RADIO WORLD

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The First and Only National Radio Weekly

Eleventh Year—539th Issue

JULY 23d 1932 15c per Copy

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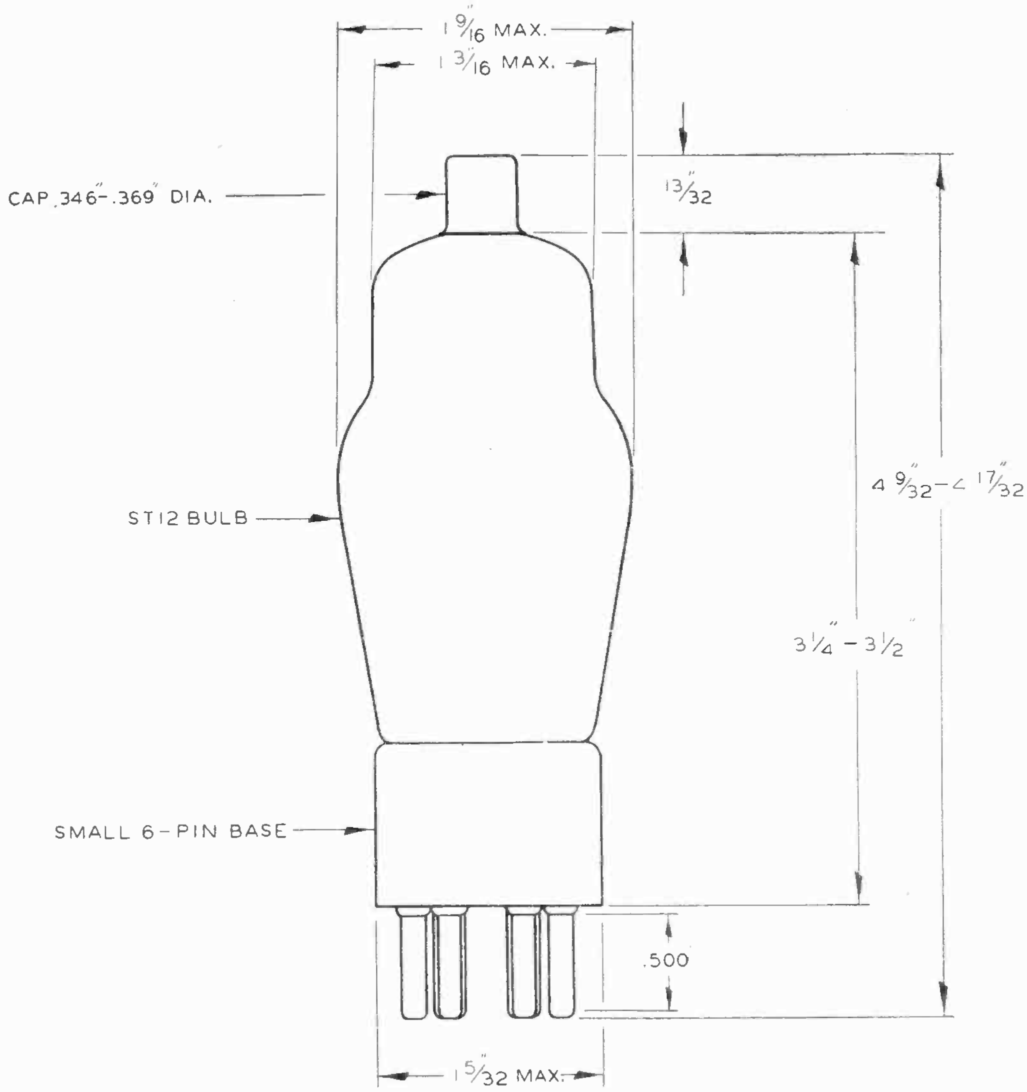

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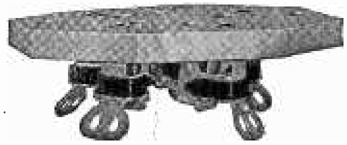

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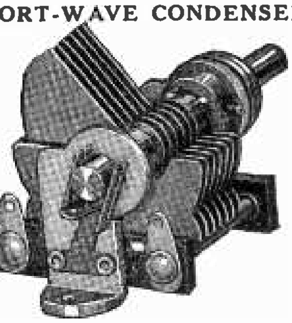

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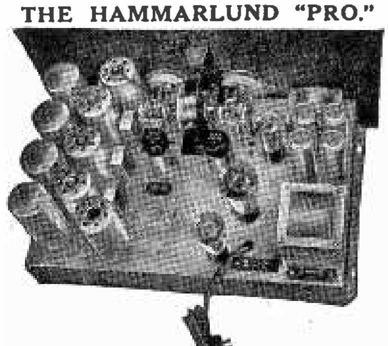

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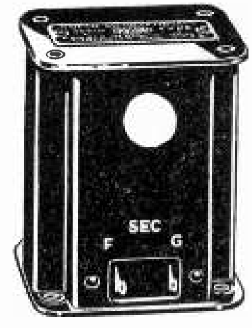

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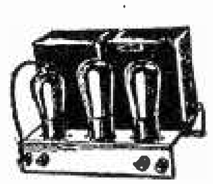

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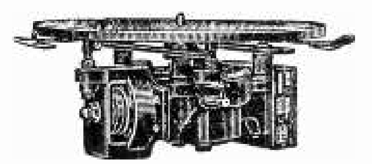

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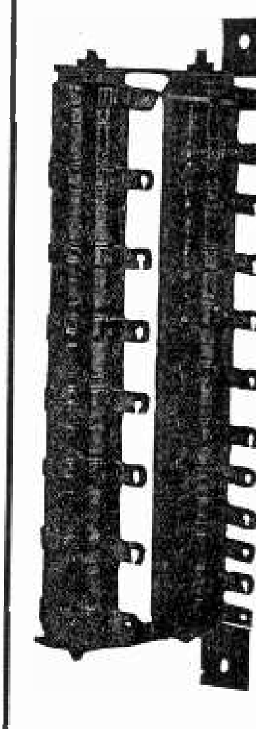

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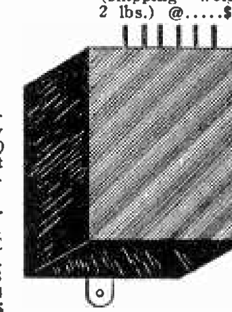

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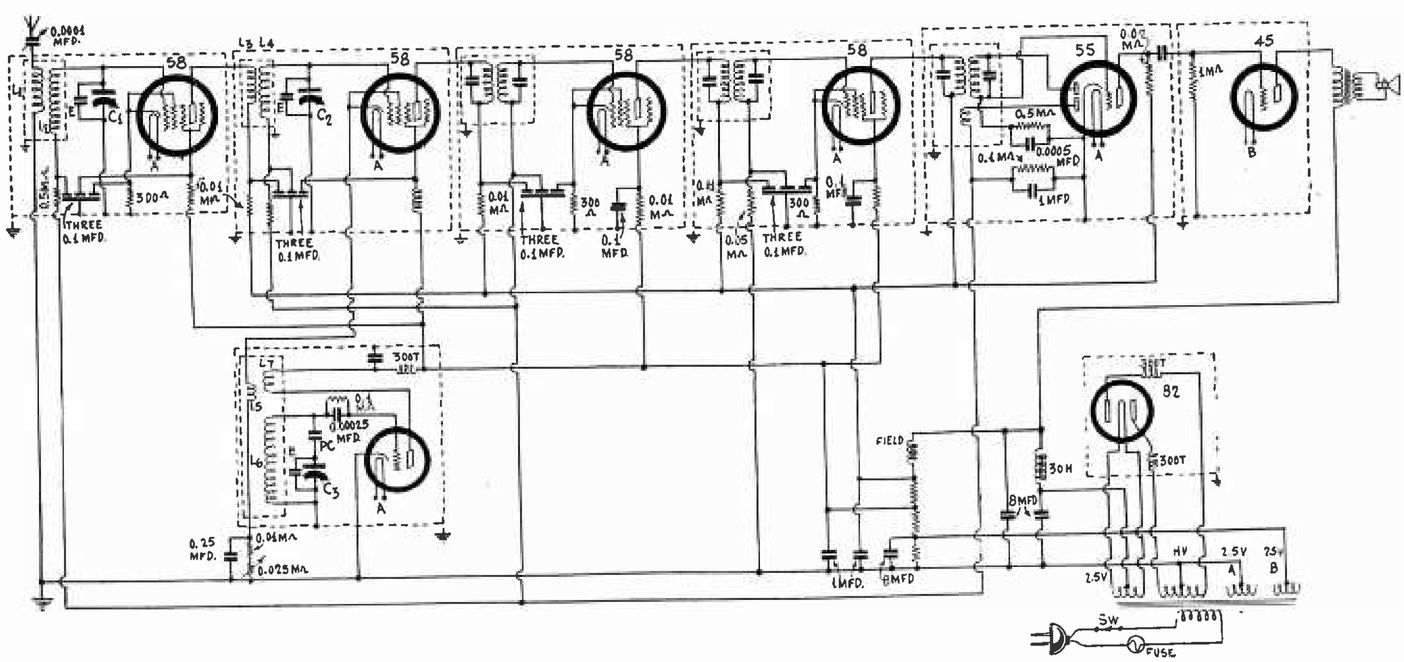
Experiences with New Tubes

Complete Filtration and Shielding Needed

By Herman Bernard



The correct way to use the new tubes is indicated in the diagram and explained in the text. This is an eight-tube superheterodyne. The second detector or demodulator is a 55, the triode part of which is the driver for the output stage.

PRACTICES in regard to the introduction of new tubes have changed for the better. The earlier way was to run curves on the tube and on that basis make recommendations for its use. These recommendations never stood up in full, in regard to screen grid tubes. The plate circuit was supposed to be tuned, for instance. Three cheers for the high impedance of résonance! But then what happened to selectivity? Tune the grid circuit, was the answer, and then gang condensers could be tracked well enough. Plate circuit tuning resulted in large minimum capacity, and if combined with grid circuit tuning made necessary large trimming condensers, and full coverage of the broadcast band became a problem. Then it was found that selectivity of another kind had to be provided—absence of cross-modulation and intermodulation. So the variable mu tube came along. The answer to the question, How shall I use the early type screen grid tubes? was, Use the new variable mu tubes.

Lately an improvement on the screen grid type tube has been put on the market, due to the introduction of the suppressor grid, so that the plate current can swing over large values without the tube saturating. Thus amplification may be much greater—meaning improved sensitivity—and fewer tubes can accomplish as much, or the same number of tubes can accomplish more.

More Caution With New Tubes

The instances of past mistakes are cited simply to show the change that has taken place, for the new tubes are not heralded as world-beaters, requiring only substitution for other tubes to work a miraculous change in set performance. Indeed, the stock phrase regarding the new tubes is that they can not be used for replacement of any other type tube.

Forgetting even the socket difference for a moment, the substitution still can not be made with profit. Severe exactions are required if the new tubes are to be used, these are stated well by the tube manufacturers, and have been printed in these columns, and where practice has not been fully worked out for special circuits, this fact is stated, as for instance the unanswered problem of where to connect the suppressor grid for special purposes.

We know that for standard practice the suppressor grid is tied to the cathode, but any difference between the two would have to maintain the suppressor negative in respect to the cathode. Some preliminary experiments indicate that the 58 becomes a good detector when the suppressor is somewhat negative, and again

(Continued on next page)

(*Continued from preceding page*)
when it is considerably negative. Values of 10 and 50 volts are suggested. The variation of voltages produces a non-uniform change, and the characteristics of the tube change abruptly, particularly the plate resistance goes up.

Special Shields for Tubes

The 58 tubes were tried in a tuned radio frequency set of simple design, as a substitution, against recommended practice, just to determine what would happen. The amplification increased so much that the shielding proved inadequate. The shielding consisted principally of shielded coils and shielded tuning condenser and tubes. If a set is very sensitive it is recommended that the special shields be used for the tubes. These aluminum shields have a removable cap that fits snugly over the dome of the tube, thus forming a capacity between the shield inside the tube and the cap of the external tube shield. But even a modest set becomes very sensitive, and so its seems that the special shields should be used in even a two stage-t-r-f detector circuit.

Box shielding becomes almost imperative. Under this system the tube and coil are in one compartment, but it is practical also to retain the special shields for the tubes, and also leave the shields on the coils. Thus the condition of double shielding exists. In that way the tube and coil shields may be aluminum or copper, but the box shield, because not proximate to the coil, may be any of the iron-base metals.

Unless these precautions are taken we revert to the old fallacy of putting high gain into a set only to face the necessity of taking it out again by introducing "lossers" of various kinds—low voltages, skinny primaries, loose coupling generally, and a requirement for high audio gain, due to attenuated r-f amplification, with danger of distortion.

Contents of Box Shield

The box shield should contain the following: socket, tube, tube shield, coil, coil shield, and filter circuit for every emerging lead except the heater. The plate circuit filtration of a preceding tube would be in a succeeding shield, because the primary of a transformer is in the plate circuit, and the transformer is in the succeeding shield. The only exception, as to a primary, is the one in the antenna circuit.

Thus, taking the input r-f stage of the eight-tube superheterodyne diagrammed herewith, the adjustable condenser, in series with the aerial, may be inside or outside the shield, and should be set once and left thus. The setting will depend on the pickup from the aerial, the conditions at one's location, etc., all of which relate to reduction of the noise level so that it will not be reached at any particular location. Primary is connected to aerial and to ground. The secondary is connected one side to grid, the other side to a resistor and condenser that serve as r-f filter. Automatic volume control is used, and the secondary is thus grounded to radio frequencies as soon as possible because a necessarily long lead is involved. This is a shielded cable, shield grounded. The biasing resistor for minimum bias serves as a filter when the bypass condenser is across it. So, too, the screen circuit is filtered. The bypass condensers should be inside the box shield.

In the second box at upper right the primary filtration is shown, the treatment of secondary, cathode and screen circuits is the same as in the preceding example, and automatic volume control governs this tube, too, although it is the first detector. This is advisable if the 58 is used as first detector, especially as the manual volume control is in the cathode leg. The negative bias should be about 10 volts steady, subject to increase by a-v-c and manual control. The limiting and adjustable resistors will be seen below the pickup winding of the oscillator coil.

Stabilized Oscillator

The same system is repeated throughout, except that the oscillator, a 56, is not subject to control, and should not be. The 56 is highly recommended as an oscillator, and its plate voltage may be the same as the screen voltage for the 58 tubes, around 100 volts. The total B voltage in the 58 tube circuits is around 250 volts, and the effective voltage on the plate, discounting the trivial drop in the primaries, would be the difference between the bias voltage and the applied B voltage. So for the first r-f tube the plate voltage might be 247, the bias 3 volts, and for the first detector, 240 and 10 volts, respectively, these subject to change due to the a-v-c.

Stabilization of the oscillation, so that voltage changes will not affect the frequency, is accomplished to a large measure by the grid leak and condenser, which are not there primarily for detecting purposes, although the circuit thus becomes a detector, for the negative bias is zero, except as made negative by any flow of grid current through the leak. For this reason a high d-c resistance grid circuit is necessary, and it is better for selectivity reasons to put the leak in series rather than in parallel with the tuned circuit. The grid will not block at 0.1 meg. for broadcast frequencies, although if short waves are to be received on any such set the oscillator leak may have to be 0.05 meg. This, however, is a broadcast set.

Abruptness Desired

The radio frequency amplifier consists of two tubes, the first r-f and the first detector circuits, for the detector does amplify radio frequencies a little. The oscillator provides some amplification, in a sense, since it oscillates only by virtue of the fact it amplifies, and this amplification shows up as a certain amplitude at a certain frequency. The amplitude changes with frequency, but not much over the broadcast band. When oscillation is intense the grid current is high, and may reach 15 microamperes. Then the negative bias would rise to 1.5 volts, but would recede as the grid current flow is cut down by the bias. That is one good point in constituting the oscillator a detector, although the detected component is not used in the output. Small changes in bias produce sharp changes in current, so that both the grid and plate current go down abruptly as the bias rises a little.

The oscillator and the modulator constitute the mixer. They must be coupled. This coupling may be established in any of a number of ways. Here the most orthodox method is shown. The feedback is provided by a fixed tickler, the coupling of modulator and oscillator by returning the cathode of the modulator (first detector) through the pickup winding to ground via the biasing resistors of the modulator. These resistors must be bypassed, and are, but the pickup winding must not be, and isn't.

55 Serves Three Purposes

From the modulator the intermediate frequency flows, occasioned by the uniting of the signal frequency with the higher oscillator frequency. The difference between the two frequencies is the intermediate frequency, hence the intermediate frequency must be established at this difference.

Primary and secondary of the intermediate transformers are tuned. Secondaries are grounded to r-f as soon as practical, in view of a long common lead to the a-v-c otherwise electrically common. The filters provide isolation, and the resistors are in the descending order of magnitude from the first tube on, to reduce feedback hazards. The current will seek the path of least resistance.

There are two stages of intermediate frequency amplification. This requires two coils, as one coil must couple to the detector.

The new 55 tube is the detector, and it is one of the finest contributions to radio so far made through the devising of special purpose tubes. The detecting part is a diode, and the diode is the oldest type tube detector, but since it is not sensitive, does not amplify at all, it was not brought forward prominently until exceedingly high-gain circuits could be built with relatively few tubes. For a superheterodyne of standing, eight tubes may be considered few.

Diode, Anode, Triode, Whatnot

Not only is the tube not sensitive, but the stage of amplification that may be obtained from the triode part of the tube still does not leave the sensitivity anywhere near what it would be, say, if a screen grid detector were used, for instance a 57. On the score of quality, however, the diode is highly superior, and radioists with musicianship in their blood will find this tube one to their utmost liking. Moreover, in a good superheterodyne we always may develop much more amplification than we can use, and the former practice has been to expend this excess on nothing, save perhaps selectivity, of which already there may have been too much. So here we can devote the excess to financing the 55 with a strong "hop," use the triode part as a stage of audio, and from the triode feed the '45 output tube.

The 55 structure consists of the following connections: two heater pins, one cathode pin, two diode anode pins, one triode plate pin and one cap for triode grid. The diode anodes are in line with the large heater pins. So the pin between heater and one diode anode is cathode and the pin between the other heater and diode anode is the triode plate.

Triode Direct Coupled

Direct coupling is used between the detector diode and the triode, by connecting coil return to the cap. as well as to the resistor in the cathode leg. The cathode is common, and by this system may be grounded. The bias on the triode is then equal to the voltage drop in the cathode resistor that also is then the grid leak.

One of the diode sections—that used for detector—has been discussed. The other diode section is used for a-v-c. A pickup winding is necessary and, if you haven't a transformer that includes it, you may wind in the space between the primary and secondary enough turns to provide a current flow through the resistor, at the loudest signal, not exceeding 0.5 milliampere. Of course, with 0.1 meg. in this circuit that much current need not be expected to flow in all locations, but the voltage drop across the resistor would be 50 volts. If smaller values of resistance are used the warning not to exceed 0.5 ma becomes important.

The adjustment can be made by reducing the value of this resistor. The condenser across it is large enough to give a satisfactorily low time constant, and the lower the resistance the lower the time constant. However, it should be noted that the a-v-c is not obtained from the receiver's detector circuit itself, and this separation makes the time constant ineffective on the detector directly, and only indirectly through the control. Some systems make the effect direct, and when tuning from one station to another there is annoying choking of the signal (time delay) before the new station is heard.

Oscillator Intensity

While in general there is no a-v-c unless there is a signal, hence the need for a limiting bias to safeguard against utter absence of bias during no-signal periods, if the oscillator is fairly intense this trouble does not arise, nor is there noise in otherwise dead spaces between station positions on the dial, for the oscillation

(*Continued on next page*)

The Use of the 89 Tube

Auto Value Has Just Been Announced

By Ishaw Frederick

THE NEW 89 tube of the automobile series has been made available for experimental purpose, although it is not yet ready for general distribution. However, those who have obtained samples have already made plans to install the tube in both automobile and line direct current receivers. When the tube is used in a receiver requiring 6.3 volts, or in any receiver in which the filaments are connected in parallel, there is no difficulty about the design. But when it is used in a receiver requiring that the filaments be connected in series. there is a difficulty, because the new tube requires a filament current of 0.4 ampere, whereas the other tubes in the series require only 0.3 ampere.

It is clear that the filament of this tube cannot be connected in series with the filaments of the other tubes without doing something about the difference in the current required. The circuit must be so designed that the total current is 0.4 ampere. This is too high for the other tubes. Hence it is necessary to connect a resistor across the other filaments and proportion this resistance so that it will carry the extra 0.1 ampere.

Circuit Arrangement

In Fig. 1 we have the heater circuit of a receiver in which all the filaments are connected in series. The last two tubes are of the 89 type and the others of the older type. In general we do not know how many of the 0.3-ampere tubes are used so we have put in a dotted line to indicate the possible variation in the number employed. What should the value of the resistance R1 be in order to give all the tubes the correct filament current, assuming that each one gets its proper terminal voltage of 6.3 volts? Let us work out a formula that will apply in any case.

Suppose there are n tubes in the series of the 0.3-ampere type. Then the total voltage across the n filaments will be $6.3n$. This is the voltage across the resistor R1. But since this resistor is to carry a current of 0.1 ampere, the value of R1 must be $63n$. For one tube it is 63 ohms, for two, 126 ohms, for three, 189 ohms, and so on. Just multiply the number of tubes of the 0.3-ampere type in series with 63 and the resulting product is the required resistance.

The resistance does not depend on the number of 89 tubes in the series but only on the number of 0.3-ampere tubes. When we come to deciding on the resistance of the ballast resistor R3 we must remember that the total filament current is 0.4 amperes, and not 0.3 amperes as it was originally. We also must take into account the number

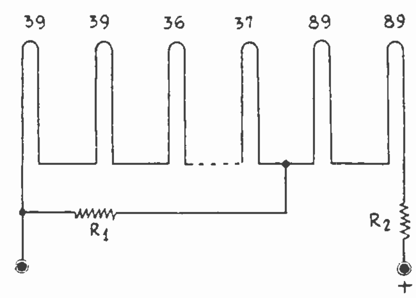


FIG. 1.

This diagram shows how 0.3-ampere tubes, and 0.4-ampere tubes like the new 89, may be connected in the same sries, as required in line d-c sets.

of 89 tubes in the series, or rather on the total number of 6.3 volt tubes in the series. Suppose we have m tubes in the series, of either type. Then the total voltage drop across the series is $6.3m$ volts. Now let us assume that the line voltage is V volts. The drop in the ballast resistor R2 should then be $V—6.3m$ volts, and the total value of R2 should be $(V—6.3m)/0.4$ ohms, or $2.5\ (V—6.3m)$ ohms.

Choice of Ballast Resistor

Suppose, for example, that the line voltage is 115 volts, which then is the value of V in the formula. Hence in this special case it becomes $R2=2.5\ (115—6.3m)$ ohms. In an eight-tube receiver the value of m is 8. Hence R2 should be 161.5 ohms. For each tube we add the resistance should be decreased by 15.75 ohms, and for each tube we deduct the resistance should be increased by the same amount.

If the speaker field is also in the series its resistance should be deducted from the value of R2 obtained by the formula above. For example, if the resistance of the speaker field is 100 ohms, the value of R2 for the eight-tube receiver should be 61.5 ohms instead of 161.5 ohms.

If there are any other resistances in series with the line, they, too, should be subtracted from the value obtained from the formula. About the only other resistor that would be in the line is that of the filter choke.

Order of Tubes

The order in which the tubes appear in the circuit is immaterial. However, if a single shunt resistor is to be used across the 0.3-ampere tubes, their filaments must be together. The 0.4-ampere tubes do not have to be together. Of course, if two 89 tubes are used they would undoubtedly be in the last stage and therefore it is natural to put the filaments adjacent to each other. It makes little difference on which side of the series the larger tubes are put, but all the tubes should be placed on the negative side of the line. That is, the ballast resistor should be put on the positive. Incidentally, it is not necessary that the filter choke be put in the heater circuit. Neither is it desirable, for the filament current would only overload the choke and decrease its filtering efficiency. But the speaker field is often put in the heater circuit advantageously, since doing so saves power which would otherwise go to waste in the resistance. The saving is exactly equal to the power required by the field, which is around 9 watts.

There are speakers having a resistance of 125 ohms which are designed for use in sets employing the 0.3-volt tubes on a d-c line. When the current is 0.4 ampere the speaker field may have to be different. A speaker designed for 0.3 amperes may overheat if made to carry 0.4 amperes.

Inequality of Tubes

When 0.3-ampere tubes are connected in a series it is often noted that the voltage drop across some of them is less than 6.3 volts and greater across others. This is due to the fact that the resistances of the filaments are not the same for all the tubes. Those having a higher resistance will develop a greater voltage drop, However, it is quite safe to assume that the resistances are all the same for the purpose of determining the ballast resistance, for when many tubes are used the average resistance is not far from the supposed value of 21 ohms. There may possibly be similar variations in the 89 tubes, but the same conclusion applies. The nominal hot resistance of the filament of an 89 is 15.75 ohms.

In cases where large discrepancies occur in the voltage drops of the tubes, the best way to remedy the condition is to substitute another tube for the one that strays considerably from normality. Of course, it is possible to treat any tube having an abnormal voltage drop just the same as the 0.3-ampere tubes were treated when used in conjunction with 89 tubes. That is, a resistance can be connected in parallel with the filament showing excessive voltage drop. But if the voltage drop is brought down to normal it may be that the tube will not get enough current for proper operation. When the tubes are in series and the current in the series is 0.3 ampere, we know that every tube gets the same current, regardless of the voltage drop across the filament of any one.

Coil Data for Quality Super

(*Continued from preceding page*)

voltage is in itself sufficient to work the a-v-c. Ordinarily, if the bias on the modulator is 10 volts, the oscillator voltage should not exceed 9 volts, to avoid modulator overload. But by tying the modulator to the a-v-c this particular limitation of the oscillation voltage to 9 volts is removed, for increase in the oscillation voltage will increase the modulator bias voltage. Since with a high resistance in the a-v-c the rectification is linear—just as it is in the second detector—the counterbalance is complete.

Out of the triode section we take the input for the power tube.

The only other tube is the rectifier, an 82, with 300-turn chokes (1.3 millihenries) in the anode legs. Tube and chokes should be in a ventilated shield.

If a dynamic speaker is used, the field may be energized as shown, and the resistance does not matter so much, so long as it is between 1,500 and 3,000 ohms. The two next succeeding resistors in the divider may be around 3,000 ohms, 25 watts, while the lowest section may be 100 ohms, 50 watts.

The 30-henry choke coil should have a low resistance. Values of 400 ohms or less should be used.

The coil information for 0.00035 mfd. condensers is as follows: L1, L2, L3, L4, identical: secondary, 127 turns of No. 32 enamel wire on 1 inch diameter for L2, L4, over which are wound the primaries, 30 turns of any insulated wire, insulating fabric between the two windings. The oscillator coil has a secondary of 86 turns on the same diameter, same wire, three layers of insulating fabric, and then the 36-turn tickler and 10-turn pickup.

HUNTING HIDDEN TREASURE THE TWO MET

By Charles

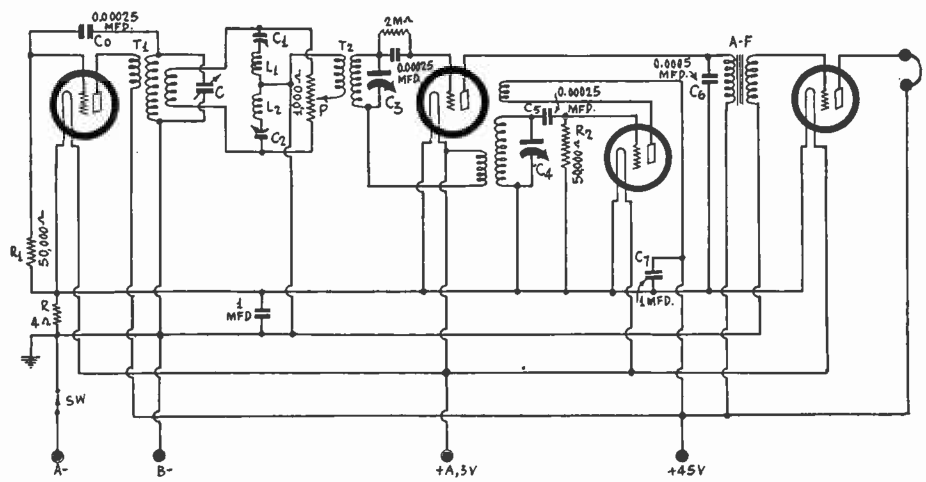


FIG. 1

A four tube circuit that is suitable for locating hidden metals. It works on the principle that a metal near a coil carrying current changes the inductance of that coil.

THERE is a virulent epidemic of treasure finding raging throughout the country. It has already claimed many victims, many of whom are radio fans, and it will claim many more before it can be checked. Men are willing to make treasure hunting their life's work. The world is their intended field of activity. They want to find sunken ships laden with gold and silver and precious stones. They want to explore the strongholds and hiding places of ancient pirates for buried loot, including pieces of eight and dead men's chests. They want to use radio as a divining rod to locate natural treasures in the forms of oil and coal and precious ores. But not all have set their goal so high. Some are content to ferret out the hiding places of petty miser's hoards or to retrieve lost coins from the sands of the beach. The search for treasure is their common interest and radio waves are their hopeful means.

What loosed the deadly virus has not been determined. It may be the economic depression or some other baneful influence not yet defined. Whatever the cause, the result is here, and it requires some potent anti-toxin to combat its evil effects. Or perhaps it only requires an exposition of the means whereby the hopefuls expect to attain their treasures. After all, it is a pleasant malady to have until the economic situation rights itself.

Principle of Radio Treasure Finding

The hope of finding treasure by means of radio is based on the fact that a radio wave is affected by the nature of the ground over which it travels, or through which it travels. The influence is not limited to valuable minerals, however, such as coal, oil, metals, and metallic ores, for even sand and plain rock will affect it. Water, too, has an effect. So, in search for treasure, it is necessary to distinguish the nature of the effect of one material from those of others.

Two methods, in theory at least, are employed. One depends on the change in direction or in intensity, or both, of the radiated wave. The other utilizes the induction field about a coil. It may be well to point out the differences between these two. When an alternating current is flowing in a coil or in an antenna, there are two electromagnetic fields about the device, one the radiation field and the other the induction field. The energy in the induction field does not leave the coil or antenna but returns to the source. It causes no power loss, unless there is some conductor or dielectric in the field in which induced current can flow as a result of coupling. The radiation field, on the other hand, leaves the radiator and does not return. It is the useful portion of the field in respect to radio transmission, and this causes loss of power from the radiator.

The induction field extends, theoretically, to an infinite distance, but practically it extends less than one wavelength. Its intensity decreases as the square of the distance. The radiation field decreases less rapidly. In ordinary radio broadcasting the decrease in intensity is proportional to the distance from the radiator, assuming no attenuation due to losses.

Use of Radiation Field

When the radiation field is used for determining the location of minerals, a transmitting station is set up at a convenient point in the region to be prospected. If the region about this transmitter is homogeneous, the waves will travel in straight lines and the field pattern will be circular. That is, the waves travel outward in the same way as water waves in still water travel away from a disturbance. If the region is not homogeneous, the wave pattern will be disturbed, and the circles will be distorted, which means that the direction of travel will be changed at some points of the wave front. The effect is about the same as that of an island, or even a boat, in water. The island or the boat breaks the homogenity of the medium.

If there is a large body of mineral in the ground over and through which the radio wave travels, this will act as an island and which will change the direction of the wave, and in some cases it will also decrease its intensity. Prospecting by radio involves the determination of the change in the wave pattern, and this is done by means of directional receivers. At every receiver the location of the transmitter is known. Hence the direction from which the wave should arrive is known. If the actual direction as determined by the directional receiver differs from the geometrical direction it is known that some influence has changed the course of the wave. If a large number of observations are taken around the transmitter, it is possible to construct a field pattern. This consists of closed contours of equal declination, or equal departure of the actual direction from the true geometrical direction. Radial lines drawn across these contours at right angles show the actual course of the wave at any point. By studying the wave pattern the location of disturbing influences can be determined, although their nature cannot be so determined.

Field Intensity Pattern

A similar set of contours can be constructed by measuring the intensity of the field. Such field patterns have been constructed about many broadcast stations to determine the coverage. The field strength pattern will yield additional information about the location of the mineral body, and this pattern should bear a close relationship to the direction pattern. The field intensity pattern will also yield some information as to the nature of the disturbing influence, because some substances will cause greater attenuation than others.

It is clear that prospecting by this method involves the use of a great deal of apparatus. It is necessary to have a transmitter and one or more receivers. It is also necessary to have surveying instruments for determining distances and angles accurately. If intensity measurements also are to be made it is necessary to have field strength measuring devices. Of course, the directional receivers and the field strength sets could be combined, for a field strength measuring set is essentially a directional receiver. A technically trained crew is essential, for without it nothing definite could be learned.

This method of prospecting is founded on scientific principles and it has been recognized by the government to the extent that wave channels have been set aside by the Federal Radio Commission for use in this kind of work. With the proper equipment and crew its use should lead to results.

Use of Induction Field

Instruments making use of the induction field cannot be employed over a large region and can only be used for locating metallic objects in the immediate vicinity of the apparatus. It depends for its action on the fact that when a coil carrying alternating current is brought in the vicinity of a conductor the impedance of that coil is changed. A familiar example is the shield around a coil. It is well known that the shield reduces the inductance. It does so because the metal shield reflects the wave back into the coil so that for a given alternating current the magnetic flux through the coil is less. The reflected field cancels part of the direct field.

If we have an open coil, that is, one that is not shielded, and if we bring a piece of metal near it, there is a certain change in the inductance, depending on the size of the metal body and its nearness to the coil. Hence if we have a coil carrying alternating current and if we place this coil near a metal body, the inductance of the coil will change, for it does not matter whether we bring the metal to the coil or the coil to the

BY RADIO; HODS USED IN PROSPECTING

Enris

metal. If, then, we have some means for detecting the change in the inductance, we have a means for determining the presence of metal. However, the effective range of the induction field is very limited, as was stated above, and if we are to have an instrument that will detect the presence of metals some distance away, we must have a very sensitive detector of the change. The same applies to the case where there is a small piece of metal close to the instrument.

A Suggested Circuit

We can best describe the induction field method by describing a possible circuit. We show one in Fig. 1. The first tube in this circuit is a high frequency oscillator that generates the alternating current that is to be used in the coil in question. The design of the oscillator is of little importance just so it turns out the desired frequency, and the frequency is not particularly important either. The tube may be a 230 if the set is to be portable. The grid leak R1 has a value of 50,000 ohms, the stopping condenser Co, 0.00025 mfd., and the oscillating coil T, contains three windings. It is a typical oscillator coil. The tuning condenser C should be adjustable but it does not have to be a regular variable condenser. It could well be a midget condenser of about 100 mmfd. capacity. The pick-up winding should be somewhat larger than the pick-up winding in a superheterodyne oscillator. It may be wound directly over the other windings provided that they be separated with an insulator so that the capacity between the coils will be low.

The pick-up coil is connected across a Wheatstone bridge in which there are two equal reactive branches, C1L1 and C2L2, and two equal resistive branches, the resistance of the two sides of the potentiometer P.

Balancing the Bridge

Balance of the bridge, or unbalance, is indicated by connecting a sensitive detector across the vertices of the bridge not used for the input coil. Suppose the impedance of C1L1 is adjusted so that it is equal to that of C2L2. It is then possible to obtain a balance by adjusting the slider of the potentiometer. But since we are dealing with reactanses and resistances we cannot obtain an exact balance unless the resistances as well as the reactances are balanced separately. To do this we can tune C1L1 and C2L2 to the input frequency, that is, the frequency of the oscillator. That is why the two condensers C1 and C2 are made variable. When the two branches containing the coils and condensers are tuned to the input frequency, these arms contain pure resistances, and they can be balanced with the potentiometer, which is also supposed to be a pure resistance.

With the bridge exactly balanced, there will be no current in the primary of T2. Hence there will be no input to the dedector and there will be no output in the phones.

But suppose there is a slight unbalance for any reason. There will then be current in the primary of T2. The is selected in the usual manner by means of tuning the secondary with C3, and the signal is impressed on the leaky condenser detector following.

But we are dealing with unmodulated signal. It is necessary to modulate it in some manner. This is best done by another frequency differing slightly from the original frequency, say by 500 cycles per second. Hence we have a second oscillator, exactly like the first except that it is tuned to a slightly different frequency. The pick-up coil in this case should consist only of a few turns, and it should be loosely coupled to the oscillating circuit. Five turns should be ample if we are dealing with a frequency of about 1,000 kc.

Beat Note Amplified

The mingling of the two frequencies in the grid circuit will cause a 500 cycle beat to be produced in the plate circuit of the detector. This beat is amplified with an ordinary audio transformer and another tube. If this transformer is peaked at about 500 cycles the set will be much more sensitive. Exact balance of the bridge will be indicated by the beat note in the phones, and the intensity of the beat note will be a measure of the degree of unbalance. In case it is not possible to obtain an exact balance, the adjustment should be made so that the note has minimum strength.

Now we have a source of alternating current, a bridge for detecting balance and unbalance, and a sensitive detector. What shall we do with this equipment?

Exploring Coil

Let L1 be a fixed coil in the set and let L2 be an exploring coil. It may be attached to a convenient handle and attached to the bridge by means of two low capacity leads. Adjust the bridge for balance when the exploring coil is in the air far from any conducting materials. Now begin to probe with it. Suppose it is placed near a sheet of metal in such a manner that the plane of the turns of the exploring coil is parallel with the plane of the metal. There will be a change in the inductance of the exploring coil and the balance of the bridge will be upset. The degree of unbalance will be indicated by the intensity of the sound in the phones. Try the instrument out in different places against different pieces of metals in order to get acquainted with it. Then proceed to find hidden treasure.

Well, that is the theory. It remains for the treasure hunter to choose his method of operation, and to make either work.

Pointers on Construction

Those who have employed heterodyne circuits will readily realize the necessity of shielding the two oscillators from each other. A zero intensity of the beat note can only be obtained if the bridge is balanced exactly and if the signal from the first oscillator can reach the detector only through the bridge. But there is a good chance that much of it will get there through the batteries and through the air. Thorough shielding of the first oscillator and the bridge from the detector part of the circuit is absolutely essential and there must be complete filtering of the supply circuits. The filtering shown in the circuit may not be nearly enough. It may be necessary to put a radio frequency choke in the plate lead to the first detector, with another large by-pass condenser from the plate return to the filament. It may also be necessary to put a large condenser across the filament battery. Indeed, it may be necessary to use separate filament and plate batteries for the first oscillator, and to shield the two sets completely.

The junction of the two coils L1 and L2 has been grounded in order to put the exploring coil at as low potential as possible. It is not necessary to ground any of the variable condensers because they may be of a type that can easily be mounted on insulators. C, C1, C2, C3, and C4 may all be the same size, which may be 100 mmfd. Compression type trimmers will do. If the capacity of each of these condensers is 100 mmfd. and the frequency is 1,000 kc, the inductance of each tuned coil, including L1 and L2, should be 253 microhenries. Only a slightly different adjustment is needed for C4.

When separate batteries are used the first oscillator should be a unit by itself. This includes the filament and plate batteries, the tube, condensers, and coils which pertain to that circuit. The shield should surround these parts completely except for the two leads which go to the bridge. Or even the input transformer could be included in the shield. The adjustment of a Wheatstone bridge at high frequency is rather critical and many things will upset the adjustment.

Salaries Reduced by Two Big Chains

The National Broadcasting Company has reduced all salaries by 10 per cent. Several months ago the number of employees was reduced in an attempt to cut down expenses so that salary cuts would be unnecessary. There are still 1,244 names on the NBC payroll.

The Columbia system has also reduced its number of employees and salaries. The cut in salaries amounted to 15 per cent. and about 75 employees were dropped from a total personnel of 600.

Tube List Prices

Effective June 27th are the following list prices of tubes. Mostly the change is upward on account of the 5 per cent. tax. The 57 and 58 are reduced 5c despite the tax. The 11, 12, 120, UV-'99, '00A, '40, '68, '52 and '65 are unchanged. The rest are increases, occasionally a trifle more than the tax, usually less than the tax.

Type	*Price List*	*Type*	*Price List*
11	$3.00	'38	2.80
12	3.00	'39	2.80
112-A	1.55	'40	3.00
'20	3.00	'45	1.15
'71-A	.95	46	1.55
UV-'99	2.75	47	1.60
UX-'99	2.55	'50	6.20
'100-A	4.00	55	1.60
'01-A	.80	56	1.30
'10	7.27	57	1.55
'22	3.15	58	1.55
'24-A	1.65	'80	1.05
'26	.85	'81	5.20
'27	1.05	82	1.30
'30	1.65	'74	4.90
'31	1.65	'76	6.70
'32	2.35	'41	10.40
'33	2.80	'68	7.50
'34	2.80	'64	2.10
'35	1.65	'52	28.00
'36	2.80	'65	15.00
'37	1.80	'66	10.50

REAL TONE QUALITY HERE
REASON: NO

By Capt. Peter

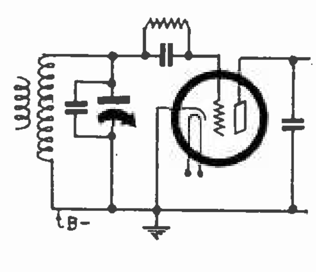


FIG-1

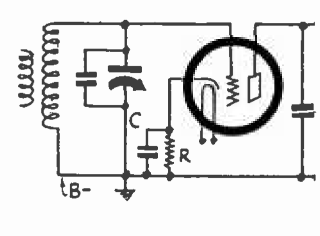


FIG-2

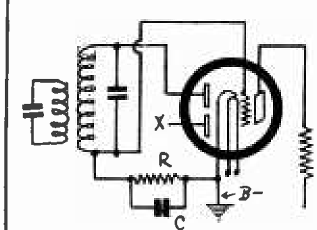


FIG-3

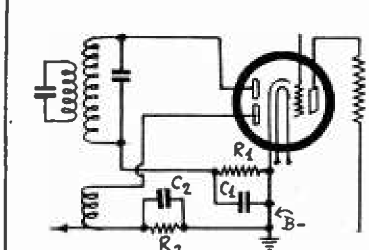


FIG-4

In Fig. 1 leak-condenser detection for 56 or '27 tube. In Fig. 2, power detection, R lifts cathode above ground. C would be 50 mfd. or so. The 55 tube as detector, Fig. 3. R is 0.5 meg., C 0.01 mfd., while X is unused diode. Fig. 4 shows a-v-c in extra diode, arrow to controlled tubes. Cathodes grounded in Figs. 1, 3 and 4.

SENSITIVITY has not proved to be a big problem; tone quality has, judging by the time taken to solve it. For about eight years commercial receivers have been marketed, for more than ten years sets have been in use, in a broadcast sense. And still we are trying to make an orchestra sound in the home just as it does in the auditorium.

The studio has its part of the problem in so arranging and using its acoustical devices as to take care of all needs, of all used audio frequencies, including treatment of the walls, ceilings and windows; placement of the musicians and other artists; use of the best and most faithful microphones and audio amplifiers and modulating systems. In the receiver most of the problem is now focused about the detector, the audio channel and the speaker, with some thought required also on the baffling and the sound chamber of the console.

Assuming that a radio frequency amplifier, with or without intermediate frequency amplifier, is so constructed as to pass the required sidebands, and deliver a sufficient voltage input to the detector, we have to consider the problem from that point on. and make such choice as will preserve the faithfulnes of the modulation as present in the carrier. We can not well borrow any problems from the artist, studio or station, but, taking what transmission they send, do our best.

The Best Quality Detector

Considering the detector, we have to choose the best. That means a diode in some form or other, either the new 55 tube, or some general purpose tube converted to a diode. For instance, the '27 and the 56 make suitable diodes when the cathode and plate are connected together at socket posts to form the cathode, while the erstwhile grid becomes the anode.

We have assumed the radio channel is satisfactory, but now that we have elected the diode we must consider the fact of its insensitivity, and therefore the r-f channel has to deliver a large input to the detector, to help atone for the low sensitivity of the diode. This input is assumed. In general, the circuit will require a superheterodyne, as t-r-f sets ordinarily can not be gaited to the high amplification required without regeneration or oscillation, neither of which is desired. There are exceptions.

The reason for the choice of the diode is that with it almost alone is it possible to attain linear detection. The output is directly proportional to the input when the load resistance is high. Since the tube resistance is low, the linearity naturally follows, as the resistance of the load is about all that counts. Therefore linearity may be regarded as fixed resistance regardless of changes in power. It is really a form of frequency stabiilty.

The diode permits of grounding the voltage inputs. Considering the audio frequencies involved, about the only condition of grounding that can exist is actual grounding. That means that the input to the tube is between ground and the high potential point of the tube.

Resistance Differences

With battery-operated tubes the resistance of the biasing battery may be small, with grid leak types of detection, using '27 or 56 tubes, the grounding is actual, since the grid return is to grounded cathode, but in all other instances actual grounding. or removing of the negative feedback through necessary resistors, is impractical. Whatever the resistance value, the condenser across it must be of very high capacity, higher than ordinarily used. Let us select 50 mfd. Every time there is a biasing resistor or a voltage-reducing resistor as in screen circuits, such a capacity is required for best tonal response.

Confining the problem for the moment to the detector, let us select a very popular screen grid tube, be it the '24 or 57. While in general grid leak detection is more sensitive, it does not stand the load that power detection does, and as avoidance of the tube overloading is one of the problems associated with quality, we select power detection. Let us take the '27 or the 56, its improved successor. If the bias is obtained from the voltage drop in a cathode resistor, this resistor should be around 100,000 ohms. The current in the plate circuit should be adjusted to 0.2 milliampere, the bias should be around 20 volts negative, although it is not critical. Therefore 100,000 ohms are needed. The 20,000-ohm resistor commonly used does not bias the tube properly for detection, nor does it permit the big voltage swing without overloading.

How About 150 Mfd.?

The input circuit is really from grid to cathode, the part of the circuit from cathode to B minus (ground) is merely the biasing portion, and therefore the input is grounded only when the cathode is grounded. We seek to effectuate that ground with 50 mfd. But how often can we afford to put that capacity in a circuit, especially as there may be two audio stages, each requiring that capacity, a total now of 150 mfd.?

In the case of the screen grid tube the situation is worse, because we have a screen resistor of some kind with which to contend, and that, too, requires such a high capacity. The feedback through this resistor, as through the biasing resistor. is negative, and we desire to reduce the impedance to as near zero as practical. The condenser has to be so large for this purpose that it makes small difference what the actual values of resistances are —1,000 ohms or 500,000 ohms. We might try some bleeder current, but that helps little. We are still dealing with a resistor of hundreds of ohms. and, as stated, the large condenser makes the value of the resistance unimportant. But not the value of the impedance. That is not zero yet, and won't be.

Condenser Dilemma

So we turn to the diode. Here we have an input circuit, consisting of a coil with a resistor in series. If we desire to ground the cathode we need remove only the modulation, or sufficient of it for the purpose, and a small condenser will do that. Around 0.01 mfd. is the usual recommendation for supers.

The secondary coil, feeding the diode, cannot have its return connected to

AT LAST! NEGATIVE AUDIO FEEDBACK

V. O'Rourke

ground if the cathode is to be grounded, because a high resistance has to be placed between coil return and ground, to limit the current in the tube. Therefore ordinary t-r-f sets can not be used in this fashion, since the gang condenser rotor is connected to ground and to one side of the coil. If the load resistor is attemped to be placed in series with the tuned circuit, then the condenser across that resistor is in series with the tuning condenser, and upsets the tracking seriously. Moreover, if the bypass condenser is made larger to avoid detuning, the high audio frequencies are sacrificed.

We could tune the plate circuit, and put a condenser of 0.01 mfd. or larger between stator of tuning condenser and plate, to avoid possible shorting of the B voltage by condenser plates touching. But then the small erstwhile primary would not be large enough for the diode input, and if we made it as large as it should be and the coupling as tight as necessary, again tracking would become difficult. The distributed capacity and the capacity between coils would be large, compared to smallness in preceding tuned-grid circuits. Moreover, tuning the plate circuit may give rise to r-f instability of an almost uncontrollable order.

In the superheterodyne we encounter no such difficulty, as the secondary may be returned anywhere, and the condenser is across it.

So our choice resolves itself into a superheterodyne with a diode second detector.

Second Harmonic Distortion

Thus far we can be content with the result. There are a few things to be watched still. We desire an output tube of respectable performance, such as the '45, because it will stand a big swing and also it will not introduce much distortion. The second harmonic distortion may be kept as low as 2 per cent., although 5 per cent. is considered passable. The third harmonic distortion is too low to require consideration, although a problem in the pentodes, and then an unsolved if not insoluble one.

Surely we need at least one stage of audio to help atone for the lack of sensitivity of the diode, which is a two-element tube, hence is not an amplifier at all. It may be regarded as a de-amplifier. But then we haven't enough audio yet, nor have we a suitable power tube. So the '45 is extra. We then have two stages of audio, and using resistance coupling, we can achieve finest quality.

With an ordinary diode we may use separate bias for the first audio tube, but that would require the large condenser again, to bypass the biasing resistor and to lift the cathode 20 volts above ground. We have our choice of using direct coupling, by connecting grid of the amplifier tube to the anode side of the diode load resistor. Therefore for an extra reason this resistor must be high. A value of 0.5 meg. is suggested. It is a grid leak, and low values of grid leak reduce the low-note response, and the sensitivity generally.

Bias Supply

Now, by using the diode as detector, and by using direct coupling, we have avoided the large condensers, not merely for reasons of economy, but rather for reasons of most satisfactorily eliminating negative audio feedback, notorious enemy of tone. Now we have only the power tube to consider, and there is no solution here except to use the large condenser, unless we desire to introduce a separate little eliminator to serve as a C bias supply. This C bias supply is an idea that will grow with time. There is virtually no signal through it, so its impedance is of no consequence to the audio tube.

The rectifier has something to do with tone. The filtration has to be good, for hum is a form of distortion, and we must keep the hum to as low a level as we can. One of the most effective ways is to put a large capacity next to the rectifier, say, 18 mfd., but this puts a very heavy starting drain on the rectifier tube, sometimes four times as much as the continuous current drain of the circuit. The tube life will be shorter.

An option is the choke input, whereby at least 20 henries are put between rectifier tube and the first filter condenser, then comes the regulation choke and other condenser. But the d-c resistance of the total chokes should not be high, otherwise there might be motorboating, due to the high impedance of the chokes constituting a coupling for the audio tubes, no matter how large the condensers. These capacities never will reduce the impedance to only a few ohms, and it is theoretically possible to encounter motorboating even with such a low impedance.

Trap Circuit or Tuned Choke

The choke input method does not reduce the hum as low as does the other method, with equal capacities, but the condenser values can be increased almost at will, with 18 mfd. after the input choke and that much or more capacity after it.

Sometimes hum can be reduced by putting a fixed condenser across the choke. The value of the condenser depends on whether the rectifier is full-wave or half-wave, for with full-wave the chief hum component is the second harmonic, or 120 cycles, whereas with single-sided rectication it is the fundamental, or 60 cycles. It is much easier to filter the second harmonic, because the frequency is higher, therefore full-wave rectification is recommended.

The small condenser across the main choke may be from 0.1 to 1.0 mfd. Try different values. Its object is to form a circuit tuned to the objectional frequency, so that current of this frequency will flow through the trap.

Then there is the speaker, but this is assumed to be as faithful a copyist of the mechanical movement of the armature as is possible to get, also it is assumed that the impedances are properly matched, which usually means that the load impedance should be about twice the plate impedance (except for pentodes, not included in this consideration).

Two Audio Stages Excel

Acoustical problems having to do with resonance chambers, baffling, room treatment, as with location of sound-affecting materials and objects, such as carpets, rugs, walls and furniture, are left to the tone-quality enthusiast himself, as these matters are individual.

When we look back at the various things we have done to achieve proper tonal values we find that we have sacrificed sensitivity in the interest of tone, that perhaps we can not get as many stations as if we used a highly sensitive detector, but our musical instincts are favored, and at last we may feel that we have a radio set worth listening to, even if we are tonally critical.

If we have automatic volume control in the set we may use a manual volume control in the audio channel, as is often done these days, especially as with our circuit we can not overload the detector, the first audio tube will stand a bias of around 13 to 20 volts, the bias will change on that tube in the right direction, with the carrier and modulation, and the output tube will stand about all that the receiver will give it.

Remembering that there are two stages of audio, we can find tonal comfort in that, because the second harmonic distortion, the only one that need concern us, is reduced. The tone from two stages is better than that from one stage because the second harmonic in the first audio tube is about 180 degrees out of phase from the second harmonic in the second audio tube, and the two would cancel, were it not for the difference in amplitudes. However, the output tube has a mu-factor of only 3.5, and a gain of 3.5-fold does not make much of an impression on the human ear, so that the theoretical advantage of two stages of audio becomes an advantage in reality.

Other Audio Forms

As for push-pull, it has its virtues, but the general tone can never be better than with resistance coupled audio. Push-pull will deliver more power—probably four times as much—but at all values less than overload the single-sided straight stage has the tonal advantage.

The same is true of the companion circuit, Class B amplification, a form of push-pull, or which can be virtually push-pull if the load constants and voltages are just right. Within the signal load capacities of the single-sided resistance-coupled amplifier the push-pull circuit is outclassed, whether Class A or Class B. For standing tremendous volume of signal input, Class B is far ahead of the others, which also goes of course for the power output. But for home use the 2-watt output of the '45 single tube is ample.

The 55 tube fills the need for the second detector diode, as well as independent automatic volume control diode, with linearity for both, and besides it contains in the same envelope the triode or amplifier tube, which will take a 20-volt negative bias for 250 volts applied through a plate load resistor of 0.02 meg.

Assuming a previous circuit that delivers the voltage, the triode of the 55 will load up the '45 very nicely. In fact, the power tube will overload first, which is probably the best way to arrange a circuit. Certainly it is comforting to realize that nothing you will put into the second detector ever will overload that tube. Previously the second detector would overload first, and as for the most sensitive detector now used (57), that overloads very quickly, with its 6 volts negative bias, while the 56 will stand around 13.5 volts, and the '27 around 20 volts bias. These account for peak signal voltage values of about 4.5 9 and 14 volts for the 57, 56 and '27.

THE 58 TUBES ATONE FOR
OF

By Brun

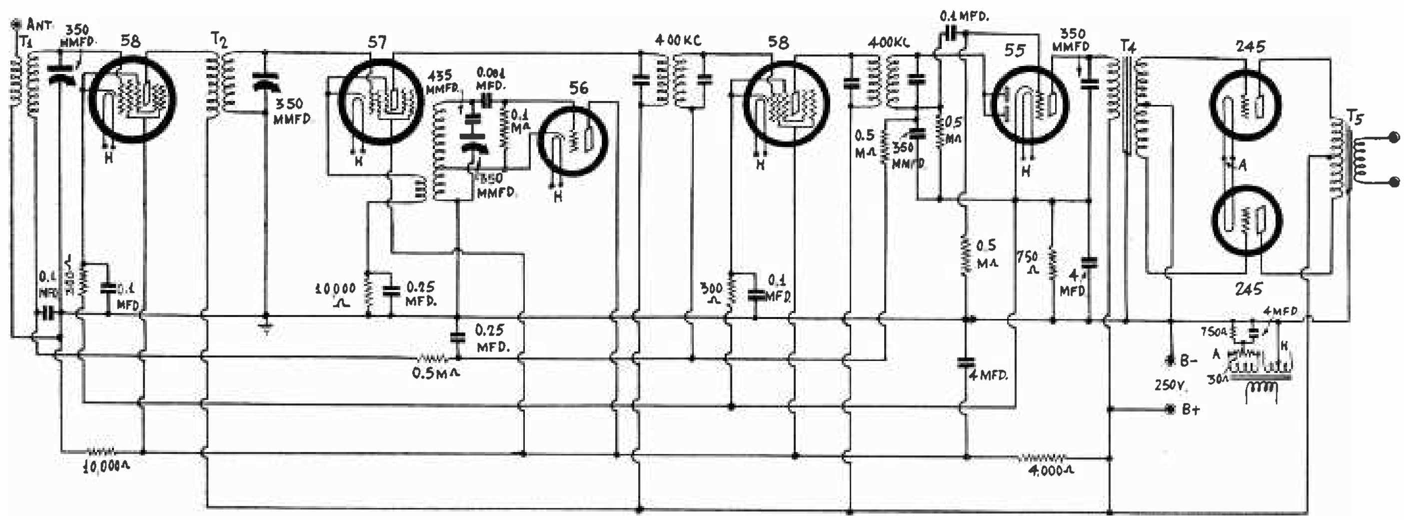


FIG. 1.

This seven-tube circuit is an experimental superheterodyne employing the new tubes, including the 55 as detector and automatic volume control.

THE DUPLEX diode triode tube, the 55, has now been announced officially, and experimenters can proceed to test their skill on it. One of the advantages of this tube is that it detects practically without any distortion provided it is made to work into a high resistance. It is a pure rectifier and as such it will take a strong signal without any distortion. If it is loaded up with a resistance of the order of 0.5 megohm the over-loading point is not even remotely approached. There may be a slight distortion on very weak signals but there is no reason why the tube should be operated with such signals.

The linearity of the detection, that is, the lack of distortion, is due to the fact that the load resistance is many times greater than the internal resistance of the tube. There is no distortion in the load resistance, for this is a pure resistance, and the small variable resistance in the tube is so small in comparison with the external resistance it can have no appreciable effect on the performance.

Disadvantages of Tube

The disadvantage of the tube is that it is not nearly as sensitive as a grid bias or grid leak detector in which there is amplification as well as detection. However, this disadvantage is partly, not entirely, offset by the fact that the 55 is also a triode amplifier. This part of the tube can be operated under its own optimum conditions as an amplifier. Therefore we have a distortionless detector followed by a practically distortionless amplifier and the net result is greatly improved quality, although with some decrease in the sensitivity.

The somewhat reduced output of the 55 detector-amplifier is compensated for by the increased amplifying efficiency of the new 58 tube. Hence if the 55 is used in a new setting with new associate tubes there will be a gain not only in the quality of the output but also in the sensitivity.

And then in addition we have the 55 tube as an automatic volume control. This is of utmost value in highly sensitive receivers with which signals from remote points are received. The 55 can be used simultaneously for detection and automatic volume control, and there need be no conductive connection between the circuits of the two functions, except the common cathode. Hence we may treat the detector circuit for best detection and the automatic volume control for most satisfactory time delay. This separation is possible by the fact that the diode contains two independent plates.

The First Detector

The 55 cannot be used advantageously as first detector in a superheterodyne mainly because it is necessary to insulate the tuning condenser which tunes the diode input circuit. This difficulty can be overcome in one or two ways. First, the tuned circuit may be put in the primary of the transformer. But then the tuned circuit will not be alike the other tuned r-f circuit and the tracking will not be good. Second, the coupling transformer between the diode and the preceding tube may be untuned. This, however, reduces both sensitivity and selectivity unless another tube and tuner be added.

There is no good reason why we should use a 55 in the first detector, for there is no question of quality involved. Moreover, either of the new tubes, the 57 or the 58, can be used with excellent results.

The proper place for the 55 is in the second detector of a superheterodyne, where all its functions may be used most effectively. The seven-tube superheterodyne shown in Fig. 1 utilizes a 55 tube as second detector, automatic volume control and audio amplifier. However, the automatic volume control and the diode detector are not entirely independent. The two plates of the diode are tied together and therefore half-wave rectification is used. The rectified current from the diode establishes a voltage across the 0.5 megohm load resistor and this voltage is used both for the input to the audio amplifier and for the automatic volume control. The carrier fluctuations are taken out by the 350 mmfd. condenser across the resistor. The audio fluctuations remain and they are impressed on the grid of the tube through a 0.1 mfd. stopping condenser and a 0.5 megohm grid leak, which is connected between the grid and ground.

Automatic Control

The automatic control voltage is taken off the same end of the load resistance as the signal to the audio amplifier, but a 0.5 megohm resistor is connected between the grid returns and the load resistor. This, of course, is used to prevent the audio from short-circuiting through the filter, and also to aid in the filtering. Following the lead from the resistor we find that it first picks up the grid return

Broadcast Coil for 0.00

In latest sets, using 58 r-f or intermediate, it will be found the screen voltage is 100 when the plate voltage is 250. There is no resistor between the high voltage line and the leads to the plates of the first three tubes, which means that as much voltage is applied to these tubes as to the power tube. This is all right, provided the voltage on the 47 is not excessive. The voltage should be about 250 volts, or slightly more, measured from ground.

Those who wish to build a new midget receiver with the new tubes may safely follow the above, with proper r-f coils. Three identical coils are needed, and they should be wound for 350 mmfd. tuning condensers. The regular midget type coils are entirely satisfactory. They usually contain 127 turns of No. 31 enameled wire on a diameter of one inch. That is the tuned winding. The primary of each may contain from 25 to 75 turns. The wire used should preferably be thin, and No. 36 double cotton is often used. The primary of the coil in the antenna circuit may be of heavier wire, however.

LACK SENSITIVITY OF THE NEW 55

.sten Brunn

of the intermediate amplifier tube. Then we come to a condenser of 0.25 mfd., one side of which is connected to ground. The size of this condenser and the magnitude of the 0.5 megohm resistor determine the time constant of the automatic volume control. We note that the time constant is ⅛ second.

Continuing on the automatic voltage control line we come to another half megohm resistor next to the 0.25 mfd. condenser and as we reach the first grid return we come to another condenser, this time one of 0.1 mfd. These are used for additional filtering. Only the first r-f tube and the intermediate amplifier are on the automatic volume control.

Fixed Bias Arrangement

There is a limiting bias on each of the controlled tubes and it is obtained from the drop in a 300 ohm resistance in each cathode. Each one of these is by-passed with a 0.1 mfd. condenser. It will be observed that the two cathode leads, after they have been joined, are connected to the cathode of the second detector, and not to ground. The reason for this is that it is desired to measure the grid voltage on the tubes, especially the controlled, from the positive end of the automatic bias resistor. That is, it is desired to avoid the complication that the drop in the 750 ohm bias resistor for the 55 triode would cause if the cathodes were connected to ground. When the two cathodes are connected to the cathode of the 55, the plate and screen currents of these two tubes are added to the current from the 55 triode and thus flow through the 750 ohm resistor together. Therefore, the drop in this resistor is considerable. It should be 20 volts. This it will be at normal current in the tubes. But as the signal intensity is increased and the plate and screen currents in the controlled tubes decrease, the bias will become less. It would be desirable to have it change in the opposite direction if it must change at all. But this would require a much more complex circuit.

If the complication is to be avoided the cathodes of the 58 tubes may be returned to ground directly provided much higher individual bias resistors be used. They should be high enough to drop 23 volts. With this bias and the cathodes returned to ground the normal bias will be just 3 volts negative with no signal. Hence the plate and screen currents will be the same, namely, 11.2 milliamperes. Therefore, instead of using 300 ohms for individual bias resistors about 2,000 ohms should be used. When the two 58 cathodes are taken off the 55 bias resistor it is necessary to boost its value to 2.500 ohms.

Audio By-passing

Large by-pass condensers are used for audio by-passing. Thus there is a 4 mfd. condenser across the 55 bias resistor and another of the same value across the bias resistor for the two power tubes. This is notwithstanding the fact that the circuit is push-pull. Whereas most of the odd order harmonics are balanced out so that they do not cause a drop across the bias resistor. and that includes the desired signal, the even order harmonics in the two tubes add up in the bias resistor. They could cause much distortion if they were allowed to affect the operating voltage. Hence the quality is noticeably improved by a large condenser across the bias resistance.

This statement about even and odd harmonics in the push-pull amplifier does not contradict the usual statement that the push-pull amplifier eliminates the even harmonics and not the odd. Seemingly the two statements are diametrically opposed. But this is not a fact because the bias resistor is placed differently in respect to the plates than the output transformer. In the transformer secondary the odd harmonics, including the desired signal, add up and the even cancel out. In the bias resistor the converse holds true. The even harmonics, if allowed to build up a voltage across the resistor, will shift the operating point, in a variable manner, to the negative. and so cause more harmonics to be produced, both odd and even.

There is also a 4 mfd. by-pass condenser across the screen voltage supply. It is important to hold the screen voltage constant and to prevent feedback.

The B Supply

The B supply of the circuit is not shown, but it is supposed to be a typical full-wave rectifier with an 82 mercury vapor tube, together with a regular filter consisting of large electrolytic condensers and husky chokes. The midget set arrangement is not suitable when 245 tubes are used because of the heavier current.

The voltage divider consists of one 10,000 ohm resistor for the bleeder current and one 4,000 ohm resistor to drop the voltage from 250 to 100 volts. If a somewhat lower screen voltage is desired the 4.000 ohm resistor might be increased to 5,000 ohms.

Some may wonder why 245 tubes are used in the output stage in preference to the new 46 tubes. There is no particular reason except that the 245 is one of the best tubes ever put out for power tube. The 46 could be used, but if so, it should be used with the screen and the plate tied together, which makes it a three element tube. The rest of the output stage is not changed, except, possibly, a different output transformer might be better. Of course, the 46 takes a five-prong socket whereas the 245 takes a four-prong socket.

The power transformer used should have two 2.5 volt windings, one for the power stage and another for the other tubes. The reason for this is that there should be no voltage between the heaters and the cathodes of the first five tubes. If the same filament winding were used for all the tubes there would be a voltage difference equal to the bias on the power tubes, which for the 245s amounts to 50 volts and for the 46 when used as suggested, 33 volts.

The Oscillator

The oscillator in the circuit is a 56 and is of the Shiepe type. If the intermediate frequency of the circuit is 400 kc as suggested, the series condenser should be about 435 mfd. when the variable condenser is 350 mmfd. This requires an inductance of 145 microhenries. While no trimmer condenser is shown across the variable condenser, one is supposed to be a part of the variable condenser. Every three gang condenser these days has a trimmer across each section.

Suitable coils for the circuit are obtainable in the midget form. The r-f coils contain 127 turns of No. 32 enameled wire for secondaries and from 25 to 90 turns of No. 36 double silk for primaries. The oscillator should contain 86 turns of No. 32 enameled wire for the tuned winding and 10 turns for the pick-up. The tap on the tuned winding should be put at the 35th turn from ground. All the coils are wound on one inch tubing. The insulation between the primary and secondary of each r-f coil and between the pick-up and tuned winding of the oscillator should be not less than 1/32 inch and the small winding in each case should be put over the ground end of the other.

Data

035 Mfd. Tuning

It is necessary to put a layer of insulating fabric between these two windings and to make it about 1/32 inch thick. The primary should start near the ground end of the primary and should not extend any farther up than necessary to get the turns on.

If the two windings are put on in the same direction, it is customary to connect the top lead of the secondary to the grid and the bottom to the ground. The secondary near the ground end goes to B plus and the primary terminal higher up goes to the plate. When the coil is connected in this manner to a single tube, there will be no oscillation, which is one test for the proper connection.

These coils should be mounted inside metal shields. The winding data are given for an aluminum shield measuring 2.625 inches high and 2.125 inches in diameter. If the shield is smaller, especially the diameter, the required turns will be greater, and conversely, if the shield is larger fewer turns will be needed. The shield should not be made smaller, and if it is larger the change in inductance is not great enough to require any allowance.

Physician, 100 Miles Away, Treats Sailor

Baltimore.

A sailor on the British freighter Aracataca was treated recently for pneumonia by Dr. Vernon Condon, medical officer of the Baltimore Mail Line City of Hamburg, while the two ships were in mid-ocean 100 miles apart. The radio operator on the City of Hamburg, Gordon Crozier, received a message from the Aracataca stating that the sailor was delirious and was running a temperature of 104. It stated that they had medicine aboard but that they needed medical advice. Dr. Condon diagnosed the sickness as pneumonia from the symptoms sent and prescribed a course of treatment. Captain Morgan of the Aracataca sent daily reports of the patient's progress to Dr. Condon during the next five days. The final message, thanking the physician, stated that the sailor was doing well and was expected to recover quickly.

OFFICIAL DATA ON THE 8
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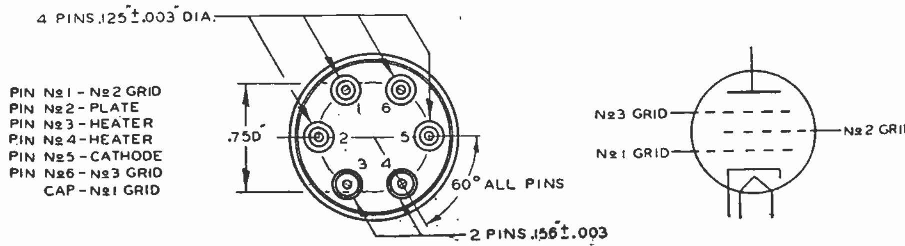
The following is the official information on two new tubes, the 89 and the 83, as announced by RCA Radiotron Co., Inc., and E. T. Cunningham, Inc.:

89

THE 89 is a triple-grid power amplifier tube of the heater-cathode type recommended especially for use in automobile receivers or in other types of mobile service. The triple-grid construction of this tube, with external connections for each grid, makes possible its application as (1) a Class A Power Amplifier Triode, (2) a Class A Power Output Pentode, and (3) a Class B Power Output Triode.

The three-fold application of the 89 to audio power-amplifier circuits is made possible by different connections of the three grids incorporated in the tube's structure. Thus, one arrangement of grid electrodes provides a triode for Class A service with a low amplification factor, a low plate resistance, and a high mutual conductance; while another provides a triode with an amplification factor so high that negative grid bias is not required for its operation as a Class B amplifier. A pair of 89's so connected in a Class B output stage is capable of supplying a large amount of power with relatively low plate voltage and with unusual overall economy of power consumption. A third arrangement of the grids makes possible the use of the 89 as a Class A power output pentode capable of giving large power output with relatively small signal voltage input.

The design of the 89 is characterized physically by the small overall size, the dome-top bulb, the rigidity of electrode assembly, and the separate terminals for each electrode.



Bottom view of base of the 89 at left, location of the three grids at right.

Class A vs. Class B Amplification Considerations

In Class A service the grid of the tube is maintained negative with respect to the cathode by an amount such that some plate current flows at all times, and such that the grid takes no appreciable current during the most positive swing of the signal voltage. These operating conditions are obtained when the normal bias without signal gives sufficient operating plate current to permit the application of a peak signal having twice the bias value without reducing the plate current below a certain predetermined minimum value under the load conditions employed, or without swinging the grid positive. Thus, the value of grid signal voltage which can be applied to any given type of tube is limited and this results in limited power output. Theoretically, the maximum plate circuit efficiency for Class A operating is 50%, assuming a sine wave input signal. The actual plate circuit efficiencies, however, are of the order of 20% for triodes and 40% for pentodes.

Distinguishing features of this class of service are that no appreciable power is required by the grid and that essentially undistorted power output may be obtained either with a single tube or with two tubes in a push-pull circuit, the latter being the nearest approach to distortionless amplification known. However, comparatively low power output is obtained at low efficiency. Furthermore, rated plate current is required from the power supply regardless of whether or not signal voltage is applied to the grid.

In Class B service the tube is operated so that the plate current is practically zero with no grid excitation. When a signal of sufficient magnitude is applied to the grid, there will be no plate current flow over a substantial part of the negative half-cycle. In other words, plate current flows only during the least negative excursions of the signal voltage. A considerable amount of second and higher even-ordered harmonic distortion is thus introduced into the power output of a single tube. However, with two tubes in a balanced push-pull circuit, the even harmonics are eliminated from the power output. In such a circuit, therefore, two tubes may be employed as Class B amplifiers to supply virtually undistorted output.

In Class B service it is possible to drive the grids of the two amplifier tubes positive to a certain amount and still obtain reasonably undistorted output, provided that sufficient input power is available to supply the grid current required by the positive grids. This power is conveniently supplied by a Class A power amplifier feeding the grids of the output tubes through a push-pull transformer having proper characteristics. Usually this transformer has a step-down ratio.

By designing Class B amplifier tubes with a sufficiently high mu-factor, it is possible to operate them with zero grid bias, and so dispense with biasing resistors whose effect would be to produce considerable loss in sensitivity because of degenerative effects. Since provision for grid bias is unnecessary with such tubes, the entire voltage of the rectifier is available for plate supply.

Distinguishing features of this class of service are that very high output of good quality may be obtained with fairly small tubes operating at relatively low plate voltage; and that unusual overall economy of power consumption is possible because the plate current is very low when no signal is applied to the grid. To give these advantages, the Class B amplifier circuit requires the use of two tubes in a balanced output stage preceded by a driver stage capable of supplying considerable undistorted power and the use of a power supply capable of maintaining good voltage regulation regardless of the variation of average plate current with signal intensity. It should be noted that the distortion present in the high power output of Class B amplifiers is usually negligible but is always somewhat higher for the ordinary range of signals than that obtained with Class A amplifiers employing much larger tubes capable of operating at the same maximum power output.

Class B amplifiers, however, have the distinct advantage of providing with relatively small tubes a reserve of power delivering ability to meet requirements for an extended volume range.

Synopsis of Purposes of the Two Latest Tubes

The latest tubes to be announced are the 83 and 89.

The 83 is a heavy-duty, full-wave, mercury-vapor rectifier tube of the hot-cathode type particularly recommended for supplying a very large amount of power of uniform voltage to receivers in which the direct current requirements are subject to considerable variation.

The 89 is a triple-grid power amplifier tube of the heater-cathode type designed especially for all types of mobile service. The triple-grid construction of this new tube, with external connections for each grid, makes possible its three-fold usefulness in audio-amplifier design as a low-mu triode, as a pentode, and as a high-mu triode for Class B circuits. The 89's diversity of application gives the radio engineer wide latitude in the design of receivers to meet various market demands.

TENTATIVE RATING AND CHARACTERISTICS OF THE 89

Heater Voltage................6.3 Volts
Heater Current..............0.4 Ampere
Overall Length.........4-9/32"-4-17/32"
Maximum Diameter..............1-9/16"
Bulb ST-12
Base ....Small 6-Pin

CLASS A POWER AMPLIFIER-TRIODE CONNECTION

(Grids No. 2 and No. 3 tied to plate; grid No. 1 is control-grid)

Operating Conditions and Characteristics:

Heater Voltage.............6.3 Volts
Plate Voltage".............160 Volts

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Grid Voltage (grid No. 1 only) .... —20 volts
Load Resistance (optimum for max. U.P.O.)** .... 7,000 Ohms
Amplification Factor 4.7
Plate Resistance .... 3,000 Ohms
Mutual Conductance .. 1,570 Micromhos
Plate Current .... 17 Millliamperes
Undistorted Power Output (5% 2nd harmonic) ... 300 Milliwatts

CLASS A POWER AMPLIFIER-PENTODE CONNECTION

(Grid No. 3 tied to cathode; grid No. 2 is screen; grid No. 1 is control-grid)

Operating Conditions and Characteristics:

Heater Voltage .... 6.3 Volts

Plate Voltage''	163	180	Volts
Screen Voltage (grid No. 2)'' ..	163	180	Volts
Grid Voltage (grid No. 1) ...	—17	—18	Volts
Load Resistance ...	9,000	8,000	Ohms
Amplification Factor	125	135	
Plate Resistance ...	7,900	82,500	Ohms
Mutual Conductance.	1,575	1,635	Micromhos
Plate Current	17	20	Milliamperes
Screen Current	2.5	3.0	Milliamperes
Power Output	1.25	1.5	Watts

**Approximately twice this value is recommended for load of driver for Class B stage.

'' Maximum plate voltage = 180 volts.

' Maximum screen voltage = 180 volts

CLASS B POWER AMPLIFIER-TRIODE CONNECTION

(Grid No. 3 tied to plate; grids No. 2 and No. 1 connected together)

Operating Conditions and Characteristics:

Heater Voltage ...		6.3 Volts
Plate Voltage		180 Volts Max.
Grid Voltage (grids No. 1 and No. 2 together)		0 Volts
Plate Current per Tube ...	—	3 Milliamperes
Peak Plate Current per Tube (max.)	—	75 Milliamperes
Max. Grid Dissipation per Tube	—	0.35 Watts
Max. Continuous Power Output (2 tubes)	—	6 Watts
Load Resistance per Tube	3,400	2,350 Ohms
Average Power Output (2 Tubes)* ...	2.5°	3.5°° Watts

*Power measured across indicated value of resistor in plate circuit of each tube, with indicated signal applied through 250 ohm resistance in the grid circuit for the 2.5 watt case and through a 500 ohm resistance for the 3.5 watt condition.

°With 5% total harmonic distortion and signal input of 16 volts RMS.

°°With 8% total harmonic distortion and signal input of 24 volts RMS.

Installation

The base of the 89 is of the small 6-pin type. Its pins fit the standard six-contact socket which may be installed to operate the tube either in a vertical or in a horizontal position. For horizontal operation, the socket should be positioned with the filament pin openings one vertically above the other. Base connections and external dimensions of the 89 are given in the drawing.

The bulb of this tube may become very hot under certain conditions of operation. Sufficient ventilation, therefore, should be provided to circulate air freely around the tube to prevent overheating.

The heater is designed to operate under the normal conditions of voltage variation of a 6-volt automobile battery. Due to the heater-cathode design, the heater voltage may range between 5.5 and 7.5 volts during the charge and discharge cycles of the battery without affecting to any great extent the performance or serviceability of this tube. The heater should be connected directly across a 6-volt battery; leads to the battery should have as low resistance as practicable.

The cathode circuit in most d-c receivers is usually tied in either directly or through biasing resistors to the negative side of the heater circuit. The potential difference thus introduced between heater and cathode should preferably be kept as much as possible below the recommended maximum of 45 volts.

The grids for any particular type of amplifier service should be connected so as to give resultant tube characteristics suited to that service. Detailed information on connections is given under "application."

Application

The 89 by virtue of its triple-grid structure and its three-fold utility as a power amplifier tube, allows the set engineer considerable latitude in the audio amplifier design of mobile receivers to meet various market demands.

For class A triode operation of the 89, the two grids (No. 3 and No. 2) immediately adjacent to the plate are connected to the plate, while the third one (No. 1) is employed for control purposes. Operation of the tube is then similar to any Class A power amplifier triode (refer to Rating and Characteristics for operating conditions).

As a Class A amplified triode, the 89 may be employed in the driver stage of Class B amplifier circuits, and thus reduce the number of tube types necessary in a receiver.

> **TUBE ARTICLES**
>
> *The* 46, 56, 57, 58 *and* 82 *were fully and completely described, illustrated with curves, in the April* 30*th* (1932) *issue.*
>
> *The* 55 *was described, with hookups and socket prong identification, last week, issue of July 16th.*
>
> *Next week, the* 85.

The tabulated values for Class A operation of this type as given under Rating and Characteristics are for its operation as a power output tube. When it is used as the driver for a Class B stage, the load requirements are changed as indicated in the note under Rating and Characteristics. This change is recommended in order to minimize distortion due to the driver stage.

The d-c resistance in the grid circuit of the 89 operating as a Class A amplifier (either with triode or pentode connection) should not exceed 1.0 megohm if self-bias is used. Without self-bias, the resistance should not exceed 0.5 megohm. The use of resistances higher than these may cause the tube to lose bias due to grid current with the result that the plate current will rise to a value sufficiently high to damage the tube.

For class A pentode operation of the 89, the grid (No. 3) adjacent to the plate is tied to the cathode and thus serves as the suppressor, while the other two grids (No. 2 and No. 1) serve as the screen-grid and control-grid respectively. Operation of the tube is then similar to any Class A power output pentode (refer to Rating and Characteristics for operating conditions).

For class B triode operation of the 89, the grid (No. 3) adjacent to the plate is tied to the plate, while the other two grids (No. 2 and No. 1) are connected together to serve as a single control-grid. No grid bias is necessary with this connection as the steady plate current at zero bias is only a few milliamperes. This feature is particularly important because it prevents the variation of bias with applied signal which would otherwise exist if any self-bias arrangement were employed.

During operation of this tube as a Class B amplifier, the interconnected grids No. 1 and No. 2 are swung positive each half cycle. Considerable power is required to do this under ordinary conditions. If, however, the secondary emissivity of the grids were made nearly equal to unity, the required power to swing the grids could be appreciably decreased. Tubes possessing this feature can be constructed, but the secondary emissivity is not independent of signal voltage and frequently causes negative grid current. Furthermore, secondary emission behaves erratically during the life of the tube. Thus, to have a Class B tube which will give uniform results throughout its life, it is preferable from the tube design standpoint, as in the case of the 89 with Class B connections, to eliminate secondary emission insofar as possible even at the expense of greater driving power. Unless tubes for use as Class B amplifiers are capable of producing uniform results throughout their life, it is practically impossible to design circuits to use them.

The direct current requirements of Class B circuits are subject to fluctuation under operating conditions. The power supply, therefore, should have as good regulation as possible to maintain proper operating voltages regardless of the current drain. For this purpose, a high voltage B-battery or a suitably designed B-eliminator may be employed. If the latter is used, a rectifier tube of the mercury-vapor type is recommended because it has a low

(*Continued on next page*)

New Mercury Rectifier

83 Rating is 250 Ua, Double 82's

(*Continued from preceding page*)
and practically constant space-charge-voltage drop within its operating limitations. As a further means of tbaining good regulation, the filter chokes and transformer windings of the B-eliminator should have as low resistance as possible. In the design of a power supply for a Class B amplifier, consideration should be given to the peak current demand of the amplifier.

As previously pointed out, the grid (No. 1 and No. 2) of the 89 is operated sufficiently positive to cause grid current to flow in its input circuit. This feature imposes a further requirement on the preceding amplifier stage. It must supply not only the necessary input voltage, but it must be capable of doing so under conditions where appreciable power is taken by the grid of the Class B amplifier tube. Since the power necessary to swing the grid positive is partially dependent on the plate load of the Class B tube, and since the efficiency of power transfer from the preceding stage is dependent on transformer design, it is apparent that the design of a Class B audio power amplifier requires that more than ordinary attention be given to the effects produced by the component parts of the circuit. These effects may be produced in the first-stage amplifier by the design factors of the power-output stage. For this reason, the design of a Class B audio amplifier with its driver stage is somewhat more involved than for a Class A system, and must be checked for each change in the component parts.

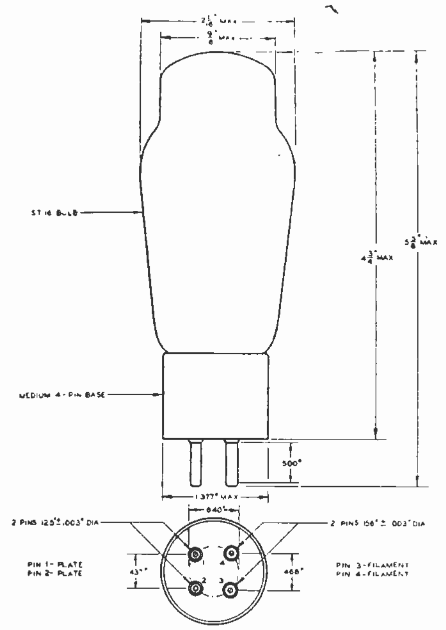
A complete discussion of design features for Class B amplifiers would be rather extensive, but certain outstanding points may be mentioned. The interstage transformer is the link interconnecting the driver and the Class B stage. It is usually of the step-down type, that is, the primary input voltage is higher than the secondary voltage supplied to the grids of the power output tubes. Depending upon conditions, the ratio of the primary of the interstage transformer to one-half its secondary may range between 1.5/1 and 5.5/1.

The transformer step-down ratio is dependent on the following factors:

1. Type of driver tube.
2. Type of power tube.
3. Load on power tube.
4. Permissible distortion.
5. Transformer efficiency (peak power)

The primary impedance of the interstage transformer should be essentially the same as if the transformer were to be operated with no load, that is, into an open grid. Since power is transferred, the transformer should have reasonable power efficiency. It should be noted that the power output and distortion are often critically dependent upon the circuit constants which should, therefore, be made as near independent of frequency as possible. This applies particularly to the interstage coupling transformer and to the loudspeaker. Since it is difficult to compensate for leaking reactance of the coupling transformer without excessive loss of h-f response, the leak reactance of this transformer should be as low as possible.

The type of driver tube chosen should be capable of handling sufficient power to operate the Class B amplifier stage. Allowance should be made for transformer efficiency. It is most important, if low distortion is desired, that the driver tube be worked substantially below its Class A undistorted output rating, since distortion produced by the driver stage and the power stage will be present in the output.



The base of the 83 and the dimensions and appearance of the bulb, base and pins.

The following notes on Class B amplifier circuits are of value from the design standpoint:

The load on the driver tube or tubes is chosen higher than for undistorted power rating to hold overall distortion to a minimum. For a single triode driver, its minimum plate load should be approximately 2 to 4 times the plate resistance of the driver tube. For a push-pull triode driver stage, its maximum plate load per tube should be approximately equal to the plate resistance of an individual tube. This ratio for push-pull operation is permissible principally because of elimination of second harmonic distortion. This minimum plate load is the value used for calculating peak power transformer efficiency.

An interstage transformer with high step-down ratio causes low distortion in the Class B input circuit, but limits the available signal. A satisfactory transformer design makes use of grid distortion to cancel a part of the distortion produced in the plate circuit of a Class B stage. For this reason, the transformer step-down ratio must not be too great. Resistance losses of the primary and secondary may be distributed on the basis of the most economical design. It is important to consider that only one-half of the secondary furnishes power at a time.

The load values for the class B amplifier stage given under "Rating and Characteristics" are per tube. These values are optimum for the given conditions, but will change slightly with available input if maximum output and low distortion are desired. The plate to plate load for each condition is four times the tabulated value per tube. It is important to consider that only one-half of the primary of the output transformer furnishes power at one time.

The Differences Between the 82 and 83 Rectifiers

In April the 82 mercury vapor rectifier was announced. Now the 83 m-v rectifier is officially detailed. The differences are shown below:

Characteristic	*82*	*83*
Filament Voltage	2.5	5.0
Max. d-c output current (continuous)	125 ma	250 ma
Max. peak plate current	400 ma	800 ma
Max. Overall Length	4 11/16"	5 3/8"
Max. Diameter	1 13/16"	2 1/16"
Bulb	Medium Regular (S-14)	Medium Dome-Type (ST-16)

83

THE 83 is a full-wave, mercury vapor rectifier tube of the hot-cathode type for use in suitable rectifying devices designed to supply d-c power from an a-c power line. It is particularly recommended for supplying power of uniform voltage to receivers in which the direct current requirements are subject to considerable variation. Typical of such receivers are those employing Class B power amplifiers.

The excellent voltage regulation characteristics of the 83 is due to its low and practically constant voltage drop for any current drain up to the full emission of the filaments. Under normal operating conditions, the tube voltage drop is only about 15 volts. This desirable feature makes it possible to attain very high overall operating efficiency.

The coated filaments employed in this tube provides an efficient source of electron emission, and reach their dull red operating temperature quickly.

Under operating conditions, the 83 has a bluish-white glow filling the space within the plates and extending to some degree into the surrounding space. This glow, caused by the mercury vapor, is an inherent operating characteristic of the 83.

The effect of the mercury vapor in the 83 is to neutralize the space-charge voltage drop so that it amounts to only about 15 volts at normal operating temperatures. This drop remains practically constant with any current drain up to the full emission of the filaments. It is apparent therefore that this tube under operating conditions has very low internal resistance, and that the current it delivers depends on the resistance of the load and the regulation of the power transformer. Sufficient protective resistance or reactance must always be used with this tube to limit its current to the recommended maximum value.

TENTATIVE RATING AND CHARACTERISTICS

Filament Voltage	5.0 Volts
Filament Current	3.0 Amperes
Maximum A-C Voltage per Plate	500 Volts (RMS)
Maximum Peak Inverse Voltage	1,400 Volts
Maximum D-C Output Current, continuous	250 Milliamperes
Maximum Peak Plate Current	800 Milliamperes
Tube Voltage Drop (approx.)	15 Volts
Maximum Overall Length	5 3/8"
Maximum Diameter	2 1/16"
Bulb	ST-16
Base	Medium 4-Pin

(*83 data continued next week*)

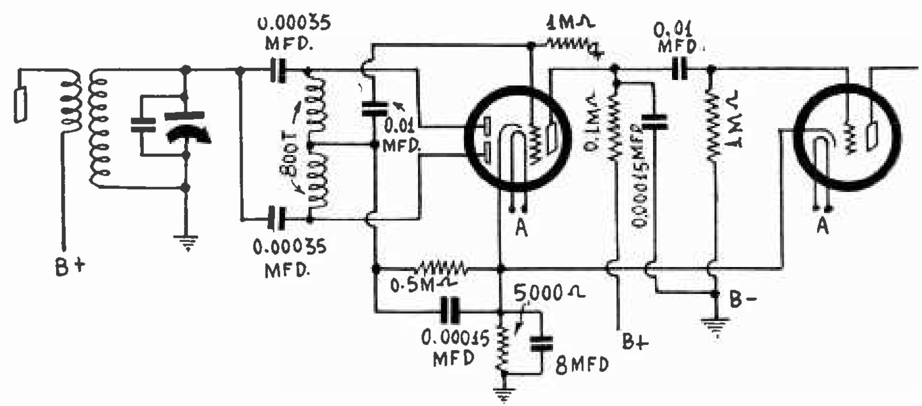
55 Diode in T-R-F Sets

How to Hook Up With Coils You Have

By Paul Erwin

WHEN the 55 is used in a set, even with the amplifier part of the tube hooked up to a resistance-coupled arrangement for an extra stage of audio, the volume of sound resulting is less than when a '24 or 57 tube is used as detector without the extra audio, but the tone is better. In tuned radio frequency sets it is not practical simply to make this change, as the lessened sensitivity is disappointing, even though the quality does improve. To come up to about the same volume as would prevail in an excellent five-tube a-c midget, including rectifier tube, still another stage of audio should be used. Then both quality and sensitivity are present.

Now, the grounding of the secondary of the transformer feeding the detector is a problem, since gang condensers require that all grid returns of tuned tubes be to the same point, or, if not to the same point, that they be adequately bypassed, and in a manner not affecting the tuning. No matter what is done with the simple transformer, either the tuning is badly upset or a lot of resistance is introduced into the tuned circuit or so large a capacity is used across a cathode-anode resistor as to eliminate all the high audio frequencies, so tone is ruined.



Although sensitivity is less when the 55 supplants a screen grid detector, even with the triode part as audio amplifier, another audio stage will about restore former sensitivity, with greatly improved tone.

For Existing Coils

Therefore a solution is offered that has been tested and that works well. It is confessedly a makeshift, in the absence of coils that have three windings, the third winding large and closely-coupled to the tuned secondary, and moreover the third winding accurately center-tapped. Such coils may be made at home, by winding the usual transformer, putting two or three layers of insulating fabric over the tuned secondary, and winding around 200 turns of No. 40 enamel wire, center-tapped, for the detector feed, and true push-pull would result. However, without monkeying with existing coils the parallel arrangement shown in Fig. 1 may be followed safely.

The diode is used here not as a full-wave detector, because anodes are really unparallel, but as half-wave rectifier, one that does not involve more sensitivity sacrifice, as the ear can tell the difference between the single-wave and the full-wave detector, as to volume of sound, since the full-wave method makes use of only half the voltage obtainable by the other method. Both have been tried and the half-wave detector is recommended for t-r-f sets. No automatic volume control feature should be attempted for t-r-f sets, as this puts a real drain on sensitivity, and t-r-f sets can not afford such a sacrifice.

The detector method consists of putting the extremes of an inductance to the plates of the diodes (for there are two diodes in the 55 and their pin positions are in line with those of the heater), while the center-tap is led through a resistor to cathode. Across this resistor, which may be 0.5 meg., a bypass condenser should be placed, and a capacity of 0.00015 mfd. or 0.0001 mfd. may be used for broadcast frequencies. It might be assumed that such a bypass condenser would not be needed, and theoretically that would be true of full-wave detection, but to omit the condenser even so, the circuit must be perfectly symmetrical, which it would not be in practice.

Bias Voltage

The effect of lack of symmetry is that there is feedback, either positive or negative. In the present instance it is positive, for there was squealing at high radio frequencies until the condenser was placed across the 0.5 meg. Another point is that some radio frequency will escape the detector and naturally enter the triode of the 55, and again there would be squealing trouble, were not a condenser placed from triode plate to ground. This, too, may be 0.00015 or 0.0001 mfd.

The extra audio stage, besides the one obtainable from the triode of the 55, well may be a 56, the new successor to the '27. The 56 will take 250 plate volts at 13.5 volts negative bias, whereas the triode of the 55 takes 20 volts negative bias at 250 volts. However, it is not necessary to apply the full negative bias, particularly as you are feeding a second audio tube that takes a lower bias, despite higher signal amplitude. For signal reasons the bias on the 55 triode might be only 2 volts, with safety, however, we may bias both tubes harmlessly at the same voltage, which is 9 volts, derived from the drop in a 5,000 ohm resistor. Actually 4,500 ohms were used at a drain of 2 milliamperes, but 5,000 ohms is a readily procurable commercial rating, and it is immaterial which value is used. The bias will be only slightly different.

Tube manufacturers are not agreed on the negative bias for the 56, as some recommend 9 volts when resistance coupling is used, and for a fact this gives more volume of sound than if the 13.5 volts generally recommended for transformer coupling were introduced, so it is well enough to stick to the 9 volts.

Will Drive a '50

The power tube is not shown, but the circuit will drive a '50 tube very nicely, and if the leak values in the grid circuits throughout do not exceed 1 meg., and the choke coil in the B supply, with 16 mfd. total filter capacity there, does not exceed 2,000 ohms, there will be motorboating. The tone will be superb and you will hear the orchestra 'cello much as if it were being played in a solo, instead of its presence being almost lost, as is true in many radio sets.

The 800-turn honeycomb chokes are commercial products and require a machine for winding. The 0.00035 mfd. condensers need not be that large. Even down to 0.0001 mfd. may be used. Do not exceed 0.00015 mfd. where specified.

Concerning the plate coupling resistor of the triode of the 55, it is 100,000 ohms. This is not a critical resistor, at all, and use of 20,000 ohms as specified in tube data causes the plate current to be around 5 ma. which is too much to pass through the pigtail resistors you probably have about the laboratory. The normal rating of 1 watt applied to such resistors would render a 20,000-ohm unit of that wattage unsuitable for long use. The resistor would burn out.

Thrill for Jaded Ears

A set such as would result from the change suggested would draw about 65 ma of B current, not allowing for bleeder, as in midget sets high resistances are used and bleeder may be ignored. The B choke, in the dynamic speaker's field coil, would drop around 100 volts, so by connecting two 50,000-ohm or other equal resistors across the choke, which is in the negative rectifier leg, the return for the '45 grid may be made to the joint of the resistors, while a 1 mfd. condenser is connected from joint to ground. The 1 mfd. condenser reduces the hum very materially.

One who has listened to radio sets for eight years and always has had some fault to find with their tone at last has achieved what he considers really enjoyable tone by using the hookup diagrammed. It is therefore hoped that a great many others will participate in the enjoyment of such excellent tone and will fix up their t-r-f receivers accordingly.

As for supers, it is practical to resort

(*Continued on next page*)

A NEW ULTRA-FREQUENCY LECHER WIRES

By Einar

WHEN waves shorter than one meter are generated electronic oscillations discovered by Barkhausen in 1919 are employed. These oscillations are not generated by the conventional vacuum tube oscillators but by electronic oscillators. If in an ordinary vacuum tube the grid is made positive and the plate negative, and the voltages are suitably proportioned, the electrons in the space between the cathode and the plate will execute a simple harmonic vibration. That is, they will move back and forth according to the sinusoidal law. Radiators employing this principle have been carefully worked out so that they give considerable power.

One advantage of the ultra-short waves is that they lend themselves readily to directional and beam transmission. Paraboloidal reflectors and directional antenna arrays can be built for a small cost as compared with the cost of similar arrangements that are to be used with waves of the order of 3 to 7 meters. What is meant by ultra-short waves here are waves of the order of 60 centimeters.

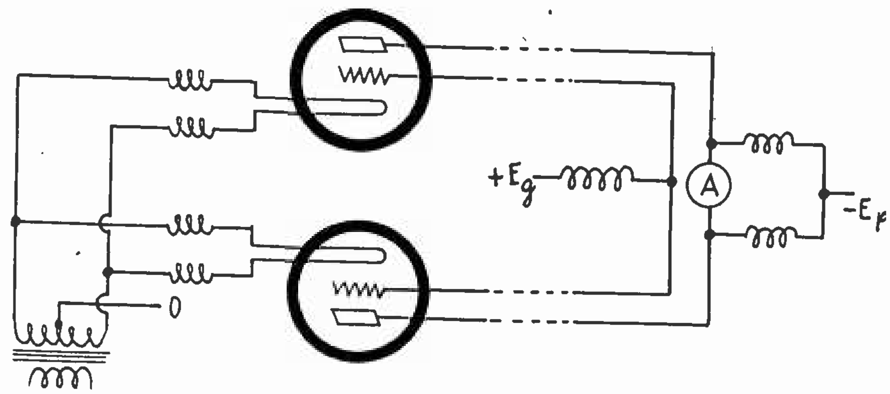


Fig. 1.
A push-pull electron oscillator operating with grid and plate Lecher wire systems. This is sometimes known as the Barkhausen oscillator from the discoverer of electron oscillations.

Use of Lecher Wires

H. N. Kozanowski of the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., reports work on the Barkhausen oscillator in the June, 1932, issue of the Proceedings of the Institute of Radio Engineers in which Lecher wires are used to enhance the efficiency of the circuits. The author gives a brief explanation of the theory and obtains an expression for the frequency of oscillation of the electrons in the space between the cathode and the plate. It is $f = (\frac{1}{2}\pi x_0)(2eEgM)^{\frac{1}{2}}$, in which e is the electronic charge, M the electronic mass, Eg the grid voltage, and x_0 is the distance between the grid and the plate. In this formula e/M is known by the physical measurements and the other two factors can be measured in any circuit arrangement. The value of x_0 would be a tube constant and Eg would be an operating voltage of the tube. Thus the frequency generated by the tube can be determined approximately for design purposes. The actual frequency, of course, can be measured by well-known methods of measurement.

In Fig. 1 is a push-pull Barkhausen oscillator as set up by Mr. Kozanowski. The symmetrical plate-grid Lecher wires terminate on the grids and the plates, one wire being connected to the plates and the other to the grids. Radio frequency choke coils are placed in all the supply leads to confine the oscillating current to the tubes and the Lecher system. A high frequency ammeter is placed in the plate wire at its midpoint to measure the output.

Peculiarity of Circuit

The author found that the radio-frequency potential of the grid was zero while that of the filament and the plate varied with large amplitude. This suggested the arrangement in Fig. 2. Here the grids are connected directly to the voltage source and the "grid" Lecher wire is connected to the filament. Chokes are still placed in the plate and filament supply leads but the Lecher wire is connected to the filaments by means of small condensers. This circuit was found very satisfactory.

Using two 852 tubes and a plate length of Lecher wire of 65 cm an oscillating current of 2.25 amperes was obtained, the voltage on the grid being 500 volts positive and the voltage on the plate 115 volts negative. The plate d-c current was not a maximum at the same time as the oscillating current. It amounted to 1.8 milliamperes when the Lecher system was 70 cm long, when the oscillating current was only 2 amperes. When the oscillating current was maximum the d-c plate current was only 1.6 milliamperes.

Plate Current a Loss

In another case the grid voltage was 500 volts positive and the plate voltage 109 volts negative, the length of the plate Lecher wire was 67 cm. The maximum oscillating current occurred when the filament Lecher wire was 52 cm and then the current was 2.4 amperes. The generated wave had a length of 67.5 cm. In this case the maximum plate current occurred when the filament Lecher wire was 54 cm, and then it was nearly 6 milliamperes. The d-c grid current was 400 milliamperes.

The reason the plate d-c current is not maximum when the oscillating current is maximum is that the plate current represents a power loss. The output cannot be measured in terms of the d-c current as in other oscillators for this reason. Indeed, the plate current is a measure of the lack of efficiency.

Function of Plate Circuit

The loss of power due to plate current is explained on the "Zusammentanz" theory. The electrons move back and forth in a cloud, or like a swarm of bees, all in phase when the adjustment is best. Some of the electrons, however, are out of step with the rest and they stray to the plate. Only those that stay with the crowd contribute to the oscillating current. The optimum adjustment of the circuit would be that which gave greatest oscillating current and least d-c plate current.

The plate Lecher system apparently determines the wavelength in the external circuit. The circuit in Fig. 2 was adjusted for maximum oscillating current as indicated by the ammeter. The length of the plate wire was then varied and the change in the currents observed. There was a decrease in the oscillating current either side, and the decrease was great as the length of the circuit was decreased. In the other direction the decrease was less rapid. However, the d-c current increased as the length of the Lecher wire was increased, until a maximum was reached. The wavelength of the generated wave varied in direct proportion to the length of the plate Lecher wire, the wavelength being measured with an independent Lecher wire system. This proportionality held over quite a wide range.

Filament Lecher Wire Effect

The length of the plate Lecher wire was adjusted to optimum operation at 67.5 cm and then the length of the filament Lecher wire was varied over a range of 16 cm. As in the case of the plate wire variation, the maximum oscillating current occurred before the maximum d-c current, that is, at a shorter length of filament Lecher wire. The wavelength did not change much, however, the total change being less than 2 centimeters for the change of 16 cm. The oscillating current has a clearly defined maximum, showing that the length of the filament Lecher wire determines the power output.

Thus the plate wire system controls

Diode-Detect

(Continued from preceding page)

to the same procedure as outlined, but as the secondary feeding the detector has both terminals free from restrictions, it may be connected one side to one anode of the diode, other side to one end of the resistor that leads to cathode. Then the other diode section may be used for automatic volume control. Diagrams were printed last week.

Full Circuit Next Week

The rest of the circuit would not have to be changed, but the condenser across the anode-cathode resistor should be 0.01 mfd., and likewise the condenser across

OSCILLATOR; CONNECTED TO FILAMENT

Andrews

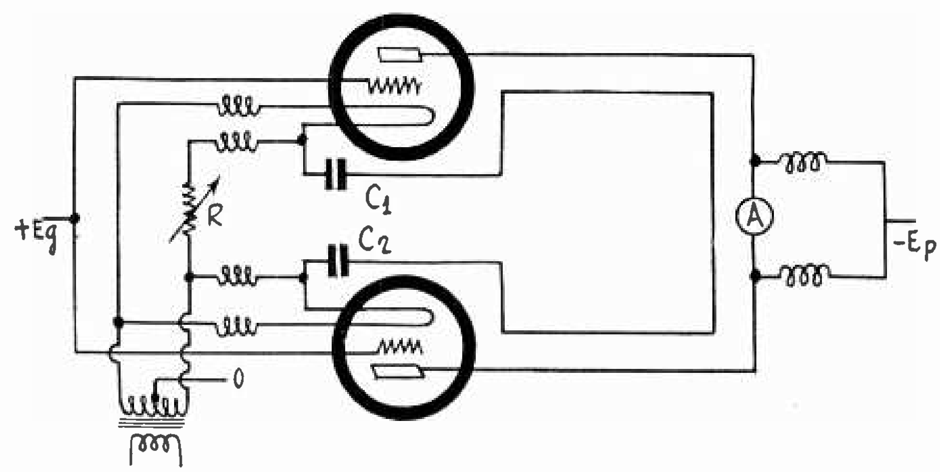


FIG. 2.
This is a push-pull electron oscillator in which the Lecher wire system has been connected to the plates and the filaments of the tubes. This can generate waves as low as 0.5 meter with considerable output.

the wavelength generated and the filament wire system the output power.

Grid Voltage Effect

On the theory of electron cloud oscillation the frequency should be determined by the accelerating voltage on the grid, but the change in wavelength with the plate circuit characteristics seems to be against the correctness of the theory. To test this the author of the paper in question adjusted the circuit in Fig. 2 for greatest output and then varied the grid voltage from 300 to 600 volts, leaving all the other factors constant, except that an adjustment was made in each case to make the grid power dissipation the same. The output was found to be the greatest at 500 volts on the plate, but the frequency did not change. Therefore the accelerating voltage alone does not determine the frequency of oscillation.

The discrepancy may be explained, it is suggested, that there exists a potentiality for oscillation over a range of frequencies and that the resonance condition in the plate circuit selects the frequency. The amplitude of oscillation is then determined by the deviation between the natural frequency of the plate circuit and the frequency at which the electrons would oscillate as determined by the accelerating voltage on the grid. The fact that there is a second order change in the frequency with grid voltage variations indicates that there is some kind of coupling beween the two frequency determining factors and that the resulting frequency is a compromise, the resonance condition in the plate circuit having the greater effect. The decrease in the output then depends on how far the plate resonant circuit succeeds in pulling the actual frequency away from the natural frequency determined by the accelerating voltage.

Temperature versus Output

There is no large variation in the frequency of oscillation with changes in the filament temperature but there was a variation in the output power. The grid current was used as a measure of filament temperature of emission. There is a straight relation between the grid and plate current, except for high values of grid current, where the plate current is less than would be expected by strict linearity. The power output varies. In the case reported the oscillating current attained a maximum when the grid current was about 525 milliamperes. At this point it was about 2.3 amperes and the d-c plate current was 4.1 milliamperes. The wavelength remained at 66 cm while the plate and filament Lecher wires were 65 and 52 centimeters respectively.

The output power varied considerably with the applied negative plate voltage. The oscillating current attained a maximum when the voltage was between 100 and 120 volts negative, the highest peak being at about 118 volts. The d-c plate current went through several changes. It had a maximum of 4.6 milliamperes at 100 volts on the plate and a maximum of 7 milliamperes at 50 volts. Minima occurred at 70 and 30 volts. While the plate current curve has rises and depressions, the general tendency is for the current to decrease as the negative voltage on the plate is increased. This is to be expected since the higher the plate voltage the greater is the repulsion of electrons.

The author points out that modulation of the output by coupling to the plate circuit will not give good results if the circuit is operating near its peak of oscillating current because of the broadness of the peak. There would be no change in the output with changes in the plate voltage and hence there would be no modulation if the change were due to an audio signal. However, if negative operating plate voltage is increased above the point of maximum output modulation will succeed for between 118 volts and 150 volts the variation in the output is linear. This would indicate practically distortionless modulation.

Modulation of Output

Radiation of power from the circuit is a function of the spacing of the filament and plate Lecher wires. When the two are close together the radiation is very small. As the distance is increased the radiation increases. The coupling between the two systems is not critical but there is a maximum separation, or minimum coupling, beyond which the circuit becomes unstable, and behavior being greatly affected by external capacities.

The proper operation of the two-tube circuit depends on equality of characteristics. But since two tubes cannot be obtained with exactly equal characteristics, a rheostat R, Fig. 2, is used to cut down the filament current in the tube having the greater emission. The rheostat is adjusted until the grid currents of the two tubes are equal. With this adjustment the two tubes are practically the same in effect.

Use of Single Tube

Oscillators of the grid-plate type can be constructed with a single tube, but with two tubes and the filament-plate circuit shorter waves can be generated and somewhat more than twice as much power output. With a single 852 tube it is practically impossible to get a wave shorter than 90 centimeters with any appreciable power output, while with two of these tubes it is possible to reach 70 centimeters with ease and still get more power out.

or T-R-F Set

the plate circuit of the triode, if there is oscillation, should be increased to 0.01. If it is not necessary for oscillation suppression it should be omitted in either instance, t-r-f or super.

Next week I hope to be able to present the six-tube t-r-f circuit built along the lines of the detector, in Fig. 1, and also give the resistance, voltage and current readings right on the diagram. It is surely a worth-while set, the only drawback being that the low radio frequencies amplified more than the high ones, due to the tuning effect of the two r-f chokes, which cause resonance broadly around 900 kc. The special coil described would avoid that.

Literature Wanted

Readers desiring radio literature from manufacturers and jobbers concerning standard parts and accessories, new products and new circuits, should send a request for publication of their name and address. Send request to Literature Editor, RADIO WORLD, 145 West 45th Street, New York, N. Y.

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S. M. Skovran (A77132), 826 Vista St., N.S., Pittsburgh, Penna.
Homer Tomlinson, 320 W. 7th St., Mt. Vernon, Indiana.
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Squealing and Poor Tone

KINDLY let me know what to do to reduce the squealing tendency of my t-r-f receiver on the lower broadcast waves. It is all right on the higher waves, except that the low note response is not good. Screen grid r-f tubes are used.—B. M. S., Tucson, Ariz.

You may use a longer aerial, if that is more convenient than putting on more antenna primary turns, and also increase the value of the limiting resistor biasing the first r-f or both r-f tubes. The coils used should be shielded and the shields grounded. The screen voltage on the first tube may be lowered, if necessary by adding a bypassed resistor from screen to present voltage supply for screen, say, 100,000 ohms. Thus will you reduce or get rid of squealing. You can eliminate it entirely by increasing the limiting resistor value sufficiently. In the detector circuit, to improve low-note response, use a higher value plate resistor, R1, even 1 to 2 meg. being practical, which would require increasing the value of the biasing resistor. Also, as the bypass condenser would be from 0.1 mfd. up, stress the "up," and use as much capacity as consistent with absence of oscillation. If you have a preliminary audio tube, increase the capacity across its biasing resistor. See Fig. 1020.

* * *

Measuring High Resistance

USUALLY IT IS NECESSARY to have a sensitive meter to measure high values of resistance. But can you suggest some method of doing this by using an insensitive meter, e. g., 0-50 milliammeter, or thereabouts?—J. G. D., Mt. Vernon, Va.

One method of measuring high resistances with a high-current meter is to hook up a power tube, such as the '45, with proper voltage supply, using sufficient bleeder current so that when a B choke is put in the negative leg it will drop 80 volts or so. Put one side of the choke to B minus the other side to grounded filament center. Put a milliammeter as stated in the plate circuit. Put two equal high series resistors (10 meg. each) in series across the choke and return grid to joint. Now as you put the unknown high resistance across the resistor that's from joint to B minus the bias will increase, and the plate current will go down. The plate current readings can be calibrated against some known values of high resistance, a curve drawn, and the curve consulted, in reference to the current, when unknown values are to be measured.

* * *

Short-Wave Coils

IS IT PRACTICAL to use three-winding short-wave coils for interstage coupling in a stage of t-r-f and regenerative detector for DX? If so what are the number of turns for the short-wave bands, 1.25 inch diameter?—K. L. M., Dubuque, Ia.

Certainly it is practical, and it is one of the best ways. To cover the band with 0.00014 mfd. capacity, the usual capacity for short waves, 200 to 15 meters or a little below, get four UX forms and four six-pin forms. The UX forms are for the four antenna coils. The six-pin forms are for the four interstage coils. The winding data are as follows, taken from commercial coils:

UX Antenna Coil

Primary	*Separation*	*Secondary*	*Wire*
1 1/8	1/8"	3	No. 18 enamel
1 1/8	1/8"	7	No. 20 enamel
2 1/8	1/8"	19.5	No. 24 enamel
5 1/8	1/8"	53	No. 24 enamel

Six-Pin Interstage Coil

Primary, separation, secondary, all the same as above. The tickler windings are as follows:

2.25 turns, No. 40 silk covered, separation 3/16 inch.

5.25 turns, No. 40 silk covered, separation, 1/8 inch.

13.5 turns, No. 40 silk covered, separation, 1.8 inch.

40 turns, No. 40 single silk covered, separation 1/8 inch.

The tickler is to be put at top, and the separation refers to its separation from the next winding, the secondary. The primary is at bottom, nearer the pins, and the separation referred to under UX therefore is that between primary and secondary. If regeneration fails, reverse the external connections to the tickler winding. Do not rewind the tickler or reconnect it to prongs, but do wind all coils in the same direction.

* * *

A-C and D-C Measurements

AS I DESIRE to make several measurements, would you please recommend to me a suitable method of measuring d-c voltages, occasionally a-c voltages of low frequency, and also d-c currents and voltages, and methods of access to receivers for taking readings?—K. M., Boise, Idaho.

An a-c, d-c 0-1 milliammeter will serve the purpose nicely, equipped with series resistors for voltage readings. These resistors must be very accurate, to 1 per cent. or better, hence wire-wound. The method of access to receivers can not be outlined now, because with new tubes with unusual connections, and with other new tubes impending, the whole situation will have to be surveyed, and a set-up arranged in the light of those facts, some of which are not now at hand. The only other course would be the use of an assortment of adapters, but this finally becomes very unhandy.

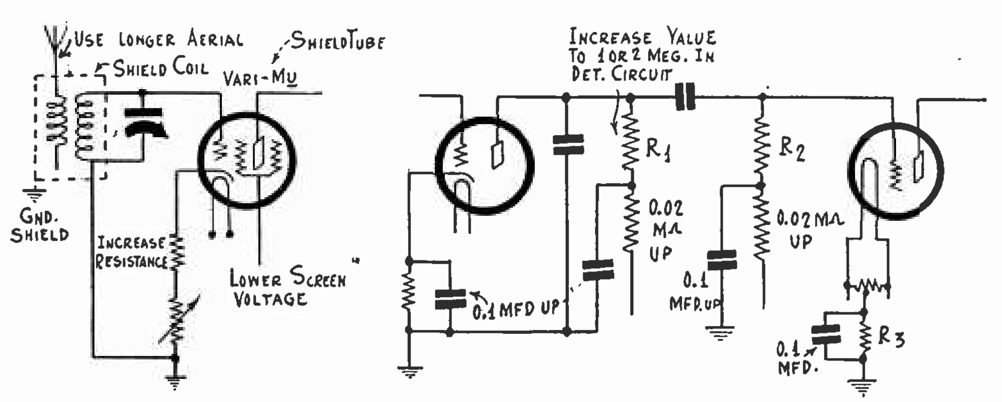
* * *

Electron Coupling

FROM TIME TO TIME I see references to electron coupling, and you reviewed Dow's article in the December, 1931, "Proceedings" of the Institute of Radio Engineers, in which he presented this method. Yet I am in the dark as to what it means, or, rather, my understanding of electron coupling does not jibe with various hookups that are floating through the magazines these days, asserted to show electron coupling.—U. Y., Pensacola, Fla.

Electron coupling is the coupling that arises from the electrons only, and independent of any use of external resistance, capacity or direct coupling. It is true that therefore some of the hookups that pass as examples of true electron coupling are not so in fact, indeed are resistance-capacity coupled, for instance. If you will consider a screen grid tube, such as the '24, with grid input as usual, with an inductive load (choke) in the screen circuit, and a fixed condenser from screen to grid, then you visualize an oscillator. Cathode is grounded. If a resistor or r-f choke is put in the plate circuit, a stopping condenser between plate of that tube and grid of an amplifier stage, you can realize that the coupling of the oscillator to the amplifier tube is not due to any external resistance, capacity or to direct coupling, but is due to the commingling of the components of the space current in the oscillator tube. That is, the electrons attracted by the plate and the electrons attracted by the screen are united in the space circuit, and this unison or commingling is the electron coupling. Others have suggested that the term potential coupling be used. They, like Dow, admit the inadequacy of the term. Dow used electron for confessed want of a better word. If you can suggest something better we would be glad to receive the idea.

FIG. 1020
Methods of reducing the oscillation tendency of a t-r-f receiver, or even completely eliminating it, and also of improving the low-note response. Increase in the capacity of the bypass condensers across biasing resistors improves the low notes, but the circuit may be made too keen at r-f for the amount of shielding, so this has its limits in small sets.



STATION SPARKS

By Alice Remsen

Hidden Treasure

For David Ross in "Poet's Gold"
WABC Sundays, 5:30 p.m.

Beauty is the darkling cloud
Fraught with rainy burden,
Borne upon the singing wind
For a poet's guerdon.

Beauty is the shining tip
Of milady's finger;
Beauty is an ecstasy
As the moments linger.

Beauty is the raging storm
Or the calmest weather;
Beauty is a ton of rock
Or a raven's feather.

Beauty is a grain of sand
Or the highest mountain;
Beauty is a torrent wide
Or a silver fountain.

There is beauty to be found
By a lonesome poet
Everywhere, in everything—
But only poets know it.
—A. R.

* * *

And David Ross rediscovers beauty for us in his beautiful program, "Poet's Gold." Listen in, all ye poetry lovers, and revel in it.

* * *

News of the Studios

WABC

Two new schedules are announced by the Columbia Broadcasting System. Sid Gary, heard many times as guest artist, made his debut as an exclusive Columbia artist on July 1st, at 7:00 p. m. With "Romance in My Soul" as his theme song, Gary's baritone voice will be heard each Tuesday, Thursday and Friday at the same time, singing popular tunes and standard songs, accompanied by a fourteen piece orchestra under the direction of Freddie Rich.

Tito Guizar, popular young Mexican tenor, will offer his songs over the Columbia network every Monday and Wednesday at 7:00 p.m., EDST, alternating with Gary.

* * *

Donald Stauffer will again direct the production of the "March of Time" upon its return to the air. Scripts will be prepared by Tom Everitt; sound effects, which play an important part in the production, will be supervised by Mrs. Ora Nichols, and Howard Barlow will resume his post as musical director.

* * *

NBC

Virginia Rea is returning to radio. The girl who rose to fame as Olive Palmer and became known to millions of listeners throughout the United States has signed an exclusive contract with the National Broadcasting Company and will appear in a series of programs over the NBC networks in the near future.

* * *

Countess Olga Albani is taking the place of Jessica Dragonette on the Cities Service program while Jessica is away on her vacation. The Countess came to radio from the stage. Her last appearance in the theatre was in the Chicago company of "New Moon." She prefers the air to stage or concert appearances because she doesn't have to leave home. The Cavaliers Quartet and Rosario Bourdon's orchestra remain with the program.

* * *

WOR

As usual, WOR has revised its schedule for the summer and during the hot months signs off from 1:00 p.m. to 5:00 p.m. This closes up the Newark studios, which were used for the majority of the afternoon programs. Many of the old features are retained, such as The Happy Vagabond, Frank and Flo, Beggars' Bowl, Uncle Don, the Minstrels, the Witches Tale, the Choir Invisible, Red Lacquer and Jade and Katherine n' Caliope. Maria Cardinale, who was taken off Footlight Echoes, has been placed on again. The Moonbeam girls are appearing with Percy Hemus on a program called "Sweet and Low," but listeners miss the old "Moonbeam" schedule.

* * *

WINS

Cowboy Tom is taking his WINS Roundup on a vaudeville tour. He opened at the Grand Opera House in New York City on July 6th. Todd Rollins, whose dance band is heard over WINS, is an amateur boxer; his present hobbies are baseball, hunting and golf. The hobby of Gregoire Franzell, conductor of the Wins American Music Ensemble, is cookery; he specializes in frog's legs. Buddie King, heard regularly over WINS as a modern song interpreter, is a versatile young lady, to say the least. She is under contract to "cover" the Olympic Games for several magazines—is at the moment "cramming" for an air-pilot's exam and has a private ambition to drive an automobile in a regular five-hundred mile auto race.

* * *

Sidelights

OLIVE WEST, NBC actress, is the daughter of a noted California pioneer. . . . SISTERS OF THE SKILLET will take six weeks of middle-west vaudville touring as their vacation this summer. . . . JOHNNY MARVIN, NBC singer, was once a New York barber. . . . FRANK LUTHER got his musical start in "The Student Prince." . . . GEORGE OLSEN is a great aviation enthusiast. . . . FREDDIE RICH'S father and grandfather were able instrumental concert artists. . . . KENNETH ROBERTS' father was a lawyer. . . . WILLIAM HALL'S father was a police officer. . . . HARRY VON ZELL is the son of an advertising man. . . . MAX SMOLEN is the son of a band director; his two brothers are musicians. . . . SINGIN' SAM likes movies, hunting, walking, turndown collars, painting, and occasional rains; dislikes crowds, shopping, tall women and continued stories. . . . EDWARD REESE, heard each week as a detective on the Eno Crime Club, is the only American-born member of the cast. . . . SYLVIA FROOS likes to sing but would love to study law. . . . VINCENT SOREY would rather play the piano than his present instrument—the violin. . . . WILLARD AMISON, the singer, would like to be a conductor. . . . CRANE CALDER would like to be a country gentleman. . . . ROGER WHITE, the conductor, wouldn't change . . . Neither would I. . . . JACK BENNY wears a straw hat while broadcasting. . . . ALICE JOY is making a movie short in which her two children will also participate. . . . BERT LAHR was born in New York City, on August 13th, 1895. . . . ERNIE HARE has a daughter, Marilyn, eight years old; she was named after Marilyn Miller. . . . HARRIET LEE, contralto, was once a stenographer in a radio station. . . . BEN GAUER, the announcer, appeared in the movies at the age of eight. . . . T. DANIEL FRAWLEY, NBC actor, was once a page in the United States Senate. . . . FRANK MUNN, NBC singer, was once a machinist. . . . FRANK PARKER, A. & P. Gypsies tenor, was once a chorus boy. . . . KARL LANDT, of the Landt Trio and White, was an instructor in chemistry. . . . ART BARNET, the Jester, was a drummer in an orchestra.

* * *

ANSWERS TO CORRESPONDENTS

C. H. ANNIS, Tacoma, Wash.: Thanks for your letter. If you can name me any great, or as you say, real actors and actresses appearing on radio, whose biographies you would like to read, I'll gladly do my best for you. Yes; I read the book you mention many years ago and of course, enjoyed it. Glad you think the page interesting.

* * *

E. VERDUN, New York City—Sorry I cannot answer personal questions of that description. Yes; Irene Beasly is a Southerner. As you see I am running the biography of David Ross in this issue. Thanks.

* * *

Biographical Brevities

About David Ross

David Ross was born in New York in 1895. His parents were very poor, so as soon as David was old enough he sold newspapers to augment the family income. His family tried farming in Virginia during David's early boyhood, but it proved no more prosperous than their other enterprises and so they returned to New York. David progressed through high school and enrolled at the College of the City of New York for a liberal arts course, but withdrew and transferred to Rutgers for an agricultural training.

After leaving college he tried various occupations. For a time he was the supervisor of an orphan asylum. After that he became secretary to a Russian baroness, but her temperament kept him in such a constant state of apprehension that he turned his hand to the more peaceful occupation of writing poetry. His poems were most often returned with polite rejection slips and when they were accepted the returns were so meagre that he was forced to supplement his writing with a more profitable position; and so, with occasional stray parts in musical comedies, writing advertising copy and reviewing one book a week he was able to eke out a living.

David started in radio as a dramatic reader. It was just an odd job as far as he was concerned, as there were but few dramatic presentations on the air at that time; but some executive recognized the unusually rich tones of his voice and the charm of his personality and signed him as an announcer.

Two years after his first appearance on the air he came to Columbia, where he is now one of its foremost announcers. He admits to being very fond of announcing the "Evening in Paris" program; says the continuity is always so well written. He also has a sneaking regard for his own program, "Poet's Gold"; don't blame him for that; it is a lovely Sunday afternoon interlude.

David Ross is five feet, five inches tall. Is slender. Has deep blue eyes and a wealth of wavy brown, greying hair. His soft black ties and gentle manner give him the romantic novelist's idea of the languishing poet, but don't let it fool you. He's a regular fellow and has a great sense of humor. Always smiling. Has thousands of friends on and off the air.

A THOUGHT FOR THE WEEK

"CROONER," by Rian James (Alfred H. King, Inc., New York, $2.00) is all about Teddy Taylor, who hasn't much of a voice but discovers that by using a megaphone and crooning softly into it, he can score with the ladies. You'll loathe Teddy about as much as the other characters, including the likable heroine, do. He's an insignificant product of publicity and makes a million almost overnight. He's a terrible cad, a dumb-bell of the first water, and an ingrate. There's a surprise ending that might catch your fancy if you can stand the thought of anything good coming out of a Teddy Taylor. Mr. James uses many cuss words—not mere substitutes for bold profanity but actual oaths—SMACK—just like that! "Crooner" belittles radio, and as for the author's opinion of columnists—well, it's scarcely fit for publication. (And we wonder if the book as a whole is!)

RADIO WORLD

Trade Mark Reg. U. S. Pat. Off.

The First and Only National Radio Weekly

Eleventh Year

Owned and published by Hennessy Radio Publications Corporation, 145 West 45th Street, New York, N. Y. Roland Burke Hennessy, president and treasurer, 145 West 45th Street, New York, N. Y.; M. B. Hennessy, vice-president, 145 West 45th Street, New York, N. Y.; Herman Bernard, secretary, 145 West 45th Street, New York, N. Y.

Roland Burke Hennessy, editor; Herman Bernard, managing editor and business manager; J. E. Anderson, technical editor; J. Murray Barron, advertising manager.

The 55 Makes Good

THE 55 tube, recently officially announced, has lived up to its expectations, and its use in a receiver constitutes a real improvement in tone. While the sensitivity will be less, even with the triode part of the tube used as an extra audio amplifier, superheterodynes, for which the 55 is intended, should have plenty of sensitivity, and some atonement may be effected in many instances by increasing plate voltages or number of turns on primaries.

The virtue of the tube lies in its detection without distortion, otherwise known as its linear characteristic, whereby the output is exactly proportional to the input. With amplifier tubes we do not have linearity, as all characteristic curves of plate current, grid voltage show non-uniformity. But the 55 as detector is not an amplifier. It is a diode, and a diode does not amplify.

In line with this improvement in quality should be the selection of the proper output tube and an excellent speaker, with adequate baffling. In general, for a-c sets for which the 55 is primarily intended, the '45 tube, single or push-pull, is highly satisfactory for output, worked as a Class A amplifier, the usual and familiar method.

Then, too, if automatic volume control is desired, it may be obtained by using a separate winding put on the core of the intermediate frequency transformer feeding the detector, circuits for which have been published in preceding issues, while others are in the present issue.

Many who have existing superheterodynes will want to know if the 55 may be used. Yes, it may. A six-prong socket is needed, replacing the present five-prong socket, and the hookup has to be changed, so that the detector and the other diode section, if used for a-v-c, are properly fed and loaded, and then an extra stage of resistance-coupled audio included. The voltages for the triode section of the 55 used for this extra audio stage should be around 250 volts applied to the plate, through a resistor load of 20,000 ohms, with either a steady bias voltage of 20 volts negative, or using for bias the drop in the detector load resistor, and coupling the detector directly to the grid of the amplifier tube. The direct-coupling method is simpler, as it permits grounding the cathode.

One of the pleasant facts about the 55 is that it so improves the tone of a circuit that the instruments of a symphonic orchestra can be distinguished from one another, and the low-note response, the weakest point in most sets, is remarkably good. Of course if there is distortionless operation all the frequencies are handled impartially, and the shortcomings, if any, would be due to the reproducer and its baffle, as well as to room conditions and other minor acoustical considerations.

We previously stated that of the new tubes the 55 was the most interesting, and now we are able to state that it is the most startling, the most agreeable and the most attractive. The other new tubes have their valuable points, but as the 55 is directed toward tone, and we aer so intensely interested in that, we hand the laurels to the 55 and urge our readers to try out this tube by all means. It will be on the market within a few weeks.

Parts Encouraging

AMID business conditions that try the patience of nearly all it is only natural that radio should find itself in the same boat as the rest of the important industries. The manufacture of radio sets has become a chronic losing proposition, nearly every large manufacturer is losing money and has been for nearly two years, and this in the face of the fact sets never before cost so little, considering what is obtained, and that midgets are made to fit even the most modest purse. It is evidently true therefore that mere price is not sufficient to maintain profits in the radio industry. It has resulted only in keeping up the turnover at the expense of the manufacturer.

Somewhat different from the commercial set business has been the record of the parts business, including parts for the building of new sets by experimenters and technicians, and the replacement of damaged parts in receivers and amplifiers. The drop in this line has not been nearly so great, the profits have been maintained almost up to the middle of summer, while the plans for the coming season are based on extended solicitation of consumer business.

Quite a few radio stores that discarded parts returned to them, noting that a profit could be made on parts. This profit was to an extent at the expense of the manufacturer. With sales scarce, manufacturers of parts who cater to commercial set manufacturers were willing to quote manufacturers' prices to retailers, including mail order houses, buying in quantity, and thus, due also to small mark-up, the consumer is able to buy parts at a very low price. The retailer's profit is said to be at the expense of the manufacturer because the manufacturer is losing money while the retailer makes a little.

Somehow the idea got abroad some years ago that the parts business was dead, probably because it was not large enough to support the great number of manufacturers catering to it. The sharpness of reduction in outlet of parts was noticeable in the number of stores and mail order houses quitting the sale of radio parts, rather than in the decline of the dollar volume of the parts sales. Then the replacement business came along as a reminder, and for a time it ran into very substantial figures. Naturally, when the price of commercial sets was reduced to its present low level the replacement business suffered temporarily, because it cost so little more to buy a new midget, complete with tubes, than it did to have the old, doubtful set repaired.

With fewer agencies in the parts business there was a larger percentage of the total business for each one so engaged, and the see-saw naturally sought its balance. Some of the radio mail order houses have thrived on the parts business and their catalogues look almost as imposing as those of the large general mail order houses of the middle west.

One branch of the exclusively parts business is derived from the amateurs, who build their own habitually and are an excellent field for development. Technical correspondence of an authoritative type is necessary to effectuate and keep sales, but those seeking this business have the proper personnel to cater to this requirement. In ten years the number of amateurs has doubled; in one year it has increased 40 per cent., and today there are 32,000 amateurs in the United States. All of them want to have better equipment, are a constant source of consumer business, and are worthy prospects.

With the number of amateurs increasing and with their greatest increase amid the accepted trough of the business depression, the amateurs may be regarded with double admiration. Perhaps they are showing the way forward to improved radio sales, and deserve special recognition for this. It would be great to be able to pin this laurel permanently on the amateurs. General business has to look to the lowly hog for its hope and inspiration, with hundredweight prices being $5.35, compared to $3.30 in May, and cattle prices being up, too, at $8,75, with $9 impending. Business leaders say that if anything can pull us out of the depression it will be hogs and cattle, but radio, surveying its own comparatively different field, may look with loftier hope to the amateurs.

Will Radio Decide It?

BY all signs the Presidential campaign will be a radio campaign, not only because the leading candidates of the two big parties will speak before the microphone, but that, without tacit admissions, their speeches are likely to take the form of debate. This is the general campaign formula that is favored by former Governor Smith, of New York, who believes that campaigns should be nothing if not debates between the candidates. It must be said in favor of the plan that there is nothing about politics that listeners like quite so much as a debate, even though the two candidates will not quickly succeed each other before the same microphone.

That there is plenty of room for debate is obvious, even though the stock phrase has it that the chief difference between the two big parties is that the names of their candidates are different. But the concerns of the Federal Government are far too numerous to permit that situation as a reality. Already the swords are crossed on the issue of development of natural resources, with Roosevelt offering a suggestion for the habilitation of waste lands, including clearing enormous acreages, planting of saplings and orchards. A Federal bond issue is involved, and indeed there is where the "issue" probably lies. Then there are farm problems, such as Government crop-buying, equilization fees to guarantee minimum prices to growers, Government credit on crops present and prospective, foreign relations, armaments, as well as ruling problems of the moment—unemployment, gigantic road and building construction, and, lest we forget, prohibition.

Hearing the party leaders and candidates talk on these subjects in a forthright manner is certainly a radio attraction, and the soundness of the facts and conclusions may decide the result of the election, though it is true that the candidate of one party is a fluent and effective orator and the candidate of the other is a stickler for scientific facts without forensic assistance or emotional impetus.

So let the campaign be waged to the fullest, and may it do the country (and also the radio business, by the way) a world of good!

TALK GIVEN ON BLACKSTONE

P. W. Wilson, special writer, proved an interesting talker on Blackstone, over WJZ recently.

85 FOR CAR SET WILL BE A TWIN BROTHER OF 55

The automotive series companion of the 55, which will be known as the 85, is to be announced next week, so some preliminayr but unofficial information about the new tube has been obtained.

The tube will be a duplex diode-triode, meaning that it has two diodes and one triode in the same envelope, which in this case also is dome-shaped. The heater type of construction is used, the heater voltage being 6.3 volts and the heater current 0.3 ampere. The tube may be used as a detector, either half- or full-wave, and also as automatic volume control, with either of the detector methods, and besides provides for using a stage of audio to make up approximately for the lower sensitivity of the diode as detector.

The automatic volume control feature is especially important, because of the inclusion of this provision in most of the latest automobile sets, to offset in part the change in volume of sound as one rounds corners, goes under tunnels and encounters other wave-absorption difficulties, including usual fading. To be able to put two, or even three, distinct tubes in one socket is a convenience appreciated in automobile set design.

The Amplifier Tube

As a triode Class A amplifier the maximum plate voltage to be recommended will be 250 volts, with a negative grid base of 20 volts, under which conditions the tube has a mu-factor of 8.3 and the plate current of the triode is 7 milliamperes. The a-c plate resistance is 8300 ohms and the mutual conductance 1000 micromhos. The 55 equivalent values are 7500 ohms and 1100 micromhos.

The close similarity between the 55 and the 85 will be seen all the way through.

For the 55 the plate load resistor recommended is 20,000 ohms, as detailed in last week's issue, but there is no reason even for the 55 why the plate resistor can not be higher, especially as 5 ma would be passed through a resistor that drops 100 volts, requiring a 5-watt resistor. However, in the case of the 85 this probably will be taken into consideration, and the load resistance cited as being not critical, with a value of around 100,000 ohms suggested.

As for the diode plates, the space current should not exceed 0.5 ma at no load when 10 volts d-c are applied. For full-wave detection and a-v-c the resistor between the plate return and the cathode should be 0.5 meg., and the condenser across it, for tuned radio frequency sets, 0.00015 mfd., whereas for superheterodynes employing the usual intermediate frequencies a capacity of 0.01 mfd. is to be recommended, it is believed. The difference in the capacities would be accounted for by the difference in the frequencies, 0.01 mfd. having no greater effect on the high frequency modulation envelope of the intermediate carrier than the smaller capacity has on the broadcast frequency carrier.

Difference in Bias

The load, for a-v-c, with fixed bias on the triode, is to be recommended at 0.5 meg., with an 0.01 mfd. condenser across it. The tube, of course, will have a six-pin base and a grid cap.

When the tube is used with a transformer in the triode plate circuit a fixed bias is recommended, 20 volts negative, for the 55, and probably will be for the 85. When a resistor is in the plate circuit, e.g., the 20,000 ohms or more for the 55 or the 100,000 ohms or so for the 85, then the fixed bias method is not necessary. The difference between the two methods is that the self-bias one calls for non-reactive coupling of the anode-cathode load resistor to the grid of the amplifier, while the fixed bias method requires stopping condenser and additional unit for grid leak, the usual method.

However, for resistance coupling for the 55 at the 250 plate volts the bias recommended by some tube manufacturers is 9 volts negative, and the same may be expected in as to these manufacturers regarding the 85. The difference is due probably to conflict of interpretation as to whether the applied or the effective voltage should control.

The list price of the 55 has just been fixed at $1.60, and it is not known what will be the list of the 85, but it will be higher than that of the 55.

Smith Can't Tune in Texas or California

AL SMITH, on his return to New York from the Democratic convention in Chicago, listened to a crooner on the "raddio" at his son's home at Rockaway Beach. If Al as a DX hound had any complaint about the set it must have been: "Can't tune in Texas and California."

* * *

You'd think that if one person in the United States were to listen to the broadcast speech of a candidate for President it would be his opponent. But the fact is one candidate seldom if ever hears any part of his opponent's radio speeches. The candidates may be on speaking terms (just about) but they're not on listening terms.

* * *

Nobody doubts the inalienable right of a man to turn the dial to any station he desires to tune in, at any volume he prefers—except his wife and the neighbors.

* * *

Seeing as sets are being produced with ever so much better tone quality, perhaps this winter will see a drop in the sale of ear muffs worn about the house by defensive members of the family.

* * *

If a manufacturer harps too much on the need of an excellent ground and aerial one begins to wonder whether the receiver needs more assistance than it can get.

* * *

Soon they will be producing tubes with so many base pins that there won't be room on the socket for all the necessary prongs, but the tubes can be retained as souvenirs of the occasion.

* * *

The fellow who "can't be bothered with plug-in coils" may not be bothered with as much short-wave reception as he expected.

* * *

Saucer-sized speakers are passing out of vogue, being too small for drinking cups.

* * *

Never hang an aerial run directly under a tin roof. You are a lucky dog to have a roof over your head.

* * *

Radio waves are the world's most prodigious travelers, which may be one reason for doubting the blurbing sales talks one hears. Credulity never attached to the traveling business.

* * *

Perpendicular aerials of great height are being used by more and more stations so that their transmission as well as their aerials will stand up.

INTERFERENCE NOW ATTACKED AT THE LEADIN

One of the new products of Lynch Manufacturing Company, Inc., is a transposition block. Ten such blocks comprise a kit and the entire kit is used for guiding two aerial lead-in wires to their entrance to the house, to prevent certain interference picked up by leadins not so treated.

The block has been designed by Arthur H. Lynch, president of the company, and consists of a ceramic base of a special material called Lynchite which is moisture-resistant and also has an extremely high insulating co-efficient for radio frequencies.

Easy Access

The blocks afford easy access for bringing down a double lead-in wire, parallel position, and transposing these wires at each block, so that at the blocks the wires cross without touching. The block safeguards against their touching. The theory is that the transposition reverses the phase of each stretch 180 degrees and therefore the pickup effect is cancelled.

"It has been found by rigid tests, by various engineers, that the leadin is responsible for pickup of much man-made static, whereas the horizontal portion of the aerial is not, because the vertical leadin is polarized to pick up these disturbances," said Mr. Lynch. "By cancelling out the pickup of the leadin much quieter and better reception is enjoyed, and the correct situation obtains, whereby the horizontal portion is the real antenna, whereas in many instances the leadin picks up more of everything than does the horizontal wire."

Other Products

The theory of transportation has been known for several years, but only now is a wide commercial manuacture undertaken, to supply set-owners with these inexpensive blocks.

Besides the transposition blocks the company has brought out four other antenna devices: cage antenna spreaders, two types of antenna insulators and an all-wave automatic antenna coupler. The larger type of insulator is made of Lynchite, the smaller of polished bakelite. The cage antenna spreaders are intended to encourage the use of cage aerials for short-wave use. The coupler may be attached to any set, and is adjustable, so that for all-wave coverage the correct coupling may be utilized at any time.

Detailed information about these items may be obtained by addressing Trade Editor, RADIO WORLD, 145 West 45th Street, New York, N. Y.

FORUM

PLEASE give us more about the American Radio Audience League.

Announceritis and advertising blah are killing radio. On every hand I am told there is too much talk, or that the programs don't justify the expense of new tubes and repairs.

Why don't radio magazines lead a campaign for better programs, programs with less talk, and no announcer names?

Folk don't mind straightforward advertising, but they sure do resent how announcers try to dramatize their incidental jobs.

C. De WAAL,
737 Kayton Avenue, San Antonio, Tex.

More Interpretations Of the New Radio Tax

The following are interpretations of the new radio tax application, as made by the Bureau of Internal Revenue:

"Royalty charges are not deductible in determining the tax. They are part of the overhead, same as factory building, and are part of the cost of the product.

"Pyramiding or exacting or attempting to exact, as a tax, an amount greater than the actual tax imposed is an offense punishable by fine up to one thousand dollars for each separate offense. If the tax is not specifically carried in the invoice no tax can be added or imposed by subsequent sellers. Only the exact amount of the tax can be passed on to the purchaser in any transaction. Dealers having stock on hand before the law became effective are prohibited, under possible fine up to $1000 on each transaction, from adding or collecting from purchaser any tax on such goods.

"The manufacturers of tubes, speakers, reproducing units or power packs have the option of paying the tax on these articles or selling same tax free under certificate. In the latter case the tax will be paid by the set manufacturer under Section 620 of the new tax law."

Station Changes

Changes in the "List of Broadcasting Stations by Frequencies," published in our issue of June 4th, 1932:

660 kc—Delete WTIC.
680 kc—KPO—Change owner to Nat'l B'dg. Co., Inc.
760 kc—Delete WBAL.
890 kc—Delete KSEI (See 900 kc below).
900 kc—Insert KSEI, Radio Service Corp., Pocatello, Idaho—250 w.
1050 kc—KFBI. Change location to Abilene, Kans.
1200 kc—WBHS. Change power to 100 W.
1260 kc—KWWG. Change owner to Frank P. Jackson.
1260 kc—WLBW. Change owner to Broadcasters of Pennsylvania, Inc.
1270 kc—KGCA. Change power to 100 W.
1200 kc—WMBX. Change owner to WMBX B'dg. Corp.
1370 kc—WQDM. Change owner to A. J. St. Antoine and E. J. Regan.
1440 kc—WBIG. Change power to 1 KW—daytime.
1460 kc—WJSV. Change owner to Old Dominion Broadcasting Co.
1500 kc—WWSW. Increase power to 250 W (daytime).

Change in "Time Table of Television Transmitters," published in our issue of May 28th, 1932.
2000-2100 kc—Add W9XX, 100 W. State University of Iowa, Iowa City, Ia.

N. Y. SHOW DATES FIXED

The date has been set for the radio-refrigeration-electrical appliance show to be open to the public in New York. The dates are September 16th to 24th, inclusive, the place, Madison Square Garden. There's a new show management, headed by Joseph Bernhart.

Tradiograms

By J. Murray Barron

Small Set Manufacturers

There are to-day in the United States several hundred small manufacturers of radio receivers. One rarely hears of them. In the majority of cases these firms do not operate under a license and yet some of them have a fair output for small manufacturers. Among a handful may be found some very good receivers and a still smaller group turn out some excellent ones; in fact, as good as can be found.

Just the mere fact of working under a license would not necessarily guarantee a better job, but it tends to law and order, so to speak, and if one is particular in being regular in the organization and working under proper conditions, one is more likely to carry out the same idea and degree of efficiency in design and manufacture. In other words, if carelessness and slipshodness of any kind is permitted in a business, condition becomes pervasive.

* * *

Columbia Phonograph Co., Inc., announces additional distributors of their new line of receivers: Milhender Electric Supply Co., Boston; Stern & Co., Portland, Me.; G. and M. Distributing Co., Harrisburg, Pa.; Rockfeller Accessories Co., Sunbury, Pa.; Kelly-How-Thompson, Duluth, Minn.; F. C. Hayer & Co., Minneapolis, Minn.; Interstate Sales Co., Milwaukee, Wis.; Electric Supply Co., Tampa, Fla.

* * *

G. W. Dickel, president of Dickel Distributing Co., 1327 North Broad St., Philadelphia, Pa., distributors of the Fada line, announces the appointment of Benjamin J. Neutra as sales representative in Philadelphia.

* * *

Lord & Thomas and Logan, the nationally known advertising firm, announces that its name will revert to Lord & Thomas, the name originally used for more than fifty-four years. Ralph Sallett is president of the firm, which has a branch at 247 Park Ave., New York City: also at Los Angeles, San Francisco and Toronto, Canada.

* * *

Directors of the Westinghouse Electric and Manufacturing Company declared the regular quarterly dividend of 87½ cents a share on preferred stock, but omitted the quarterly dividend of 25 cents on the common stock. In view of the earnings, it was the unanimous opinion of the directors that the company should conserve its cash resources and not further reduce the surplus by payment of any dividend on the common stock. The company has no outstanding bonds or bank loans and is strong on cash and net quick assets.

* * *

Try-mo Radio, N. Y. City, has a portable power amplifier.

Polo Sets Pace with Road King Receiver

Polo Engineering Laboratories decided to set the pace and produced a six-tube wired automobile set, The Road King, that sells for $30, complete with tubes, less batteries and aerial. The new 239 tubes are used as radio frequency amplifiers, the 236 as detector, the 237 as first audio and the two 238 pentodes in push-pull, as output, to work into a special Magnavox dynamic speaker, also supplied.

Automobiles, containing the receiver installed, have been touring about New York City, demonstrating results, and thereby the laboratories have built up quite a local sale, besides the national business developed by advertising direct to consumer.

The Road King has a remote control tuning unit, of which the volume control is also a part, as well as the keyed on-off switch. The chassis is doubly shielded, and there is a B battery box, shielded antenna leadin wire about 1 inch in diameter for prevention of loss through capacity to ground, and a set of spark suppressors and a commutator condenser.

Two other new products of Polo are a five-tube a-c home superheterodyne, in a small mantel cabinet, at $17. including tubes, and a larger table model 7-tube superheterodyne, at $26, including tubes. The new 58 and 57 tubes are included, with pentode ('47) output.

Further information on the Polo products may be obtained by addressing Trade Editor, RADIO WORLD, 145 West 45th Street, New York, N. Y.

WOC-WHO Service Disputed at Hearing

Washington.

The Iowa Broadcasting Company, owner of KSO, has applied to the Federal Radio Commission for permission to move its station from Clarinda to Des Moines, Iowa, and the application has been heard by Chief Examiner Ellis A. Yost. The company based its support of the application on the contention that Des Moines is inadequately served. Attorneys for the company, Louis G. Caldwell and Howard Vesey, charged that the Central Broadcasting Company, which synchronously operates WOC, Davenport, and WHO, Des Moines, operates almost entirely for the benefit of Davenport and to the detriment of Des Moines' service.

Elisha Hansen, counsel for WHO and WOC, contradicted the assertion, pointing out that nearly half of the local talent used in programs by the two stations comes from Des Moines, and that such programs benefit and are of interest to Des Moines. KSO asked permission to use 100 watts at night and 250 watts until local sunset.

NEW INCORPORATIONS

Lehman Radio Salon, New York City, radios—Atty., J. Wattenberg, 1440 Broadway, New York City.
Emerson Television-Radio, New York City, radio accessories—Atty., S. B. Williams, 1440 Broadway, New York City.
Reo Electric Co., New York City, electrical work—Atty., E. Levinsky, 401 Broadway, New York City.
Ronard Electric and Hardware Corp., New York City—Attys., Attorney's Albany Service Co., 315 Broadway, New York City.
Edison-Splitdorf Corp., West Orange, N. J., mechanical and electrical apparatus—Atty., Henry Lanahan, West Orange, N. J.
Electrical Sound, New York City, machinery and appliances—Attys., Thomas and Friedman, 321 W. 44th St., New York City.
Edsinger Electrical Co., New York City—Atty., E. J. Singer, 39 Vesey St., New York City.
R. V. Clum, Brooklyn, N. Y., electrical appliances—Atty., H. P. Solomon, 191 Joralemon St., Brooklyn, N. Y.
Enterprise Refrigeration Co., Middletown, N. Y., machinery—Attys., Watts, Oakes Bright, Middletown, N. Y.
A. & H. Miller, New York City, refrigerating supplies—Atty., W. F. Timme, 350 Madison Ave., New York City.

CORPORATE CHANGES

Capital Increase

Radio Productions Corporation, Philadelphia, Pa., 6,000 to 10,000 shares, no par.

Dissolution

Blanding's Electrical Supply Co., Binghamton, N. Y., to Blanding's.

Name Change

U-S-L Radio, Niagara Falls, N. Y.

BRANKRUPTCY PROCEEDINGS

Equity Receiver Appointed

National Radio Advertising, Inc., 120 W. 42nd St., New York City—The Irving Trust Co. was appointed by Judge Mack upon the petition of the National Electrical Transcription Corp., a creditor for $3,177, and upon the consent of the debtor corporation. While the corporation was said to be solvent, the income is said to have decreased to a point where it is inadequate to meet the costs of operation. No estimate of the liabilities or assets was contained in the complaint.

POINTED OPINIONS

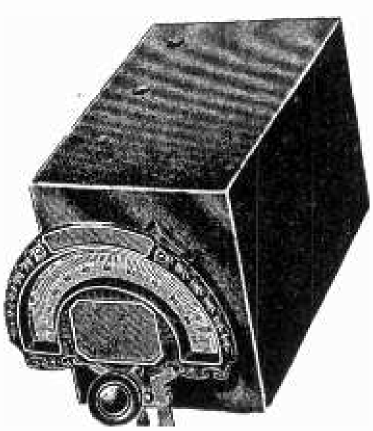
B. A. ROLFE, orchestra leader: "Within time plays and musical shows will be produced in central studios and distributed directly over the air to theatres in all parts of the land. There will be no more traveling companies, instead entire productions acted in studios will be offered to the screen."

TUBES FULL OF INTEREST

The most interesting devedopments in the last few months have to do with tubes. To date the new tubes are nine in number: 46, 56, 57, 58, 82, 55, 89, 83 and 85. The 85 will be detailed next week, issue of July 30th.

MATCHED TUNING UNITS

DIAL, SHIELDED CONDENSER, SHIELDED COILS



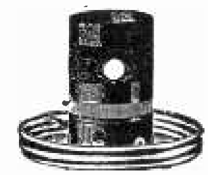
A 5-to-1 vernier dial (ghost type), with travelling light; a three-gang brass-plate shielded condenser, with trimmers built in; and a set of three shielded coils constitute the Matched Tuning Units for tuned radio frequency (two screen grid r-f and any type detector).

The coils are tapped once on each secondary, so tha. by switching it is possible to tune in from 80 to 200 meters, as well as the full broadcast band.

Order Cat. TU-RF @ $4.13

For double detection circuits two equal coils are furnished as above, while the third coil is for padding for broadcast band only. The padding condenser is supplied for 175 kc.

Order Cat. TU-O @..$4.83



Coils, 1" diam. tubing, 2" diam. shields. Four lugs at bottom, one at side. Code follows: P and B, primary; G and side lug, secondary. The tap for 80 meters, to which condenser stators may be switched, is the ground symbol lug at bottom. Markings stamped on shield base over which base the shield (not shown) fits tightly. For oscillation connect B to plate and P to B plus.

GUARANTY RADIO GOODS CO., 145 West 45th St., N. Y.

BLUEPRINTS OF STAR CIRCUITS

8-TUBE AUTO SET

Sensitivity of 10 microvolts per meter characterizes the 8-tube auto receiver designed by J. E. Anderson, technical editor of Radio World, and therefore stations come in with only six feet of wire for aerial, and without ground. Most cars will afford greater aerial pickup, and besides the car chassis will be used as ground, so with this receiver you will get *results*. The blueprint for construction of this set covers all details, including directions for cars with negative A or positive A grounded. The circuit features are: (1) high sensitivity; (2), tunes through powerful locals and gets DX stations, 10 kc either side; (3), latest tubes, two 239 pentode r-f, two 236 screen grid, two 237 and two 238; push-pull pentodes, all of 6-volt automotive series; (4), remote tuning and volume control on steering post, plus automatic volume control due to low screen voltage on first detector; (5), running board aerial. The best car set we've published. This circuit was selected as the most highly prized after tests made on several and is an outstanding design by a recognized authority. Send for Blueprint 631, @ 50c

SHORT-WAVE CONVERTER

If you want to build a short-wave converter that costs only a very few dollars, yet gives good results, furnishing all its own power from 110 volts a-c, and uses no plug-in coils, you can do so from Blueprint 630. Price.........25c

5-TUBE AC, T-R-F

Five-tube a-c receivers, using variable mu r-f, power detector, pentode output and 280 rectifier, are not all alike by any means. Forty circuits were carefully tested and one selected as far superior to the others. This prized circuit was the 627, and if you built it, you will always be glad you followed our authentic Blueprint, No. 627. This is the best 5-tube a-c t-r-f broadcast circuit we have ever published. Price 25c

A-C ALL-WAVE SET

An all-wave set is admittedly what many persons want, and we have a circuit that gives excellent broadcast results, and is pretty good (not great) on short waves. No plug-in coils used. Cost of parts is low. Send for Blueprint, No. 628-B, @.........25c.

In preparation, an 8-tube broadcast superheterodyne for 110v d-c. Write for particulars.

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

EBY antenna-ground binding post assembly for all circuits. Ground post automatically grounded on sets using metal chasses. Assemblies, 30c. each. Guaranty Radio Goods Co., 143 West 45th St., New York. N. Y.

THE FORD MODEL—"A" Car and Model "AA" Truck—Construction, Operation and Repair—Revised New Edition. Ford Car authority. Victor W. Page. 708 pages, 318 illustrations. Price $2.50. Radio World, 145 W. 45th St., New York.

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- ☐ OPEN ROAD FOR BOYS (monthly, 12 issues).

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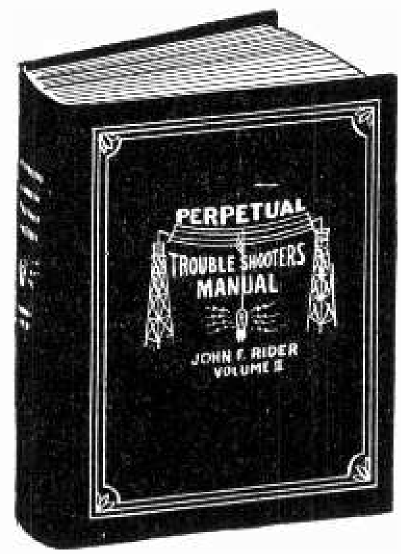
RADIO WORLD, 145 West 45th Street, New York. (Just East of Broadway)

Volume No. 2 of Perpetual Trouble Shooter's Manual



Having assembled 2,000 diagrams of commercial receivers, power amplifiers, converters, etc., in 1,200 pages of Volume No. 1 of his Perpetual Trouble Shooter's Manual, John F. Rider, noted radio engineer, has prepared Volume No. 2 on an even more detailed scale, covering all the latest receivers. Volume No. 2 does not duplicate diagrams in Volume No. 1 but contains only new, additional diagrams, and a new all-inclusive information on the circuits covered.

All Electrical Values Given for First Time

This new detailed, comprehensive information gives the resistance values from point to point in all circuits in Volume No. 2—such complete information as is unobtainable elsewhere. All condenser values are given. Chassis diagrams (pictorial), schematic diagrams and photographic views of receiver "insides" are included. Parts are identified on photographs. Intermediate frequencies are stated. Socket and tube identities are revealed, color codes given, continuities of sealed units disclosed. The information is painstakingly complete. Rider made personal trips virtually all over the country to obtain the information, and it's now yours.

Everyone who makes his living as a radio service man, salesman, laboratory man or in any other technical capacity, as well as all students and teachers of radio, should possess Volume No. 2.

Volume II and Volume I are loose-leaf editions of 8½ x 11" page size, flexible fabrikoid binding.

Volume No. 2—Perpetual Trouble Shooter's Manual, by John F. Rider. Shipping weight 6 lbs. Order Cat. RM-VT @ $5.00 Volume No. 1 (8 lbs.). Order Cat. RM-VO @ $4.50

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THE FIVE NEW TUBES, 46, 56, 57, 58 and 82, characteristics, installation data, uses, fully described and illustrated in the April 30th issue (7 pages) and in the May 7th issue. Send 30c for these two copies. Radio World 145 West 45th Street, New York, N. Y.

"1932 OFFICIAL RADIO SERVICE MANUAL," by Gernsback. Complete Directory of all 1931-1932 Radio Receivers. Full Radio Service Guide. Leatheroid binding, $4.00. Radio World, 145 W. 45th St., New York, N. Y.

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