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RADIO WORLD

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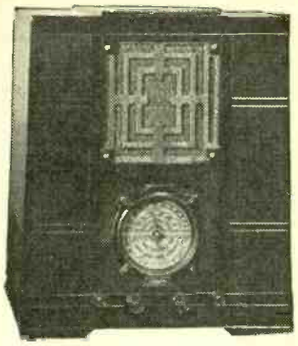
The First National Radio Weekly

678th Consecutive Issue—14th Year

Electrons Limit Amplification

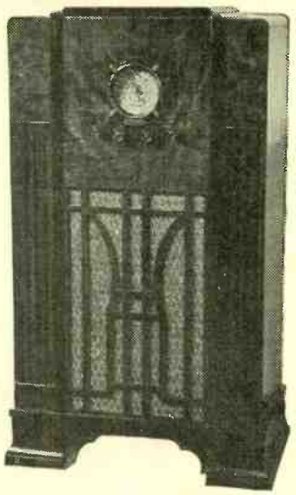
EXPERIMENTS COSTING LESS THAN $2

ALL-WAVE DIAMOND



DE LUXE TABLE MODEL
$32.70

THE All-Wave Diamond, introduced only a few months ago, has proved the most popular receiver we have ever offered. Customers are completely satisfied, delighted, overjoyed. Not only low price—the lowest, in fact—but performance on full par with that of expensive receivers. We highly recommend the all-wave model to broadcast-short-wave listeners. It is obtainable in two table-model forms, De Luxe, as illustrated, @ $32.75, with eight RCA tubes, or Gothic, @ $31.55, or in a console model, as illustrated, @ $41.70. The set tunes from 150 kc to 22,000 kc (2,000 to 13 meters) by front-panel rotary switching. Foreign reception on short waves is guaranteed. Thus you have world-wide reception. Automatic volume control, tone control, manual volume control, five-band switch, latest RCA tubes, large airplane dial calibrated in frequencies and meters, 8" dynamic speaker, 3-gang condenser, and lowest price are the attractions. The circuit is a superheterodyne and easy to tune. Tone quality and selectivity are excellent. Sensitivity is remarkably high as far as consistent with low noise level.



CONSOLE MODEL
$41.70

You can buy the chassis, speaker and tubes, or either table model set, or console model, whichever best suits your needs.

Cat. 1008-WCH, wired chassis, with eight RCA tubes (one 6A7, two 6D6, one 75, one 76, two 42 and one 80) and heavy-duty dynamic speaker, 50-60 cycles, 110-125 v. Primary power consumption 80 watts. Chassis 13" wide, 7" high, 8¾" front to back. Shipping weight 25 lbs.)..... **$26.10**

Cat. 1008-WCH-25, same as above, except for 25 cycles (25 lbs.)..... **27.60**

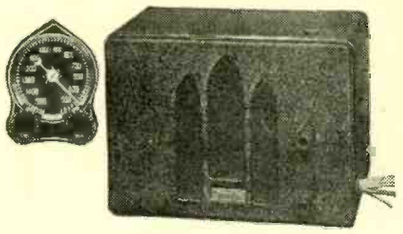
Cat. 1008-WCH-220, wired chassis, etc., for 50-60 cycles, 220 v. (20 lbs.)..... **26.70**

Cat. 1008-WDL, standard chassis in de luxe table model cabinet 14½" wide, 16" high, 9½" front to back (28 lbs.)..... **32.70**

Cat. 1008-WG, table model in Gothic cabinet (28 lbs.) **31.50**

Cat. 1008-WCO, console model, 21" wide, 36½" high, 12" front to back (51½ lbs.)..... **41.70**

Cabinet models as listed above are for 50-60 cycles, 110-125 volts, but are also obtainable for 25 cycles, 110-125 volts @ $1.50 extra or for 50-60 cycles, 220 volts @ 60c extra.



DIAMOND AUTO SET
$23.95

OUR previous model Auto Set was so good that the model was not changed in three years. Now at last it has been improved upon, certain mechanical refinements introduced, and tubes of somewhat higher efficiency included. Some of these tubes were not manufactured until recently. Also the set now has a. v. c.

Our 1009-T Auto Radio is a six-tube superheterodyne set, using one 6A7, one 41, one 75, two 78's and one 84, and tunes from 540 kc. to 1,600 kc. It is a one-unit receiver, ruggedly built for long life, and is equipped with a dynamic speaker. It has an illuminated vernier airplane type control. The manual volume control and lock are one combination. The power consumption is 4 amperes.

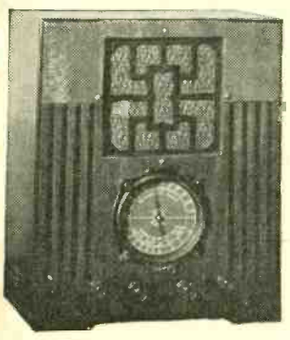
No B batteries required. There is a B-eliminator built in.

This is one of those fascinating auto sets that has single-hole mounting provision, and therefore is a cinch to install. There are only two connections to make: (1) to the ammeter; (2) to the aerial.

The remote tuner is, of course, supplied with the set. And the spark plug suppressors and commutator condenser are supplied also.

The size is 8¼ inches wide, 6 inches high, 6¼ inches front to back. Shipping weight is 18 lbs.

Order Cat. 1009-T, wired, in cabinet, complete with six RCA tubes. Price, **$23.95**



2-BAND DE LUXE
$20.37

ANOTHER popular receiver is the dual-wave type that covers the broadcast band and one short-wave band. On that one short-wave band are found the most important foreign stations. The coverage of the Model 1042-PD receiver is: broadcast band (550 to 1,500 kc) and short-wave band (5,500 to 16,000 kc). Therefore the short waves are tuned in from 18 to 55 meters, and that is the band on which the most important foreign program transmitters are working. Anybody who has not had his taste of short-wave reception will do well to be initiated with either of these two dual-band receivers. Model 1042-PG is illustrated at right, and is a superheterodyne for foreign and domestic reception. There are also the following valuable features: built-in antenna, frequency-calibrated dial, separate short-wave switch (no plug-in coils), dynamic speaker, figured walnut cabinet with figured Oriental overlays. And the price of Model 1042-PG is only $19.17 net.

Model 1042-PD, illustrated at left, is the same circuit in a de luxe table cabinet. The two table models have an airplane frequency-calibrated and illuminated dial, and besides can be obtained for battery operation and 32-volt operation. It is a superheterodyne of the switch type, covering the broadcast band and 18 to 55-meter short-wave band. It has automatic volume control and tone control. It is for 105-120 v. 50-60 cycle operation. Primary power consumption 60 watts; shipping weight, 17½ lbs. Net price. **$20.37**

Cat. 1042-PCH, wired chassis, 9" wide, 7" high, 6" front to back; dynamic speaker, five RCA tubes (one 6A7, one 6D6, one 75, one 42 and one 80), 550 to 1,500 kc and 5,500 to 16,000 kc. For 50-60 cycles, 110-125 v. (14½ lbs.) **$17.10**

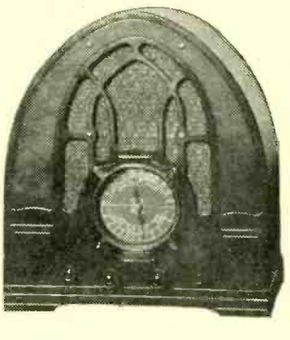
Cat. 1042-PG, table model Gothic cabinet. (17½ lbs.)..... **$19.17**

Any of 1042 series, 50-60 cycles, 220 v. @ 60c extra; 110-125 v., 25 cycles @ $1.50 extra.

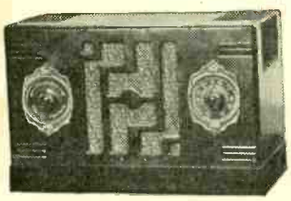
Cat. 1042-PBCH, battery model chassis for 6-volt storage batjery and B battery operation (batteries not supplied); complete with tubes and speaker. (14½ lbs.) **$21.90**

Cat. 1042-PBG, same as above (battery model) in Gothic cabinet, with tubes, speaker. (17½ lbs.)..... **$23.97**

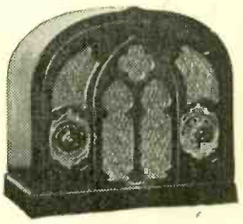
Cat. 1042-PBD, battery model, in de luxe table cabinet. (17½ lbs.)..... **$24.17**



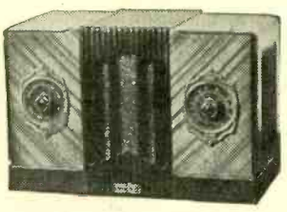
2-BAND GOTHIC
$19.17



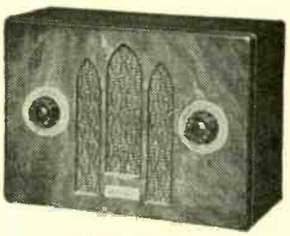
$13.17



$13.77



2-BAND OBLONG
$17.37



AC-DC MIDGET
$11.37

540-1900 KC BROADCAST SET

FOR those interested only in the broadcast band we have a splendid ac t-r-f model DIAMOND OF THE AIR that tunes from 540 to 1,900 kc, and therefore gets some police and amateur calls as well; that has frequency-calibrated and illuminated airplane dial; and that can be bought, complete with tubes, all wired and ready for operation of its self-contained dynamic speaker (left-hand illustration above) at only $13.17. Order Cat. 1041-XG, for 50-60 cycles a.c., 105-120 volts. The same set is illustrated at right in de luxe cabinet, price $13.77. Order Cat. 1041-XD. Not only may the receiver be bought already in either cabinet, but separately as a wired chassis, with speaker and tubes (less only cabinet). Besides, there is a model for 25 cycles a.c., 90-120 volts, and another for 220 volts a.c., 50-60 cycles. This is a tuned-radio-frequency receiver, five-tube model, using two 6D6, one 6C6, one 42 and one 80. It will be noticed that the economical and electrically strong 6-volt series tubes are used in the receivers proper. The primary power consumption is 55 watts. Not only is this a fine receiver, but it is made right, and every attention has been paid to detail. The airplane type dial is frequency-calibrated, so that the frequencies are read directly. There is provision for phonograph connection. The wired chassis is Cat. 1041-XCH, complete with speaker, tubes, $11.97. Shipping weights of 1041 series, 11½ lbs. 25-cycle models, $1.20 extra. 220-volt models 60c extra.

The above set is a two-band 5-tube ac-dc universal receiver for 50-60 cycles, 110-125 volts, and is Cat. 1042-U, $17.37 (10¾ lbs.). It uses one 6A7, one 6D6, one 75, one 43 and one 25Z5. Sold complete with RCA tubes. Ranges, 550 to 1,500 kc, 5,500 to 16,000 kc. Approximate kilocycle calibration. Band change by switching.

Cat. 1042-UE is in the same cabinet, etc., but tunes from 150 to 350 kc and from 540 to 1,500 kc. For European use. Price $18.57, complete with tubes.

Either above, with 220-volt adapter, 90c extra.

Model 1040-V. 4-tube universal, ac-dc, 90-120 v., wired receiver, complete with four RCA tubes, and coil for the broadcast band only; contained in attractive midget cabinet; dynamic speaker. Shipping weight, 8 lbs. Net price $11.37

Model 1040-VSW. Same as above, except that four coils are supplied for the short waves only, 1500 kc to 20 mgc. Shipping weight, 8 lbs. Net price $14.97

Model 1040-VAW. Same receiver, with broadcast coils, also low-frequency coils (to 110 kc) and short-wave coils (1,500 kc to 20 mgc). Shipping wgt., 8 lbs. Net price..$16.77

ADAPTERS

Auto adapter, complete with suppressor. Cat. 1040-VATAD.....$7.50

32-volt Farm Light Plant Adapter. Cat. 1040-VFLPA $5.60

220-volt adapter for ac-dc use. Cat. 1040-V-220 ..... .95

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FOURTEENTH YEAR

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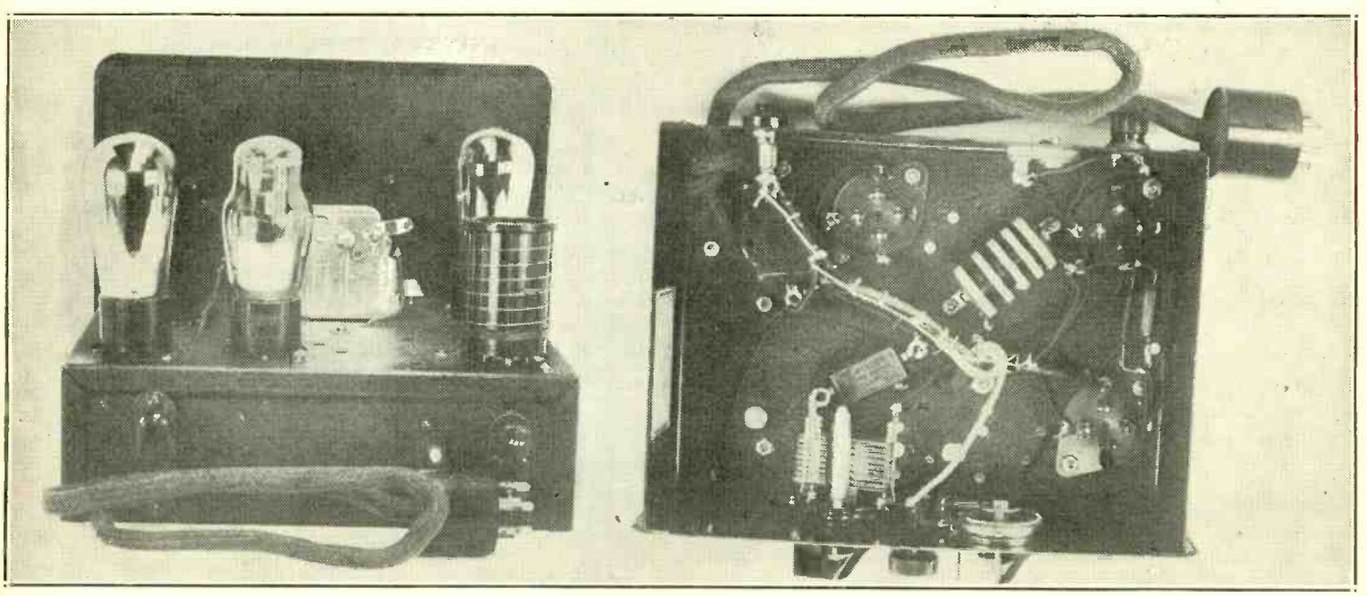
That Vital Condenser

In Series with the Aerial in Short Waves

By Herbert E. Hayden



Photographs by Herbert E. Hayden

Rear view of the three tube battery operated short wave set at left and underneath view of the wiring at right.

THE practice of connecting the antenna to the grid of a short wave regenerative set through a small condenser is followed very much. It is surprisingly true that many do not object to reaching to the rear of the set to adjust the series condenser once for each band. It does not make so much difference what the maximum capacity of this condenser is, so long as the minimum is small enough to permit regeneration on the highest frequency tuned in. That means on the smallest coil, with such sets, when the tuning condenser is at minimum. For each successive band, rising frequencies, the series capacity is less. Therefore the adjustment position may be marked at rear and reverted to for the particular bands to which they apply.

Theoretical Values

It is interesting to investigate somewhat the working of this series antenna condenser, because reliance is placed on it to insure regeneration, and if regeneration fails all (or nearly all) is lost.

First we must consider the antenna itself as a condenser, of which one plate is the stretch of wire aloft and the other plate is the ground. Between these two plates all waves oscillate. Naturally, the aerial has large physical constants but small electrical values. The capacity of an average antenna is taken as 0.0002 mfd., the inductance as 20 microhenries, the resistance as 8 ohms. These three values are small, considering the physical sizes of parts used to produce them.

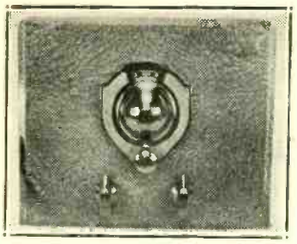
If antenna is connected to grid and the grid return to ground there is a capacity put across the tuned circuit larger than the tuning capacity. Hence the frequencies will be far lower than expected, moreover the frequency ratio will be very small. Worse yet, the circuit will not oscillate. Why not? Because the antenna's radio frequency resistance has an equivalent series value so high that the resistance is positive in the entire circuit and there can be no regeneration. It must be possible to have the radio frequency resistance negative or at least zero before there can be regeneration.

Therefore when the series antenna condenser is adjusted, it becomes effective when it reduces the equivalent series antenna resistance below the value that the tuned circuit is ready to offer negatively. Then does the effective resistance remain negative.

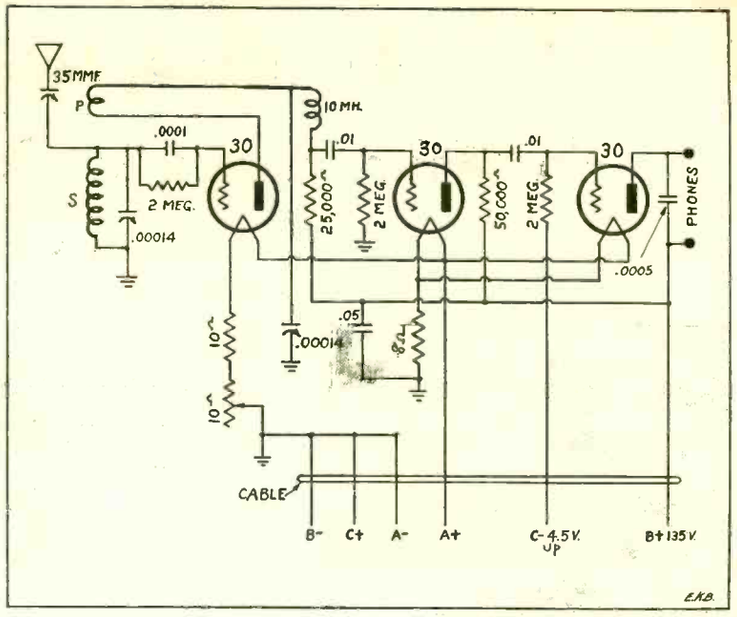
Analogy of Dam

It is perhaps simpler, though not so accurate, to state that the antenna has resistance that we desire to keep out of the tuned circuit, at least so much out as would prevent regenerative possibilities, therefore we insert the condenser as a sort of resistance dam, and adjust the height of the dam (capacity of the condenser) so that not enough resistance spills over to the secondary to prevent regeneration.

It is no doubt handier to have the an-



At left, the front panel view of the three tube set. At right, the circuit diagram.



tenna condenser on the front panel, and to use a numerical es plate along with pointer knob, so that band for band one may return time and again to the proper positions. These settings are determined largely by the actual antenna connected to circuit, although depending mildly on circuit construction, tubes, etc.

Obviously a two winding coil suffices for this type of antenna coupling, and since a variant is introduced not otherwise found, it is the almost unbroken rule that results will be superior. There are arguments in favor of adding a tuned radio frequency stage, but the properly working regenerative detector represents about the maximum obtainable from the regenerative system on short waves, the quantity of sound or the sensitivity being a matter of audio choice. Worked at its proper point, the detector alone yields satisfactory selectivity, not much improved on by an r-f stage. The reason is that regeneration makes selectivity so high that a mere tuned radio frequency stage will not make it much higher. It is not pretended, however, that the selectivity is enough for all purposes, even with two r-f stages. Instead it is admitted that in some bands, and under particular conditions, it is impossible to get adequate service from any regenerative short wave set.

Why So Much Audio

However, accepting the principle that when regeneration works splendidly the circuit itself is splendid, all we need do is to use enough audio frequency amplification to suit our preference. It has been stated in effect that there is small value in adding tuned radio frequency amplification. It can not be overemphasized that more audio than commonly present should be used even in an earphone set such as this.

And when the amplification at audio frequencies is high there is also the practicality of increased selectivity. Selectivity? Yes, selectivity. This is true because still looser coupling between grid and antenna may be used, which greatly increases selectivity, though reducing the volume. If there is plenty of audio amplification this tone reduction can be stood.

Hence the three tube design herewith for battery operation shows 30 tubes throughout. They are inexpensive and work well.

From what has been written it might be supposed that the regeneration depends principally on the series antenna condenser not being too large. However, it is assumed that the tickler is adequately coupled, that the voltages on the tubes, particularly on the detector tube, are right and that the coil is not too close to any metal.

The value of the plate voltage has an effect on regeneration. The effective plate voltage must be high enough for the tickler condition, or the load resistor must be reduced. It is idle to argue for very large plate load resistors in such regenerative circuits, no matter if screen grid tubes are used.

Reduced Plate Load

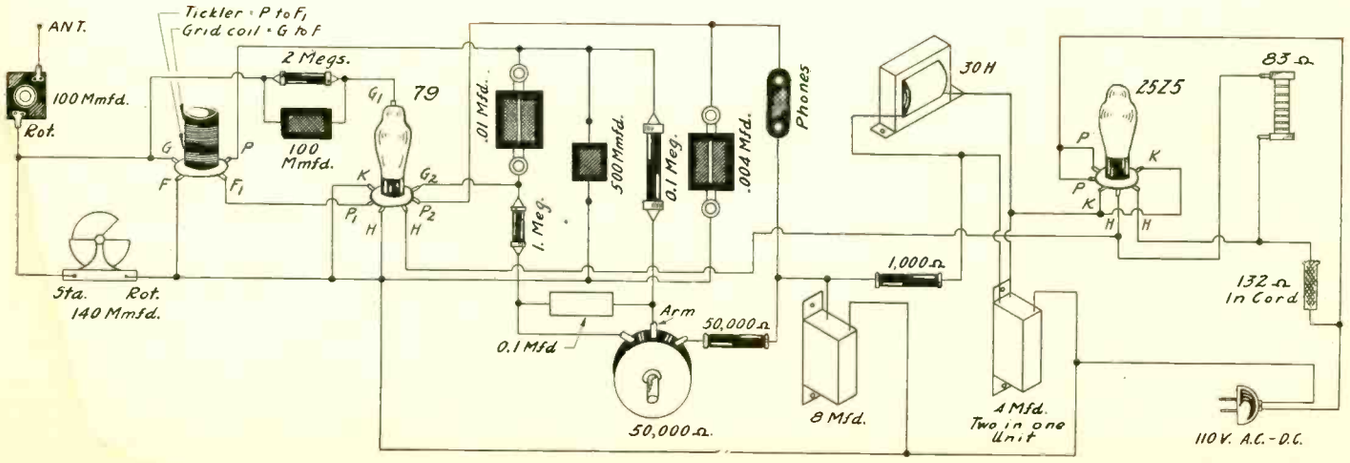
The plate load must not be such as to prevent all-band regeneration, and if 25,000 ohms in the detector plate leg does not yield the performance that may be rightfully expected, then reduce the value, even finally to 10,000 ohms, if need be, so that regeneration prevails all the way through.

The rheostat in the detector negative filament leg is set once at left thus. The guide is that there should be just 2 volts across each filament. In time this voltage will become less, but the rheostat may then be adjusted to compensate for the difference. Still the filament voltage must be 2 volts. That is a critical and important consideration in this particular circuit. For the audio tubes a little difference is not so important, and reliance on the effect of the 8 ohms is sufficient.

It seems that every time a circuit is shown for similar operation on the "universal" principle, numerous persons write to the editor asking what about a little something once in a while concerning battery operated sets. Well, this being such a battery type set, perhaps it is just as well to forestall the reverse inquiry and show the pictorial diagram of a two-tube universal short wave set, and that is done below.

CATHODE RAY PHOTOS

Considerable improvement in the photography of screen patterns of cathode ray tubes has been experienced since tubes were introduced for this special purpose. Even the tubes previously used did not give bad results, except that sometimes the exposure had to be longer than would enable one to do the job with comfort, knowing the tube cost. Now the picture can be taken more quickly and cheaply and results are better.

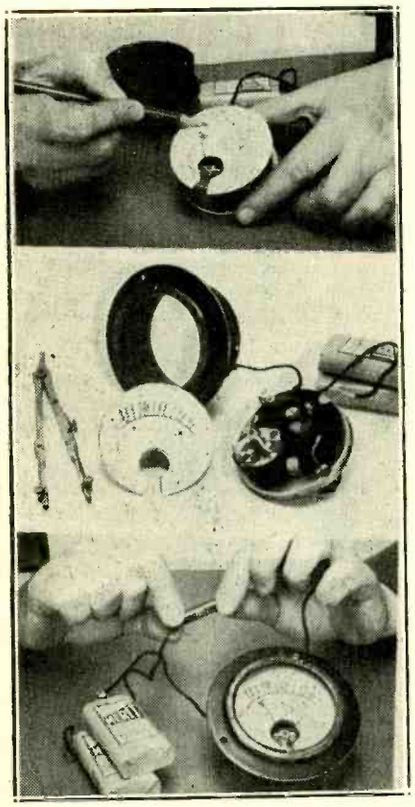


Pictorial diagram of a "universal" two tube short wave receiver.

Revamping A Voltmeter

To Make It Direct Reading Ohmmeter

By Jack Tully



A voltmeter may be converted to a direct reading ohmmeter. The new scale may be prepared entirely, without the aid of any other meter, or any information except what is on the present meter, plus the ohms per volt rating. How this is done is told in the text. Illustrations show removed parts and preparation of new scale.

NEARLY everyone has a d.c. voltmeter around the house or shop and it can be made into a direct reading ohmmeter. The method is to find out how much current is flowing when the full scale voltage is applied. This is done by putting a milliammeter in series with the voltmeter. Suppose the full-scale deflection voltage is 12 and the full-scale current is 6 milliamperes. The meter resistance is computable as the voltage in volts divided by the current in amperes, or 12-0.006 or 2,000 ohms.

If a circuit is set up, with the voltage applied that would cause full-scale deflection, the external resistance is zero. More plainly, if the circuit is interrupted by two poses, across which a strap must be put to make the circuit continuous, if the strap has no resistance to speak of, the meter will deflect to full scale. If there is a resistance across the posts, the meter will read less than full-scale deflection, and the higher the resistance, the farther will be the deflection from full scale, so that when the resistance is very high the meter needle will not seem even to move when the voltage is applied.

Resistance in Steps

It will be noticed that no external resistor is required. Also it has been said that the meter resistance can be computed. Really the meter resistance may be all there is inside, but that would be true if the meter were more sensitive than the inexpensive types now in mind. What may be true is that the limiting resistor is inside the meter case, along with the meter's own resistance, but at all hazards we do not have to use an external resistance. We note that we have a 6 volt, or 12 volt meter, etc., and we apply the full voltage by closing across two posts.

Whatever resistance is present inside the case we can compute, as we have done, and also we can compute what the total resistance is. Then the unknown is the difference. If the computed total value is 10,000 ohms and the meter, or meter plus inside resistor, is 2,000 ohms then the unknown is 8,000 ohms.

That is all right for determining values of unknowns, but here we are faced with a somewhat different problem: we desire to calibrate our meter to make it a direct-reading ohmmeter in regular steps.

Since we have a current meter, or at least could use one, all we have to do is to select such values of unknown resistance that we want to calibrate and ascertain the current that corresponds.

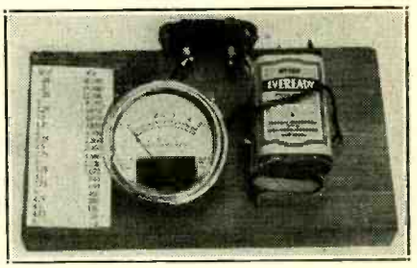
How to Compute

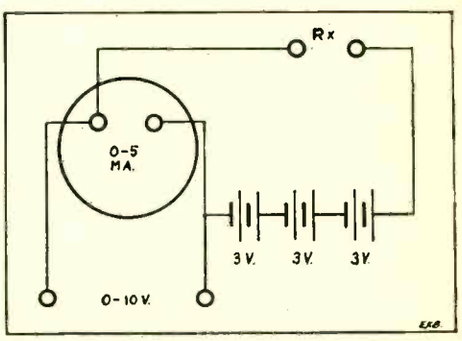
The current value, I, equals the voltage divided by the sum of the meter and desired calibrated resistance. Suppose we desire to start with 25 ohms, which would be as low as practical for such meters as we are considering. The current reading for a 12 volt meter would then be 12-2025 or 5.9 milliamperes, so close to full scale it is just barely possible to discern the difference. Next we might select 50 ohms, knowing that would represent again a small difference compared to a short circuit. Anyway, the current reading would be 12-2050 or 5.85 milliamperes, Try 100 ohms, yielding 5.7 milliamperes. Next 200 ohms yields 5.4 milliamperes. 400 ohms yields 5 milliamperes, etc., until we reach the opposite limit, where ten times the "inside" resistance is usually right, that is 20,000 ohms in this example. The reading in current would be a bit more than half a milliampere. It is possible to calibrate for higher resistances, too, but the point is reached when the difference between 30,000 and 50,000 ohms is so small you can't tell whether the resistor is one or the other or somewhere between, therefore there is no use in calibrating beyond the useful point.

Having No Current Meter

Now, it may happen that one does not have a current meter but that he has measured or does know the maximum meter current. That is, the manufacturer set forth that the full-scale deflection current is 12 milliamperes, or 5 milliamperes, or otherwise. If the instrument is a voltmeter the scale is calibrated in volts and this voltage is proportional to the current. The sensitivity of the instrument in ohms per volt may be given. Then the full scale current is computable. It is the number 1 divided by the resistance in ohms per volt. Suppose the resistance is 250 ohms per volt. The number 1 represents 1 volt and the current is 250 divided into that, or 0.004 ampere, said as 4 milliamperes. This value follows from Ohm's law that the current is equal to the voltage divided by the resistance.

If the full-scale current is known or computed, then if the zero and the maximum needle positions are marked, the in-between points are proportional to the voltage gradations already present, or may be interposed with dividers. Suppose the meter reads 0-12 volts. Suppose the full-scale deflection current is 4 milliamperes. The terminals are set down in pencil, or taken from the voltage scale. If there is one division for each volt, then these serve also for current division, i.e., total being 4 milliamperes, divided into 12 equal parts, or 33 1-3 microamperes per division. Knowing this, we can find out the current positions for intended resistance registrations, and ascertaining the position the position on the meter scale from the apportionment just outlined.





If a current meter is desired to be retained as it is, a table may be prepared, and pasted on a board which houses the meter and battery. Thus to ascertain an unknown resistance, read the current and consult the table for the resistance value. The current reading alone still become is preserved, and the particular meter, Readrite 805, may be used as a 0-10 voltmeter by multiplying the current scale by 2.

Direct Reading Ohmmeter

In most instances the reader will de-

sire to confine the instrument to direct reading of resistance. That means he will want to get a stiff piece of cardboard and prepare it as substitute for the present scale, or put the voltage values on additionally, using a new scale of his own making.

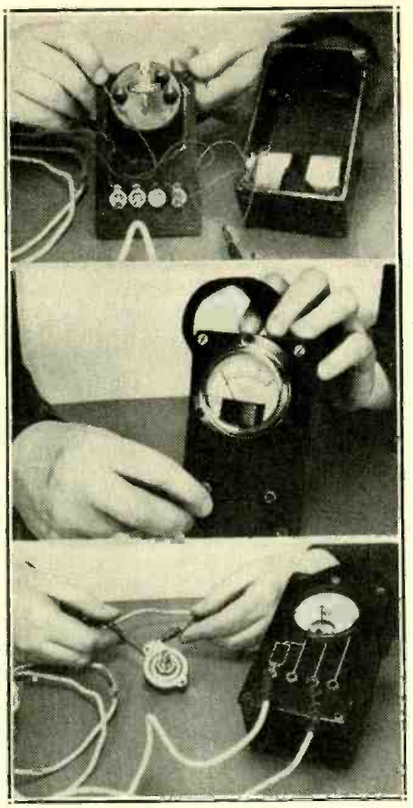
The mechanical process is easy enough. The meter is removed from its case. In some special instances this requires breaking a seal, but there is nothing sacred about the seal, except to destroy the manufacturer's guarantee, and the meters we are discussing were made so long ago that they are practically in disuse about the shop or home and we want to put them to an up-to-date purpose.

When the meter is taken out this gives access to the scale and needle. It is easy to remove the screws that hold the scale plate in place, but extreme care must be taken in removing the scale plate to slide it off in such a manner that it passes smoothly under the needle, without bending the needle at all. Persons not familiar with these needles may be surprised to learn how tender they are, not brittle, but pliable.

Ohmages Suggested

The plate removed may be used as template for cutting a piece of white cardboard to just the same pattern and finding the mounting holes. Also by using dividers on the original plate it is practical to find out just where the needle registration line is, above which the calibration is to be put, or, if desired, the blank scale may be tentatively affixed and the extremes noted (minimum and maximum current) as well as the arc.

The resistance values have to be selected in advance and their current equivalents then are determined, say, using 25, 50, 100, 200, 300, 400, 500, 750, 1,000, 1,200, 1,500, 2,000, 2,500, 3,000, 3,500, 4,000, 5,000, 7,500, 10,000 and 20,000 ohms. Remember that the voltage to be used is the maximum voltage the meter will read, so



If continuity, resistance, voltage, current and other instruments prove very valuable they finally win a respectable housing from their owners.

that we need no extra limiting resistor, and that we find the current positions for the needle to indicate the enumerated resistance values by computation, as already outlined, and can do our draughting on a comfortable board, instead of on a difficult meter panel. It is well to use black India ink.

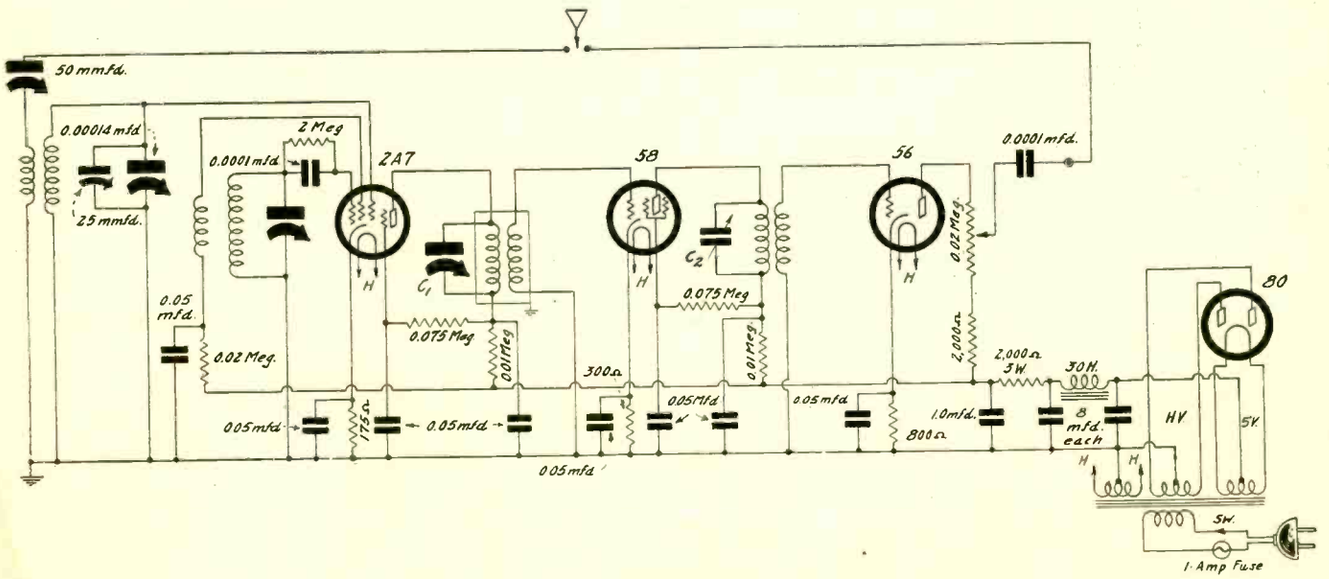
Then when we assemble the new scale on the meter and introduce the two posts or other open condition between the meter voltage supply and the meter, we have our direct-reading ohmmeter, safely 25 to 10,000 ohms for the run of meters of types drawing up to 15 milliamperes at full scale. The conversion of the meter to the use described costs practically nothing except two hours time.

Non-Direct Reading "Dual"

Some may have a meter that they would not care to monkey with along the lines just laid down, but would desire to convert to volt-ohmmeter extensive service. The method was outlined in text last week (issue of March 16, page 13), using the Readrite Model No. 805. This is a 0-5 milliammeter. By using it as an ohmmeter with 9 volts no external limiting resistor is necessary. The tabulated resistance values in terms of current were given, 25-40,000 ohms, consulting the published current table. The meter also may be used as a voltmeter by multiplying the readings by 2, hence read 0-10 volts. The diagram is given herewith, with a view of the instrument as constructed on a wooden panel. The total cost was $1.87.

Sometimes one builds an instrument of the resistance, dual, continuity, etc., type, and comes to the conclusion, after using it, that it deserves some more respectable housing. Then he fixes up a nice box and supplies a panel, whereupon the measurements are made more handily, though no more accurately, and there is less danger of damage to a helpful instrument by accidental dropping or falling. Light and disjointed things don't seem to want to say on top of tables or benches.

DIFFERENCE BETWEEN THREE TUBE AND NINE TUBE CIRCUITS



There are some three-tube short-wave sets that are supposed to work a speaker. Here is a four-tube short-wave converter only. With this a receiver of more than five tubes is used normally. So it is a case of three tubes against nine or more. What is the difference? First, the superheterodyne of which the converter is a part is easier to tune, then it is more selective, and, finally, it is more sensitive. The switch at top moves antenna from converter to receiver.

High Fidelity Servicing

Calls for New Technique—Example of Stromberg-Carlson 70 Series

ENGINEERING data on the No. 70 series Stromberg-Carlson receivers have just been released. These receivers are the new high-fidelity models, the first ones of that type manufactured by this company, which is the second company in the country to put high fidelity receivers on the market.

Model 70 is for 50-60 cycles, Model 70-B is for 25-60 cycles; Model 72 is for 60 cycles, with 5A phonograph Assembly; Model 72-D is for 50 cycles with 5D phonograph assembly; Model 72-B for 25 cycles with 6B phonograph assembly. The 74, for 60 cycles, has two more 2A3 tubes in the audio power output stage, and the 6A phonograph assembly. No. 74-D, 50 cycles has the 5D phonograph assembly, while 74-B (25 cycles) has 6B phonograph assembly. Fundamentally therefore the circuits are the same.

There are thirteen tubes normally, and when the extra output tubes are added, as in the 74, sixteen tubes are used, because an extra 5Z3 rectifier is added in the power unit of the auditorium type loudspeaker.

The circuit is of the all-wave type, with front panel switching for band selection, there being four bands, with unused coils that might cause harmful losses shorted out.

The Band Coverage

The four bands are designed A, B, C, and D, the higher the order of letter the higher the frequency. Thus A represents the broadcast band, 520 to 1600 kc; B goes from 1500 to 4200; C from 3700 to 10000 and E from 8500 to 23000 kc.

The 6.3-volt series tubes are used; except for rectifier and power tubes. The first 6D6 radio frequency amplifier at the station carrier level is in service only for bands C and D, when the extra amplification is needed because of the natural rise of circuit losses at these frequencies. On the two lower frequency bands the tube is shorted out of service and the tuned circuits act as a bi-resonator.

The following 6D6 was used as a radio frequency amplifier at all station carrier frequency levels. The remaining two 6D6 tubes are intermediate frequency amplifiers.

Only modulation purpose is served by the 6A7, the more formal electron coupling as provided by the tube itself when triode is oscillator and pentode is modulator being purposely avoided so as to obtain maximum freedom from detrimental coupling. This is particularly avoidance of overcoupling at higher frequencies, since by the more formal method, the coupling being practically constant, the two frequencies would tend to become one when high, or sensitivity would be reduced due to absence of the effect of tuned pre-selection, due to locking of oscillator and modulator.

Two Speakers Used

The circuit uses two speakers, one called the bass and the other the treble. The frequencies are handled by these speakers in such a manner as to give even pressure response from 30 to 7500 cycles. There is acoustical treatment of the sound chamber, called an acoustical labyrinth. The totality represents linear response on a mechanical actuation basis and with impartial distribution of sound. Box resonance and other forms and causes of peaks and hollows in the curve are absent. The tonal result is very remarkable indeed, realistic to the point of ecstacy. The individuality of orchestral instruments is readily indentified, even woodwinds of overlapping spectra.

Presence of both automatic volume control and high fidelity makes the intermediate frequency alignment rather difficult. In fact, service men are warned to leave this adjustment alone, unless a correction is really imperative.

The Official Directions

The official engineering data includes the following on this point:

"Because of the necessity of obtaining the proper shape of resonance curve of these stages it is recommended that, unless the opposite is absolutely essential, these adjustments be untouched. In the factory these adjustments are made, using a visual system which allows the operator to see the exact shape of the resonance curve. However, in the case where resetting is necessary the procedure should be as follows:

"Set the signal generator to exactly 260 or 370 kc, depending on the intermediate frequency of the particular receiver stamped on the chassis. Operate the range switch of the receiver to the A band position. Set the receiver tuning dial at the extreme low frequency position and operate the tone control to the normal position. Turn the high fidelity control to the normal selectivity position. Never attempt to adjust the i.f. stages with the high fidelity control set at the high fidelity position."

It is recommended that for other purposes a dummy antenna of some sort be used in connection with the signal generator, and simply a series condenser of 0.00025 mfd. suits the purpose, connected between output of the generator and input of the receiver.

"Before proceeding with the aligning," continues the treatise, "remove the 250 mmfd. capacity (artificial antenna) from the signal generator lead and substitute for it a capacity of at least 0.25 mfd. Now connect this lead to the grid cap of the 6D6 tube used in the second i.f. amplifier stage. Do not remove the grid lead from the chassis connecting this tube. Before attempting to adjust any of the i.f. tuning capacitors release the locking nuts and after making the adjustments make sure that these lock nuts are securely tightened."

Setting Condensers

The condensers across the i.f. windings now adjusted. It will be noted that in two instances there are three windings and three condensers, also that the selectivity must be adjustable, now being used at normal selectivity position, and that output meter readings consequently must be maximum and may increase as on proceeds forward from stage to stage. The tube ahead of the second detector has a coil system uniting it with that detector, and here the first adjustment is made, of two condensers.

The signal generator connection is made again through the large capacity but to the grid cap of the prior i. f. tube, also a 6D6, again two capacity adjustments being made for maximum output. Perhaps the output will not increase at readjustment, but that would disclose that the alignment was correct in this stage originally.

The third move is from previous grid cap to the grid cap of the 6A7. Two condensers in this coil system are adjusted and this work completes the realignment of the i.f. channel.

In the high fidelity receiver some means must be used to obtain that selectivity which will give the necessary band width for high fidelity reproduction. In these receivers it will be noted from the schematic diagram that the first and second i.f. transformers are made up on three tuned circuits: the primary, secondary and a third coil, the tertiary circuit. Included in each tertiary circuit is a variable resistance in series with the coil. Incorporated in these variable resistance is a switch that opens or closes this circuit.

Fidelity Control Positions

When the fidelity control is turned counterclockwise as far as it is possible, the receiver functions with normal selectivity because the switches (incorporated in the variable resistors) are open. When the fidelity control is operated in a clockwise direction as far as it is possible, minimum resistance is inserted in series, with the coil, resulting in the tertiary circuits acting as a heavy load across the secondary circuits, which, of course, results in broader tuning. As the fidelity control is operated in the opposite direction, more resistance is added in series with the tertiary coils which makes these circuits less effective, resulting in greater selectivity.

When the r.f. and i.f. circuits are carefully aligned, operate the high fidelity control to the high fidelity position (maximum clockwise rotation). As certain the location of the aligning capacitors in each tertiary circuit. Then, with the signal generator still set at the intermediate frequency, and its lead connected to the grid cap of the 6A7 tube, adjust these capacitors. Adjust the first i.f. tertiary aligning capacitor until a *minimum* reading is obtained on the output meter. Then, adjust the second i.f. tertiary aligning capacitor in the same manner.

Care Needed

Instructions for the treble speaker include these:

Unplug the speaker cord and remove the four machine screws holding the speaker to the baffle.

Care should be exercised in handling this speaker. *Do not drop it face down on a flat surface or the center may be damaged* due to the resulting air compression. Later speakers are provided with a stud on the front ring which prevents their being damaged in this manner. This stud may readily be removed from speakers to be used for replacement service, if the baffle is not provided with a hole for its accomodation.

The driving coil leads on these speakers are made of fine aluminum wire in order to reduce the mass to the value necessary for the reproduction of high frequencies. Avoid touching them as they are delicate and easily broken. Do not attempt to blow dust or chips from these speakers with compressed air as lead breakage may result.

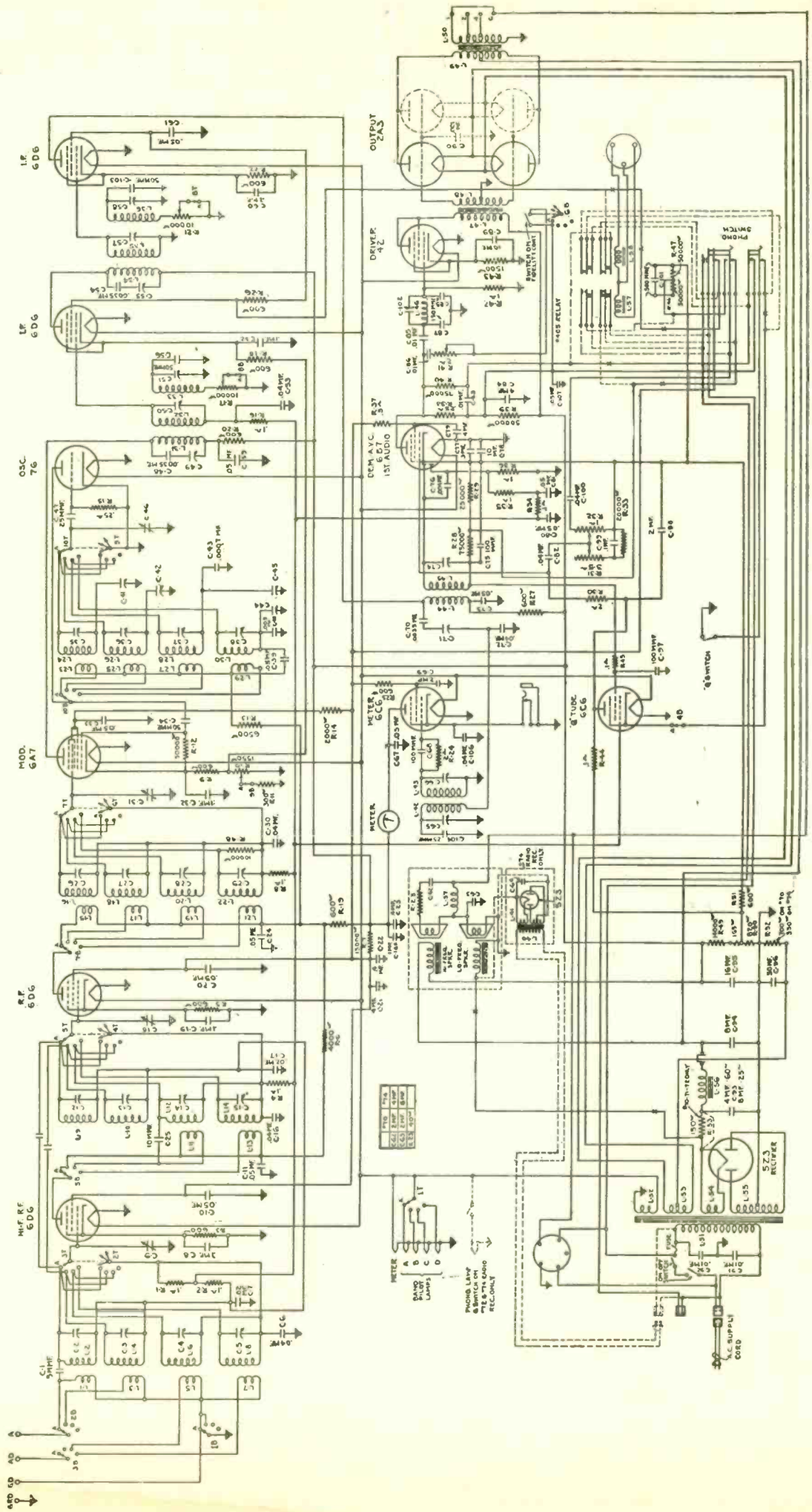
The movement of the cone in actual service is only a few thousandths of an inch and is adequately taken care of by the thin aluminum center suspension. Do not force the cone back and forth with the fingers as you would an ordinary dynamic speaker or the center suspension may be damaged.

Centering Driving Coil

Once the coil is correctly centered, it

(*Continued on page* 16)

First Publication of Stromberg-Carlson High Fidelity Circuit

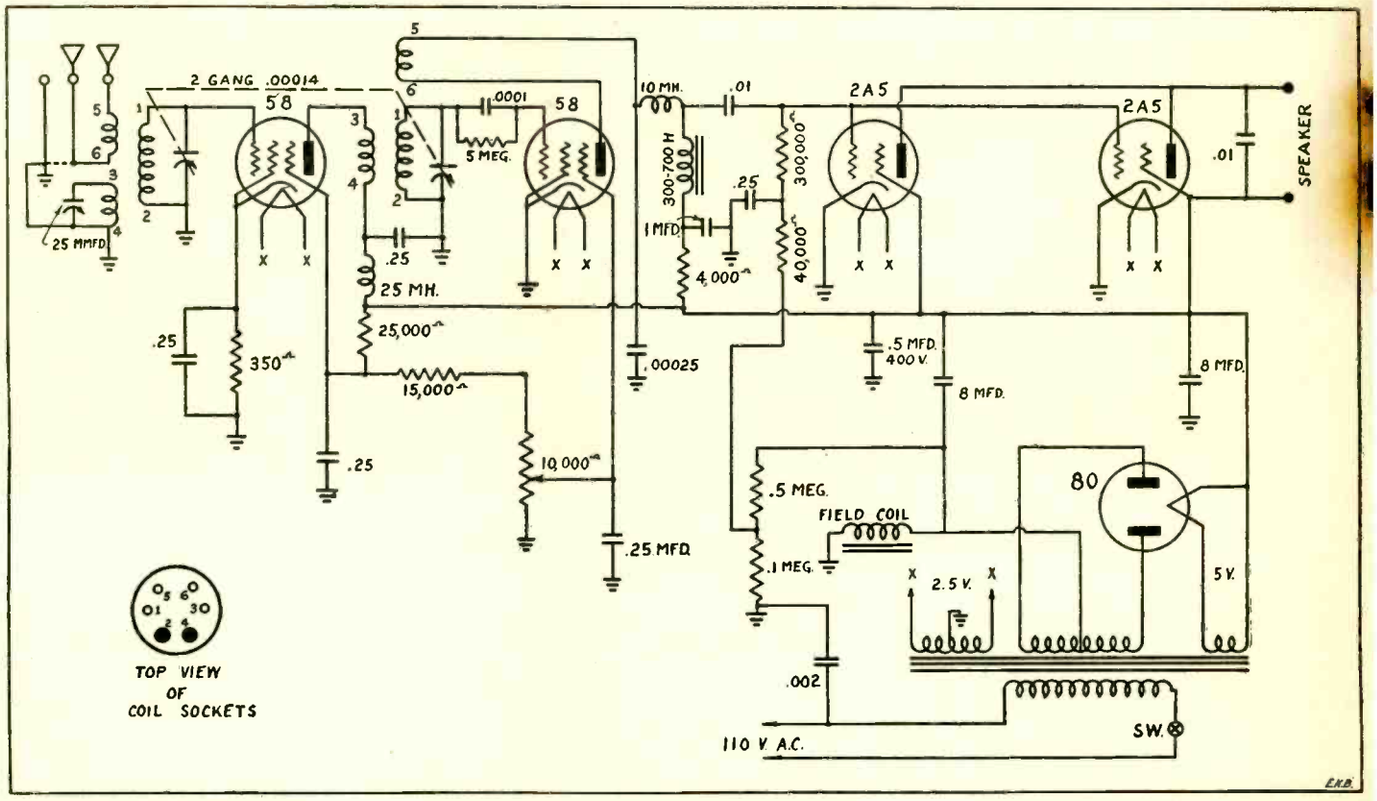


The RGH-5 All Wa

Gothic Panel Niche Part of

By Robert G

Chief Engineer,



Photographs by Herbert E. Hayden

A well-established circuit, without frills or foolishness, is used for the RGH-5.

AN original chassis layout, designed by Louis Kranz, including Gothic niches in the front panel for the accommodation of the plugin coils, affords a workmanlike appearance to the RGH-5. This is an all wave regenerative receiver, using a stage of tuned radio frequency amplification, detector and single stage double-powered audio. With the rectifier the tubes total five.

It will be noticed that three-winding coils are used throughout. This represents the more efficient method of coupling, at least between tubes. Otherwise some sort of choke load would be needed in the plate circuit of the r.f. tube, or plate circuit tuned, or other maladroit selection. In the antenna stage the third winding is used as a tuned absorption circuit, not directly related to the resonant frequency, effective rather because of the change of effective capacity upon the tuned secondary. This change is of the vernier order and the control is splendid.

The Case of the Ground

The individual primary permits use of a doublet antenna without special coupling means. A doublet is advantageous in permitting reception with minimum of noise, provided a transmission line is used, connecting receiver and antenna. However, in localities not noisy in this sense, a 40 to 60 foot single antenna may be used, with a good ground. For the lower of the short wave frequencies, and for standard broadcasts, good ground is important, as the ground wave is ratable, but at the higher frequencies the ground wave is rapidly dissipated, hence whether there is ground or not makes little difference then. So it is well to have a good ground and let the absence of effect take place when it will, with ground permanently connected, although for the higher frequencies automatically ineffective.

Whether a doublet or a single antenna is used it is advisable to erect it in the clear, rather than on the roof. In reality the roof is the ground and the antenna height is measured from roof to antenna, so it isn't likely to be a substantial height. But if the antenna is strung from the corner of the roof to another building or pole, as across a court, better results will be obtained. Hence take heed: Erect your antenna in the clear.

Series Condenser

The reason for desiring a good antenna is to lay down a good signal right at the start. Then the better the receiver, the more this signal will be built up, until the final value, in terms of acoustical response, will measure up to the most fastidious expectations of those never

LIST O

Coils

Two sets of RGH coils (8 coils).
One 10 m.h. r.f. choke.
One 2.5 m.h. r.f. choke.
One N.S.44 300 henry choke.
One RGH power transformer.
One RGH speaker.

Condensers

One 140 mfd two gang.
One 25 mfd. midget.
Two 8mfd 450v. electrolytics.
Four .25 mfd by pass.
One .25 mfd 400v by pass.
One .5 mfd 400v by pass.
One 1 mfd. 400v by pass.
Two .01 mfd.
One .002 mica.
One .00025 mica.
One .0001 mica.

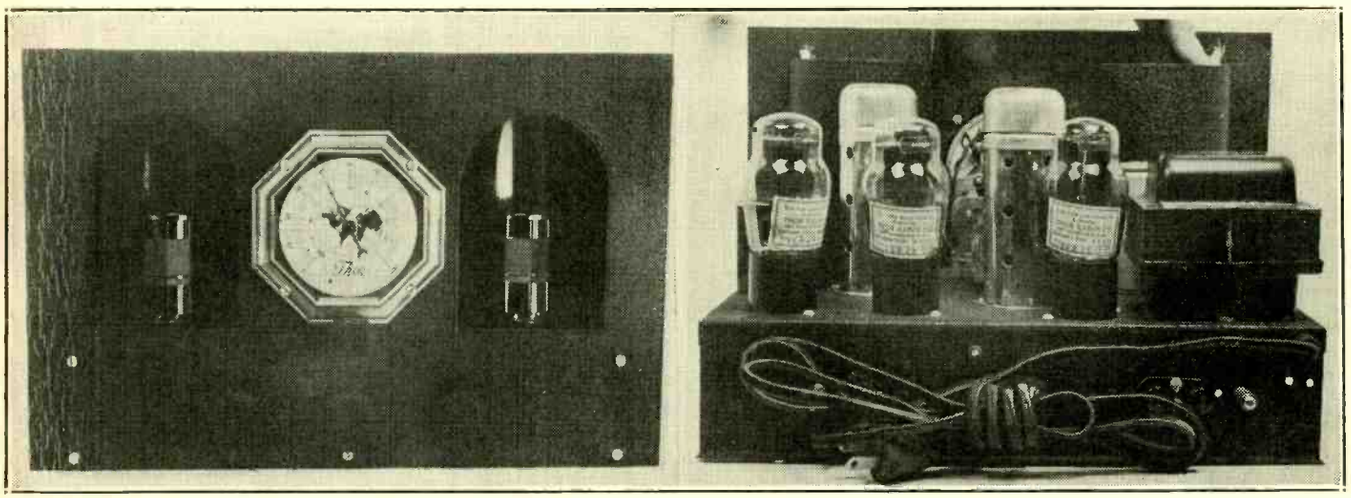
Resistors

One 10000 ohm potentiometer and switch.

.ve Regenerative Set

Louis Kranz's Chassis Design

. *Herzog, E. E.*
Thor Radio Corp.



The Gothic niche is shown on the front panel illustration. Wiring is basic, simple and sound.

really satisfied with receiving merely foreign locals.

If the single antenna is used, a series condenser of 30 to 70 mmfd. is put in the leadin circuit, and there is some advantage in having this controllable, band for band. One setting, right for one band, may not be so effective for some other band. However, with the doublet and transmission line this series condenser is not needed.

The bias on the radio frequency tube is steady. The idea of controlling this bias for sensitivity adjustment in this circuit was tried out and found not of special advantage, hence abandoned. Sensitivity is sufficiently controlled by the absorption circuit in the forefront, while the detector screen voltage variation controls the regeneration. Hence the tickler coil is fixed, the throttle condenser is fixed (0.00025 mfd.) and the screen voltage control is used for the change it produces in the transconductance.

F PARTS

One 25000 ohm 1 watt.
One 5 megohm.
One .5 megohm.
One .3 megohm.
One .1 megohm.
One 40000.
One 15000.
One 4000.

Miscellaneous

One RGH 5 chassis, coil shields, and panel.
Two 58 tube shields.
Six wafer sockets.
Two coil sockets.
One Crowe No. 123 dial etc.
Three knobs.
Three binding posts.
Resistor racks.
Hook up wire.
Two screen grid clips.
Solder.
Hardware.

The Plate Choke

A high value of leak is used in the detector circuit for high sensitivity, and the condenser across it is large enough to permit sustenance of oscillation at the highest frequency (around 21 mgc), although the circuit is to be worked just below the point of oscillation, for maximum sensitivity.

The audio load is mainly a choke coil of the iron-core type, 300 to 700 henries inductance at the same current flowing. The radio frequency choke ahead of it aids the regenerative action and also helps keep the radio frequencies out of the audio amplifier.

By using a choke the d.c. resistance of which is small and even considering the 4,000 ohms in series, the total d.c. resistance presented to the plate circuit is low enough to permit substantial effective plate voltage, which means ease and assurance of regeneration, and under the circumstances also the absence of fringe howl.

The power tubes are in parallel and are loaded to the signal by 0.3 meg. The circuit consisting of the 40,000 ohm resistor and the .25 mfd. condenser comprises a hum filter. The grid return is made to the juncture of two resistors that are across the speaker field coil. This field is not tapped. Indeed, the field resistance is not critical.

Bias Apportionment

In the present example the total field was 1800 ohms. The two resistors, 0.5 meg. and 0.1 meg., apportion 0.6 meg across 120 volts, so the negative bias 1/6x120 or 20 volts and the rest of the drop across the field is 5/6x120 or 100 volts. From the juncture to ground a condenser of 0.1 mfd. or 0.25 mfd. may be tried as further means of hum reduction, due to phase shift introduction, and besides the speaker connections may be reversed for the same reason.

Surprising as it may be to many to learn this fact, the direction in which the speaker output transformer primary's connection is made does have an appreciable effect on hum. So simply make a reversal and test aurally. You will be able to tell the difference with a vengeance under such circumstances when there is any difference at all.

There is nothing about the circuit that is new or astonishing, but it is perhaps well to add in this connection that with a short wave set the novelties had better be left to the adventurous and the surprises then may be confined to the reception. And what will be received will depend as much on tuning skill as on anything else, and this sort of skill is based mainly on (1) patience and (2) more patience and (3) still more patience.

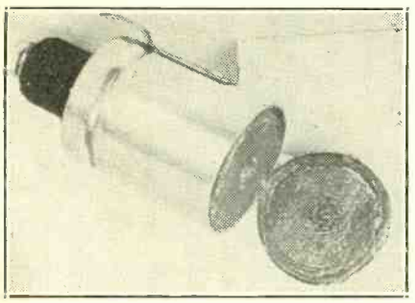
Do not skim over the frequencies with a merry twirl of the dial as if it were a roulette wheel.

Wiring Assistance

In wiring the set all the ground leads are connected together as well as to lugs on the chassis itself. The filament screen, and B plus leads, are run around the edges of the chassis to leave the center clear for the small parts and more important wires. All soldered connections should be solid, made with a clean hot iron. Use only rosin core solder. The antenna leads, the r.f. and detector plate and grid leads should be wired with heavy busbar from point to point. The leads to the caps of

(*Continued on next page*)

Sawing Apart An Electrolytic Proves—*What?*



An experimenter with a scientific bent had read something in these columns about how electrolytic condensers are made, what materials go into them, etc., and took it upon himself to saw a dry electrolytic as shown. He found out that the dry condenser is not really dry, just as dry wine isn't dry but wet. The article had set forth as much, but there is nothing like verification. A sort of paste was inside.

Soon after the major operation was performed, the experimenter's wife said inquiringly:

"I smell something funny."

The radioist replied:

"I just cut open an electrolytic condenser."

Answer: "Well, close it again."

"I can't."

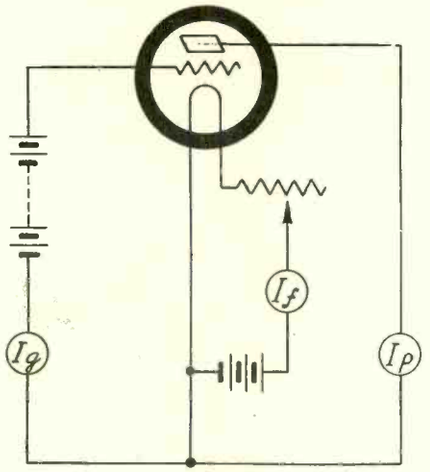
"Well, if you don't, I will. The thing smells awful. Was it defective?"

"No, I was just curious. There was nothing the matter with it at all."

"Well, if there was nothing the matter with it, though it smells bad, then there must have been something the matter with you for opening it up. What did the experiment teach you?"

"Nothing, except that the condensers work better than they smell."

Centimeter Waves Created



The diagram looks like nothing much of anything, except reading grid, filament and plate currents. However, positive is toward the grid; the plate has no voltage; the filament has the usual supply. It is obvious therefore that the positive grid serves a purpose. That purpose is the production of oscillations at very high frequencies. The circuit is fundamentally the Barkhausen-Kurz for centimeter waves. The frequency is determined by the voltages, when one takes the tube geometry for granted. The reason for using such a circuit at all is that conventional methods fail with such tubes at much lower frequencies. Usually the tube stops oscillating. Or the external load becomes practically a short circuit to the intended input or tank, which amounts to the same thing as if the tube for reasons of its own stopped oscillating. The transit time of electrons from cathode to plate is somewhere in the neighborhood of the frequency to be generated, and therefore the voltaic control of frequency becomes effective, as governing the transit time. Tubes with cylindrical elements should be used.

The RGH-5

(*Continued from preceding page*)

the tubes should be as short as possible with No. 18 flexible wire.

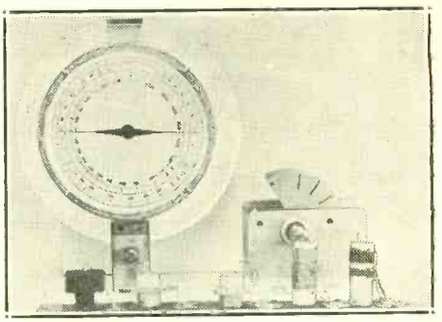
The resistors are mounted on small racks located near the respective tubes to which they are connected. This adds to the neatness as well as the efficiency of the receiver.

When the set is completely wired, check carefully, making sure no splashes of solder have lodged where they may do harm. After having checked the wiring, plug in the tubes and coils, connect the antenna and ground, and the a.c. line. The set is now ready for tuning.

Tuning Help

No complicated alignment is necessary, for when wired correctly, the RGH 5 will play immediately. Try the 200 meter band first. This should be easiest to tune. When the tubes are fully heated, turn the regeneration control until a hissing sound is heard in the speaker. Rotate the tuning knob very slowly until a slight squeal is heard in the speaker. Concentrate on this squeal, rotating the dial very slightly backwards and forwards until some signal is distinguishable, reducing somewhat if necessary on the regeneration control. When a signal is heard it can be brought out more clearly by means of the parallel antenna compensating condenser.

Self-Tracking With Calibrated Generator Dial



Dials, Condensers and Coils for Generator

The essential parts for a signal generator are shown in the illustration. There are a frequency calibrated dial, a tuning condenser and a coil system. When these are connected up with practically any tube, the inductances being accurate, the calibration on the scale applies to the frequencies generated. Naturally a switching method is used for convenience. It can be seen that the coils are stacked Indian file on a strip. The lowest frequency coil is at left (goes to 54 kc) and the highest frequency coil at right (goes to 17,000 kc). All frequencies are covered fundamentally.

Despite all that has been printed about the calibration of signal generators and test oscillators (they are the same thing), nothing seems to approach the frequency calibrated or direct reading dial type, especially if the calibration takes care of itself, as it were. That is, when the parts are put together, the generator does what it is supposed to do, including disclosure of its generated frequencies with accuracy.

Checking With One Station

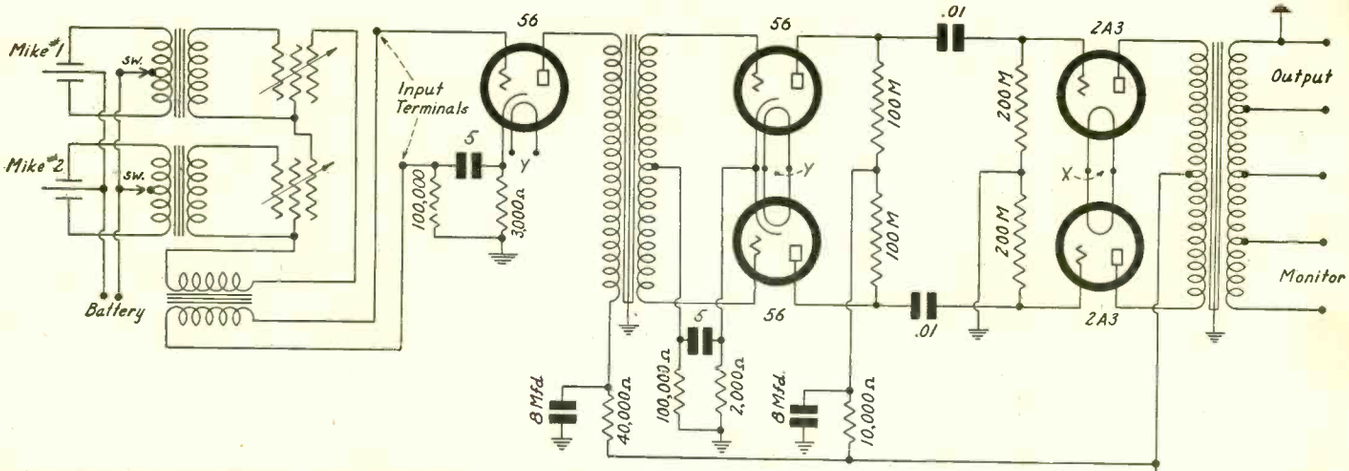
It is not necessary to take for granted the accuracy at all. It is easily checked. For instance, to introduce the system suggested by the illustrated parts, take the high frequency region of the low frequency coil. The scale assumes a windup at 170 kc. Suppose one had a station on 660 kc as a local. The fourth harmonic of 165 kc would be 660 kc, so 165 kc will do for adjusting the circuit to produce zero beat. When that adjustment is made, all adjustments have been made, and the coils must be accurate enough to track.

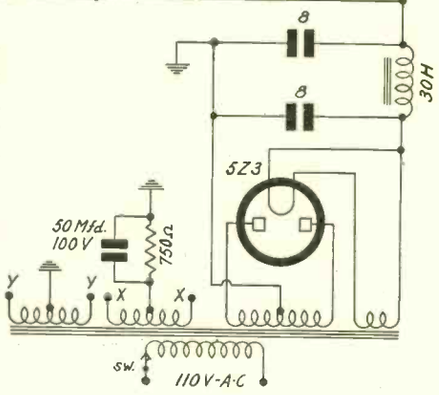
Keeping the 660 kc station, received on a set, and turning the generator dial, since we divided 660 by 4, now we divide by 5, 6, etc., to get the other frequencies, 132, 110, 95 almost, 82.5, 73.3, 66, 60, 55. We have covered practically the whole dial and can check by noting how much the reading for zero beat is off from what it should be, and dividing the intended generator fundamental into that number. For instance, if the generator reads off a bit more than 1 kc at 110 kc the accuracy is 1 per cent. Approximately that accuracy should prevail.

Determining Frequency

The next coil can be checked the same way, the broadcast band more familiarly, by fundamentals, and the short waves by fundamentals only, in the absence of an additional generator (even of the low frequency type) than the one being tested.

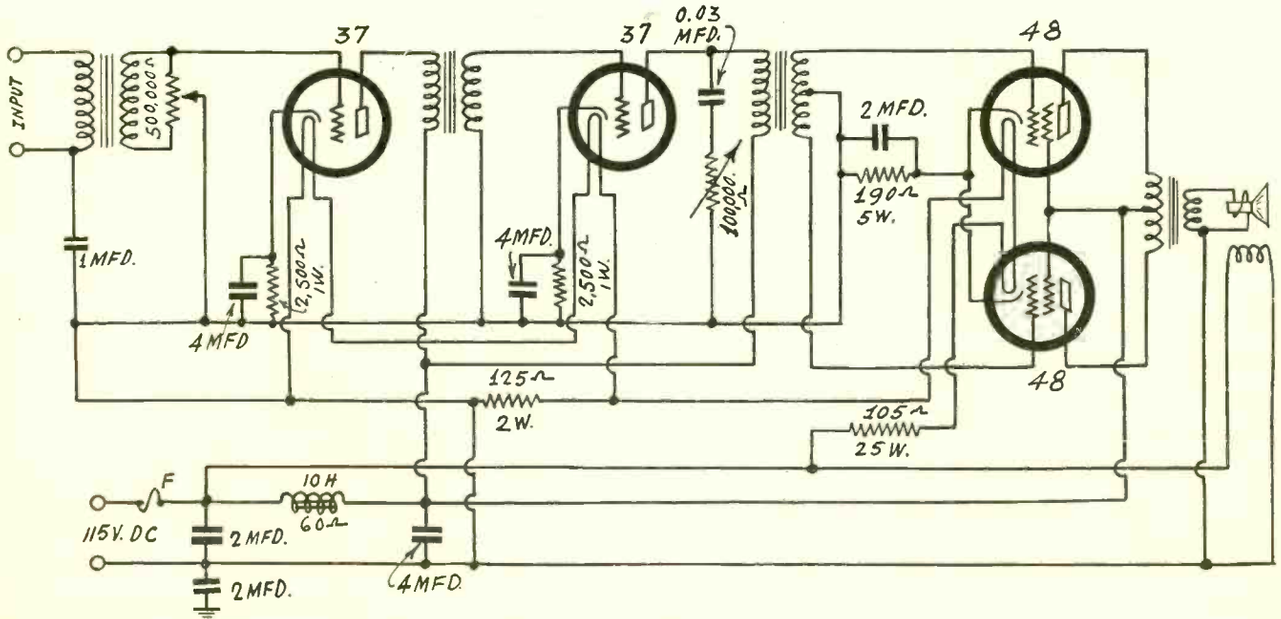
Pads Appear in Sets Now





It is a hard job finding a suitable volume control at radio frequency or audio frequency levels, without introducing detuning or distortion. In fact, it simply can't be done without resort to a pad. So receivers with pads are beginning to appear. Roughly, a pad is a device for keeping the current or load or resistance constant, though changing the volume level. At top the T pads are shown in a power public address system. Below an attempt is made at left to use a simple potentiometer for constant impedance. The secondary is unchanged, regardless of what point on the potentiometer is grounded through the arm, but the input load impedance to the first 37 is considerably changed, in fact, becomes zero, and so volume control here is accompanied by distortion. Purposeful distortion, of the soothing type, is present in the tone control at right of the second 37.

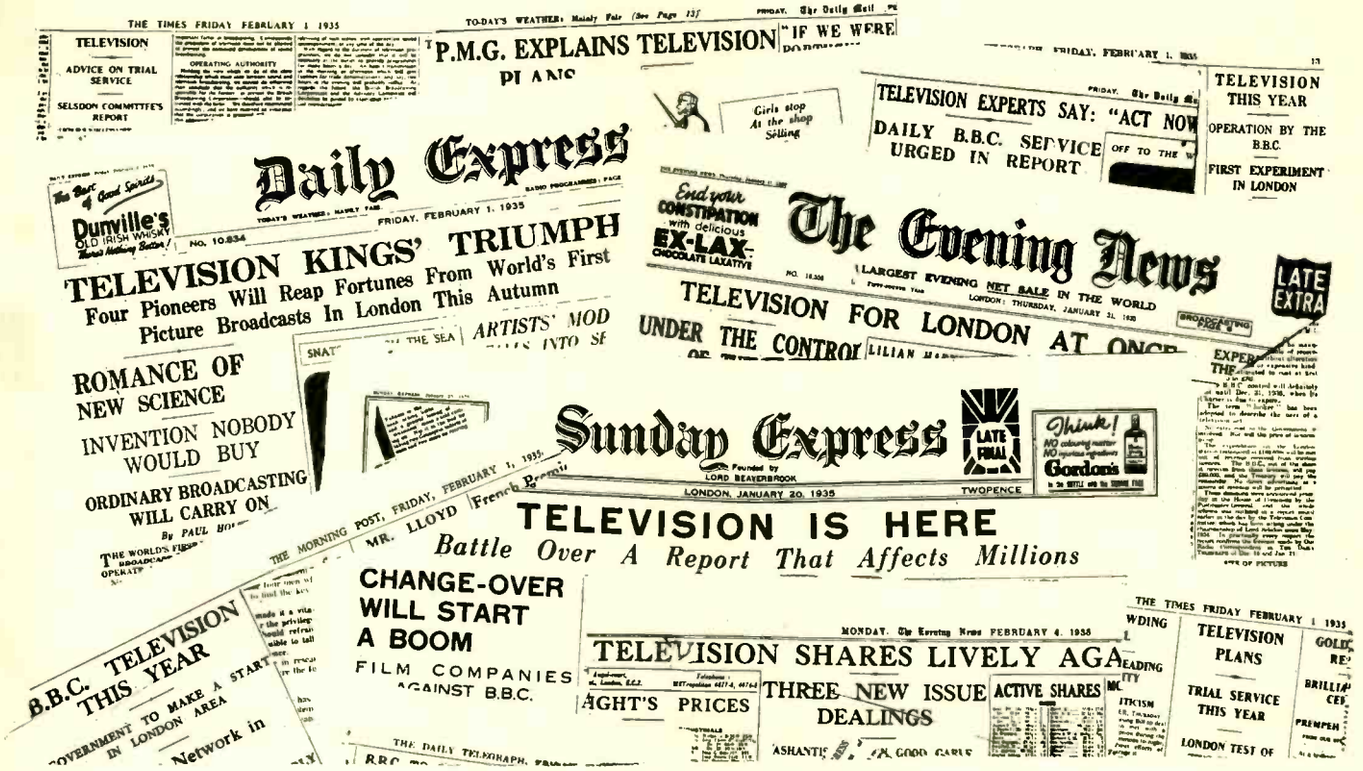
The T pads are used across the secondaries of the matching transformers. The pads have a fixed value. If the secondaries from which they come have a 500 ohm impedance the primaries that they face have a 250 ohms impedance on account of the pads paralleling the first winding.



The attempt to create a constant impedance device out of a potentiometer fails in the example at upper left because of the variation of the input load impedance, which finally becomes zero. Hence the current is inconstant. Pads offer practically the only solution and are beginning to be used in receivers this year. They are T and L pads, particularly.

The Liberalism of the Conservative Press

By J. Lawrence Cassel



How the London newspapers featured television news.

ONE glance at the bold "scare headlines" of the conservative London daily newspapers printed at the time that the television committee' report was made public will give the reader a slight idea the way that television with all its tremendous possibilities was welcomed by our English friends.

A committee, sent to all the principal countries, to study television developments, actually recommended the immediate building of a television transmitter in London, claiming that television is *now* out of the laboratory stage and is in such a state of high development that it can unquestionably be called commercial.

To rate the head lines of conservative newspapers something of national importance must take place. A kidnaping, a ghastly murder, a war, or the sounding of the death knell of some vital issue must occur and these same headlines in bold type that announced the advent of commercial television in the British Isles also sounds the death knell to the five year plan of a well known American company in its attempts to hold back television in this country for that period of time.

Start Is Imminent

When such an astute group as the members of the Postmaster General's television committee decided that television is here and they recommended immediate commercial transmission it was with a great deal of pleasure that well wishers of the new industry read the half hearted attacks and the considerable amount of back watering that has been going on in the daily papers since the broadside of English dailies last month. William Hoyt Peck, of Peck Television of Canada, gives this five year plan another great jolt because within the next two weeks there will be installed in the Canadian Cement Building, on of the lofty skyscrapers of Montreal, a one hundred watt television transmitter, the property of Peck Television of Canada, for the purpose of obtaining field strength measurements on the seven meter micro wave which Marconi has done such tremendous work with in the past few years.

Dealers Fear of Television Hurting Business Found Unwarranted—Sales Impetus Now Deemed Certain

Montreal radio amateurs and owners of ultra short wave radio receivers are especially invited to cooperate in these tests because within five weeks and not five years there will be a high definition film scanner in constant operation with greatly increased power in the television transmitter.

Dealer Aspect

Radio dealers should do a brisk business in ultra short wave receivers during these tests as there is nothing more alluring than pioneering along untraveled paths.

In these same "scare headlines" is hidden the new lease on life of the legitimate stage. Television, as one well known Broadway impresario claims, will be a renaissance to the stage, and well may he be right because communication is the one thing that binds countries together and brings forth more developments than any other two agencies in this rapidly moving age that we are now living in.

Television will give the continuity writer a new lease on life to broaden the scope of his already fertile brain because we all know the old Chinese proverb "One picture is worth ten thousand words."

After reading the pretentious plans in London for the studios in Crystal Palace one does not have to take with a grain of salt the statement that television will provide work for many, many Canadians. New jobs will be created by this new industry, new names will take the place of many radio stars just the same as the change that took place in the motion picture industry.

Interest in Advance

The radio dealers who are now afraid of their business will soon, one fine morning, wake up and find a new kind of prosperity that they had not even hoped for in the radio business. The present broadcast structure will remain for some time to come, as the junking of thousands and thousands of dollars worth of equipment is not good business judgment and television will when properly analyzed not put out of business but serve as a tremendous stimulus to the radio networks already in operation.

It will be of tremendous interest to watch the rapid advance that will be made in actual installations in 1935 and it is significant that even before the roar of the broadside discharged in England that Canada, which only a very, very few years ago took Marconi to her bosom and gave him the wherewithal to continue the now so successful experiments that have bound the far flung corners of this great world so closely together, has seen fit to extend again the helping hand to the well known inventor, William Hoyt Peck, in proving his television system to an eagerly waiting world.

RCA Prepares for Field Test of Television

The report of the board of directors to the stockholders of Radio Corporation of America reports, as usual, progress in television, states that developments meet or exceed foreign standards, and discloses that preparations are being considered for actual field tests as the next major developmental step. The part of report relating to television follows in full:

Continued research in the field of ultra-short waves and in the technique of visual transmission and reception has maintained your Corporation's position in the forefront of television development.

Our laboratory efforts in this direction have been guided by the principle that the commercial application of such a service could be achieved only through a system of high-definition television, which would make the images of objects transmitted clearly recognizable to observers. In this respect it is notable that transmission results attained by RCA in laboratory experiments meet or go beyond the foreign standards indicated as satisfactory for the inauguration abroad of experimental television service. Similarly, cathode ray tube reproduction, as developed in our laboratories, provides a larger field of vision for the picture received than has been hitherto attainable. In addition, RCA's development of the "iconoscope"—an electric eye that facilitates the pick-up of studio action and permits the broadcast of scenes outside the studio—has been further developed.

Viewed, however, from the standpoint of public service our own studies agree with the conclusions reached abroad by competent engineering and public authority. These conclusions are that sound broadcasting and sound receiving equipment comprise the fundamental broadcasting and receiving facilities of the nation, with television facilities as a supplementary service; that there are no short cuts to the inauguration of television; that it must proceed step by step through the processes of research, laboratory development, field demonstration and thence to regular service, and that the technical, program and financial problems involved are so great as to make it impractical to erect and maintain a system of television on a nation-wide basis, particularly in the United States, in the present state of the art.

The report of the British Commission which recently recommended the establishment of an experimental television station in England, states that transmission difficulties "may seriously limit the extent to which the country can be effectively covered" and "that the area capable of being effectively covered by ultra-short wave stations of about 10 kilowatts capacity will not exceed a radius of approximately 25 miles over moderately undulating country." The cost of this experiment at a single location in London is estimated to be approximately $900,000. For a service limited to half the population of England, it is stated that probably ten transmitting stations at suitable locations would have to be erected, and that "some time is likely to elapse before the price of an efficient receiver will be comparable with that of the average type of sound receiver."

With England occupying a territory not much larger than that of New York State alone, the vastly greater problems of television service for the United States are self-evident. The present wire systems are not suitable for interconnecting television stations as they are for broadcasting stations. For that purpose either a new wire system must be created or radio relays must be further developed and established.

In view of these facts it is apparent that the next step in the development of the art in the United States must begin with the establishment of television on the basis of field demonstration in order that subsequent plans may be founded on the practical experience thus obtained.

In view of the continued laboratory progress of RCA and the wide public interest in this new field your management is diligently exploring the possibilities of such a demonstration.

The television report thus ends.

Relay Cuts in New One and Show Goes On

By Joseph Leeb, E.E.

"THE show must go on!" This has been the slogan of the theatre since Shakespeare's time. On the legitimate stage the principal players usually have understudies, who can step in whenever a star is indisposed, but not so in the talkies. Failure of the sound equipment to function is very embarrassing, besides usually entailing a serious loss to the management.

In the good old golden days of silent pictures, almost everything was done by hand, but we have gone off the gold standard, monetarily as well as insofar as silence is concerned. With the advent of sound equipment, the tendency is to make automatic as many operations as possible. The arc lamps for the projectors are kept in perfect adjustment with scarcely any attention on the part of the operator. The speed of the film is maintained exactly right by intricate devices. A mechanical arrangement detects flaws in the film during the rewinding process. And so on down the line.

Yet every now and then the sound reproducing equipment fails, very often on account of a broken-down filter condenser, although working voltage specifications have been increased by a substantial margin. The writer, after giving considerable thought to the subject, has devised a means of instantly and automatically placing the equipment back into operation in the event of a filter breakdown.

Consider the connection of a B supply filter. A sudden surge of current throws a terrific strain on condenser A, which often causes it to short circuit. Replacing this part usually requires more time than an audience is willing to tolerate.

The arrangement hereby suggested is the remedy. A locking type relay, single pole double throw, has its winding connected in series with the B+ lead of the filter system. As long as current flows in the plate circuit of the tubes, the relay is energized, and condenser A is in the circuit.

When condenser A breaks down, short-circuiting the filter output, the relay becomes de-magnetized, releasing its armature, condenser A is thrown out of the circuit and condenser A' is thrown in. Theshort circuit is thus automatically removed, and the show continues, interrupted for no more than a split second. At his leisure, the operator may replace the defective condenser and reset the relay.

This arrangment is suitable not only for motion picture equipment, but for public address systems and receivers as well. The relay proper need not possess any unusual features, and can be purchased on the open market. It is only necessary to specify the type of winding to conform with the requirements of the filter system.

Radio University

Questions answered weekly. From the great number of questions submitted by many readers only those deemed of wide interest are published in these columns, with answers. Readers desiring individual question and answer service by mail may obtain it by subscribing for RADIO WORLD *for one year (52 issues) @ $6.00 and obtaining a Radio University membership card. No other premium with this offer.*

RADIO WORLD, 145 West 45th Street, New York, N. Y.

I DESIRE two diagrams of one-tube signal generators, one for a-c operation and one for battery operation.—J.J.N.

Two similar oscillators are depicted. In the a-c model, a 56 type tube is energized from a single filament transformer and hum is the modulation, while the d-c model uses a 1.5 volt and a 22.5 volt battery, no modulation, unless the leak is increased to 5 to 10 meg.

* * *

High Fidelity Practice

IN HIGH FIDELITY receivers I notice that there are two ways of making the selectivity high, as occasion demands, and which of course stops high fidelity: one is to use a variable series resistance in a coupled tuned circuit at the i. f. level, the other is to use the variocoupler idea. However, is it not practical also to have high fidelity in a tuned radio frequency set, where the band width is permanently large enough, and there is no attempt to introduce high selectivity? Also are not other methods applicable to the i. f. channel?—L. K.

The two methods you mentioned, applicable to the i. f. channel, work well and simply. Any method that produces variation between a high extra load and practically no extra load on the amplifier circuit will do the trick, but the methods outlined exist commercially and are therefore most readily tried. The idea as you suggest can be worked well with a tuned radio frequency receiver for the broadcast band under the conditions of selectivity sacrifice that you impose, since there is no selectivity variation. It should be observed that not only must high fidelity be considered in the selectivity of the radio frequency and intermediate frequency levels but also the audio channel and the speakers and baffling must be such as to render high fidelity practical.

* * *

Use of A.V.C.

TO WHAT EXTENT should automatic volume control be introduced in a receiver, particularly a superheterodyne?—I. K..

The superheterodyne is the only circuit in which it is really advantageous to introduce this, because the sensitivity is high enough to enable the sacrifice that automatic volume control requires, and the effect of the filter circuits on reduction of selectivity need not be considered, because, there is selectivity to spare. However, in the case of the super the r. f. stage or stages may be subjected to a. v. c., and it is always advisable to have a. v. c. on the mixer tube or modulator, if of the type that stands it (remote cutoff). If there is only one i. f. stage it is of no advantage to use a. v. c. on it, as sensitivity is reduced without any improvement of the signal to noise ratio. If there are two i. f. stages a. v. c. may be omitted from the first stage and included in the second stage. Full a. v. c. on the modulator is recommended, considering it as a pentagrid converter unit. Less than full a. v. c. (say, 50 per cent.) on the rest of the tubes specified. The object of a. v. c. is to keep the output approximately level, regardless of the input. In reality this does not occur completely but a good enough approximation is reached if the pentagrid converter has 100% a. v. c., that is, its modulator grid returned to the high side of the diode load resistor, with as much or as little a. v. on the r. f. stage or stages as desired, say 50 or 100 per cent. Where sensitivity has to be high, or circuit losses have to be compensated, as in high frequency bands, say around 15 to 30 meters, the secondaries may be so returned as to omit a. v. c. for the band completely. It is more important to hear a station, even with intensity variations, than it is to have the silence from the station uniform.

* * *

Frequency Ratio

HOW IS IT possible to attain a frequency ratio of 520-1600 kc with the same tuning condenser with which it is ordinarily possible to get a somewhat smaller ratio?—I. L. C.

The tuning ratio depends on the capacity change. This capacity change arises principally from the tuning condenser. However the distributed capacities enter, and when these are small the frequency ratio of tuning is larger. The main reason has to do with the method of coupling primaries and secondaries. Certain methods make for small capacity, as when the primary is wound alongside of (not over) the secondary.

* * *

32 Volt Circuit Desired

WILL YOU PUBLISH a diagram of a 6-tube superheterodyne for 32 volts d-c power in which two of the tubes are 48s and for which only 32 volts are used on the plates?—G. T. K.

None of the tubes that are available on the market at present can operate satisfactorily with a plate potential of 32 volts, excepting only a few detectors, and it is accordingly not possible to print such a diagram.

* * *

Lone Tube

PLEASE ADVISE WHETHER it is possible to obtain variable delayed A.V.C. with the 2-volt battery tubes and if so which tube can be used for best results?—A.E.W.

At this date there has not as yet been generally introduced a battery tube that is the prototype of the diode and ampli-amplifier, equivalent of 55, 2B7, etc., so this circuit is not applicable for 2 volt battery sets. Until such a tube is generally introduced it will be necessary to use an extra tube for this purpose. One manufacturer, so far as we know, is alone in offering the tube.

* * *

What the Tank Is

The main tuning circuit of a transmitter is usually called the tank circuit since energy is received and stored during part of the oscillation cycle and dissipated during the rest of the cycle.

HIGH FIDELITY SETS

(*Continued from page* 8)

should never need readjustment. However, in case the center screw should be inadvertently loosened and the adjustment lost, the following instructions are given:

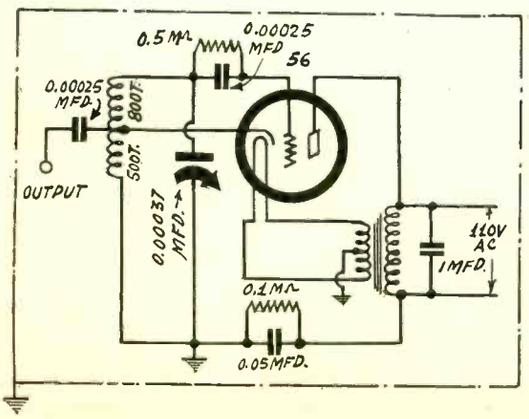
Provide three strips of clean, smooth paper, .006" to .008" thick, about ¼" wide, and about 3" long, for use as gauges. With the cone center clamping screw loosened, insert one end of each of the paper strips in the gap between the outside of the driving coil and the hole in the front plate, spacing the strips equidistantly around the coil. This may easily be done if the ends of the paper are cut to a point and tweezers are used for inserting them.

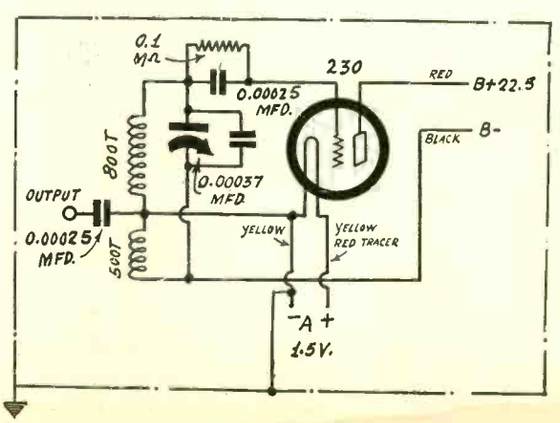
Now, tighten the center clamping screw and "feel" the paper strips by pulling them with the tweezers to determine if any are pinched tightly in the gap. If this is found to be the case, the center screw should be loosened, and the cone moved slightly sidewise in a direction to relieve the pinched strip. Then, the screw should be retightened.

The coil is considered centered when the three strips are equally free in the gap. Remove the strips by grasping them with the tweezers close to the front plate, rather than by pulling on the end of the strip, otherwise the paper may tear off against the edge of the hole, and thus a piece may be left in the gap.

In performing the centering operation, use great care not to damage the driving coil leads.

The amount of hum in the output of these receivers will be found to vary. This is due to the characteristics of the 2A3 tubes used in the output stage. Therefore, if a particular receiver is found to have excessive hum, it is recommended that several 2A3 tubes be tried. In this way a suitable set of matched tubes can be obtained which will give minimum hum.





Two oscillator circuits, one for a-c operation and the other for battery operation.

Station Sparks

By Alice Remsen

NBC OPENS SPECIAL WORKSHOP STUDIO

A **SPECIAL studio to be used exclusively as a workshop for NBC artists,** was officially dedicated recently on the fifth floor of the RCA Building and christened "Artists Service Studio." George Engles, NBC vice president, and managing director of NBC Artists' Service, and Daniel S. Tuthill, assistant managing director of Artists' Service, presided at the ceremonies. Lucille Manners, young soprano, who is now being heard on the Cities Service programs, sang several songs to test the equipment, and O. B. Hansen, chief engineer of NBC, took personal charge of the controls during the dedication. The studio is now available as an "idea hatchery," where NBC artists may work out new ideas with complete broadcasting equipment. An engineer and production man will be available at all times and there is plenty of space in the control room for friends or clients to listen to sample broadcasts. In addition, this new studio is hooked up with all the remote control loudspeaker units throughout NBC offices. This is, I believe, a step in the right direction. Artists with ideas may be able to get somewhere, if there is not too much red-tape attached to obtaining the use of the studio. . . . Jan Garber, the diminutive band leader, now has the Yeast Foamers period to himself, without dramatic continuity, each Monday at 8:00 p.m. NBC and WJZ network.

CANDID CAMERAGRAPH

RAY NOBLE . . . England's jazz king mounts the podium to make his American radio debut over a nation-wide NBC network . . . tall, slender, straight . . . in full dress . . . blonde hair combed tightly back . . . looks like a Nordic Alfonso . . . corners of mouth upturned in an easy grin . . . carries no baton . . . arms and hands serve the purpose . . . sweeps them with grace of a ballet dancer . . . delicate twists of long tapering fingers bring out what, during rehearsal, he calls "color" . . . gestures like caresses in pantomime . . . smiles as four brass players dash from rear seats to microphone . . . turns around, bows quickly to smile greeting to a friend . . . calm, cool, easy-going . . . steps off podium during an obligato . . . rests elbow on music stand . . . as if he were merely an interested spectator . . . points wrist watch at control room to check time . . . smiles again . . . steps on podium, directs briefly, leaves it to enter control room . . . returns in middle of selection . . . taps one toe lightly as he directs . . . then the other . . . gestures never violent . . . facial expression never solemn . . . music seems to reveal his personality . . . sophisticated . . . polite . . . Park Avenue . . . gives to American dance music the refined Oxford accent.

DON MARQUIS ON DECK

Don Marquis, celebrated newspaper columnist and creator of the Old Soak, archy, the cockroach; mehitabel, the cat and many other characters, has just inaugurated a series of radio talks for listeners in the New York metropolitan area. Marquis, who discusses a variety of subjects in his own humorous manner, is heard over NBC station WEAF each Tuesday and Thursday evening from 11:00 to 11:15 p.m. E.S.T., and over NBC station WJZ each Sunday morning from 11:05 to 11:15 a.m., under the sponsorship of Simon Ackerman Clothes, Inc.

Well known to thousands of New Yorkers who read his stories of archy and mehitabel in local newspapers for years, Marquis also is the author of numerous books and plays. His play, "The Old Soak," was one of Broadway's outstanding hits, and has since been made into a successful motion picture and radio dramatization.

JOE COOK LANDS IT

Circus Nights in Silvertown, a new 45-minute radio carnival starring Joe Cook with B. A. Rolfe and his Silvertown orchestra, Tim and Irene, Phil Duey, Lucy Monroe, Peg La Centra and the Silvertown Singers, made its debut over an NBC-WJZ network on Friday, March 8, at 10:00 p.m., E.S.T.

With Cook, circus trained zany, playing the barker, handyman, circus manager and water carrier to the elephants, Circus Night in Silvertown is on the air each Friday night with a repeat performance for West Coast listeners at 11:30 p.m., E.S.T., under the sponsorship of the B. F. Goodrich Company and Silvertown tire dealers throughout the country.

The sponsors are particularly gratified at having obtained Cook for their leading funnyman. When the series first was created, Cook was thought of for the starring role. It was felt he would not be available, however, and the part was not offered him. Later, before the sponsors announced the complete cast, Cook was asked to listen to the recorded auditions of the program. That settled it. The man who ran away from home to join a circus said "Count me in."

CBS SIGNS 'EM UP

Several program renewals at CBS. Soconyland Sketches, a program which has been on the air continuously for more than seven years, has renewed and will still continue to feature the "Snow Village" scripts, with Arthur Allen and Parker Fennelly. . . . "The Big Show," a popular feature, has also renewed. The cast will remain intact. . . . "Buck Rogers in the 25th Century," a program catering to the youngsters, will continue to broadcast each Monday, through to Thursdays at 6:00 p.m., according to a new contract renewal. Cast remains the same. . . . Connie Gates is the new singer on the "Outdoor Girl Beauty Parade" program each Saturday at 7:30 p.m. Featured with Miss Gates is Richard Norton, young baritone. . . . There is a change in cast on the "Diane and Her Life Saver" program. Audrey Mason, lyric soprano, and Edward Nell, Jr., baritone, have been assigned both the singing and speaking roles of Diane and her mysterious suitor. . . . It was Carlyle Stevens, youthful CBS announcer, who won the "BBDO Award for Good Announcing," according to an announcement by Roy S. Durstine, vice-president and general manager of Batten, Barton, Durstine and Osborn, Inc., the leading advertising firm which made the award, consisting of cash and an appropriately engraved stop-watch. . . . There is a new program, emanating from Boston and featuring an anonymous vocalist, together with an orchestra conducted by Baron Sven Von Hallberg, a member of the Swedish nobility. It is called "Lilac Time with the Night Singer," and may be heard over WABC and the Columbian network each Monday at 10:30 p.m. Sponsored by Pinaud, Inc. . . .

STUDIO NOTES

Charles Winniger is one of the best shots in radio. He averaged 95.80 out of 2,000 shots in a recent clay pigeon tournament. . . . Roxy is another crack shot. . . . John C. Schram, of the WOR production staff, is a graduate of Columbia University. . . . Jolly Coburn has a wrist watch which spells out his name instead of the usual numerals. . . . Anne Jamison, NBC soprano, is now on the Coast making pictures. . . . Wally Magill, of the NBC music library, is at the Breakers Hotel in Palm Beach for a series of concerts. Wally is a very fine baritone. . . . Gus Haenschen has taken his first holiday in ten years. He is in Florida with his "missus." Dan Lieberfeldt, his chief arranger, is directing the programs during Gus' vacation.

The Mutual Broadcasting System, which has WOR as its key station in New York, and WLW, Cincinnati, WGN, Chicago, and WXYZ, Detroit as its network, is corralling quite a few commercial accounts, among them, M. Hohner, Inc., harmonica manufacturers, who are sponsoring Carl Freed's Harmonica Harlequins, each Saturday at 7:45 p.m.; also the Consolidated Cigar Corporation, which is sponsoring Nat Brusiloff and his orchestra in a variety show, with the well-known comedians, Harv and Esther. Each Monday, Wednesday and Friday at 9:30 p.m. . . . Another new slant on amateur radio entertainment has been created by the program directors of Station WBNX, New York. They have invited the public to submit amateur scripts for radio presentation; requests for scripts brought hundreds, some of them not at all bad, a few good; these are being broadcast. . . .

Latty Taylor, of WOR, likes to wear a hat when he broadcasts; he prefers fedoras. . . . One of Joe Penner's fans sent him a cigar eleven inches long. . . . Doris Sharp, CBS vocalist, is writing a play . . . Davidson Taylor, also of CBS, is writing a magazine story; well, let's hope they both sell their brain children. . . . Bert Park's wags his head when he's announcing. . . . Annette Hanshaw nods her head whilst singing. . . . Everett Marshall uses his fists when he sings. . . . Victor Arden crouches while conducting. . . . Jane Pickens cannot keep her hands still while singing. . . . Ralph Wonders has been added to the already large roster of radio folk entitled to be called Colonel in Kentucky. . . . Gladys Thornton, heard in "The Shadow" program, had a veritable avalanche of yams sent to her from Georgia. . . . Phil Duey is getting ready for spring; practicing his golf swing at a driving range near his home.

A THOUGHT FOR THE WEEK

They Call her "Sugar Cane," she's seven years old, hails from New Orleans and was an outstanding figure in the broadcast that introduced recently the 50,000-watt transmitter at Station WOR. But that's not the main thing about the little girl who has been appearing in "Roses and Drums" and with Angelo Patri and out-and-out kiddie hours on the air. "Sugar Cane" is something more than "Sugar Cane." She is a small package in which are wrapped such personalities as Greta Garbo, Mae West, Zasu Pitts and that comparative newcomer, Katharine Hepburn. That is to say, the eleven-yearer is so excellent in her impersonations of these and other famous ones that the announcer insists it is necessary that he tell the listeners just who is on the air and also who is not. Otherwise the public wonders how Mae, Greta, Zasu and Katharine could be on the air at one time for one sponsor.

Anyway, the parents of "Sugar Cane" are busy considering the offers they are receiving for their amazingly clever little imitatrice. It looks as if this particular family would not have to worry about the rent for a long time to come.

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The Electrons in a Tube

Primary and Secondary Emission Explained

By Morris N. Beitman

Supreme Resistor Company

IN 1883 Thomas Edison discovered that when an additional electrode was placed inside an incandescent lamp and connected to a positive potential with respect to the filament a current passed through the circuit. It was much later, however, that Thomson proved that the charges emitted by the hot filament were electrons and Richardson was first to derive quantitive relations between the number of electrons and the temperature of the cathode. This relation in one of its forms is below:

$$I = A\,T^{\frac{1}{2}}e^{-\frac{B}{T}}$$

where

I = electrons' current per unit area
A = a constant depending on the units of measurement and material used
B = a constant for the given material
T = absolute temperature
e = the base of natural logarithms, 2.71828

From this it is important to note that emission increases rapidly with the temperature rise. Other similar equations have been derived and the constants have been obtained from experimental data.

Electron Removal

Work is done when an electron is removed from the surface of a metal. The smaller the affinity of a substance for electrons, the easier will it be to remove electrons. The work function of a substance is the expression of the ease of removing electrons.

Substances show great variations in their thermionic emitting properties. In selecting a suitable substance for the filament of a vacuum tube quite a number of different factors must be considered. By combining two substances, each of which may possess different favorable factors, the needed operating conditions may be obtained.

Thoriated tungsten is one such substance that is used in commercial application. Tungsten has a melting point of 3382° C. and its work function is 4.5, which is very high by comparison to other metals. But tungsten has an affinity to hold thorium on its surface close to the point at which thorium alone would melt and evaporate. Thorium further is an excellent emitter. The melting point of thorium is 1845° C., but it is possible to operate a filament made of thoriated tungsten at about 1700° C. This filament will yield a thousand times as many electrons as pure tungsten under the same operating conditions. The life of a thoriated tungsten filament may be renewed a number of times by flashing the filament at a somewhat higher temperature.

The Oxide Coated Types

Oxide coated cathodes are also very good emitters. Usually oxides of barium and strontium are used and are deposited upon a metal core that acts as the filament heater. A number of different commercial methods is used to place the oxide upon the core. Further a great many different materials are utilized for the core, including many alloys. The exact behavior of oxide coated cathodes is not understood and the theories advanced are conflicting in parts.

For alternating current operation an indirectly heated cathode is used. In common practice a tungsten wire, carrying the heater current, is surrounded by a refractory insulating material. Over the refractory material is drawn a nickel sleeve coated with an oxide. In this manner the nickel sleeve keeps relatively constant temperature although an alternating current is used to heat the tungsten filament. Another point of advantage of an indirectly heated cathode is its constant potential at all points on the surface and the insulation from the filament circuit.

Secondary Emission

Electrons may be freed from matter by a number of various methods. We have already considered thermionic emission. Another process is called secondary emission and is due to the impact of electrons against a cold body. If electrons strike a surface with a sufficiently high velocity, they will dislodge other electrons from the surface. Many times each electron will knock out quite a number of other electrons. This is a familiar occurrence in the triode vacuum tube. The electrons dislodged form a space charge around the plate and reduce the possible plate current. In the multigrid tubes one grid is used to overcome this charge.

The dynatron oscillator makes use of this secondary emission to create a negative slope in the plate voltage-plate current characteristic, thereby creating a stable operating oscillator. The secondary emission is accomplished with the aid of application of a higher positive potential to the grid than the plate of a triode vacuum tube.

Pass Through Grid Spaces

Since the grid consists of a mesh of wires, most of the electrons will pass through the spaces between the wires and upon striking the plate dislodge electrons from it. These dislodged electrons may be attracted to the grid because of its higher positive voltage. Therefore, within certain limits, the increase of plate voltage will increase the amount of electrons striking the plate, increase secondary emission, and decrease the plate current.

The Basis of "Good" and "Bad" Index of a Tube

Vacuum tubes are important implements in the art and science of radio. The great number of types that the market presents is likely to have a confusing effect on the average radio fan. Somewhat to alleviate the possible confusion, vacuum tubes have been categoried in various directions. They have been classified as to the number of electrodes, the magnitude of their electrode potentials, the size of their bulbs and the number of prongs in their bases. Other factors that have been defined for this purpose and which have been found to be generally useful are amplification constant, plate resistance and mutual conductance.

One of the most useful of these tube characteristics is mutual conductance, which is closely related to the ability of a vacuum tube to conduct a current in one circuit to induce a voltage in another. Conductance, as used in ordinary electrical practice, relates to the opposite characteristic to a resistance. It is expressed mathematically as the quotient of a current and a voltage—the reverse of the classical resistance formula of ohm. In radio, since the change in plate current is a result of a voltage change in the grid circuit, the word "mutual" is added to this term to indicate the quantities exist in two different but related circuits.

With the advent of the multi-electrode tubes, that is those having more than three elements, it has been found necessary to add another term to take care of this special situation. The new term is called "transconductance" (Sm) and is defined as the ratio of the change in the current in the circuit of an electrode to the change in the voltage on another electrode, under the condition that all other voltages remain unchanged. Since the triode type of tube is not used so much as previously the new term of transconductance is becoming more generally heard rather than the term of mutual conductance. However, the correct usage of the trans-conductance term is only possible when the electrodes involved are specified with the transconductance figure. Thus, if the transconductance between plate and screen No. 2 is involved, this fact should be so stated.

Mutual conductance or transconductance refers to static conditions generally, and the values given in characteristics charts for the mutual conductance or transconductance of a tube are static.

For amplification and oscillation, and even for detection, mutual conductance may be taken generally as a tube's figure of merit, but not for power tubes, as in their case the amplification factor may be low and thus reduce the mutual inductance, though the power handling capabilities are excellent. The mutual conductance includes the plate resistance and amplification factor therefore a valuable index.

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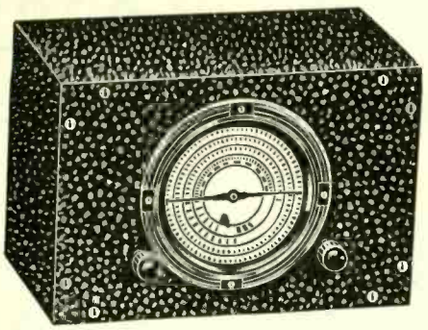

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THE new 339 Signal Generator, designed by Herman Bernard, operates on fundamentals from 54 to 17,000 kc, 5500 to 18 meters, on a.c. or d.c., with modulation option in either use, and sells at approximately half the price of equivalent instruments. Bands are shifted by a front panel rotary switch.

One of the outstanding features of the 339 is the vernier airplane dial. This has direct-reading scale both in frequencies and wavelengths and is of the decimal-repeating type, a new invention of Mr. Bernard. Thus the top scale, in frequencies, is 54 to 170 kc. The lower scale in frequencies is 170 to 540 kc. The other bands are read as 10 or 100 times these frequencies.

Answers in Wavelengths, Too

As wavelengths are calibrated on the dial, too, division by the same factors, applied to the wavelength scales that adjoin the frequency scales, gives the answer in wavelengths. Bernard signal generators are the only ones that yield determinations both in frequencies and wavelengths.

The dial is 3.5 inches in diameter and has a double pointer enabling close readings. The decimal repeating dial itself enables close readings because the circumference of scales is not diminished for succeeding bands. The 54 to 170 kc scale has gradations in spaces of only 1 kc. Thus for the broadcast band, 540 to 1700 kc, 10 kc separation prevails. The 170 to 540 kc scale has gradations in 1 kc from 170 to 200 kc, and bars separated by 5 kc for 200 to 540 kc.

Coincidence of generated frequency and scale reading is very close. Never is the accuracy less than 1 per cent., and for most settings there is no observable difference between the true frequency and the read frequency. This high order of accuracy obtains in no other instrument, selling at less than three times the cost of the 339.

Why 339 is Best Choice

Many, no doubt, have been somewhat confused by the numerous types of signal generators, but will note that the best of them cover wide ranges on fundamentals, have an attenuator, and permit of presence or absence of modulation. Also they have a vernier dial and are direct-reading in frequencies, accurate to at least 3 per cent. The 339 has all these advantages, besides affording wavelength determinations as well, and operation on 90-125 volts a.c. (any commercial frequency) or d.c. And the accuracy is three times as great. Moreover, the 339 is well built, for lifetime use, and covers all waves fundamentally, besides permitting measurements of frequencies up to 100 mgc (down to 3 meters) by resort to a slight calculation method, applying a simplified harmonic system to the 5,400 to 17,000 kc fundamental band.

The 339 has a 37 rectifier tube, so that d.c. is used on the plate. Modulation is provided by a neon tube relaxation oscillator at a frequency of about 1,000 cycles. Limiting resistor for the tube heaters is built into the a-c cable assembly for maximum heat dissipation.

Lowest Prices for Precision Products

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USES FOR THE 339

The primary purpose of the 339 is to enable lining up radio receivers at intermediate-frequency and station-carrier-frequency levels. The generator emits the desired radio frequency, accompanied or unaccompanied by a superimposed sound, as desired (switch controlled). The sound is generally useful when the indicator consists of speaker or earphones.

Also, the 339 serves as a frequency and wavelength meter for all stations, 54 kc to 17,000 kc, when the 339 is used in conjunction with a receiver. Not only is the 339 a station finder, but also a device for measuring the frequency and wavelength of the station. Hence listeners may use the 339 to advantage with their all-wave sets, without any molestation whatever of the receiver or its wiring.

The 339 has three knobs, instead of two shown.

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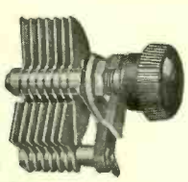

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