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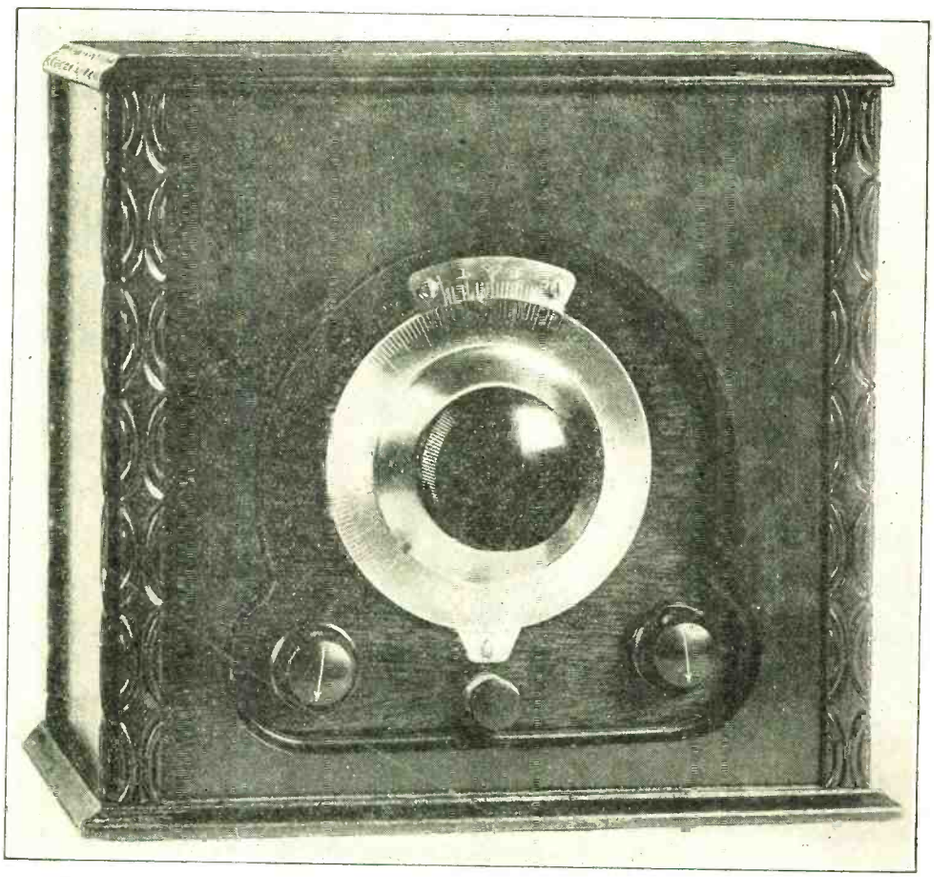

Reading the condenser setting to an accuracy of one-tenth of a division is extremely helpful in working an oscillator. See pages 14 and 15.

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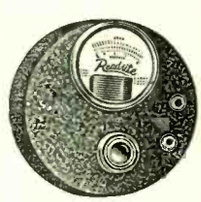

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(*Continued from preceding page*)

reduced interference to be able to select either the higher or the lower. This can be done readily by putting a regular vernier tuning dial on the oscillator, and using a knob for separately tuned modulator. Such was done in the present instance. No possible performance improvement can be made by teaming the two tuning condensers, although convenience might then be served, and the second dial setting of the oscillator "hidden." Image interference might exist then without means of remedying it.

Image interference is the reception of two stations at the same time, due to any given oscillator setting being greater than the modulator frequency for one wave heard, as well as being less than the modulator frequency for the other wave heard. Tuning the modulator is one remedy. This, of course, is done here. The tuning of the modulator requires only the knob, because except on weak signals the tuning is not very critical here. For the most part the two circuits track in tuning if identical condensers are used—they do so very well on the two smaller coils—therefore the approximate setting of the modulator knob, if there is even only a dot on the knob as indicator, will guide you sufficiently. Tuning will not track on the large coils.

The output of the modulataor had better be a tuned circuit. This develops the greatest voltage across the plate load. The output may be tuned to the desired intermediate frequency and left thus. A large voltage drop in the output is vital, as some energy will be lost in the transfer process, and besides the mixer itself inevitably is a drag on the set, as are all mixers. They do not amplify, so it is necessary to get the most out.

In thus tuning the output, if the condenser is left at one setting, the result when the antenna is switched over to the set is to give the set antenna input, but since the coil L7, is tuned to a particular frequency, it acts for the set as a wave trap to that frequency—one channel out of 96. So you may select a channel that does not bring in a station on your set anyway, helpful, too, because of no interference by direct broadcasts, or dip below the broadcast wave or go above the highest for the intermediate frequency.

Next comes the coupling feature. If you have a screen grid set of either tuned radio frequency or superheterodyne type you can simply remove the grid clip from the first r-f stage and put another clip there, soldering to this clip the wire lead to be run to the converter output. A grid return for the first tube in the set is provided automatically, because the output coil's secondary is grounded, one side of it actually connecting to the ground post of the set. If you have a screen grid set, therefore, this may be the better way to connect the output of the converter to the set's antenna post. Also, the antenna post method may be used even if your set is of the screen grid type.

For sets with a small winding primary in the antenna stage the coupling to antenna post is excellent when L6 L7 is a broadcast r-f transformer, but if there is a radio frequency choke coil as the grid load impedance, or a resistor in that position, the coupling may not be good, and it will be preferable to use the direct-to-grid method even with non-screen grid sets. Then a special adapter is required that renders the grid of the set's first tube accessible without picking up the set's intended choke or resistor grid load. This adapter costs around a dollar.

Now for the rectifier. It is a 227, hooked up as a simple diode, being entirely satisfactory for the purposes of modest current and modest voltage for which it is used. One side of the alternating current line goes to the tied grid and plate elements of the rectifier, the other side of the line goes to the B supply choke coil. The other side of the choke connects to the lead that is run to the ground post of the set. There is no danger of short-circuiting the line with this method because of the special location of the choke. At worst you simply would put the choke across the line, which is all right, as its impedance is even higher than that of the primary or the filament transformer that is across the line. If this transformer has a center-tapped 2.5 volt secondary, put the center to the actual ground, as shown, but if the transformer has no center tap, disregard this connection entirely.

The right-hand 8 mfd. condenser must not have case grounded, as the cases of the two condensers go to different potentials.

The theory of converter operation has been told often in these columns, but a few words may not be amiss on this subject for the benefit of those who have not read the earlier expositions.

The modulator is tuned to the frequency of the station desired to be received. The oscillator is tuned to a different frequency. The amount of difference must be equal to the intermediate frequency. The two different frequencies are united in the modulator. This is done by coupling the two circuits. The result is a third frequency in the modulator, equal to the difference between the two put in. The set itself is tuned to this difference frequency, or the converter tuned to produce an output of the frequency the set is tuned to, and the result is the output of the converter is fed into the set, amplified and detected (second dectector), then amplified at audio frequencies, finally being fed to the speaker for your immeasurable pleasure and enjoyment.

What intermediate frequency to choose—where to set the dial of your set—depends principally on the region in which your set is most sensitive. Usually this is at the higher broadcast frequencies. You know from experience in what region of the dial stations of approximately equal distance and power come in loudest. You may try different frequencies. Each one will require a different setting of the oscillator to gain response in the intermediate channel. Therefore you may tune in a station, leave the modulator tuned to it, and change the intermediate frequency while compensating with the oscillator dial. As the intermediate frequency is lowerer (higher waves brought in), the oscillator frequency has to be lowered (more capacity used in the tuned circuit). This is true because the difference becomes smaller.

It is therefore submitted that the converter meets the requirements laid down by the concensus of exacting individuals, most of whom wanted to spend next to nothing on parts, but all of whom, it is reasonably supposed, are abundantly eager to obtain about the finest results possible with a simple, inexpensive converter. Such results are within the reach of those who follow the diagram, Fig. 1, and abide by the suggestions made regarding the wiring of the set.

The only important suggestion for parts layout is that coils be at the rear, as distance from the hand is more important than short leads, and we are dealing with two circuits that are coupled, anyway. Where a choice exists as to which coils should be farther back, put the large coils farther back. This seems an inconsistent suggestion, but is due to experimental findings.

Each week names of new members of the Short-Wave Club are printed. There is no repetition. Here is this week's list:

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Designs for Four

Three, Four and Five Tube Models,

By Henry

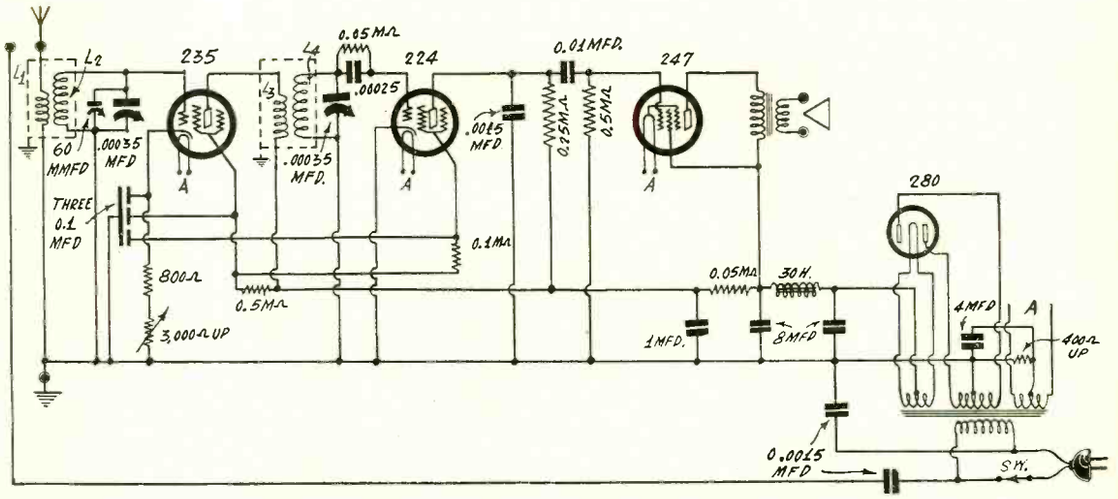

FIG. 1
A simple circuit for speaker operation. Good for local reception in urban communities. A total of four tubes is used.

HOME constructors, too, have started building midget receivers, so that makes it unanimous.

Here are diagrams for some alternating-current models, including a four tube, five tube and a six tube receiver for broadcast wavelengths, as well as a five tube short wave set.

Some suggestions will be given for getting rid of trouble, although it must be said right now that the midget arrived at a time when a great deal was known already about trouble in sets, and remedies were applied at the start, instead of afterward, the earlier custom.

The number of tubes specified includes in all instances a 280 as rectifier. A tube is a tube, even if it is only a rectifier, and you want to know how many tubes you have to buy, so the inclusion in of the rectifier in the count is quite proper.

The four tube model can be built of parts costing about $16, including dynamic speaker with field coil and output transformer built in. The field coil is used as the B supply choke, and while marked 30 henries in the diagram, is more familiarly known by its direct current resistance, which may be up to 1,800 ohms. If the resistance is lower than that in any speaker you may care to use, it means only that the voltage on the plate and suppressor grid of the pentode output tube will be somewhat higher than 250 volts (plate to center of 2.5 volt winding).

This center, by the way, if not present as an actual center tap, may be provided by using a center-tapped resistor of a total resistance of from 15 to 30 ohms.

Lamp Socket Antenna

It is fashionable to include in midget sets the convenience of a lamp socket antenna, even though this does not infallibly supply enough pickup, especially for the modest circuit now under discussion.

If two posts are provided at the aerial position, then if a wire connects the two, shown by a dotted line, the lamp socket aerial will be connected to the set, whereas if the wire is not connected, an outdoor or indoor aerial may be used without the other being in circuit.

If one side of the line serves as aerial, the other may be used as ground, and a condenser of mica dielectric, of any value from 0.001 mfd. up, will serve the purpose as well as possible. However, it is often necessary to provide an actual ground connection to the cold water pipe, because otherwise the variable mu tubes used as radio frequency amplifiers may squeal. In the four tube design there is little if any danger of squealing, because shielding is used and the radio frequency amplification is not so high as to create this menace to good, stable results.

The lamp socket antenna is usually sensitive to polarity, so reverse the plug in the outlet socket, and leave it in the position that provides greater volume and best stability. The two go together.

Manual Trimmer Valuable

A two-gang condenser is used for tuning, but as there is nothing one can afford to lose in the radio amplification, extra precautions must be taken to assure resonance. Therefore a manual trimmer should be provided, and should be located across the antenna coupler secondary, because the detector circuit has a relatively high minimum input capacity.

It is interesting to find the leak value at 5 meg., despite full voltage applied to the detector plate resistor, for it has not been heralded. Also, a high value of leak permits the full plate voltage of 275 volts being applied without any danger of choking almost certain to result if a rather low value of leak is used. Besides, the high value of leak does not act so much as a low value would to accentuate the high frequency audio notes, which the pentode tube does, anyway. In the detector output will be found a 0.0001 mfd. fixed condenser as bypass of radio frequencies which obviously cuts down the intensity of high notes, and a smaller value may be substituted by those who so desire, but a reason for its presence is to atone for the accentuation of the high notes by the pentode. The volume thereby is reduced a little on all notes, but mostly the amplitude is less on high notes, so that the result is a more nearly even amplification over the audio scale, in the interest of quality.

The 235 tube is the variable mu radio frequency amplifier. This type of tube will not detect as a grid bias detector despite large changes in bias voltages, so a variable-bias control may be used for volume adjustment. This resistor should have as a companion a fixed resistor, so that there will be a minimum value of bias of about 0.5 to 1 volt negative, while the variable portion serves for volume control. Thus the bias could not be reduced to zero, at which point, by the way, the amplification would be very low. At 0.5 volt negative the amplification is greatest, and from then on declines, at first more rapidly than at last, until the bias may be made as much as 10 to 15 volts negative. This would tune out all save the strongest signals.

Selectivity Better

Another point about the tube is that the more negative the bias the more selective the circuit. Thus when strong locals are too loud not only may their volume be reduced but also the set is better able at reduced volume to cut down any interference from other locals. There will be no cross-modulation, however, as the variable mu tube was especially designed to prevent such a nuisance. The selectivity is much better than with general purpose tubes.

The value of the fixed part of the resistor in the volume control section depends on the current, and therefore the suggestion is made that the value of resistor be such as to produce from 0.5 to 1 volt negative bias when the volume control itself is at zero resistance setting. This had better be done with a voltmeter, as even a cheap one will afford satisfactory reading for this purpose, but if you have no voltmetere you can put in values of different sorts until any test signal is loudest. It may surprise you what value will be required, as some of the variable mu tubes under these conditions draw very little plate-screen current. Something around 400 ohms to 800 ohms should prove satisfactory.

The use of a heavy-duty voltage divider is avoided by including series resistors of the 1 watt or ½ watt type. Either type may be used. The full voltage from the rectifier, after filtration, is supplied to the pentode plate and suppressor grid circuits. The suppressor grid is that element represented by the socket connection that for more familiar tubes would be the cathode. The other screen, tied to the filament of the 247, is connected that way as part of the tube construction and need not concern you.

Resistor and Bias Values

As a load on the plate of the detector, a resistance of 0.25 meg. or 0.5 meg. is suggested, while the grid leak in the

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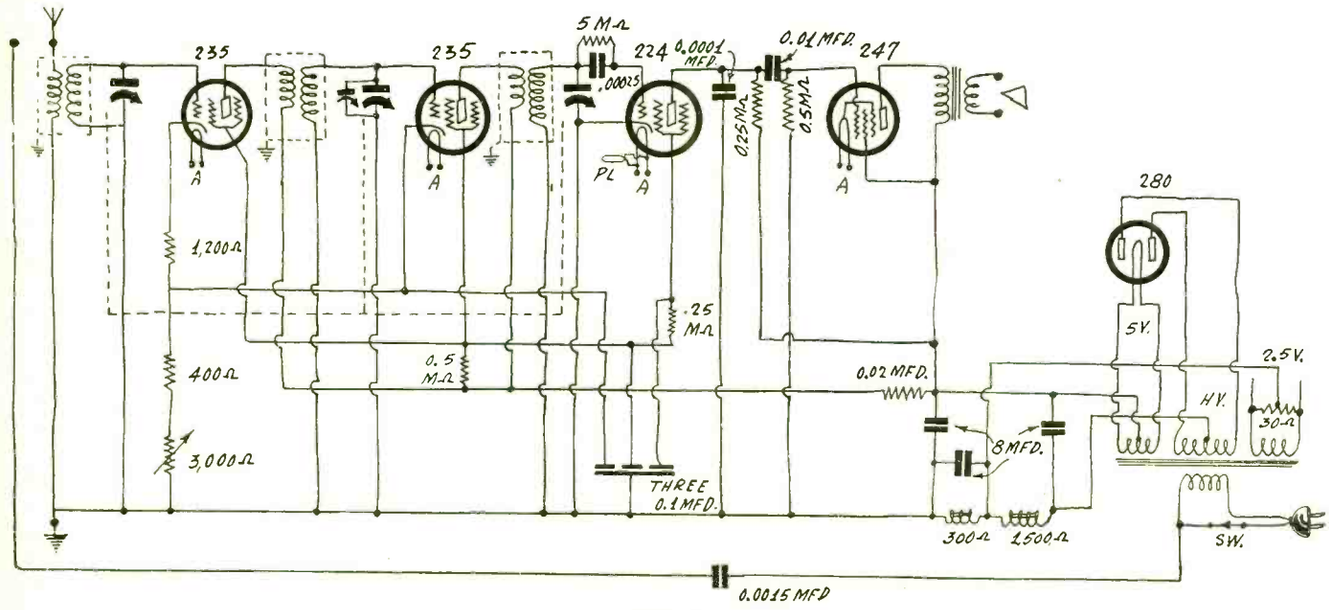


FIG. 2
The five tube broadcast model. One stage of audio is used.

pentode circuit should not greatly exceed 0.5 meg. With such audio amplification as we have here—only that stray audio amplification obtained from the detector plus the genuine audio amplification from the pentode—we may try higher values of grid leak, since danger of motorboating is small, but if gurgling or other distorted sounds are heard, reduce the value to 0.5 meg. and you will find the trouble has disappeared.

Bias for the pentode's grid should be negative by about 16.5 volts, due to the drop in the resistor marked 400 ohms up. The theoretical value is 418 ohms, but there is nothing critical about it, and also it is true that commercial pentodes do not always draw as much plate current as the tube charts of average characteristics indicate, so the resistance may be increased until the bias voltage reads between 16.5 and 20 volts. Pentodes I have been using, with 500 ohms in this position, have afforded a negative bias of 15 volts, showing that the combined plate-suppressor grid current was 30 milliamperes, instead of nearly 40 amperes.

A separate B supply choke is shown, used in familiar style, and the negative bias is obtained through an independent resistor but other systems will be discussed.

Next we come to a five tube set, with two stages of tuned radio frequency amplification, instead of only one, and using a three-gang condenser and three coils. Naturally, we will obtain greater volume and greater sensitivity. The total parts cost, including cabinet and speaker, should not exceed $20.

Precautions Against Squealing

Here we may run into trouble due to squealing, but it is easily enough remedied. In the first place, it is assumed that the primary of the first radio frequency transformer, in the antenna circuit, is a radio frequency choke coil. The same might be true of Fig. 1. The object is to provide a greater input at lower radio frequencies, and thus compensate for the rising characteristic of tuned radio frequency systems, whereby the higher the frequency, the greater the amplification. Under, uncompensated circumstances the squealing naturally is worst at the high frequencies, but with the input levelled this tendency to squeal is reduced. The choke coil may be a 300 turn honeycomb that fits inside the tubing used for the secondary. The coupling is relatively loose—the choke is about half an inch away from the secondary it feeds.

The second precaution against squealing may be taken by introducing a resistor in series with the cathode of the first tube, and putting no bypass condenser across it. The feedback through a cathode resistor serving one tube is negative, and negative feedback is an oscillation suppressor. So by using a resistor here we can correct for squealing, and since the amplification does not vary considerably with increase in negative bias, this resistor may be as high as required. In the circuit diagrammed 1,200 ohms was tried without serious impairment of the amplification, and with full correction of squealing, although about 800 ohms served the purpose, also.

It should be borne in mind, however, that a real ground connection is the best preliminary corrective for squealing, as often a set needs nothing else to check the trouble.

The third remedy is to increase the value of the resistor shown as 0.25 meg. in the plate circuit of the detector screen. This is rather critical, comparatively, so that twice as much resistance would be too much, normally. The next step to try after 0.25 meg. is 0.3 meg., by introducing a series resistor of 0.05 meg. (50,000 ohms).

The resistor shown as a common fixed element in the volume control network, 400 ohms, may be increased to correct squealing.

These remedies will be ample, provided the shields are grounded, as they would be if on a metal chassis which is itself grounded.

Field Coil Serves Two Purposes

The five tube model shows a different method of using the field coil as B supplied choke and biasing "resistor" for the pentode. The total direct current resistance is 1,800 ohms, of which 300 ohms are on the ground side and 1,500 ohms on the high-voltage return side. Thus the choke coil system is in the negative leg of the rectifier, which requires that one of the 8 mfd. electrolytic condensers be insulated from a metal chassis, since the case of the condenser in that instance (at right, Fig. 2) does not go to ground.

Because all the B current flows through the 300 ohms section (as well as through the 1,500 ohm section), the bias afforded by the 300 ohms is the same as that afforded by 400 ohms resistance solely in the power tube's circuit, as in Fig. 1. The current is 25 per cent. greater through the 300 ohms than through the 400 ohms; hence the voltage drop across unequal resistance values in is the same.

A condenser should be placed across the 300 ohms, and it should be as large as possible, because low notes are suppressed by the absence of such a bypass condenser. A minimum value of 4 mfd. is recommended. Omission of this condenser tends to bring out most strikingly the high audio notes, at the expense of the low ones, and gives the set a shrill effect.

The six tube model, parts for which cost about $21, is the same as the five tube one, except that there is an extra stage of resistance coupled audio. The values of the grid leaks should be as prescribed, for if either value is raised there will be motorboating. Using the values stated, there will be none of this trouble.

The first audio tube is a 227, and it is practical to use 0.25 meg. in the plate circuit for the cut-down on the intensity of

(*Continued on next page*)

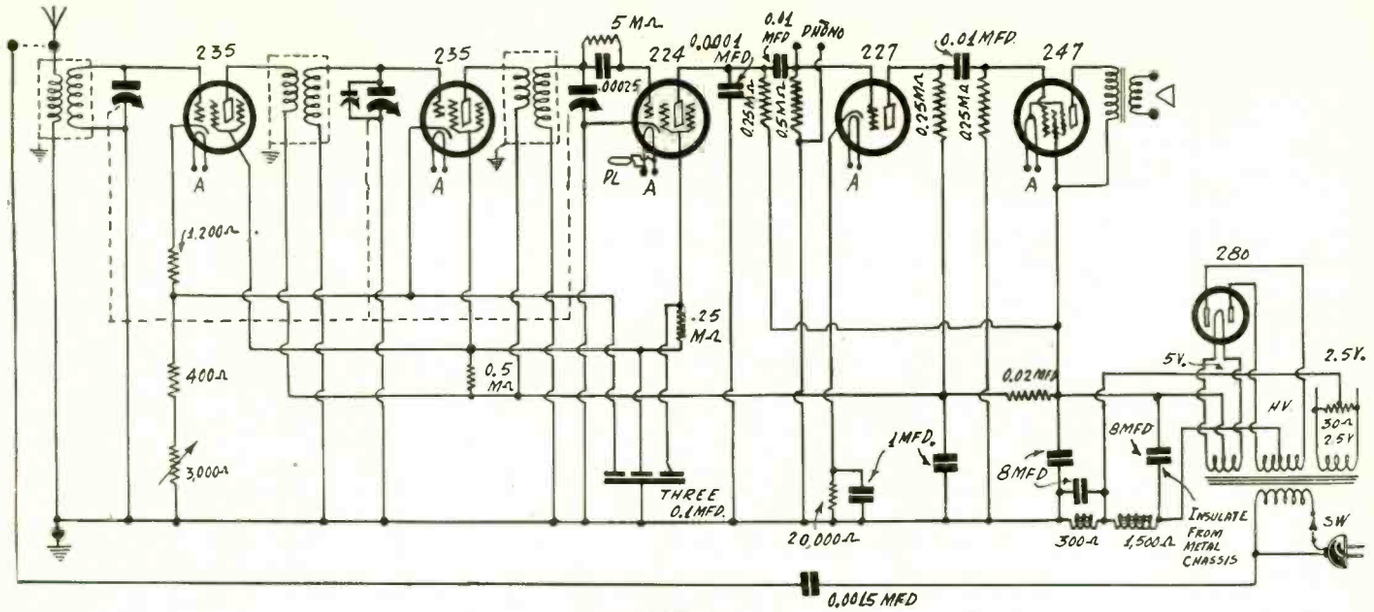


FIG. 3

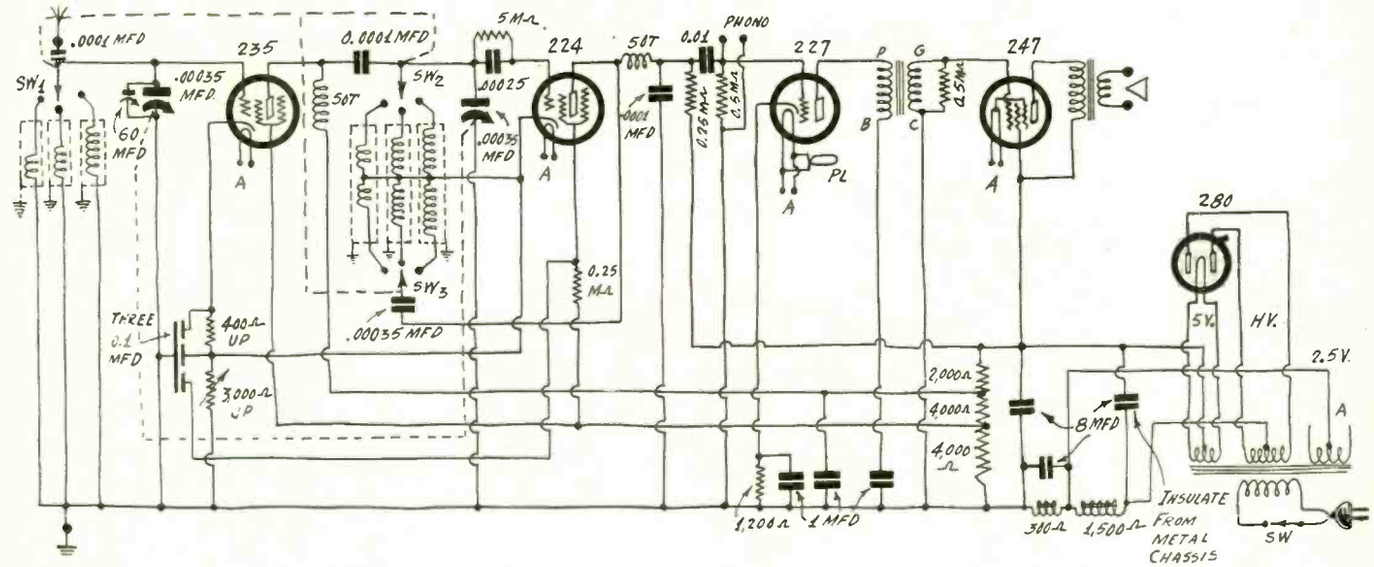


FIG. 4

(*Continued from preceding page*)

the high notes, and if greater reduction of such notes is desired, the value of this resistance may be increased to 0.5 meg. The 1 mfd. across the 20,000 ohm biasing resistor may well be increased to 4 mfd. for low-note assistance.

Short-Wave Midget

A special treat is the short-wave midget set, and, so far as is known, it is the first of its kind.

For short waves one stage of tuned radio frequency amplification with regenerative detector is sufficient, indeed, it is hard to manage more than one such tuned stage of r-f. Wave bands are altered by means of a switch having three layers, with three taps per layer (triple pole, triple throw). If there are more taps, same number of layers, just use three, as only three taps are necessary.

The coils marked 50 T are 50 turn honeycomb coils. The rest of the values are stated in the diagram.

For the midget sets coils with about 1 inch diameters are used. For broadcast work, Figs. 1, 2 and 3, the 1 inch diameter may have primaries of one-quarter the number of turns on the secondaries, except for the choke primary in the antenna coupler. The secondary turns for 0.00035 mfd. tuning are 135, using No. 40 enamel, which with tight winding takes about 280 turns to the inch, so there is plenty of room for a 34 turn primary begun (or ended) one-eighth inch away.

The shields are about 2 inches in diameter and about 2.75 inches high, if one popular type, or 2.5 inches diameter, 2.25 inches high, if another equally popular type.

Short-Wave Coils

For 0.00045 mfd. tuning the number of secondary turns would be 120, while for 0.0005 mfd. the number would be 107, so you can wind the coils for any capacity tuning condenser you have that will cover the broadcast band. Usually 0.00025 mfd. will not do so in shielded circuits. In the present instance 0.00035 just will, as 550 kc then comes in at 98 and 1,500 kc comes in at 5 (there being slight capacity difference between 5 and 0 due to the cut of the plates).

For short waves, the number of secondary turns for the largest coil, for 0.00035 mfd. tuning, is 50, using No. 28 enamel, the number for the next largest coil is 18 of No. 18 enamel and the number for the smallest coil is 7 of No. 18. Thus you will tune from above 200 meters to around 15 meters, probably a little lower, depending on where you place parts etc.

The coils in the oscillator have two windings each, or, to look at it differently, one winding, tapped, the tap going to cathode. The winding for the 50-turn coil's extension consists of 20 turns, that for the next coil (reading right to left) has 10 turns, and that for the smallest coil has 7 turns. The wire is No. 28 enamel throughout. It can be seen that the ratio is 1-to-1 for the smallest coil, because this is necessary to insure regeneration.

Between the two windings is a distance of one eighth inch for all three coils.

The same switch actuates the two tuned circuits and the three plate windings of the detector circuit. Regeneration is controlled by the high resistance rheostat, due to plate current control.

The coils are small enough—or, rather, the shields are—so that one may be above the chassis and another in the same relative position below the chassis, that is, mounted upright, one coil upside down, as it were. Six coils are required, and as even two coils may be mounted under sockets, still leaving enough room, there is no difficulty in accommodating the coils.

The audio stage ahead of the pentode is transformer coupled to the output, as short wave signals normally are weaker than broadcast signals, and the extra volume thus obtained is necessary.

[*Readers desiring further information on layout, location of parts and other particulars regarding midget receivers, including the short-wave midget, should address communications to Midget Set Editor,* RADIO WORLD, *145 West 45th Street, New York, N. Y.* —EDITOR.]

Poor Volume Controls

They May Prevent Getting Any Distance

By Warren Worcester

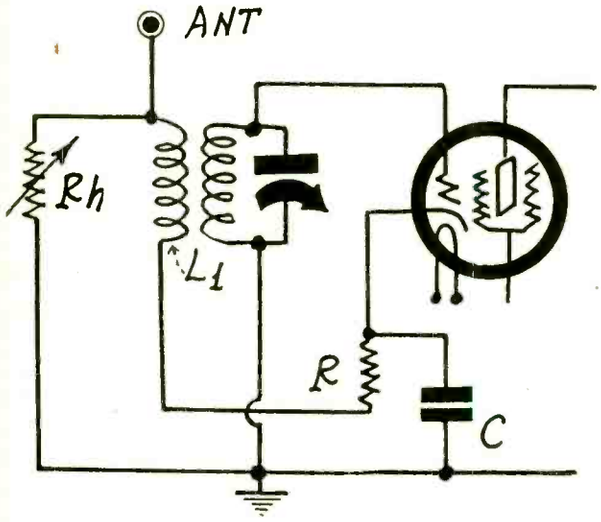


FIG. 1

In this volume control the grid bias and the shunt across the primary work in opposition and for that reason the control is not recommended.

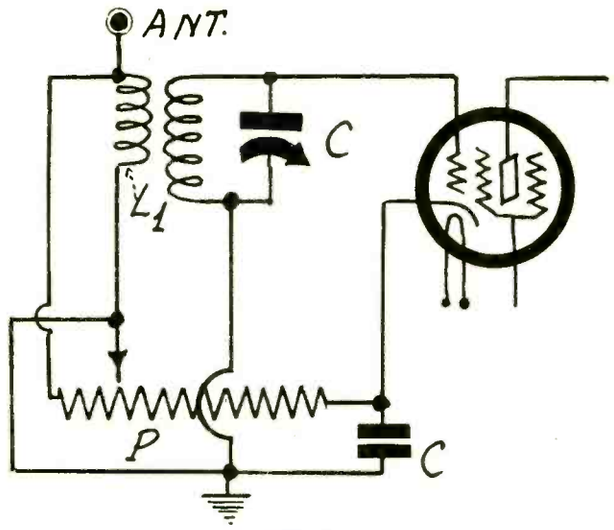


FIG. 2

In this volume control the grid bias and the shunt across the primary operate in the same direction and for that reason this control is satisfactory.

THE volume control in many midget receivers is like that shown in Fig. 1. The object of the arrangement is to increase the grid bias of the tube at the same time that the input to the set is decreased by the shunting effect of the variable resistance and the fixed bias resistance R. It is clear from a study of the circuit that the dual object is not achieved, but that the two variable factors work in opposition. As the resistance of Rh is increased the bias on the tube is increased, for Rh is in series with R, as is the coil L1. This reduces the amplification of the tube, which was one of the objects of the arrangement. But as Rh is increased more and more of the signal is forced through the primary L1. This increased the input to the set. Therefore the two act in opposition when the bias is increased.

It necessarily follows that the two work in opposition when the resistance of Rh is increased. But let us examine the effect in detail. We have a weak signal and it is necessary to adjust the bias so that the tube amplifies as much as possible. Therefore we reduce the value of Rh, presumably to zero, if R has that value at which the amplification of the tube is best. Now, then, we have R and C, connected in series, across L1, the primary. C is so large that it offers no appreciable impedance and we may treat the circuit just as if it were not there, as far as the signal is concerned.

Therefore we have only R, a low value resistance, across L1. Hence most of the signal will go through R to ground and very little will go through L1. Hence there will be very little input to the receiver just when we want most of it. We want as much as possible because the signal is weak tc begin with. The device works fairly well when we want to decrease the signal strength but it does not work at all when we want to receive a weak signal and want to make the set as sensitive as possible.

Of course, the arrangement shown does control the volume. The preceding statements were intentionally exaggerated the more strongly to call attention to the opposition of the two variables when they were supposed to work in the same direction. The predominating influence is the variation in the bias. When the total resistance of Rh and R has attained a certain value the shunting effect does not amount to much. However, there is a definite limitation at the other extreme, when the shunt resistance is small. The sensitivity of the circuit cannot be made as great as it could be made with the shunt across L1, but this fact is not made evident during the manipulation of the control.

A better control is illustrated in Fig. 2. In this circuit a potentiometer P is used as shunt and as bias resistor. The low potential end of the primary L1 is grounded as it was before, and the extreme ends of the resistance are connected to the cathode and the antenna just as before. But now the single variable controls the two effects in the same direction. As the slider of the potentiometer is moved to the right, the portion of it used as grid bias resistance increases, and therefore the amplification of the tube is decreased. At the same time the portion of the resistance used as shunt across the primary decreases. Thus the input to the set decreases. The reduction in the sensitivity is therefore decreased rapidly without any opposing effect as in the previous case.

When we want to increase the sensitivity in this case we move the slider toward the cathode. The bias resistance is decreased and at the same time the shunt resistance is increased. Hence the amplification and the input increase together. However, there is a limitation to the increase. After the bias resistance has decreased beyond a certain value the amplification no longer increases, but decreases. It is doubtful, however, that a potentiometer which has a resistance high enough to make it useful in this arrangement will have a minimum so low that decrease in the amplification will be met. The resistance of the potentiometer P in Fig. 2 may be 10,000 ohms.

The tube controlled is supposed to be a 235 variable mu tube. The bias on the grid of this tube can be increased to very high values before the current cuts off. In fact, the tube is called an exponential tube, a name indicating that the plate current never does cut off as the bias increases. The variation in the plate current, or in the mutual conductance, is so gradual that amplification decreases gradually without any appreciable increase in the wave form distortion or modulation.

If the amplifier tube is of the 224 type, it is better to control the output by controlling the input in preference to controlling the amplification of the tube. Thus shown in Fig. 2 is a control of the input and for that reason Fig. 2 is a better arrangement when a 224 is involved than one in which the bias alone is varied.

Lamp Socket Antennas

How Good They Are and Are Not

By Jack Tully

IN current designs for receivers, particularly those in the midget class, the lamp socket antenna is often included, so that the sales argument may be presented that "the set works without any aerial." The argument is true enough to be acceptable, for only in relatively few instances will the pickup from the alternating current line be too feeble to bring in a few local stations.

A condenser may be connected from the other side of the alternating current line to the chassis, for a provisional ground, but in general this is not satisfactory, as the set, if it has acceptable sensitivity, likely will squeal badly unless independently grounded. The best ground is none too good for any set.

Wide Choice Indeed!

So while it may be said that the set works "without any aerial"—that being a figure of speech, as the wire of the AC line is the aerial—it can not be said that it works without aerial or ground, and in not enough cases will it work well without the external ground. That ground should be run to the nearest cold water pipe, and if no such pipe is near, run the wire to the pipe wherever it is, and do not select the hot water pipe, and above all not the gas pipe. No, it must be the cold water pipe or nothing, and it must not be nothing, so you have your choice!

Aside from the selling feature of a set that "needs no aerial," it is not a bad idea to consider the fact that nothing quite takes the place of a good, outdoor aerial for tuned radio frequency sets. And the lamp socket antenna is not likely to be nearly so good as an external aerial, even a modest length of wire run around the picture moulding, or in any other place acceptable to the skirted ruler of the home (or is it a case of pajamas these days?)

Four-Station Fans

Many persons will use only the lamp socket, as reception will be satisfactory to them as thus obtained, and they may have not the slightest desire to reach out to any greater distance than the nearest quartet of locals. A great many of the midget set users in the metropolitan area of New York City listen to WOR, WJZ, WEAF and WABC, but virtually no other stations. Thus they have no difficulty in tuning in these strong locals.

But midgets will be used by persons living in rural localities, where the nearest station may be a hundred miles away or so, and if little or nothing is heard on the lamp socket antenna, it is only fair to remember that the set is not the most sensitive in the world, and that it certainly deserves an outdoor aerial, to enable determination if the set is really a satisfactory performer.

It will be found to give good results as soon as its input has the benefit of the outdoor aerial and a good ground.

However, in such instances where only the lamp socket antenna is used, it may happen that the signals do not sound as clear as they should. Sometimes a soft, high-pitched wobbly interference is imposed on the signal, and this may be due to slip ring noises or other mechanical effects at the power plant that produce electrical disturbances to radio signals.

A Word for the Company

The lighting company does its full duty when it maintains service at the stated frequency of the line, and keeps the voltage fairly uniform (at low prices), and it should not be expected to supply quite yet a current wholly free from all interference effects to radio frequencies when the line is used as an antenna. It is the company's line and the company did not sell or lease you an antenna.

It is not easy to get rid of this interference, as it comes in all over the dial. It is not disturbing. Some persons may listen to it for a lifetime, and die not knowing they ever heard it. Others, with acute ears, and trained to observe the least detriment to finest radio reproduction, will notice it at once.

One way of reducing the effect is to use the correct side of the line for pickup. One side may be said to be at a higher radio frequency potential than the other, even though said other is not actually grounded so far as outlet connection is concerned. The ground connection may be to the center of a line transformer out in the yard somewhere, near where your washline terminates, and the radio frequency potential difference between that grounded point and your outlet may be considerable. Nevertheless nearly always one side of the line works better as aerial than the other, so choose your sides! The right side produces much more volume, much better stability, and clearer signals.

Same Thing Said Two Different Ways

If the audio frequency amplification in the receiver is large, so that room volume is easily obtained from local stations with the volume control well retarded, then the high-pitched humming interference referred to will not be easy to notice.

The well-known AC hum, of the 60 cycle or 120 cycle variety, both being present where the line frequency is 60 cycles, will not be picked up by the lamp socket antenna, unless the condenser from line, to serve as aerial input, is connected direct to grid. If there is a radio frequency transformer in the antenna input stage the hum will not find a suitable impedance. The primary isn't one, and the magnetic field will not transfer any hum frequency to the secondary. Not only is the impedance virtually a short for the hum frequency, but also the hum frequency is too far removed from the radio frequency, two statements that amount approximately to the same thing.

If an option is to be provided for lamp socket antenna or independent antenna it is well to have a separate post for the external aerial, so that when that is connected to the set there will not be any input from the AC line for antenna purposes. A wire between the two posts, outside aerial absent, would connect up the lamp socket aerial. The reasons are two-fold. First, the humming interference (which is not always present, remember) could not be fully eliminated were it impossible to separate the two types of input; and, second, the capacity effect in the socket antenna system may be large, whereas with the independent aerial it is usually around 0.00025 mfd. or less.

Short Wavers Beware!

For this very reason of high antenna capacity from the line it is not suitable to use the line for short wave, for even a series condenser, no matter how small, would not cure the condition, the capacity referred to being across the power transformers on the pole or elsewhere, and often constituting an effective trap to high, radio frequencies, whereas there is additional high capacity likely between the antenna constituted of the wire from pole transformer to outlet, especially between the wire and the conduit, or BX cable or loom shielding the wire. While the conduit or other metal covering may not be actually grounded, it is often at a low potential due to proximity to ground or grounded objects.

POSSIBLE HETERODYNE FREQUENCY

WHAT is the greatest heterodyne frequency that may occur between two stations, one operating on 700 kc, plus or minus 50 cycles, and the other operating on a frequency of 1,400 kc, plus or minus 500 cycles?—F. W. K.

If we confine ourselves to the lowest possible heterodyne, which is the most likely to occur, we having possible beating between the second harmonic of the 700 kc station and the fundamental of the 1,400 kc station. If the 700 kc station is maintained with 50 cycles, plus or minus, the harmonic of that station is held to 100 cycles plus or minus. Suppose it is minus. The 1,400 kc station may be off 500 cycles. Suppose it is off 500 cycles above. Then the difference between the two beating signals is 500 plus 100, or 600 cycles. The is the greatest possible as long as both stations are within the law.

CURRENT FOR AUTOMOTIVE RECEIVERS

I HAVE a seven tube automobile receiver in which all the tubes are of the 6.3 volt type. How much current does this set take from the car battery and is it all right to keep the set going for hours at a time? What I mean is, will the battery keep charged with this extra load on it?—W. T.

The receiver will draw 2.1 amperes from the battery. If you do a great deal of driving at high speed this extra drain is compensated for but if your driving is mostly at low speed and if you do a lot of starting and stopping, the battery may run down. Take readings on the battery electrolyte once in a while to make sure that the battery is kept charged. If not, either use the set less, change your mode of driving, or have the battery charged occasionally. If you do most of your driving during the day ,there is little danger of battery run-down.

The August "Proceedings"

High Frequency Communication One of Topics

By J. E. Anderson

"APPLICATION of Frequencies Above 30,000 Kilocycles to Communication Problems," by H. H. Beverage, H. O. Peterson, and C. W. Hansell, of R. C. A. Communications, Inc., is described in the August "Proceedings of the Institute of Radio Engineers."

The authors describe the results of certain experiments with frequencies above 30,000 kc covering a period of several years. They have found that the altitude of the terminal equipment has a marked effect on the signal intensity, and that this is true even when the equipment is beyond the optical range. Frequencies below about 43,000 kc appear to be reflected back to earth at relatively great distances in the day time in north-south directions, but east-west transmissions over long distances is extremely erratic.

Frequencies above about 43,000 kc appear not to return to earth beyond the ground wave range, except at rare intervals. The frequencies which do not return to earth also appear to be free of echoes and multiple path transmission effects and are therefore free from distortion due to selective fading and echoes. The range is limited to the ground wave range and therefore these frequencies may be duplicated at many points without interference. As the frequency is increased the range approaches the optical range. That is, the transmitter and the receiver must be in direct line of vision if communication by the short waves is to be successfully carried out.

Experiments with frequencies above 300,000 kc (below one meter) have shown that the maximum range is limited by the optical distance.

100 Mile Test

A transmitter using a UX-210 oscillator delivering about one watt to a horizontal doublet antenna and located on an airplane could be heard 100 miles on 60,000 kc at a receiving station located 80 feet above sea level. At that distance the plane was about 6,500 feet up. The same transmitter could only be heard three miles away when the transmitter was located in an automobile.

These short waves were heard to have marked directional qualities. When the transmitting doublet pointed to the receiver no signals could be heard. The receiving doublet antenna had a similar directive property. A possible application of this directive effect to guiding ferries across rivers in foggy weather was investigated. It was found that it was quite feasible to use short waves for guiding a ferry into the slip. Some suggested uses of the short waves are:

(1)—Point-to-point communication up to 300 miles between mountains.

(2)—Ground-to-aircraft communication up to at least 100 miles and communication between aircraft.

(3)—Point-to-point communication between high buildings or towers up to 50 miles or more.

(4)—City police alarm distribution up to a few miles, portable receivers being carried in scout cars.

(5)—Possible application to high speed visual image distribution over local areas.

(6)—Local audio, fascimile, or ticker distribution.

(7)—Communication and direction finding for ferryboats, tugs, and harbor craft.

(8)—Marker beacons for air and water craft.

Color Reactions

An "Automatic Color Organ" is described by Edward B. Patterson, Engineering Department, R.C.A. Victor Company, Inc., Camden, N. J. The idea is to accompany music with appropriate colors to emphasize the moods of the music. The colors would appear in various patterns. Various previous attempts have been made to associate color with music but the assignment of given colors to given notes has been artificial. The question is whether any association can be found that is not artificial. Luckiesh, the author points out, in his "Color and Its Application" gives the following as the emotions and reactions commonly associated with color:

Red—warm, exciting, passionate
Orange—warm, exciting, suffocating, flowing, lively
Yellow—warm, exciting, joyous, gay, merry
Yellow-green—cheerful
Green—neutral, tranquil, peaceful, soothing
Blue-green—sober, sedate
Blue, cold, grave, tranquil, serene
Violet—solemn, melancholy, neutral, depressing
Purple—neutral, solemn, stately, pompous, impressive.

A general circuit arrangement of the color organ is given in the paper.

G. D. Gillett, Bell Telephone Laboratories, New York, discusses "Some Developments in Common Frequency Broadcasting." He describes the results of the simultaneous operation of WHO and WOC on a common frequency, using independent crystal controlled oscillators. These stations had previously been compelled to share time on 1,000 kc but now each is able to render full time service.

The exceptional stability of the crystal controlled oscillators used is described and the method employed for adjusting for small changes explained. A monitoring receiver is set up midway between the two stations and the resultant program is sent back to WOC by wire line as a guide in adjusting the frequency of WOC to that of WHO. Curves are presented showing the impairment of the quality caused by different degrees of isochronism and signal strength ratios.

Improved Service Envisioned

"The marked increase in the service rendered by these stations through simultaneous operation is indicative of the improved service that can be rendered to urban areas by common frequency broadcasting. Although it is probable that the high powered stations on a cleared channel will remain the best means of affording a high-grade service to a metropolitan area while also rendering an acceptable service to large rural areas, common frequency broadcasting now appears to offer definite means by which to provide an improved coverage to a number of noncontiguous communities."

F. T. McNamara, Yale University, New Haven, Conn., describes "A Thermionic Type Frequency Meter for Use up to 15 KC" of very simple construction. The instrument absorbs a negligible amount of power from the circuit under test, has a linear calibration curve, and a sensitivity of about eight microamperes for one per cent change in frequency. A model was constructed and it required an input between 5 and 10 volts. The instrument uses a type of bridge and a push-pull stage of amplification. The indicating meter is connected from plate to plate of the tubes and the current read is the unbalance current and this is directly proportional to the percentage change in the frequency from a critical frequency at which the bridge is balanced. The frequency range of the meter is changed by changing the resistance values in the bridge and the frequency by changing the capacities. This device is well worthy of study by those who are looking for a simple frequency meter covering the audio frequency band and the lower intermediate frequency band.

Pentode Performance

A timely paper on the "Performance of Output Pentodes" is contributed by J. M. Glessner, Crosley Radio Corporation, Cincinnati, Ohio. Twelve different tubes are studied and the performance curves given for each. It is shown that the d-c economy and the power sensitivity of the pentode is greater than for the three element tubes. Distortion is generally greater in the pentodes than in three-element tubes. The need for a high capacity by-pass condenser across the bias resistor is pointed out and curves shown how the output and the power sensitivity varies with the capacity across a 330 ohm bias resistor at a frequency of 400 cycles per second. At least 6 mfd. are necessary at this frequency. For lower frequencies even larger capacities are needed . It is pointed out that one cause for the predominance of the high notes in the output of a pentode is due to lack of sufficient capacity across the bias resistor of a self-biased pentode. It is also shown that a pentode tube requires a much higher load impedance than a triode to give maximum undistorted power.

Directive SW Antennas

E. Bruce, Bell Telephone Laboratories, contributes a paper on "Developments in Short-wave Directive Antennas." Difficulties met in short-wave reception which are partly overcome by directive antennas are (a) Inherent receiver noise, (b) External noise such as static and man-made noises, and (c) Signal fading.

Those who are interested in quality of output and of means for measuring the harmonic content in the output of receivers will find interesting reading in "A Simple Method of Harmonic Analysis for Use in Radio Engineering Practice," by Hans Roder, General Electric Company, Schenectady, N. Y. Practical hints for doing the work graphically are given after the theory has been explained mathematically.

A Public Ad

Amplifier With 5 Watt O

By Brunst

PUBLIC address systems are coming into use more and more, and custom set builders and service men can pick up considerable business by building them. They are used in theatres, auditoriums and out of doors. They are used for entertainment, instruction and advertising. There are countless cases where public meetings are held when the attendance is so great that not all can get into the hall where the meeting is held. In such cases it is often desirable to duplicate the speeches outside the building or in some other building close by. A public address system is ideal for such a purpose. At ball games a public address system is much more effective than an announcer with a megaphone. For advertising, public address systems are often used in air planes. There are thousands of places where public address systems could be put. It is for the custom set builder to find these places and sell the idea as well as the amplifier.

Volume Requirements

The volume required will depend on the use of the amplifier. If it is to be used in a plane high above the ground and if the sound is to be audible on the ground over a considerable area, much sound power is needed. If it is to be used in a small hall not much is needed and the design of the amplifier is about the same as that of one used for radio reception.

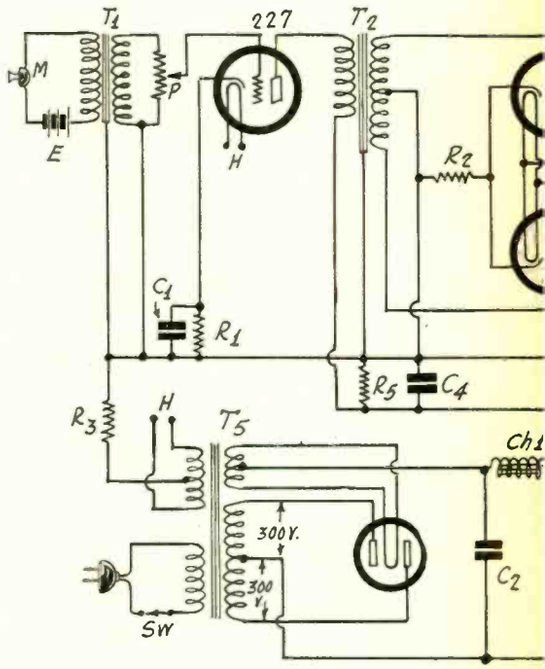
An amplifier containing two 247 tubes in push-pull in the last stage will put out about 5 watts of undistorted power and this may be increased if necessary without increasing the distortion appreciably. If the amplifier is designed so that there is no distortion in the stages ahead of the power stage when the output stage is loaded up, the quality will be good and the volume satisfactory. It is not difficult to load up a stage of 247 tubes without previous distortion because each of these tubes only takes a signal voltage, peak value, of 16.5 volts. It is reasonable to assume that the amplification in a 227 tube followed by a transformer is 16.5 times. This would mean that the input to this tube would only be one volt, peak value, when the output tube is loaded up.

Public Address Amplifier

In Fig. 1 is the circuit of a public address amplifier suitable for small halls or small out door gatherings. It consists of one stage of single-tube amplification and two stages of push-pull. The first three tubes are 227s and the tubes in the output stage are 247s. Transformer coupling is used throughout.

Let us describe the circuit in detail, giving the values of the various essential components. We start with the microphone M, which in this case is assumed to be of the carbon button type. The current to be varied by the microphone is supplied by the battery E, the voltage of which is determined by the particular microphone used. The makers of the microphone will specify the voltage necessary. Following the microphone is a transformer T. The design of this also depends on the microphone, but if an average microphone is used the transformer is more or less standard. It is the type listed in manufacturers catalogues as a microphone-to-tube transformer. It should have a low impedance primary and a high impedance secondary.

Across the secondary of this transformer is a high resistance potentiometer for the purpose of varying the input to the amplifier, and hence also the output. A resistance of anywhere from



The circuit of a three-stage public addre

LIST OF PARTS

Coils

T1—One microphone input transformer
T2—One push-pull input transformer
T3—One interstage push-pull transformer
T4—One push-pull output transformer
T5—One power transformer having three center tapped windings, one of 2.5 volts and 10 amperes, one of 5 volts and 3 amperes, and one of 600 volts and 125 milliamperes
Ch1—One 15 henry, 125 milliampere choke coil
Ch2—One 30 henry, 85 milliampere choke coil

Condensers

C1—One by-pass condenser of 2 mfd. or more, 400 volts
C2—One 4 mfd. condenser, 1,000 volts
C3—One 4 mfd. condenser, 1,000 volts, or a 4 mfd. electrolytic
C4—One 8 mfd. electrolytic condenser

Resistors

R1—One 2,000 ohm bias resistor, one watt
R2—One 1,000 ohm bias resistor, one watt
R3—One 225 ohm resistor, 5 watts
R4—One 4,000 ohm resistor, 10 watts
R5—One 20,000 ohm resistor, 10 watts

Other Parts

M—One carbon button microphone
E—One dry cell battery to actuate microphone
Sw—One AC line switch
Five UY sockets
One UX socket

30,000 to 500,000 ohms may be used without making any appreciable difference in the output. If the higher resistance is used, the maximum output will be slightly greater than if the lower resistance is used.

After the first tube is an ordinary push-pull input transformer T2 and after the second stage is a push-pull interstage transformer T3. This is made by several manufacturers of audio frequency transformers and can be obtained without difficulty, if not in local radio stores, then from the manufacturers directly.

The output transformer T4 may not be obtainable so easily. While there are many output transformers for tubes like the 171A, 245, and the 250, no special transformers have appeared for the 247. Of course, set manufacturers use them. In case no transformer especially designed for the 247 tubes can be found, then a transformer made for the 210 tube is a good substitute. But the transformer must also fit the speaker used. Usually dynamic speaker manufacturers build into the speaker transformers that fit particular tubes. Hence in getting the speaker it is only necessary to specify that it is to be used with two 247 tubes in push-pull.

Much depends on the proper choice of output transformer, or of the proper speaker. If the impedance of the primary is too low there is likely to be strong emphasis on the high notes so that the output will sound shrill.

The proper bias resistance for a 227 tube is 2,000 ohms. Hence R1 should have this value. But R2 serves two tubes of the same type, and therefore this resistance should only be 1,000 ohms. R3 serves the two 247 tubes and should have a value of 200 ohms or somewhat higher, for the correct bias resistance for one 247 tube is 418 ohms. In push-pull the bias may be a little greater than when a single tube is used and therefore the bias resistance for two tubes may be a little greater than one half that required by one tube. Therefore R3 may have a value as high as 225 ohms.

A by-pass condenser C1 of at least 2 mfd. should be connected across R1 in order to prevent reverse feed back. If the by-pass condenser is small it will not prevent the reverse feed back on the low frequencies and the output is likely to be deficient in the bass region.

No by-pass condenser is needed across either R2 or R3 because if the stages are strictly push-pull there will be nothing to by-pass for there will be no signal current in either resistance. And if there is some unbalanced in the push-pull stages the

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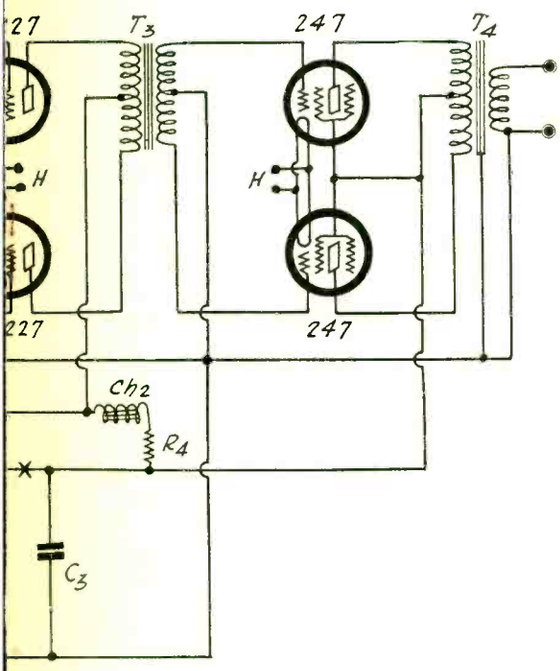

G. 1

s system amplifier with built-in power supply.

reverse feed back resulting therefrom will tend to restore the balanced.

It will be observed that the single heater winding H serves all the tubes in the circuit. Since there are three 227 tubes, each drawing 1.75 amperes, and two 247 tubes, each drawing 1.5 amperes, the total filament current will be 8.25 amperes. A winding rated at 10 amperes or more will handle the circuit in this respect. If this winding is center tapped R3 should be connected between this center and ground. In case the winding is not center tapped a center tapped resistance of about 30 ohms may be used to provide the center for the R3 connection.

The B supply is a standard rectifier and filter utilizing a 280 full wave rectifier tube. The power transformer T5 should have two center tapped windings besides the 2.5 volt heater winding H. It should have one 5-volt winding for the rectifier tube and one 600 volt winding for the plates. This will give a rectifier output voltage of about 300 volts.

Since two of the stages in this circuit are push-pull it is not necessary to filter the plate voltage as thoroughly as if the amplifier were single-sided throughout. It is sufficient to make condenser C2 4 microfarads. It should be rated at a high voltage, say 1,000 volts, to guard against possible break-down. C3 may be a similar condenser, both as to voltage rating and capacity, but it may also be an electrolytic condenser of the same value.

The choke Ch1 carries all the current in the amplifier and therefore it must have a heavy current rating. In fact the total current will be about 100 milliamperes and therefore the choke should have a rating higher than this. It is not necessary that the inductance at this current be greater than 15 henries. This may require a rating of about 30 henries at 85 milliamperes. But if the coil is rated at only 85 milliamperes it is not advisable to use it because it will heat up and the voltage drop in it will be excessive. In case a choke of 100 milliampere rating cannot be obtained, the same filtering action can be secured from two 30 henry chokes in parallel, and each of these may have a rating of 85 milliamperes.

The voltage supplied to the 227 tube amplifiers is lowered by resistance R4 and it is also filtered by an additional choke coil Ch2. This choke should be one of 30 henries and a rating of about 85 millihenries. This coil, however, will only carry about 25 milliamperes normally, the plate current of the three 227 tubes and the bleeder current in R5. An additional filter condenser C4 is also used across the supply for the three 227 tubes. This condenser may well be an 8 mfd. electrolytic condenser.

The Voltage Divider

The voltage applied to the plates of the 227 tubes should be 193.5 volts, which allows 180 volts for the plates and 13.5 volts for the grids. Under these conditions the plate current of each tube is 5 milliamperes. If we assume that the current through R5 is 10 milliamperes, the total current through R4 is 25 milliamperes. Assuming that the voltage across C3 is 300 volts we should drop 106.5 volts in R4 and Ch2 when the current is 25 milliamperes. Therefore the sum of R4 and the resistance in Ch2 should be 106.5/.025, or 4,250 ohms. It is sufficiently close to make R4 4,000 ohms. R5 we determine simply by dividing 193.5 by .010. Hence R5 is 19,350 ohms. The nearest standard resistance is 20,000 ohms.

In case it is desired to lower the applied plate voltage on the three 227 tubes, the value of R4 may be increased to 5,000 ohms.

We assumed that the total voltage across C3 was 300 volts. It may be higher or lower according to the voltage actually delivered by the power transformer T5. If the voltage is excessive it may be lowered by putting a resistance in series with the line carrying all the current, for example, at the point marked X. The value of the resistance put at this point depends entirely on how much the voltage is to be cut down. Since the total current is very close to 100 milliamperes, to cut the voltage one volt, 10 ohms are necessary. This may be used as a basis for cutting down the voltage at least 10 per cent. Suppose the voltage is 300 and we want only 275 volts. We have to cut it down 25 volts. Hence the resistance at X should be 250 ohms.

Normal Voltage Rating

The normal voltage required by the two 247 tubes is 226.5 volts. 250 volts on the plates and 16.5 volts on the grids. Therefore if the output voltage of the rectifier is 300 volts we have to cut it down 33.5 volts, which would require 335 ohms. The voltage is not critical because good results will be obtained if it is less than 226.5 and higher than 300 volts, but the output decreases as the voltage decreases and the life of the tubes decreases as the voltage increases.

A word should be said about the power rating of the various resistances in the circuit. First we have R1. The resistance is 2,000 ohms and the current through it is 0.005 ampere. Hence the wattage is 0.05 watt. Therefore if the rating of the resistor is one watt there will be an ample factor of safety. The resistance of R2 is 1,000 ohms and the current is 0.01 ampere. Hence the wattage is 0.1 watt. Again a one-watt resistance will be sufficient.

R3 carries a current of 79 milliamperes, normally. The resistance is about 225 ohms. Hence the wattage is 1.4 watts. Therefore the rating of the resistance used should be at least 5 watts. R5 carries 0.01 ampere and its resistance value is 20,000 ohms. Hence the wattage is 2 watts, and the rating should be 10 watts. R4 carries 25 milliamperes and its value is 4,000 ohms. Hence the wattage is 2.5 watts. The rating might be 10 watts, allowing a safety factor of 4 in this case.

If a resistance is put at the point X its wattage must be determined on the basis of the resistance value used and the total current that is flowing. The normal current is about 100 milliamperes and therefore the wattage dissipated in a resistance R ohms is 0.01R watts. Or using voltage, the wattage dissipated in the resistance is 0.1V, where V is the voltage dropped in the resistance. In the case where we dropped 33.5 volts, the wattage dissipation is 3.35 watts, and we should have a resistor that is rated at 15 or 20 watts.

List Prices of Tubes

The following table gives the prevailing price lists of the various tubes:

Tube	Price	Tube	Price	Tube	Price
227	@ $1.25	551*	@ $2.20	240	@ $3.00
201A	@ $1.10	224	@ $2.00	WD-11	@ $3.00
245	@ $1.40	171A	@ $1.40	WX-12	@ $3.00
280	@ $1.40	112A	@ $1.50	200A	@ $4.00
230	@ $1.60	232	@ $2.30	222	@ $4.50
231	@ $1.60	199	@ $2.50	BH	@ $4.50
226	@ $1.25	199	@ $2.75	281	@ $5.00
237	@ $1.75	233	@ $2.75	250	@ $6.00
247	@ $1.90	236	@ $2.75	210	@ $7.00
223	@ $2.00	238	@ $2.75	BA	@ $7.50
235	@ $2.20	120	@ $3.00	Kino	@ $7.50

*This tube comparable to the 235.

A DeLuxe

Switch Enables Modu

By Einar

THE 235 variable mu tube is an excellent dynatron oscillator and it is now used in that manner extensively for testing purposes. The main reason is that the oscillator is very simple.

In Fig. 1 we show a typical oscillator of this type together with a simple B supply which will deliver sufficient power to operate the circuit. Provision is also made for modulating the oscillations generated as well as for taking off the oscillations without putting a heavy load on the tube. If too much energy is taken from the tube oscillation stops and for that reason it is important to couple the oscillator to the circuit in which the

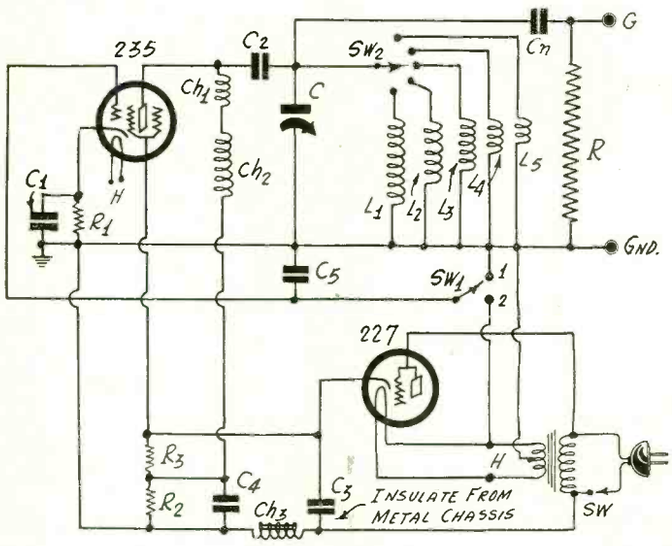

FIG. 1

A dynatron oscillator with a 235 tube and a built-in B supply. Provision is made for 60-cycle modulation.

output is to be used in such manner that the least possible energy is taken from the tube. This is provided in the circuit.

In making an oscillator of this kind it is important that the rotor of the tuning condenser be grounded. At the same time it is important to arrange the circuit so that there is no possibility of shorting the high voltage by means of the tuning condenser. The arrangement shown in Fig. 1 achieves these results.

Parallel Feed

The plate of the tube is fed through a choke coil Ch2, the inductance of which should be so high that it does not alter appreciably the effective inductance of any of the oscillator coils put in parallel with it. Since the oscillator may be used for both very high frequencies and comparatively low intermediate frequencies, the distributed capacity of the choke may defeat the purpose of the choke at the higher frequencies, if it is large enough to be effective at the lowest frequencies for which the oscillator is designed. Hence a small choke Ch1 is put in series with Ch2.

It is desirable to design these coils so that the combined impedance is never less than 10,000 ohms. Suppose, then, that the lowest frequency of the oscillator is to be 15,000 cycles. At this frequency the larger coil does nearly all the work and therefore it should have an impedance of 10,000 ohms. Thus this coil should have an inductance of at least 100 millihenries, if we want to go as low as 15,000 cycles. A standard 85 millihenry coil will be large enough for most practical intermediate and broadcast frequencies.

At 6,000 kc the smaller coil may have to take up the load due to the distributed capacity in the larger coil. If the small coil is to have an impedance of 10,000 ohms at 6,000 kc, its inductance should be 265 microhenries. This coil may be wound with wire as fine as No. 36 and it should be wound on a long form of small diameter. A coil 1.5 inches long and 0.5 inch in diameter will have an inductance of 266 microhenries. Hence that is satisfactory for the smaller choke coil.

The Series Condenser

The series condenser C2 is used to prevent the plate current from entering the tuning system. This condenser must have a low impedance at all frequencies which are to be generated. Hence if it has a comparatively low frequency at 15 kc it will have a still lower impedance at all higher frequencies. A 0.1 mfd. condenser at 15 kc has an impedance of 106 ohms, which is low enough. At 6,000 kc this condenser has an impedance of only 0.265 ohm. This is quite negligible.

The tuned circuit comprises the tuning condenser C and any one of the coils L1, L2, L3, L4 and L5. The coil desired is selected by means of switch Sw2. Each coil, of course, covers a different frequency band. All of these need not be separate coils as taps on a single layer solenoid may be used for some of the smaller coils. If, however, the oscillator is to cover frequencies from 15,000 cycles up some of the coils cannot be single layer solenoids for not enough inductance could be obtained in a reasonable space.

The Output

There seems to be only one way in which the output can be taken from the oscillator, and that is by direct coupling as indicated. If a second winding is used, one will have to be put on each coil and another switch would be necessary. If it is only a question of getting enough out of the circuit to produce a beat with another oscillator, all that need be done is to place the coils near each other, that is, the coils carrying the currents of the two beating frequencies.

The direct method of coupling is more useful and is equally good for all the coils in the set. The circuit comprising the small isolating condenser Cn and the high resistance R is connected across the tuned circuit. Whatever voltage exists across the tuned circuit will also exist across the CnR circuit. If Cn is small and R large this shunt across the tuned circuit will not impose any appreciable load on the oscillator tube and it will not appreciably alter the frequency of oscillation. If the top G of the resistance R is connected to the grid of an amplifier tube and the low end Gnd to the grounded side of the same amplifier, a high voltage will be impressed on the amplifier. Cn should be a small trimmer condenser set at a low capacity value and R should be one or two megohms.

Modulation of the Oscillation

If it is desired to modulate the output of the oscillator this can be done by moving switch Sw1 to point (2), which puts half of the heater voltage in the grid circuit, that is, a 60-cycle voltage of 1.25 volts. C5, a condenser of 0.01 mfd., is used to by-pass radio frequency currents when the switch is set on (2). This will not pass any appreciable current at 60 cycles.

The plate voltage is supplied by a simple oscillator utilizing a 227 tube as rectifier. The 110 volts from the line is applied directly to the tube so that the output voltage of the rectifier cannot exceed about 150 volts, which is near the peak voltage of the supply. The filter consists of two 8 mfd. electrolytic condensers C3 and C4 and a 30 henry choke Ch3, the choke being placed in the negative side of the line. Due to the fact that the current is small the filtering is very good.

The full output voltage is applied to the screen of the oscillator tube, but only one-third of the voltage is applied to the plate. This division of the voltage is accomplished by making

LIST OF PARTS

Coils

Ch1—One r-f choke as described
Ch2—One 85 millihenry choke
Ch3—One 30 henry filter choke
T—One filament transformer
L1, L2, L3, L4, L5—One set of oscillator coils
L6—An output coil suitable for frequency used and purpose of oscillator

Condensers

C1, C5—Two 0.01 mfd. condensers.
C2, C6—Two 0.1 mfd. condensers.
C3, C4—Two 8 mfd. electrolytic condensers
Cn—One 20-100 mmfd. trimmer condenser
C—One National 270 degree, 150 mmfd., straight line frequency tuning condenser

Resistors

R1—One 300 ohm grid bias resistor
R2—One 10,000 ohm resistor
R3—One 13,000 ohm resistor (for Fig. 1) or 10,000 ohms (for Fig. 2)
R6—One 2,000 ohm grid bias resistor
R—One megohm grid leak, or two megohms

Other Parts

Sw—One a-c line switch
Sw1—One single pole, double throw switch
Sw2—One five-point selector switch
Three UY sockets (two for Fig. 1)
One National 270 degree vernier dial, type N.

Oscillator

lation from A-C Line

Andrews

frequency. If the coil that covers the broadcast band tunes from 500 to 2,000 kc in covering the scale there is a change of 1,500 kc and therefore each vernier division represents one kilocycle. This would hold throughout the scale. If the coil and condenser don't cover as wide a band, one division will represent an even lower frequency. Of course, this does not hold when the frequency is above the broadcast band, but on the other hand, below the broadcast band the possible reading is even closer in terms of cycles. The percentage accuracy is the same for all the coils and frequency ranges.

The dial is of metal and it is grounded so that there is no body capacity effect.

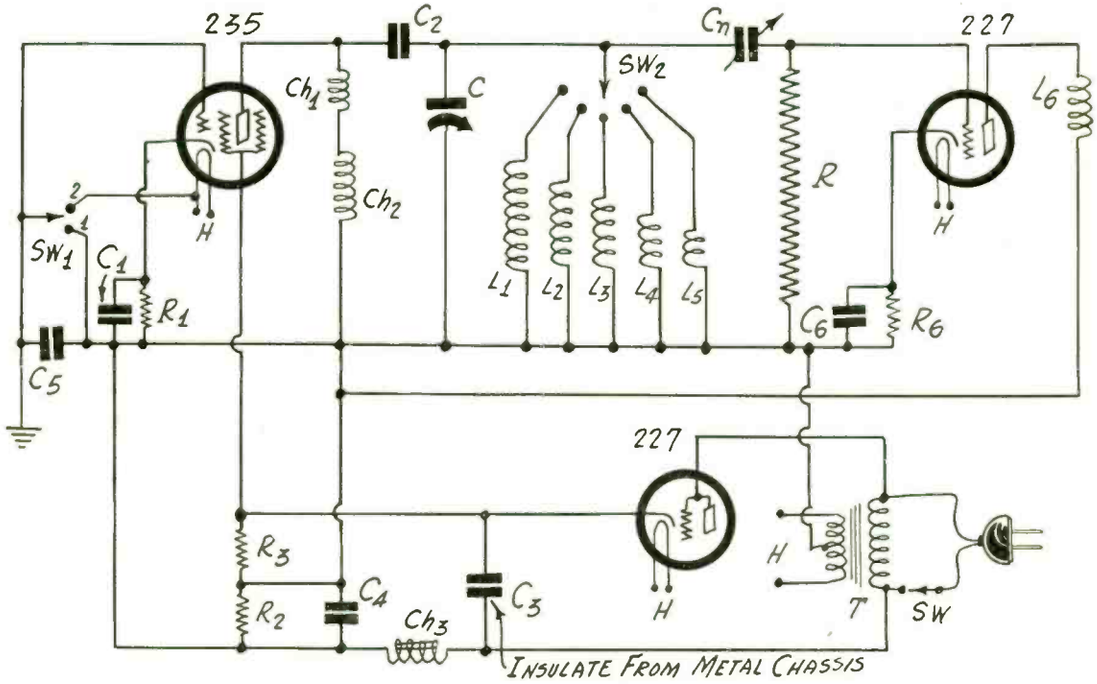

FIG. 2

The same dynatron oscillator as in Fig. 1 but with a stage of radio frequency amplification to reduce the load on the dynatron.

R2 10,000 ohms and R3 about 13,000, allowing 5 milliamperes for bleeder current and the 2.5 milliamperes for the plate.

The same heater winding H is used for both the rectifier and the oscillator tubes. The center of this winding is grounded and it is this fact which permits putting a 1.25 volt potential on the grid for modulation.

The grid bias resistance R1 should be 300 ohms and the condenser C1 across it should be 0.01 or 0.1 mfd.

Oscillator With Amplifier

In Fig. 2 is the same circuit as in Fig. 2 except that an amplifier has been added. This addition necessitates a few changes in the voltage divider. The resistance of R2 remains at 10,000 ohms since we have not changed the current in it. But R3 requires a different value. If the added tube takes a current of 2.5 milliamperes, the total current in R3 will be 10 milliamperes. Hence to drop 100 volts in it we need a resistance of 10,000 ohms.

The grid bias resistance R6 for the output tube should be 2,000 ohms and the condenser C6 across it either 0.01 or 0.1 mfd. A coil L6 has been put in the plate circuit of the output tube. This represents the coupling coil to the circuit in which the oscillation is to be used. Its design depends on the application and on the frequency. A small loop could be used in many instances or simply a solenoid of large diameter and a few turns. If this coil be placed near the input of a radio receiver and the oscillator is started, the output of the oscillator can be picked up by the receiver. If the signal is modulated, the modulation frequency will be heard. If the oscillator is unmodulated a beat frequency will be heard in the receiver when the oscillator condenser is turned and the receiver is tuned in to some frequency. Beats will be heard both when the oscillator and signal frequencies are nearly the same and when one of the harmonics of the oscillator is equal to some harmonic of the signal. The harmonics do not have to be of the same order. For example, the third harmonic of one may beat with the second of the other.

Vernier Dial Used

A National vernier dial is used on the tuning condenser. This has 150 divisions on the scale, spread out over 270 degrees. By means of the auxiliary vernier scale each division can be read accurately to 1/10. Hence the scale effectively contains 1,500 divisions. The condenser used is approximately straight line

The maximum capacity of the tuning condenser used in this dynatron oscillator is 150 mmfd. To this must be added a capacity to allow for the distributed capacity of the coil and for the capacity of the tubes associated with the tuning system. It is sufficient to allow 5 mmfd. for the coil and 10 mmfd. for the tube. Thus the maximum capacity in the circuit will be about 165 mmfd. The minimum will be greater than 15 mmfd. because the condenser itself has a certain minimum. This may be taken as 10 mmfd. so that the minimum is 25 mmfd. This will be the approximate minimum. It is impossible to give accurate values because there are too many variable factors which cannot be taken into account.

Set of Coils

On the basis of 165 mmfd. maximum and 25 mmfd. minimum the capacity ratio of the tuner is 6.6. The frequency ratio is the square root of this, or 2.57. Therefore, if a coil be designed so that its lowest frequency is 550 kc., the highest frequency will be 1,410 kc. The tuner with the 150 mmfd. condenser will not cover the broadcast band even in the most favorable circumstances. But in a calibrated oscillator this does not matter just so the coils are chosen to have some overlap, and it is particularly unimportant in the dynatron oscillator shown in Figs. 1 and 2 because the frequency can be changed by turning a switch.

A coil system that will cover the band from 550 to 30,000 kc. can be wound on one form 1.75 inches in diameter, using No. 28 enameled wire, taps being used to vary the inductance. Let us determine the turns necessary for the various coils and thus determine the location of taps, basing our computation on a maximum capacity of 165 mmfd. and a frequency ratio of 2.57.

The first coil is to tune to 550 kc. We need an inductance of 507 microhenries. This will require 129 turns. This coil will tune up 1,410 kc. But to make sure of an overlap let us start the next coil at 1,350 kc. For this we need an inductance of 84.1 microhenries. This will require 37 turns. This coil will reach 3,470 kc. To insure overlap let us start the next coil at 3,300 kc. Then we need an inductance of 14.1 microhenries, which will call for 16 turns.

7 Turns on Smallest Coil

This coil will tune up to 8,400 kc. Let us start the next at 8,000 kc. Now the coils are so short that we may consider the turns to be inversely proportional to the frequency. Hence we have $16 \times 3.300 = n8{,}000$, or the smallest coil will have 6.6 turns. We call it 7 turns.

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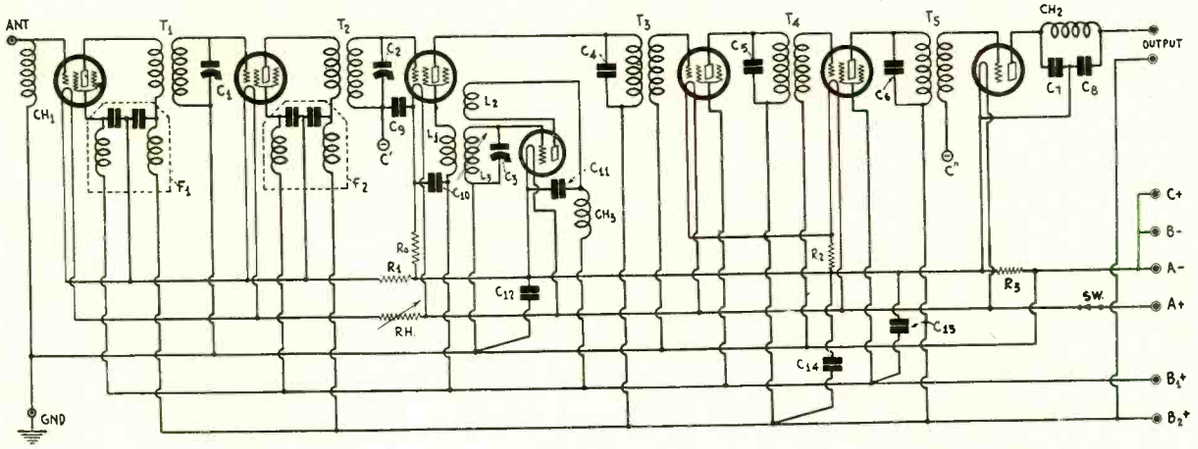


FIG. 948

This seven-tube superheterodyne circuit can well be built with the 2-volt tubes. It is capable of high sensitivity.

A Battery Super

WILL you kindly publish a circuit diagram of a superheterodyne receiver that is suitable for the 2-volt tubes. It is sufficient to publish the radio and intermediate frequency parts of the circuit as I have a good audio frequency amplifier. Please give values of resistors and by-pass condensers suitable for the circuit.—R. W. L.

In Fig. 948 is such a circuit. All radio frequency chokes may be 85 millihenry chokes, or any value down to about 10 millihenries. C7 and C8 should be 0.00025 mfd. condensers. All other by-pass condensers should be 0.1 mfd. or larger. If all the screen grid tubes are 232s and the rest 230s, disregard all the ballast resistances such as R0, R1, R2, R3, and Rh. That is, use plain connecting wire. Then use a common resistance in the negative lead to the filament battery. The filament battery should have a voltage of 3 volts and common ballast resistance should be 2.38 ohms. The best way to get it is to use a 6-ohm rheostat and then with the aid of a voltmeter adjust it until the voltage across the filaments is just 2 volts. Put a stop on the rheostat so that the resistance cannot be made less than 2.38 ohms. The proper place for the rheostat is where R3 is.

* * *

Vibration of Condenser Plates

I HAVE heard that a howl in a radio receiver can be caused by the vibration of the plates in the tuning condensers. Is there anything to this rumor, and if so, how can an audio howl be set up in this way when the tuning condensers are in the radio frequency part of the receiver?—W. L. D.

It is true, all right. If the condenser plates vibrate the capacity of the condenser changes at a rate equal to the rate of vibration and by an amount proportional to the amplitude. This will tune and detune the receiver at a rapid rate and the output will vary at the same frequency. Thus the vibration will cause the output to be modulated and this modulation appears as a howl in the output of the detector. If the howl is amplified by the audio amplifier and the loudspeaker is near the condenser that vibrates, there is a feedback through the air, which intensifies the howl. If the condenser plates are subject to vibration it takes an extremely small amount of feedback to build up a very loud howl.

* * *

Impedance of Choke and Condenser in Parallel

IF a choke coil is used as a coupler and a small condenser is connected across it, is the combination still useful as a coupler at all frequencies? If not, how does the impedance vary with the frequency?—E. E. B.

It is only useful at one frequency, but it really depends on the relative values of the choke and the condenser. If the choke is an audio choke, say one of 30 henries or more, and the condenser is of the order of 0.0005 mfd., then the combination is useful as a coupler at all audio frequencies. If the condenser is of the order of one microfarad, the combination is only useful at the very lowest audio frequencies. If the choke has an inductance of a few millihenries and the condenser a capacity of 0.00025 mfd. the combination is only useful at one frequency, and that is the frequency of resonance. For example, if the inductance has a value of 5 millihenries and the condenser is a 0.00025 mfd. unit, the frequency of resonance is about 142 kc. Above this frequency the combination is a condenser and below it is an inductance. At the resonant frequency the impedance of the combination is 20/R megohms, which is the radio frequency resistance of the choke. Thus if R is 20 ohms the impedance is one megohm.

* * *

Fahrenheit to Centigrade Degrees

I HAVE a table giving the temperature coefficient of resistance of various resistance wire but the temperature is given in Centigrade degrees. I have only a Fahrenheit thermometer. How can I convert the coefficients to Fahrenheit degrees and also how can I convert the temperature to Centigrade?—B. W. R.

The relation between Fahrenheit and Centigrade temperature is $F=1.8C+32$. The 32 comes from the fact that zero on the Centigrade scale is 32 degrees Fahrenheit above the Fahrenheit zero. The ratio of the magnitudes of the two degrees is expressed by the coefficient of C in the equation. This ratio is $5F=9C$, which shows that the Centigrade degree is the larger. To make use of the tables it is best to convert the Fahrenheit readings to Centigrade with the aid of the equation, which for this purpose may be put in the form $(F-32)/1.8=C$. Having done this you can use the temperature coefficients expressed in terms of the Centigrade degree. If you have a temperature difference expressed in Fahrenheit degrees, just divide this difference by 1.8 to get the corresponding difference on the Centigrade scale.

* * *

Using 2-Volt Pentode in Push-Pull

CAN the 233 pentode be used in push-pull in the last stage of a small receiver? If so, what filament current will the two tubes require and what should the bias be?—W. H. J.

Any tube can be used in push-pull provided that the two tubes in the stage are equal. The filament current required by the 233 is 0.26 ampere and therefore two of them will require 0.52 ampere. The bias required by this tube was not announced when the characteristics of the tube was announced but try voltages between 4.5 and 7.5 volts. Use the bias that gives the best results, considering quality more than volume. In finding the best bias experimentally, start with high voltages first because it is better to use too high bias than too low.

* * *

Derivation of Factor K

WHENEVER you compute the inductance of a single layer solenoid you always bring in a factor K which you say can be found in tables or in curves. Just what is this factor and how is it derived?—W. J. S.

When the inductance of a single layer solenoid is computed mathematically the results comes out as an infinite series, or the sum of an infinite number of terms, all involving the ratio of the diameter to the length. In order to find the value of this series for any given value of the ratio of the diameter to the length it is necessary to compute a larger number of these terms and add them up. The terms become smaller and smaller

and if a sufficient number of them is taken the last does not change the result. The sum of all the terms is then called the sum of the series and that sum is the value of K. The computation is long and tedious and it is for this reason that K was tabulated so that it would not be necessary to compute the values more than once.

* * *

Power Tube After Detector

I AM planning to build a small receiver and I don't want to use any more audio stages than necessary. If I use a 230 tube detector with grid leak and condenser can I follow this tube with a 231 power tube, using transformer coupling? Would it be better to use two stages of audio?—H. E. H.

It is not advisable to follow the detector with the power tube because the detector will be overloaded long before the power tube. It would be much better to use two stages of audio. However, if you use grid bias detection with plenty of radio frequency amplification you can safely follow the detector with the power tube, provided that you use transformer coupling between the detector and the power stage.

* * *

Operation of Screen Grid Tube as Detector

I HAVE built a receiver in which I used a screen grid tube as a grid bias detector, working into a resistance of 250,000 ohms. This receiver did not work well at first, as there was a great deal of distortion. Finally, I put a resistance of 50,000 ohms in the lead to the screen and that cleared up the distortion. Now the circuit works very well. What I should like to know is why grid bias detectors are not designed that way? I should also like to know why the detector works better with the high resistance in the screen circuit.—T. H. R.

Almost since the screen grid tube was first made available, detectors using this tube have been designed that way. Not only have detector's been designed that way but amplifiers using the screen grid tubes in resistance coupled circuits have been designed that way too. There is one alternative way of operating the tube, and that is to make the applied screen voltage comparatively very low. The two methods really amount to the same thing. The reason for the distortion is that when the plate resistance is high the effective plate voltage is less than the screen voltage part of the signal cycle, especially when the input on the grid is high. When the screen voltage is higher than the effective plate voltage the tube does not function right.

* * *

Magnetostriction Oscillators

CAN you suggest some good materials out of which to make magnetostriction oscillators, materials easily obtainable? Are magnetostriction oscillators as stable as piezo oscillators? Are they suitable for standard for audio frequencies?—W. J. F.

Monel metal, Nichrome and nickel are some of the best materials. Monel metal is one of the best. Some samples of Nichrome do not oscillate. The frequency stability is of the order of one part in 10,000 but may be made greater by special care. Piezo oscillators are much more constant. Magnetostriction oscillators could be used as standards of audio frequencies and they are easily made. A short rod of the material is used as the core of a transformer. The rod should be mounted so that its ends are free, in fact, so that nothing touches the rod except at the center. One of the windings of the transformer is mounted over one end of the rod and connected in the grid circuit while the other winding is mounted over the other end and is connected in the plate circuit. The connections are opposite to those required to excite oscillation without the rod. To vary the frequency vary the length of the rod.

* * *

Converter Oscillator

IF the oscillator coils of a converter are designed for an intermediate frequency of 550 kc can the same coils be used if the intermediate frequency is higher than that? If so, what will the effect on the tuning be?—E. R. V.

Yes, the coils can be used but all the oscillator coils in the set will be too large. This means that less capacity will have to be used in the oscillator for tuning in a given signal, or it may be that a smaller coil in the set may have to be put in.

* * *

Detuning Effect of Antenna

WHY does the antenna when connected directly to the tuned circuit affect the tuning characteristic of the coil and condenser? Also, why does a small condenser in series with the antenna reduce this effect? Is the tuning range of a given condenser and a given coil increased or decreased by the antenna?—R. T. B.

The antenna is effectively a condenser having a certain capacity. When the antenna is connected to the stator of the tuning condenser, its capacity is added to that of the tuning condenser. Hence the frequency of resonance for a given setting of the condenser is lowered. When a small condenser is connected in series with the antenna, this condenser is also in series with the antenna capacity and the series combination is put across the tuning condenser. When two condensers are connected in series the effective capacity is always less than the smaller of the two condensers. Therefore the series condenser reduces the effect of the antenna. The tuning range of the variable condenser and the coil is reduced by the antenna capacity because the antenna capacity is always there. That is, it is a minimum capacity, and when this is large the percentage variation in capacity is small. Hence the frequency change is small as the variable condenser is changed from maximum to minimum.

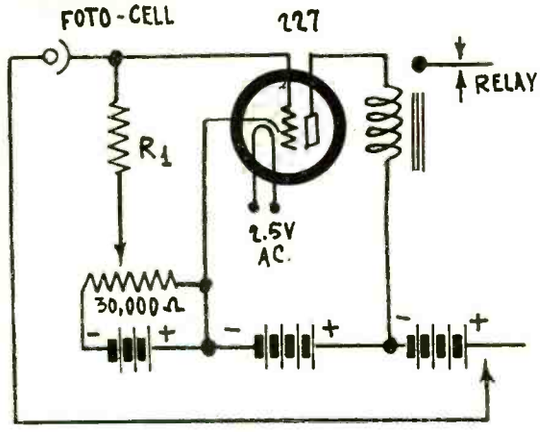


FIG. 949

When a photo-electric cell is used in conjunction with a vacuum tube amplifier and a relay, a circuit like this can be used.

* * *

Meaning of Coupling

THE term coupling is used so often and in so many different connections in radio that it seems to be used only when no other word can be found. Just what is the meaning of coupling?—E. W. R.

By coupling is meant that two or more circuits have a common impedance. The larger this impedance the closer the coupling. An example of coupling is the ballast resistor in the filament circuits of tubes. If the same resistance is used for two tubes, the filament circuits are coupled by the resistance. In a transformer the primary and secondary circuits are coupled by a mutual inductance, or rather by the mutual inductive impedance. Two circuits may also be coupled by a choke coil or a condenser. If, in going around either circuit, it is necessary to go through the impedance, the two circuits are coupled. Sometimes the condenser between the plate of one tube and the grid of the next in direct coupled circuits is referred to as a coupling condenser. It would be more nearly correct to call it a decoupling condenser, for the two tubes are coupled more closely when the condenser is large, that is, when its impedance is small. If it were a coupling condenser the coupling would be closer the smaller the condenser.

* * *

Circuit for Photo-electric Tube

WILL you kindly show a circuit of a photo-electric tube with a 227 amplifier, or any other similar amplifier? What I want in particular is the arrangement whereby I can get a negative bias on the vacuum tube and a positive voltage on the photo-electric cell with the use of a stopping condenser. I must have a d-c amplifier for a relay will be connected in the plate circuit of the tube.—F. C. M.

In Fig. 949 is probably the very circuit you need. Note that both the grid voltage and the voltage on the cell are variable, and in such a way that you can give the tube the correct grid bias for any particular voltage on the cell. The load on the vacuum tube is the winding of a relay.

* * *

Varying Screen Voltage

IN the Aug. 22nd issue, on page 19, you have a resistance coupled amplifier with a screen grid tube in the first stage and a pentode in the second. If the screen voltage on the first tube should be too high for good amplification, what changes could be introduced to lower it?—F. W. R.

There is a voltage divider in the circuit composed of R6 and R7. The voltage across these two resistances is constant and is equal to the applied voltage across the B supply terminals. The voltage on the screen is the voltage drop across R7. By varying the ratio of R7 to R6 we can make the screen voltage any fraction we desire of the total voltage. The current flowing into the screen is so small that it may be assumed that the same current flows in both R7 and R6. Hence the voltages are divided in proportion to the resistances. If the total voltage across the two resistances is 180 volts and we desire only a voltage of 22.5 volts across R7, we have R7/22.5=R6/157.5, or R7/R6=1/7. We may choose almost any reasonable value for one of the resistances and make the other such that it satisfies this relation. For example, if we make R7 1,000 ohms, R6 must be 7,000 ohms. If we choose R6 as 10,000 ohms, R7 must be 1,430 ohms.

A THOUGHT FOR THE WEEK

THE National Broadcasting Company officials are not generally regarded as being related to the village idiot. There are showmen at the head of it. Therefore, it is all the more interesting to note that George Engles, N. B. C. vice-president in charge of the N. B. C. Artists Service, has just signed up Rudy Vallee to continue under N. B. C. exclusive management for the coming three years. Mr. Engles knows talent when he sees it, and, what is especially important, he keeps his thumb on the pulse of things and knows when an artist is falling behind, is standing still or is going ahead. In signing up Rudy Vallee on a new contract Mr. Engles is putting to rout the Great American Society of Knockers whose members declared Rudy was an accidental hit, that he wouldn't last and that the N. B. C. would not sign him for a new period of air activities. No?

RADIO WORLD

Title Reg. U. S. Pat. Off.

The First and Only National Radio Weekly

Tenth 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; L. C. Tobin, advertising manager.

Reading Aloud

MOST of the words spoken into the microphone are read from manuscript. This is deemed by many to be the best way to insure the saying of just what is intended to be said, and is supposed to represent the acme of care. Prof. Robert A. Millikan, in a radio talk a couple of months ago, voiced this opinion, saying that the importance of radio, where one's audience may number high in the millions, requires that each word be carefully weighed, so the talk should be committed to writing and read.

Announcers on large chains read what they say and say what they read. The practice at small stations, where announcers do their own improvising for the most part, is taken to represent something less than extreme care. Actors in radio playlets nearly always read their parts. This is supposed to be punctilious, too. Digesters of the news do not confine their reading to newspapers, but indeed read their own condensations and comments from their own prepared text. The task of radio talking is lightened when one reads what he himself writes. Actors and announcers who must read others' words perhaps feel that the thoughts are not expressed quite so well as if the selection of words had been made by the utterer of the sounds.

If there is anything that tends to take the zest from a talk it is the fact that the speaker is reading from a manuscript. He naturally feels the effect of reading and is unconsciously or consciously cast into enunciatory difficulties by the mental hazard of misreading. It is not a fact that a person can pick up almost anything and read it well. First must come an understanding of what is being read, with interpretive and clarifying effects such as emphasis and parenthetical effects lend. These can not be subject to guess or chance.

Probably the goal of a radio talk is that it should be inspiring. Reading from script is no incentive to inspiration. The most impassioned orators did not read from script. Patrick Henry, Edmund Burke and even Demosthenes (though he had to speak in Greek) did not read their speeches. Even Daniel Webster spoke without reading the words. The text of their speeches comes to us as their statement of what they said, with careful revision and literary polish, perhaps, supplied in the interim. But the speeches sounded better as delivered, we believe, than if they had been read in the refurbished form intended for printing.

When a speech is read it is a sign rather that the speaker is less prepared than if he delivered his talk without reading it or even without consulting notes. If one were asked to give a radio talk he would at once seize on the accepted method of writing the speech first, practising reading it aloud, and then read it to the microphone. The first impulse is nearly always the easiest way. It would be more difficult to commit the speech to memory, and then utter it without benefit of paper. Therefore, the lazy way is to read the speech, and is it not true, though Millikan and others think so, that because the speech is first written, then revised, then finally delivered, that each word is therefore carefully weighed, and due recognition given to the importance of radio's wide audience. It is rather an affront to the importance of radio that a person should not know or learn his subject so utterly well that he can discourse on it without resort to notes or other writing, whether the words are committed to memory, or merely the thoughts are thus embedded, and the words left to the gushing well.

Written talks may become too studied, too greatly entangled, too boresome. The emotion that should creep into them may be levelled by the calm of the library or the study. The heart is trampled while the rule of rote is trumpeted. More heart and more head find their way into the so-called extemporaneous talk. But there is really nothing extemporaneous about it, for to be able to give an interesting, unhalting and moving talk on a subject the preparation must be far more complete than if one is merly to do some reading aloud. The humdrum effect of read talks may be one reason for so much cotton in people's ears, whereas we have the best medical advice that you should never put anything in your ear smaller than your elbow. But in self-defense one will ignore even the best medical advice.

One need not be a particularly sharp observer to discern when a talk is read and when it is not. Few of the talkers are actors, and it takes a really good actor to disguise the fact he's merely reading aloud. Even the playlets would be far more interesting if the actors had to commit their lines to memory, just as if the presentation were for a stage audience. Is it not an admission that the radio studio is subordinated to the stage in the rating of the radio directors themselves, when they have actors reading the lines? It shows that less preparation is encouraged. You can not encourage an actor to do his worst, because respect for his own talents and reputation prevent that, but you can make it easier for him to do less than his best.

As college entrance examinations are made more difficult to weed out all save those most deserving of a college career, so should the tests for radio talkers be made more severe, the requirements higher, the manuscript sidetracked, except as assurance to the station from the prospective talker that, in substance, his speech will be that. Thus could stations protect themselves from the possibility of unfit topics and bad language crossing the sacred threshold of the microphone, while the man at the monitor could be ready to shut off any offender from benefit of the transmitter, just as is now done with read speeches.

Anything that has to be read—even statistics—should be subject to suspicion. If it is something even one so keenly interested in the subject as the speaker can not easily remember, the audience will not remember it after he has read it. The first test of what the audience can readily remember should be made on the talker himself.

Eager to Get Started

PRELIMINARY response to the suggestion voiced in an editorial in last week's issue, that manufacturers consider the idea of supplying kits for midget receivers, has brought out the fact that the radio set builders with the home-working trend have felt slighted. They, too, are interested in midgets, particularly as sets of that type, that work very well indeed, can be made by persons who will take more pains than can ordinarily be put into a manufactured midget set that is to sell at a price the manufacturer will tell you is fairly ridiculous.

We are still awaiting some word from manufacturers, for the prospective builders have spoken first. However, with a large prospect list, the manufacturers will not long remain in slumber, and it is easy to predict, without much danger of having to take back the words later, that the coming Fall will see manifold activity by home set builders engaged on midget set construction.

All this is no more than we expected, for the home constructor is as eager as ever to engage on his preferred efforts, and only wants dependable circuits that can be built economically of dependable parts, which may include some parts he has, but of course will have to include others he must purchase, for the traditional Gothic cabinet with speaker grille, and small dynamic speaker, with field coil and output transformer for the pentode built in, are not likely members of the unused heap of parts and accessories. They are too new for that.

Meanwhile those who have midget set problems should bear in mind that RADIO WORLD has a Midget Set Editor who is always glad to answer questions, and who should be addressed in care of RADIO WORLD, 145 West Forty-fifth Street, New York, N. Y. Arrange questions in tabulated form and leave room after the questions so that the answers can be written in.

New Corporations

Telephoto and Television Corp., Wilmington, Del., photo-electric cells, Curry vacuum switches—Corporation Trust Co.

Newspaper Radio Programs—Atty. G. Frankenthaler, 120 Broadway, N. Y.

Radio Exchange, artists engagement bureau—Atty. J. Sheffield, 1,472 Broadway, New York, N. Y.

The Great Northern Electric and Television Corp., Denver, Col., patents—Colonial Charter Co.

Television Manufacturing Co. of America, Inc., Wilmington, Del., operate Broadcasting Stations—Corporaton Trust Co.

Freed Televsion and Radio Corp., Wilmington, Del., television, radio—Corporation Trust Co.

International Radio and Electric Corp., Union City, N. J., appliances pertaining to radios, te'ephones—Corporation Trust Co.

South American Radio Corp., Dover, Del., radios, radio supplies—United States Corporation Co.

Consolidated Television and Radio Corp.—Atty. J. E. Walschied, Union City, N. J.

Artkin, Inc., Elizabeth, N. J., radio, television—Atty. Solkin L. Levenson, Atlantic City, N. J.

Metropolitan Philco-Transitone Corp., Newark, N. J., manufacture radios and supplies—Attys. Green & Green, Newark, N. J.

IMPORTANT NOTICE TO CANADIAN SUBSCRIBERS — RADIO WORLD will accept subscriptions at the present rates of $6 a year (52 issues); $3 for six months; $1.50 for three months; (net, without premium). Present Canadian subscribers may renew at these rates beyond expiration dates of their current subscriptions. Orders and remittance should be mailed not later than September 20, 1931. Subscription Dept., Radio World, 145 W. 45th St., New York, N. Y.

Sparkles

By Alice Remsen

CHINOISERIE
(Red Lacquer and Jade. WOR Sundays, 7:15 P. M.

In my rock garden I await thee,
O my love!
The gentle wind stirs the delicate plum blossoms;
They flutter to the ground,
Fit carpet for thy fair feet.
I sit in the benign shadow of Kwan Yin,
Goddess of Mercy She has smiled upon me,
For thou comest,
A kiss on thy lips,
Light as dew in the cup of a lotus.
In your hand a tiny red lacquer fan,
And the sun shining
Upon the jade pins in your hair.

* * *

Television Is Playing A Great Part in the Columbia Broadcasting System's schedule nowadays. Boxing, wrestling, dancing, a miniature musical comedy by Ned Wayburn, a puppet show by Peter Williams, a chess playing demonstration by Edward Lasker, and introduction of the Television Ghost, first of his kind, are some of the features that were projected last week over W2XAB for sight and W2XE for sound. Still with all the ballyhoo about this sight station, please do not forget that the De Forest Experimental Station W2XCD in Passaic, N. J., was quietly sending out very creditable entertainment at least six months before any other television station, in the East, at least.

* * *

Another "Mystery" Singer Has Been Unmasked. During the last few weeks "The Street Singer" has attracted quite a lot of attention over the WABC-Columbia network. Only a few intimates knew his identity. He preferred to make good under a pseudonym. His radio possibilities were discovered by Ed Wolfe, who brought him to Columbia. That he did make good as "The Street Singer" has been proven by fan mail. Thousands of his listeners demanded that he be unmasked, and so we discover that his name is Arthur Tracey, and that he has been in musical comedy, concert and motion picture theatre productions.

* * *

One Of the Best Bets emanating from the NBC Chicago studios, is Ted Weems' Orchestra, with Ilo May Bailey, soprano; Sundays at 10:15 p. m. E. S. T.

* * *

Did You Know that our dear old friends, Weber and Fields, had been added to the B. A. Rolfe Saturday night broadcast over WEAF at 10 p. m.? Even though they will be my own opposition at that time, I must tell you about it, anyhow. You may tune me in for the first fifteen minutes on WOR and then get their program for the rest of the hour. I'm sure you'll enjoy them. They are great old boys; made their first stage appearance together in juvenile sketches at the old Bowery Theatre, in 1878 and continued their partnership in small variety theatres until 1885, when they formed their own comedy company. They have maintained this association, with the exception of an eight year separation from 1904 to 1912, through fifty-three years, which I firmly believe is without precedent in the annals of theatre history.

* * *

Well, Well, Well! The NBC has snared another of Columbia's well-known artists. This time it is Jesse Crawford, one of America's finest organists, who has gone NBC. Seems to me it's tit-for-tat, or is that rumor speaks the truth when she says that NBC will soon gobble up Columbia. But then we hear all sorts of rumors, even that WOR will have a chain of thirty stations this winter. Hope so, for, in all business, competition is still the life of trade.

* * *

Jessica Dragonette is back from her vacation. Her voice is all the better for a rest. Vaughn De Leath filled her place very capably, but Jessica has carved out a little niche for herself in the hearts of her listeners and we are glad to have her back.

* * *

It Was Left To Nellie Revell to flash to a waiting world the news that Mr. and Mrs. Peter Dixon were to receive congratulations upon the birth of a baby boy, born at 11:08 p. m. August 19th., E. D. T. Mr. and Mrs. Dixon are known to the radio audience as Ken and Joan Lee of the nightly "Raising Junior" sketch. They have another child, David, four years old. Here's "congrats" Peter and Aline; and to you too, Nellie, for being so slick as to read the news over the air before you signed off. Nellie also beat everyone to it, when Howard White, of the Landt Trio and White, married recently. It was supposed to be a secret, but "Nellie knew."

* * *

Quite A Few Colored Folk are coming to the fore in radio, among them Miller and Lyles, comedians. They are on WABC, and are newcomers to the air; Eva Taylor, crooner, has been making good on WEAF for quite a while; "Careless Love", negro sketch, on WJZ is excellent; Georgia Jubilee Singers, WIBO, Chicago are excellent; in fact, the latter organization, is one of outstanding discoveries of recent years and we probably shall have the pleasure of quoting Marshall Bartholomew, of Yale University, anent the Georgia Jubilee Singers in one of our future issues.

BIOGRAPHICAL BREVITIES

Alonzo Deen Cole

A. D. (Anno Domini) Cole, writes and acts in "The Witches' Tale" over WOR every Thursday night and has acquired quite a fan following, many of whom demand a composite picture of said A. D. Well, he has a birthday on the same day as George Washington and his ancestors on the maternal side came over on the Mayflower. He is French on the paternal side. His father's people settled in Louisiana when Robespierre was dictator, who had told them they would have to emigrate,—or else. His own name of Cole was derived from said ancestors, their name being de la Coule.

He was an only and adored son for many years and wore long blond curls, velvet suits and lace collars; his mother insisted upon calling him Alonzo, and he suffered from all of these.

His father wanted him to enter law, his grandfather to West Point and his mother medicine. He himself wanted to be a portrait painter, so he went on the stage.

With the exception of a few widely separated years, during which he soldiered in France, essayed a successful flyer in real estate, an unsuccessful one in Wall Street, an exciting one as operator and general manager of a huge excursion steamboat, and a small amount of advertising work which included painting several fairly good posters and a number of pen and ink drawings, he has continued on said stage both as an actor and a writer of vaudeville acts, song lyrics and a trunkful of uncompleted plays.

His hobbies are: buying more books than he can afford or has room for and tinkering with the fortunately still healthy engine of his 1927 Buick.

His habits: smokes too many cigars and stays up all night to accomplish work that should be done in the daytime.

His complexes: picking up paper clips that someone else has dropped, and collecting books of matches—he is very miserly about both and hates to buy either.

His enthusiasms: going places with plenty of time to get there and really good Scotch.

His delusions: that he can play cards, pick prize fight winners and successful aspirants for political office before election.

His ambitions: next to writing the Great American Drama and starring in it, he would like to live on the Emerald Coast of Brittany and possess a yearly commutation ticket to Paris.

* * *

Sundry Suggestions for Week Beginning September 6

Sunday, September 6, Melody Hour, WEAF, 8:00 A. M.

Sunday, September 6, Candlelight Musicale, WJZ, 7:30 P. M.

Sunday, September 6, Stadium Concert, WABC, 9:30 P. M.

Sunday, September 6, Moonbeams, WOR, 11:30 P. M.

Monday, September 7, Old Dutch Girl, WABC, 9:45 A. M.

Tuesday, September 8, Corner Drug Store, WEAF, 7:30 P. M.

Tuesday, September 8, Eddy Brown, violinist, WOR, 9:30 P. M.

Wednesday, September 9, Gladys Rice, WEAF, 8:30 P. M.

Wednesday, September 9, Footlight Echoes, WOR, 9:15 P. M.

Thursday, September 10, Lanny Ross, WEAF, 12 noon.

Thursday, September 10, The Weaver of Dreams, WOR, 10:00 P. M.

Friday, September 11, Singing Sam, WABC, 8:15 P. M.

Saturday, September 12, Street Singer, WABC, 2:00 P. M.

Saturday, September 12, Alice Remsen, WOR, 10:00 P. M.

MESSAGES FOR ARCTIC WILL GO VIA WBZ-WBZA

Pittsburgh.

The Far North broadcasts of KDKA which have brought thousands of messages of cheer from home to explorers and others in the distant icy wastes have met with such success that the service will be enlarged in the Fall when WBZ, Springfield, and WBZA, Boston, inaugurate a mid-week arctic broadcast.

During the eight years that KDKA has been sending these messages they have brought cheer and comfort to the members of the Richard E. Byrd Expedition with base established at Little America, Antarctic, Dr. Herbert Spencer Dickey and his Orinoco Expedition during their scientific investigation and discovery of the source of the Orinoco River, and the Matto Grosso Expedition in South Western Brazil, engaged in making sound motion pictures of animals and natives of that section, and to Captain Bob Bartlett and his Expedition on the Greenland seas, as well as to the Dr. Sutton Expedition in the Far North, and hosts of others from the outposts of civilization.

Begins Next Month

The new series of broadcasts by the New England stations will begin in October. The Far North programs from the New England stations also will be transmitted by the short wave station W1XAZ. The first of the new arctic programs carrying music and information from loved ones back home will be broadcast Wednesday, October 7th. The programs are scheduled to begin at approximately 11:15 o'clock p. m., E. S. T. and will be broadcast on 990 kilocycles, or 303 meters.

With KDKA and short wave station W8XK at Pittsburgh sending out Far North broadcasts each Saturday night the additional Wednesday programs from New England means that the missionaries, members of the Canadian Royal mounted police, trappers employes of the Great Fur Companies, and others in the isolated wastes of the arctic will be receiving programs twice weekly.

Schedule of WBZ-WBZA

A mid-week broadcast such as is to be inaugurated insures more rapid reception of important news by the dwellers of the arctic as they will no longer find it necessary to wait until the week-end in order to hear from home.

Under the new schedule KDKA will include messages to United Presbyterian missionaries in Ethiopia, India, and other countries during the Far North broadcasts on the first Saturday of each month, beginning with the first Saturday in October.

The schedule of explorers broadcasts from KDKA every Saturday night beginning at approximately 11:15 o'clock E. S. T. during the fall and winter months, and 10:15 o'clock E. S. T. or 11:15 o'clock E. D. S. T. during the spring and summer.

The schedule for 1931-1932 of broadcasts to the Far North of WBZ-WBZA is as follows:

October 7, 14, 21, 28.
November 4, 11, 18, 25.
December 2, 9, 16, 23, 30.
January 6, 13, 20, 27.
February 3, 10, 17, 24.

POLYMET APPOINTS DETSCH

The Polymet Manufacturing Corporation of New York City has appointed Arthur S. Detsch district sales manager for Washington and Oregon. His office address is the Security Building, Portland, Ore.

Pointed Opinions

POWEL CROSLEY, JR., president of Crosley Radio Corporation: "It is normal for people to work for what they get," Mr. Crosley remarked. "I believe that when things fall in our laps and business comes without effort, things are abnormal. Therefore, it behooves all of us—those in the radio business in particular—to forget that there was a time when people mobbed radio stores to buy radio apparatus, and, instead, to get out and work for business. He who sits and waits for business to come to him will be just 'out of luck' today. Too many people have not learned this lesson. Too many dealers are still sitting around waiting for business to fall in their laps. Hence we have hard times. So let's recognize our business methods; let's get out after business. He who works hardest will profit most."

OWN CHAUFFEUR FOR NEW QUEEN

The new season's lines of all major manufacturers will be revealed to the public at the Eighth Annual Radio-Electrical World's Fair, at Madison Square Garden, New York City, the week beginning September 21st, coincident with National Radio Week. Receivers containing the latest innovations will be in the elaborate exposition. Combination radio-phonograph and home-talkie units will also be shown by prominent manufacturers.

The complete accessory lines of all major parts and specialty manufacturers will also be included.

This year electrical household appliances will be displayed at the Fair. Complete lines of refrigerators, washing machines, vacuum cleaners, clocks, toasters, percolators, waffle irons and other household appliances will be displayed and demonstrated because they are being distributed through radio channels.

Elaborate scientific displays revealing the latest wonders in the fields of radio and electricity will be featured.

In connection with the Radio-Electrical World's Fair, the show management is sponsoring the third annual search for the most beautiful radio artist in America. A committee will select the winning entrant who will be brought to New York City to reign at the Fair. An elaborate suite will be reserved at the Park Central Hotel for "Miss Radio, 1931" and her chaperone. A car and chaueur will also be at her disposal. Bernardine Hayes, of WBBM, Chicago, the reigning "Miss Radio," has appeared in talking motion pictures and filled numerous personal appearance engagements in Los Angeles. Olive Shea, of WABC, New York, "Miss Radio, 1929," has been featured in several Paramount and Warner Bros. productions and, last season, was seen on the Broadway stage in "Blind Mice."

HERTZBERG LEAVES PILOT

Robert Hertzberg, for two and a half years sales promotion manager and more recently advertising manager of the Pilot Radio & Tube Corporation, of Lawrence, Mass., announces his resignation, effective September 15th. He will return to New York, where he formerly was active in radio publishing circles.

NBC TO REPORT LEAGUE'S WORK

The National Broadcasting Company is sending a representative to Geneva, Switzerland, to make a daily repot by radio, beginning early in September, of the activities of the League of Nations and its various committees.

M. H. Aylesworth, president of the National Broadcasting Company, announced the appointment of William Hard, Washington newspaper correspondent, as radio representative of the company in Geneva. Hard sailed for Europe. His voice will be heard in America direct from Geneva. His daily reviews of the League's activities will be relayed from Switzerland by short waves.

In announcing the broadcasts, Aylesworth pointed out the September meetings of the League and its committees would be the most important, as far as the United States is concerned, in the history of the League.

"Although the United States is not a member, this country is seriously concerned with the discussions of the world's economic situation which will take place at the League meetings," Aylesworth said. "In addition, the League will touch on other matters of vital interest to America."

Three-Stage Tube Used in Compact Amplifier

A compact field amplifier housed in a little black box not much larger than the medicine case doctors used to carry has been developed by National Broadcasting Company engineers. The mite monitoring device will facilitate broadcasts originating in spots inaccessible to heavy motor cars.

The wooden box in which the amplifier is encased is five incehs wide, eight inches deep and sixteen inches long. Its development is the result of years of experiment and refinements. The use of a foreign-built, three-stage tube, which actually is three tubes in one, conserves much space.

In the early days of special events broadcasting the amplifiers used in the field were clumsy affairs, mounted on trucks. Gradually the dimensions have been decreased, but even those used in recent broadcasts have been heavy and difficult to transport.

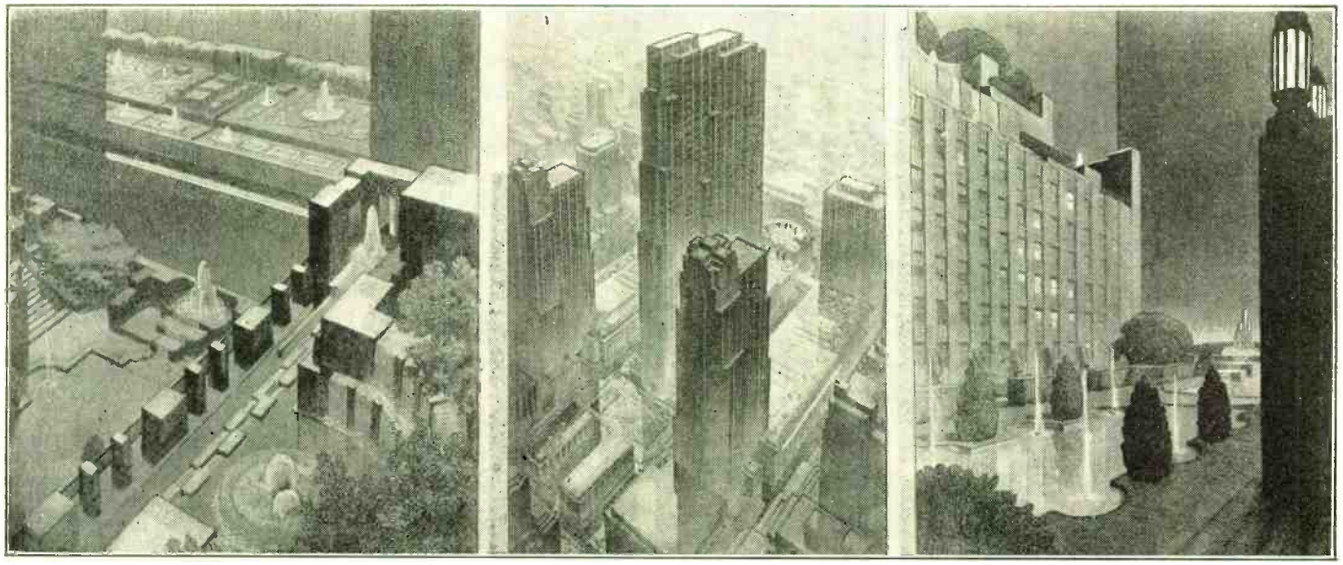
Air is Being Purged of the Prognosticators

The air is being gradually purged of mystics. Even large companies that sponsored astrologists and numerologists are dropping this method of appeal. The motive behind such instrumentalities of sales is to catch the women's money, as it is assumed that the women are more gullible. Where replies were sought from listeners, the majority of the responses was from women.

Even chains carried the hokum programs. Small stations went so far as to permit mystics, fortune tellers, clairvoyants and others of the gifted tribes of money-catchers to answer over the air intimate problems sent in by mail. One "Rajah" in reading letters he was about to answer would state occasionally that there was a dollar bill pinned to the epistle. Thus the idea of how to be sure of getting a reply was gently implanted. Some of his answers, in line with the usual trend of others, stated that a personal visit would be preferable. The personal visit was always the grand opportunity for gold.

Protests against this sort of broadcasting rained in on the Federal Radio Commission. Radio, however, merely fell heir to the results of a craze for the necromancy nonsense.

Radio City in Prospect—An Architect's Panorama



(A) (B) (C)

(A)—Excavation work is now being done on the Radio City site, Forty-eighth to Fifty-first streets, New York City. John D. Rockefeller, Jr., is financing the project through one of his corporations. This view represents the scene as it will appear from the low-level roof extension of the large office building, one of the three tall structures going up.

(B)—The illustration is an architect's sketch of how Radio City will look from the air. The central figure represents the largest office building in the world. Its extension at rear, low altitude, is gardened. Beyond is the International Music Hall. Fifth Avenue is in the foreground. The sunken plaza flanks a fountain that appears as a ring.

(C)—A poet's paradise, yet a poor man's stamping ground! The garden scene from "Faust" never was staged in as glorious a setting as this. Spouts in miniature bayous play on the placid lake in the sunken garden, while greens in symmetrical sequence provide a branching border. The scene is from the low roof extension of the 66-story office building.

Contracts have been awarded to general contractors for the construction of three of the most important units in the colossal Rockefeller mid-town building project, which will transform the three blocks between Fifth and Sixth Avenues, from 48th to 51st Streets, New York City, into the world's greatest office, shop and amusement center under one real estate ownership.

The largest of the three units is a sixty-six story office building with a sixteen story wing. This structure will have a gross area, or floor space of 2,500,000 square feet, nearly 500,000 square feet in excess of the gross area of the very largest office building in the world today. It will occupy more than half of the middle block.

A second unit is the International Music Hall, world's largest theatre, to be located on the west half of the block between 50th and 51st Streets, and flanked on the Sixth Avenue side by a 31-story office building. Similarly situated in the block between 48th and 49th Streets will be a capacious sound motion picture theatre, completing the triumvirate with which the contractors are now concerned.

Seven Other Buildings

Actual construction will start some time in the autumn. The theatres will be completed by October 1st, 1932, and the office building by May 1st, 1933.

Latest plans for the development show seven other building units. They include two office buildings of 45 stories each in the north and south blocks; two 6-story office buildings fronting on Fifth Avenue; a 13-story department store facing Fifth Avenue in the northern block, and an office or club building just east of the International Music Hall, the size of which has not yet been determined. A large area in the south block is being left out of the building picture at present, while negotiations are continuing with the Metropolitan Opera Company for a new opera house.

The plans show a radical innovation in architectural city planning. The lower roofs and setbacks of the building in the three blocks will be turned into a modern and much magnified Hanging Gardens of Babylon. Seven acres of intensive landscaping will be devoted to waterfalls, fountains, reflecting pools, trees, shrubbery, formal flower beds, multi-colored tile walks, grass plots, and statuary. Plans for covering the outer walls of the buildings with a heavy network of living ivy are also a tentative part of the scenic picture.

An acre of ground space, visible from the street, will be devoted to a Sunken Plaza, studded with a central 30-foot fountain, smaller fountains, statuary, grass, flowers and mosaic pavements. In following out this plan, more than $17,500,000 worth of open land area will be devoted to beautification for the public's benefit, without any revenue to the owners of the Development. Between a quarter million and a half million dollars will be spent on the general landscaping.

Imitation of Niagara Falls

Forty feet above the roof of the 16-story wing in the center block, a curved waterfall, a miniature of the famous horseshoe falls of Niagara, will send a tumbling torrent through a series of cascades to end at the roof level in a reflecting pool, from 80 to 100 feet long and 25 or 30 feet wide. The waterfall will have 50 feet of spillway, with approximately a 30-foot radius between the ends of the arch. The water from the spillway will drop about 20 feet into a ribbon pool, thence about 10 feet into another ribbon pool, from which it will spill into the large reflecting pool at the roof level. Fountains will play at each end of the lower pool.

Thirty-foot trees, shrubbery, grass, flowers, and multichromatic walks will furnish a general background for the water effects.

There will be two levels of landscaping above the studios of the National Broadcasting Company, in the lower roof area between the main building and the main cast wall of the 16-story wing. Those areas will be at the thirteenth and eleventh floor levels and connected by stairways. They will have terraces, formal flower gardens, benches and geometric grass plots, with at least two small fountains. The general appearance will be that of a formal garden.

Extensive landscaping will be worked out on the roofs of the International Music Hall and of the sound motion picture theatre. On the north side of the Music Hall and the south side of the sound theatre there will be 30-foot hedges of beech, hemlock or linden, so that as one gazes at the gardens the hedges will form a frame for the picture. The rest of these two roofs will be devoted to formal gardens, with hedges, grass plots, flower beds, fountains and reflecting pools.

$250,000,000 Enterprise

Trees rising to a height of 30 or 35 feet, planted in at least three feet of earth and ingeniously anchored to the roof will be prominent features of the general landscape scheme

Approximately one-quarter of the space in the entire development will be used as offices, studios, and theatres by the Radio Corporation of America, the National Broadcasting Company, Radio - Keith - Orpheum Corporations and their affiliates. The latter company will occupy practically the entire 31-story office building on the Sixth Avenue side of the block between 50th and 51st Streets.

Metropolitan Square Corporation, of which Arthur Woods is president, is the holding company for the $250,000,000 Rockefeller enterprise, largest building project in the world's history. Todd, Robertson, Todd Engineering Corporation and Todd & Brown, Inc., are builders and managers. The architects are Reinhard & Hofmeister; Corbett, Harrison & MacMurray; and Hood & Fouilhoux.

Forum

Why So, If Not?

CAN you answer this question? Why do you publish circuits which you say will work and which you yourself know will not? So far I have only one circuit of yours that would work. I am now working on a superhet converter that appeared in your magazine about ten weeks or so ago. If it works I'll be tickled pink, but for this to happen is just as likely as that the world will end tomorrow, although I invested nearly ten dollars in parts.

May I humbly suggest that you label all practical circuits with a great big black star that readers will be able to see at a glance, thus saving them from wasting a whole lot of time reading fill-in stuff? One of these fake circuits appeared in May 30th issue and also in the latest issue of "Short Wave Craft," entitled "Practical One Tube All Wave Set."

THOMAS A. BLANCHARD,
438 North 9th Street,
Reading, Pa.

* * *

Reality in the Upper Atmosphere

ISN'T it about time that someone came forward with a new theory to account for the numerous facts of observation which do not fit, and cannot be made to fit, into the Heaviside Layer theory of wave reflection? Permit me to present a new theory which not only accounts for the reflection of radio waves but also explains other phenomena.

Instead of a hypothetical layer of ionized gas let us substitute a real layer to account not only for the reflection of radio waves but also for the reflection of light (the "Zodiacal Light" and "Gegenshein") and also the reflection of sound waves such as the roar of artillery. (Popular Science, Sept., 1931, page 45.)

Briefly stated, this real layer of which I speak is composed of meteoric particles revolving around the earth, forming a canopy partly above and partly within the upper layers of the atmosphere, kept overhead by centrifugal force which holds the moon in its place above the earth and keeps the rings of Saturn, also meteoric in structure, from falling upon the planet.

Another similarity to Saturn's rings is that the earth is over-canopied by at least two such layers, one at a fairly constant height of about seventy miles and another layer at about 100 miles, the latter receding to a distance of several hundred miles according to the time of day and time of year. (See Bureau of Standards report on the Heaviside layer, Radio World, May 16th, 1931.)

The present unsatisfactory explanation of this variation is that the sun shining upon this layer of ionized gases depresses it toward the earth in the same manner, say scientists, as comet tails are repulsed by the light of the sun! A more satisfactory explanation of this lowering of the layer when the sun (or moon) is overhead, would be that because of the difference in their respective densities the earth would be more strongly attracted by the sun (or moon) than would the diffuse layer of meteoric articles and therefore would take up a position within the hollow sphere formed by the meteoric layers as near the sun as possible, thus causing the apparent lowering of the canopy with the sun overhead and apparent raising on the opposite side of the earth.

A further illustration of this principle may be shown by a consideration of the behavior of comets as they approach the sun. As they exist, while far from any large attracting body, in the form of a compact mass, they are invisible in the distant sky; but as they approach nearer and nearer to the sun they gradually grow a "tail" that invariably points away from the sun. A little reflection will show that what at first sight appears to be repulsion of the materials which go to make up the tail, the lightest material in the comet, is actually a contest going on between the internal forces which tend to hold the comet together in the shape of a compact ball and the external pull from the sun which by more powerfully attracting the denser parts is actually trying to disrupt the comet and separate it into its constituent parts according to their density, much as cream is separated from milk, not because the earth pushes the cream upward but because it attracts both the cream and the milk and attracts the milk more strongly.

Likewise with our canopy of meteorites; while they are also attracted by the sun the attraction upon their small mass is less, proportionately, than upon the earth as a whole; wherefore the earth moves sun-ward to a gretaer extent than do these rings, or canopies, as a whole. This gives the effect of depression upon the rings when the sun, or moon, are overhead, as observed in the case of the so-called Heaviside layer. The lower canopy, being closer to the earth and therefore more strongly attracted than the upper layer, varies less in distance than the upper as it is more directly under the earth's gravitational pull than is the upper layer.

GEORGE HENRY GABUS.
P. O. Box 353, Galveston, Tex.

* * *

Variety His Motto

IN reply to Thos. Windsor's letter in the Aug. 1st issue, permit me to air my views.

It seems to me that there is no other radio magazine which so completely covers the wants of the average radio-minded layman, the amateur and the professional service man as does RADIO WORLD.

In this publication one can start out with the latest hook-ups and constructional details on short wave, television and broadcast receivers, and end with a rather complete discussion of the various phases, problems and doings of the radio trade in every part of the globe. (With never a dull page in between).

Any amateur who reads (and digests) every successive copy of RADIO WORLD for a period of six months can have a more complete knowledge of how to construct, operate and repair the various types of radios, than the average technician of today.

More power to you!

I, for one, sincerely hope that you never let your magazine turn into a dry non-technical publication that deals only with the latest radio stars, the doings of the radio commission, etc. We want variety!

C. S. BOONE.
3359 El Cajou, San Diego, Calif.

"More Orders From Radio World Ad Than We Can Fill"

Philadelphia, Pa.

Advertising Manager
Radio World,

Kindly discontinue our ad. Have received more orders from Radio World ad than we can fill for some time to come.

Kindly send credit on difference. Thanks.

Whenever we have any advertising on radio parts, we surely will use Radio World.

Very truly yours,
PHILADELPHIA ARMATURE WORKS.
Per A. Apfelbaum.

2711 Girard Avenue,
Philadelphia.

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.

Isa William Jacobs, Infanta Luisa No. 2, San Juan, Porto Rico.
Schober's Radio Service, 17 S. Van Brunt St., Englewood, N. J.
J. B. Huslage, c/o Jacobs Mazur Co., 226 E. Houston St., San Antonio, Tex.
John Crentz, c/o Mr. Steuer, Loon Lake House, Loon Lake, N. Y.
Mr. Harold Scott, Utility Shop, P. O. Box 482, Marmarth, No. Dak.
D. F. Chappell, c/o Sears Roebuck & Co., Winston-Salem, N. C.
W. E. Gibson, 21 Wallace St., Greenville, S. C.
H. C. Barry, 175 Broadway, Newport, R. I.
O. G. Messenger, 909 Leader Bldg., Cleveland, Ohio.
Robert S. Lange, R. F. D. No. 1, Fredonia, Pa.
Garry Joustra, 433-20th Ave., Paterson, N. J.
Chas. L. Land, Farner, Tenn.
Robert Knight, Chief Eng., 55 Dannedaike, Gulf Shipping Co., Whitney Bank Bldg., New Orleans, La.
Wynan Yarborough, 206 North Michigan, Roswell, New Mex. (Radio, Television, Sound).
Edward Johnson, 99 White Horse Ave., Trenton, N. J.
Hyman Koltman, 514 Williams Ave., Brooklyn, N. Y.
K. W. Cooper, Youngstown, Ohio.
Claude G. Edge, 101 New Haven Ave., Melbourne, Fla.
Harry Kerlin (Radio, Television, Sound), 3525 17th Ave., No. Birmingham, Ala.
G. Brooks, Jr., 4272 Sunnyside Ave., Riverside, Calif.
Lester Lappin, 451 Blue Hill Ave., Roxbury, Mass.
Truman Kirby, 203 Middle Ave., Jackson, Tenn.
John Rau, 1460 West 54th St., Cleveland, O.
William F. Shapleigh, 220 Washington Highway, Snyder, N. Y.
E. R. Jackson, Best Theatre, Pulaski, Tenn.
Isidoro Delgardo, Jr., Service Man c/o A. Ramos Medina, P. O. Box 3657, J. Pablo Duarte St. 14, Esq. Carretera Nueva, Santurce, P. R.
Charles Horne, Box 266, Dover, N. H.
Adrian Meat, Room 24, 12-5th Ave., New York, N. Y.
Edward W. Chamberlain, P. O. Box 42, St. Albans, Vt.
W. J. Rush, 1105 Adelaide St., Normal, Ill.
R. N. Kinnaird, Jr., 1401 Olive St., Jackson, Miss.
High Quality Radio Service, J. C. Biaggi, Guanica, Playa, 26, Puerto Rico.
G. R. Lowe, 54 Union St., Halifax, N. S.
Bert Clark, 1221 N. Church, Decatur, Ill.
R. J. Gatling, 251 Fairview Ave., Bogota, N. J.
Francisco Lopez, Radio Technician. Bureau of Post Radio, Pasay, Rizal, Philippines.
Calvin R. West, Battery operated receivers and short wave supplies, Route 3, Vinita, Okla.
Lawrence W. Baldwin, Apt. 722, Drake Hotel, Kansas City, Mo.
John Bansano, Box 267, Mohawk, Mich.
Raoul Weisman, 5302 Gratoit Ave., Port Huron, Mich.
John Hull, Waupun, Wis.
Robert Foster, 3708 Hawthorne Ave., Omaha, Nebr.
Paul Stalcup, Gen. Del., Mitchell, Ind.
E. P. McKenney, Federal Reserve Bank, Birmingham, Ala.
Leemon Nitchum, P. O. Box 331, Humboldt, Tenn.
Harry Maasbach, 22 Central Ave., Brooklyn, N. Y.

Beat Note Oscillator

Wireless Egert Engineering Company, Inc., 179 Varick Street, New York City, has a beat note or heterodyne oscillator for service and laboratory use. This instrument can be used in many ways by the serviceman such as testing speakers, amplifiers, microphones and for audio and acoustical apparatus in general.

The audio frequency generated from the oscillator is continuously variable from 60 to 15,000 cycles. Four tubes are used; two as radio frequency oscillators, one as detector and one as amplifier. All four tubes are of the four volt type.

RADIO WORLD Show Number will be dated September 19th and will be issued prior to the public show to be held in New York. Complete advance news of the show will be published. If you can't attend the show be doubly sure to get a copy of this issue. Otherwise singly sure.

RADIO ADVERTISERS!

Let Us Help You to Cash In On the

1931 New York Radio Show

The September 19 issue of Radio World, the first and only National radio weekly, will be a 1931 New York Radio Show Special. Last advertising form closes Tuesday, September 8, and the paper will be in the hands of subscribers and on the news-stands by September 16.

Radio World is going to do all it can to interest its thousands of readers in a Radio Show that will be held in a city of nearly 7,000,000 people, and where the possibilities for enormous attendance are obvious. Then there is the army of people throughout the country who are interested in radio and who will come to New York for the 1931 Show. Further, this special issue of Radio World will also reach many thousands who will not be able to come to New York but will be interested in what the exhibitors are offering in the new season.

Let us help you to tell the great American radio public about the merits of your goods through the medium of the advertising pages of this special number. Regular rates in force. Radio World at $150 a page or $5 an inch is big advertising value.

Please let us know at an early date if you are interested in cover or other special position.

Very truly yours,

RADIO WORLD.

Deepest Cut Prices

Flexible insulated coupler for uniting coil or condenser shafts of ¼ inch diameter. Provides option of insulated circuits on both sides. Order Cat. FL-C @ $0.20

Antenna coil for .0005 mfd. Order Cat. ANT-5 @ ..... .45

Three-circuit tuner for .0005 mfd. Order Cat. 3-CT-5 @ ..... .75

Antenna coil for .00035 mfd. Order Cat. ANT-3 @ ..... .47

Three-circuit tuner for .00035 mfd. Order Cat. 3-CT-3 @ ..... .79

Screen grid RF transformer, for .0005 mfd., to couple screen gride tube to next tube. Order Cat. SG-5 @ ..... .45

Screen grid RF transformer, for .00035 mfd., to couple screen grid tube to next tube. Order Cat. SG-3 @ ..... .47

AC electric motor and turntable, for playing phonograph records. A synchronous motor, 60 cycles; 80 turntable revolutions per minute. Order Cat. SYN-M @ 4.45

A battery switch (Benjamin). Order Cat. A-SW @ ..... .25

A eliminator or dynamic speaker transformer (Jefferson), 20-volt secondary. Will pass 2¼ amps. Order Cat. 20-V-T @ ..... .49

30-henry shielded choke for B supply filtration or filtered speaker output. Will stand 100 ma. Order Cat. OS-30HS @ 1.65

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NATIONAL DRUM DIAL

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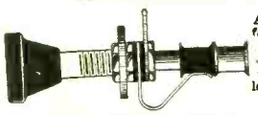

A push-pull switch for battery-operated sts. Made by Benjamin. Firm, sure ontact, extremely long life. Price, 25c.

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145 W. 45th St. New York City

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25,000 OHM POTENTIOMETER, wire wound, in shield case; takes ¼" shaft. Will stand 20 ma. easily. Excellent as a volume control. Price, 90c. Direct Radio Co., 143 West 45th Street, New York, N. Y.

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THE FORD MODEL—"A" Car and Model "AA" Truck—Construction, Operation and Repair. By the Ford Car authority, Victor W. Page. 703 pages, 318 illustrations. Price $2.50. Radio World, 145 W. 45th St., New York.

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WANTED—Addresses of Manufacturers of Radio sets to be sold through mail orders. G. E. Ralstin, 1049 Hosbrook St., Indianapolis, Indiana.

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BALKITE A-5 RECEIVER, eight-tube, three stages of Neutrodyne RF and two stages audio with push-pull output. Good distance-getter and very sensitive. Has post for external B voltage for short-wave converters. Brand new in factory case. Berkey-Gay walnut table model cabinet. Price $35 (less tubes). Direct Radio Co., 143 West 45th St., New York.

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MACHINIST-SERVICEMAN, age 30, wishes to connect with factory or laboratory in New York City or vicinity. 4 years as custom set builder and serviceman. Supreme analyser. Graduate R.C.A. Inst. 8 years machinist and toolmaking experience, complete set of tools. Edwin Jahrl, 2130-59th St., Brooklyn, N. Y.

OPERATOR—Commercial Operators' License. Age 26. Two years Broadcast operating. Both codes. Graduate Dodge Radio Institute and National Radio Institute; also member of Institute of Radio Engineers. Desires position, anything considered. H. D. Rissler, Hughesville, Missouri.

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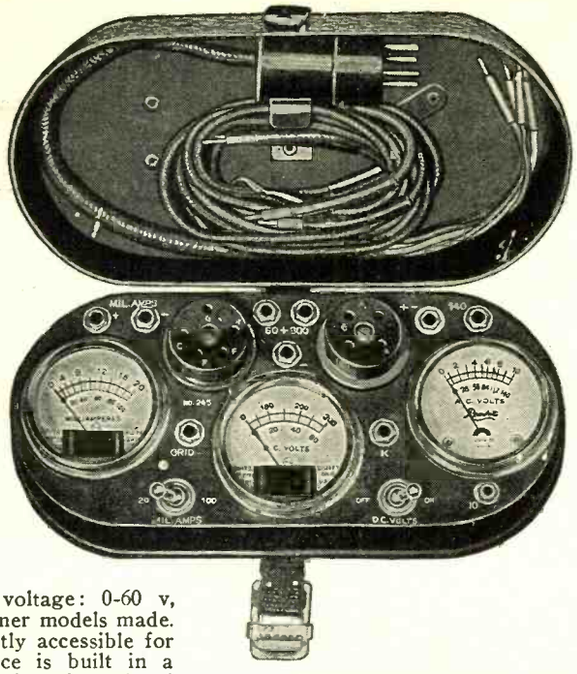
Send $8.26! Get This Tester!

HERE is your opportunity to get immediate delivery of the Jiffy Tester at $8.26 remittance with order, balance of $3.50 payable in one year. Your credit is good with us. This Tester will read plate current, plate voltage and filament voltage simultaneously, when plug is put into any set socket and tube in the Tester.



Jiffy Tester, Model JT-N, consists of three double-reading meters, with cable plug, 4-prong adapter test cords and screen grid cable. The ranges are filament, heater or other AC or DC 0-10 v, 0-140 v; plate current: 0-20, 0-100 ma; plate voltage: 0-60 v, 0-300 v. It makes all tests former models made. Each meter is also independently accessible for each range. The entire device is built in a chromium-plated case with chromium-plated slip-cover. Instruction sheet will be found inside. Order Cat. JT-N @ $11.76; $8.26 down.

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115 Circuit Diagrams of Commercial Receivers and Power Supplies supplementing the diagrams in John F. Rider's "Trouble Shooter's Manual." These schematic diagrams of factory-made receivers, giving the manufacturer's name and model number on each diagram, include the MOST IMPORTANT SCREEN GRID RECEIVERS.

The 115 diagrams, each in black and white, on sheets 8½ x 11 inches, punched with three standard holes for loose-leaf binding, constitute a supplement that must be obtained by all possessors of "Trouble Shooter's Manual" to make the manual complete. We guarantee no duplication of the diagrams that appear in the "Manual." Circuits include Bosch 54 D. C. screen grid; Baikite Model F, Crosley 20, 21, 22 screen grid; Eveready series 50 screen grid; Erla 224 A. C. screen grid; Peerless Electrostatic series; Philco 76 screen grid.

Subscribe for Radio World for 3 months at the regular subscription rate of $1.50, and have these diagrams delivered to you FREE!

Present subscribers may take advantage of this offer. Please put a cross here ☐ to expedite extending your expiration date.

Radio World, 145 West 45th St., N. Y. C.

BRACH RELAY—List price $4.50; our price 99c. Guaranty Radio Goods Co., 143 W. 45th St., N. Y. C.

Tubes at 30¢ Each

Four for $1.00

280	200A
226	245
171	

Sold on basis of remittance with order. We will pay the postage.

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SYNCHRONOUS MOTOR, $4.25

For use on 60-cycle AC line. 12-inch turntable included. 80 revolutions per minute. The speed is self-regulated. This compact synchronous motor may be used with a phonograph pickup to play records. Cat. SYN-M @ $4.25.

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The Polo AW-5 All-Wave A.C. Midget Receiver affords a wave coverage from 15 to 550 meters, with the broadcast band being tuned in completely without switching. Band selection for broadcast or short waves is made by simply turning a single front panel knob. Also has volume and sensitivity controls. For 110 Volt, 10-50 cycles. Wired model in Gothic Cabinet Complete with tubes ..... **$55.00** complete

The following parts used in the A.W.5 are the best:

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One equalizer condenser	.25
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Cabinet	6.00
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Two 8 Mfd. Cond. (each)	1.15
Four resistors (each)	.25
Front and sub panel with five sockets	4.50
Nat. Dial	2.50
A.C. Cable and plug	.25
Toggle Switch	.25
Binding posts, wire, brackets, screws and nuts	.50
¼ MLH Choke	.50
Kits partly assembled (less tubes)	25.00
Wired model (less tubes)	30.00
(Cabinets $5.00 extra)	

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