on a single shaft next to the panel, and as these condensers have only a small swing, the row of tubes can be placed close without mutual interference.



INTERIOR VIEW OF THE VICTOREEN-HAMMARLUND AC RECEIVER. THE VICTOREEN 112 AUDIO UNIT AND THE VICTOREEN FILAMENT TRANSFORMER ARE IN THE FOREGROUND. THE VICTOREEN THREE SOCKET OUTLET BLOCK IS AT THE LEFT REAR AND THE HAMMARLUND TUNING GEAR IN THE CENTER NEXT TO THE PANEL. SMALL FRESHMAN TYPE COILS ARE USED FOR TUNING INDUCTANCES. THIS RECEIVER IS COMPLETE EXCEPT FOR THE LOUDSPEAKER AND THE B BATTERY ELIMINATOR.

NEW CORPORATIONS

Wonder Cabinet Co., Radio cabinets—Att. M. Blin, 2 Rector St., New York.

Caldwell Radio and Music Salon. Inc., Caldwell, N. J.—Att. Bloom & Cohen, Caldwell, N. J.

Arena Radio and Electrical Supply Co.—M. Davidoff, 41 Park Row, New York, N. Y.

Child's Radio Co., Musical Instruments, Attorneys, A. B. Nathan & S. H. Imbrey, 110 William St., New York, N. Y.

International Television Corp., Radio Apparatus, Attorneys, Barron, Rice & Rockmore, 220 West 42 St., New York, N. Y.

Literature Wanted

THE names and addresses of readers of RADIO WORLD who desire literature on parts and sets from radio manufacturers, jobbers, dealers and mail order houses are published in RADIO WORLD on request of the reader. The blank below may be used, or a post card or letter will do instead.

RADIO WORLD,
145 West 45th St., N. Y. City.

I desire to receive radio literature.

Name .....

Address .....

City or town .....

State .....

William Rose, 75 Tompkins Ave., Brooklyn, N. Y.
Gordon Dukek, 1942 Lamar Bvd., Memphis, Tenn.
H. Walsh, 167 Water St., Newburyport, Mass.
L. D. Rowland, 1512 W. 9th St., Sioux City, So. Dakota
D. S. Smith, 7009 Ogontz Ave., Philadelphia, Pa.
J. E. Deal, Rogerson, Idaho
H. M. Scoonover, 5 W. Webster St., Marshalltown, Iowa
James Ott, 123-18 146th St., So. Ozone Pk., L. I., N. Y.
Edward Woerz, 9 Hall Place, Tuckahoe, N. Y.
J. D. Avery Ave., Huron, S. D.
Orle J. Pomeroy, Fremont, Iowa
Wm. Fiore, 1101-66, Brooklyn, N. Y.
Kreth McKee, Money, Mississippi
John Myszenski, 2237 Yemans, Hamtramck, Mich.
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Paul S. Estep, 243 Cherry Street, Wauseon, Ohio
Willard Huffman, Chestnut St., Wauscon, Ohio
Wlson Hanenstein, McKinley Avenue, Wauseon, Ohio
J. Galloway, 11 Margord Ave., W., Detroit, Mich.
Howard R. Deane, Storm King School, Cornwall-on-Hudson, N. Y.
Arthur Kransberger, Stearns Rd., Temperance, Michigan
Ira D. Witten, 1215 E. 37th St., Brooklyn, N. Y.
W. J. Haynes, 870 3rd Ave., Troy, N. Y.
J. Daly, 17 East 124th St., New York, N. Y.
W. H. Merritt, 502 No. 4th St., Phoenix, Ariz.
E. Cooney, 507 14th St., Oakland, Calif.
F. Rongas, 1402 Barnett Bld., Jacksonville, Fla.
Ira Schiller, 320 Walsh Court, Brooklyn, N. Y.
A. E. Stuart, 205 Monroe, Cleburne, Texas
P. W. Fitzkee, Philtower Bldg., Tulsa, Okla.
Samuel Brown, 201 Mt. Holly Ave., Mt. Holly, N. J.
M. Weiman, 660 Snediker Ave., Brooklyn, N. Y.
W. E. Hutchinson, 130 N. 220 St., Camden, N. J.

Eleven Good Rules for Filter Condensers

For effective service in electric radios, condensers must have the following qualities:

(1) Effective insulation—This insulation must withstand high-voltages without breakdown. It must be able to withstand these voltages continuously, month in and month out, in spite of variations in temperature and without deterioration.

(2) The insulation must be compact, that is to say—thin. The closer together the plates of a condenser can be set, the smaller those plates have to be, and the more compact the condenser itself will be for any given capacity. With sufficient separation and thickness of insulation or dielectric, it is not difficult to make a condenser which is satisfactory—but it will be too large and might easily take up most of the space in a radio cabinet.

(3) Freedom from leakage—E v e n though the insulation may be capable of withstanding the breakdown if it is not of such quality as to set up an enormous barrier to electric current at high-voltages a certain amount of current will leak through, heating up the condenser and causing it to deteriorate slowly. The current passing through must be practically nil. For best results, a one Mfd. condenser should have a resistance not less than 150,000,000 ohms.

(4) Compactness—As we have seen, this depends upon the insulation used. It is also dependent upon—

(5) Thickness and effectiveness of material used for plates. This is usually tin foil of a special quality. It must be very thin.

(6) Accuracy—Condensers must have a capacity very close to their rating. If much variation is allowed, the purchaser cannot be sure they will do the intended work. Accuracy should not vary more than 5 per cent.

(7) Rigid construction—To maintain this accuracy the construction must be rigid so that the relation of the parts will not change. The condenser must be cased in such a way as to preserve the accuracy.

(8) Proper casing and packing—The condenser must be attractively cased. It is also preferable in reducing the hum in a B-Eliminator to put the condenser in a metal case, which can be connected to the ground. The condenser must be packed in an attractive carton for display on the dealer's shelf.

(9) Convenience of connection to wiring—Proper soldering lugs must be provided, so connected to the condenser that some little abuse with the soldering iron will not cause damage.

(10) Means of securing to set—The condenser must have suitable strong lugs for securing it to the baseboard or other part of the apparatus in which it is installed.

(11) Insurance of quality to purchaser—Every high-voltage condenser should be tested and stamped with date of test and initials of tester. The customer is then insured against defect.

First Trade Training Course Is Inaugurated

The first vocational training course for radio service men as a national enterprise, undertaken by the Radio Manufacturers Association, has been launched successfully at Newark, N. J.

The new vocational training school, established by the Essex County, New Jersey, Board of Education, in cooperation with the Radio Manufacturers Association, has opened its doors with a class of youths embarking upon a full three years training course. The Essex County course is well financed and organized under the direction of Robert O. Beebe, director of the Essex County, schools and James F. Johnson, assistant supervisor of vocational training. A night radio school also is contemplated.

Success of the first radio servicing school established by the Association has interested many other institutions of technical training, including the Baltimore Board of Education, a Pittsburgh radio school, the Y. M. C. A., private trade schools, and even correspondence institutes and technical employment concerns. Public interest in radio as a vocation also has been widely evinced.

The Association endeavors to develop trained radio service men, to aid not only the radio industry, but the public in its purchase and satisfactory use of radio sets, is regarded as of such importance that the Association's board of directors is establishing a special committee to plan and execute a program for national development of radio service schools.

Radio manufacturers, jobbers and retail dealers of Newark and the adjacent New Jersey vicinity aided in planning the Newark vocational course and are making contributions of man power and material toward its success.

That opportunities in the radio industry not only as service men, but as salesmen and in other higher capacities, exist for men having technical service training, is the opinion of radio industry leaders of the Association's board of directors. Most of them believe that salesmanship as well as technical training should be given in service vocational courses.

Special personal qualifications also are regarded as desirable. In considering the question of providing the public and the industry with a supply of trained service men by establishing vocational training courses nationally, manufacturing industry leaders, members of the Association's directorate, agree that a grammer school education for trainees is imperative and high school training desirable. Estimates of the salaries and prospects for trained service men range from $25 to $50 a week and higher as trainees develop in the industry.

Among interesting statements from RMA Directors regarding the training of service men and their opportunities are the following:

A. T. Haugh, Rochester, N. Y.—"Opportunity lies in the graduation of the service man into a radio salesman. I do not mean to say that a man thoroughly grounded in radio service work can immediately become a good radio salesman, but I certainly believe that a grounding in service work is necessary to radio salesmanship and the best kind of a beginning towards taking up the latter work. The opportunities in salesmanship, of course, are unlimited."

Morris Metcalf, Springfield, Mass.—"The radio industry has grown more rapidly than any other industry and is one of the few in this country that is constantly short of good men in all branches.

In my opinion the field is wide open and there is plenty of opportunity. A really good radio service man will have many opportunities to step up into higher jobs, either in the sales or engineering or manufacturing departments of the business."

Lester E. Noble, Buffalo, N. Y.—"The ultimate future, opportunities, compensation, etc., of men trained in radio servicing, are, undoubtedly, most limited if such individuals are themselves limited in their capacity to service work, since the are undoubtedly tends toward the reduction of the need for service work, as well as tends towards the reduction in the degree of training, experience and intelligence required for the carrying on of such service work. Because, however, the natural field of activity of the service man is extremely varied, since it includes not only contact with product, but contact with the customer, the experience of actual service work should prepare him for sales and actual executive work."

E. N. Rauland, Chicago, Ill.—"A service man who has, in addition, sales ability should be able to earn up to $30 per week with a dealer, $50 with a jobber, and as much as $100 per week as a sales engineer for a manufacturer."

A. J. Carter, Chicago, Ill.—"I should say a sufficient time should be given to theoretical and practical work to properly acquaint the student with fundamentals, and a small proportion of time be devoted to the question of salesmanship. As the radio industry grows, there will be of course increased demands for those properly trained in radio servicing and sales work, just the same as in the automotive field."

L. G. Baldwin, Cleveland, Ohio.—"There is a good opportunity and actually positions waiting for high class service men. There are too many poor service men in the field today. The com- with service lines in other work. A good service man should make anywhere from $40 to $50 a week from a salary standpoint alone."

Station Put Off Air For Wave Wabbling

Washington.

The Federal Radio Commission has for the first time ordered a station off the air for deviating from its assigned frequency more than permitted by the commission.

The station ordered off the air is WNBA, Forest Park, Ill. Michael T. Rafferty of station WNBA was notified that "due to your consistent violation of commission's General Order No 7 specifying maximum deviation from frequency assignment, you are hereby ordered to discontinue operation until further notice."

Commissioner Sam Pickard, who is in charge of the Chicago zone, was informed that this station was continually "interfering with good programs."

The banished station was supposed to operate on a frequency of 1440 kc but it deviated more than 500 cycles.

Two New Licensees Under R. C. A. Patents

The Phanstiehl Radio Company, Waukegan, Ill., has transferred its license, granted by the R. C. A. for TRF receivers and power amplifier units, to the Grigsby-Grunow-Hinds Co., 4540 Armitage Avenue, Chicago. The Grigsby-Grunow-Hinds Co. manufacture Majestic B eliminators, but expect to branch out.

The Sterling Manufacturing Company, of 2831 Prospect Avenue, Cleveland, Ohio, has been licensed by the R. C. A. under the TRF and power supply and amplifier patents.

EVERY FRIDAY at 5.40 P. M. (Eastern Standard Time) Herman Bernard, managing editor of Radio World, broadcasts from WGBS, the Gimbel Bros. station in New York, discussing radio topics.

MEMBERS OF THE TRADE—Write for proposition on blueprints of 4-tube Diamond (standard tubes), 5-tube Diamond (standard tubes), and 4-tube Shield Grid Diamond (one SG tube). Guaranty Radio Goods Co., 145 W. 45th St., N. Y. City.

Tobe "A" Filter

Tobe Deutschmann Co., 11 Windsor St., Cambridge, Mass., has just announced a filter suitable for an A battery eliminator. The filter consists of a 3,600 mfd. dry electrolytic condenser and choke coils with adequate current carrying capacity. The filter is intended for use with chargers such as the 2 ampere Rectigon and Tungar chargers. When the filter is connected between the output of one of these and the filament circuit of a receiver which does not take over 2 amperes a steady, well-filtered filament current will be available as long as the power is on.

Two New Wires

Flex-O-Color and Cell-O-Flex are two additional radio products of the Wheeler Insulated Wire Co. Oswald Dale, insulation engineer, vice-president of the organization said special consideration was accorded the design of these connection wires to provide an insulation which will not fray when the wire is stripped and which will not burn when the wire is touched with a hot iron.

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LARGE MANUFACTURER of popular priced Radio Cabinets wants representatives selling radio dealers. Models listing at $13 and up. Well made in large modern plant. Quantity sellers. Straight commission basis. For full details, address Drawer RW 10, Boonville, N. Y.

"RADIO THEORY AND OPERATING," by Mary Texanna Loomis, member Institute of Radio Engineers, Lecturer on radio, Loomis Radio College. Thorough text and reference book; 886 pages, 700 illustrations. Price $3.50, postage paid. Used by Radio Schools, Technical Colleges, Universities, Dept. of Commerce, Gov't Schools and Engineers. At bookdealers, or sent on receipt check or money order. Loomis Publishing Company, Dept. RW, 405 9th St., Washington, D. C.

GUARANTEED Safety Razor, with strop, in neat, strong carrying case, 25 cents. First-class, new. Send coin, M. O. or stamps.—P. Cohen, 236 Varet Street, Brooklyn, N. Y.

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NEW SHIELDED GRID TUBES for Diamond, S-M Six or Laboratory Super, Tyrman 70. Price $5 each. Philip Cohen, 236 Varet St., Brooklyn, N. Y.

MAGNAVOX M7 cone speaker, List $15, A1 condition, used two weeks. Fine tone. Price, including baffle, $9. Send M. O. on 5-day money back guarantee. I. Andersen, 118 Goodrich St., Astoria, N. Y. City.

A Scientific Trouble-Shooting Test Set

Consisting of Tube Checker That Reads Filament Voltage and Plate Current; Extra Meter Reads Plate Voltage, including B Eliminator Voltages.

Only $10.00

The best inexpensive combination for trouble-shooting is a Double R Tube Checker, comprising a 0-10 D.C. milliammeter, a 0-6 D.C. voltmeter, a switch, a rheostat and a socket. Add a high resistance voltmeter (0-300 v.). With these it is advisable to use a plug, so that all you need do is remove a tube from a receiver that you're testing, put the plug in the empty socket and the removed tube in the socket of the tester. You can immediately find open any short circuits, broken or flimsy connections, reversed connections, etc. The Double R Cord and Plug, the Double R Tube Checker, and 0-300 high resistance voltmeter constitute the Scientific Trouble-Shooting Test Set.

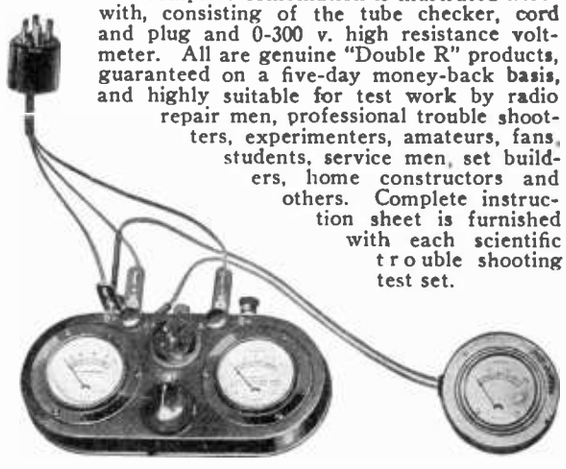
The Biggest Value That $10 Can Buy

No. 210 Tube Checker consists of 0-6 volts D.C. Voltmeter, 0-10 D.C. Milliammeter, Grid Bias Switch, Rheostat, Socket, Binding Posts (with instruction sheet) in handsome noire case....$6.50

The cord terminals of the plug leads correspond with the binding posts of the tube checker. Now connect the 0-300 volts high resistance voltmeter from A+ to B+ posts and you get all necessary readings. You can test plate voltage from B eliminators, or any other B supply, D.C. plate current and D.C. filament voltage, as well as the efficacy of the tube, by throwing the grid bias switch, for the plate current should change within given limits, depending on the type of tube.

No. 346—High resistance voltmeter, for reading any and all DC voltages, including B eliminators, up to 300 volts. Portable type, full nickel finish, long connecting cords and tips $4.50

No. 21—Cord and plug, with markers and lugs that fit tube checker binding posts..$1.85



The complete combination is illustrated herewith, consisting of the tube checker, cord and plug and 0-300 v. high resistance voltmeter. All are genuine "Double R" products, guaranteed on a five-day money-back basis, and highly suitable for test work by radio repair men, professional trouble shooters, experimenters, amateurs, fans, students, service men, set builders, home constructors and others. Complete instruction sheet is furnished with each scientific trouble shooting test set.

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