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RADIO WORLD

REG. U.S. PAT. OFF.

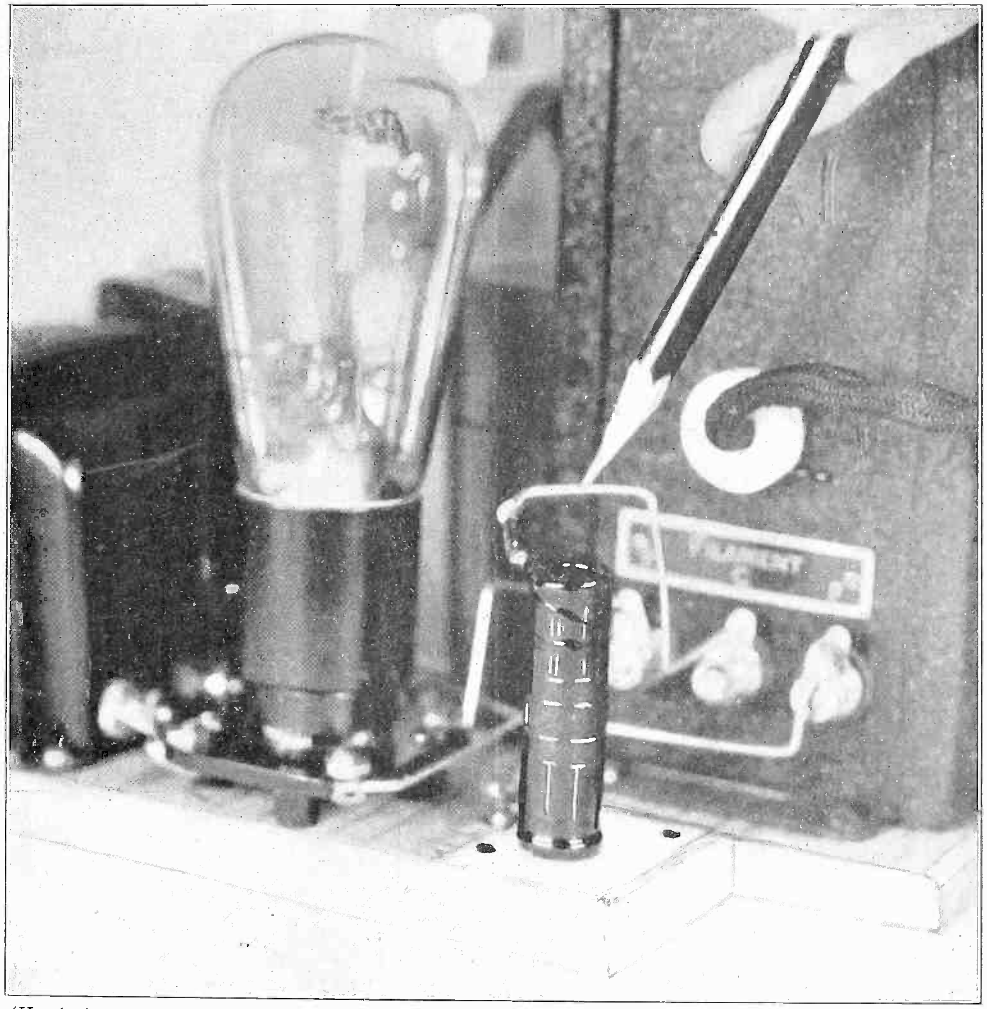
INTIMATE REVELATIONS ON SERIES FILAMENTS

The Motorboat Madness And How It Was Cured

MAKING SUPERS EFFICIENT

The New AC Tubes of R.C.A.

"CHIMNEY" COOLS RESISTOR



(Hayden)

A FIXED RESISTOR, of the hollow tubular type, carrying heavy current in an eliminator, will heat up much less if mounted upright on a small asbestos square, thus utilizing the hollow as a chimney.

HOW LINDBERGH USED INDUCTOR COMPASS

SIXTH YEAR

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Tricks in Series Filaments

How Voltages and Currents Differ in Tube Chain

By J. E. Anderson

Contributing Editor; Consulting Engineer

[In view of the recent development of the Raytheon 350-milliampere rectifying tube, the Q.R.S. 400-milliampere tube and the R.C.A.'s new rectifiers, UX-280 and UX-281, a discussion of series-connected filaments is vastly important at this time. The usual practice will be to heat all the filaments, except the filament of the power tube in the last audio stage, from the rectified supply, by series-connection of filaments. The last tube may be heated by AC from a special winding on the power transformer.—EDITOR.]

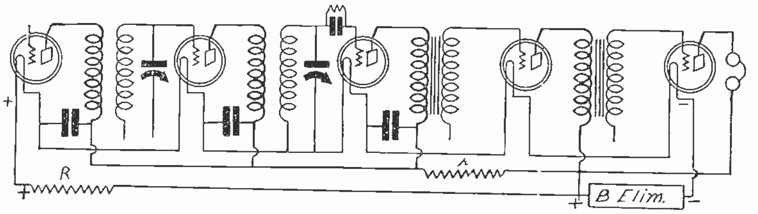

FIG. 1

Circuit diagram of a typical five-tube receiver in which the filaments are connected in series and heated by rectified current from a heavy-duty B battery eliminator. The resistor r is used to adapt the output voltage of the filter to the first three tubes. The resistor R is used to limit the filament current.

IN many circuits the filaments of some or all the tubes are connected in series. This is done where a high DC voltage is available and when it is desirable to keep the heating current down to a minimum for purpose of ripple elimination. For example, suppose a high voltage source is available and it is desired to wire up a set of five of the —01A type. These draw a current of .25 ampere and each requires a terminal voltage of 5 volts. When the five tubes are connected in series the total filament voltage requirements will be 25 volts while the total current will be only .25 ampere. If the B battery eliminator is capable of delivering a quarter ampere and more, part of the output of the eliminator can be used to heat the filaments, provided that 25 volts of the output voltage is put across the filament circuit.

But the series connection of the filaments introduces a complication due to the flow of plate current, which upsets the equality of the effective heating currents in the various tubes. Only one tube in the series receives the normal amount of current. All the others receive different amounts, which may be greater or less than normal depending on the position of a tube in the series and on the adjustment of the circuit.

The Series Circuit

In Fig. 1 is shown a typical circuit in which the filaments are connected in series and which is served by a single eliminator for both filament and plate power. It contains five tubes, each of which normally takes a .25 ampere filament current. The voltage drop across all the filaments is 25 volts. The negative terminal of the B eliminator has been connected to the negative end of the filament of the last tube in the series, that is, to the output tube, placing this tube at the lowest potential and making its filament the common plate return of all the other tubes. It is obvious, therefore, that not only does the normal filament current flow through this tube but also the sum of all the plate currents. This might cause overheating of the filament of that tube, particularly the negative end of it, through which all the plate current of the last tube also flows.

Let us see how much the increase in the heating current is. Suppose that the first two plate circuits pass 5 milliamperes each, the detector plate circuit one milliampere, and the two audio frequency plate circuits 9 milliamperes each. The accumulated plate current in the negative end of the filament of the last tube is then 29 milliamperes, which makes the total filament current in that tube more than 10% greater than the normal value, or 279 milliamperes. But this is rather an extreme case met only in transformer coupled circuits in which the grid bias is inadequate and the plate voltage too high. Strictly, the plate current in the last tube should not have been added to the effective filament current, since that is there under normal conditions. With this subtracted there remains a current of 20 milliamperes, which is still 8% greater than normal.

Let us now go to the first audio frequency tube. Four tubes precede it in the series and the total accumulated plate current before it is 11 milliamperes, so that the effective value of heating current is 261 milliamperes. This is about 4.4% over normal. In the detector tube the situation is not much better. Two tubes precede it and the accumulated plate current is 10 milliamperes, so that the effective heating current is 260 milliamperes. This is much more than should be applied to the detector filament, since this tube usually works better when the filament current is somewhat under normal value for amplification.

In the second radio frequency amplifier the effective heating current is 255 milliamperes and in the first it is the normal value of 250 milliamperes.

In a resistance coupled amplifier the plate currents in the audio tubes are very small, sometimes less than .5 milliampere in each tube. The sum of these plate currents would then not cause a great change in the effective heating current in the last tube in the series, even when more than five tubes are used in the receiver. The plate current in the radio frequency tubes can also be reduced by reducing the effective plate voltage and employing suitable bias until its contribution to the accumulated plate current is negligible, yet not decreasing the amplification noticeably.

As will be seen from the diagram the radio frequency tubes and the detector are placed ahead of the audio frequency tubes. In fact the filaments are connected in the order in which the tubes receive the signal. This makes the heating current in last tube greatest. A little overheating here does no harm but it may produce a great improvement in the quality. The first tube gets the least heating current and here a high current is neither necessary nor desirable. A subnormal value of the heating current will not introduce distortion but it may prevent oscillation.

The master rheostat R can be adjusted very easily so that the heating current in any one tube is normal. Thus the filament current in the last tube can be made normal, when that in the first tube will be subnormal; or the filament current in the first tube can be made normal, when the current in the last tube will be greater than normal.

Effect in Different Circuits

Of greater importance than the variation in the filament current is the fact that resistance of the various filaments is a common resistance in the plate return circuit. This might readily cause oscillation in some circuits. It is almost certain to cause oscillation in the radio frequency end of the circuit unless by-pass condensers are used. One should be connected between the negative end of each filament and the low potential end of the primary of the following coupling transformer. The size of each of these condensers should not be less than .001 mfd. and very much larger condensers would work better.

What applies in this respect to the radio frequency circuit also applies to the audio circuit, and here very much larger condensers will have to be used, in case the circuit oscillates at an audio frequency.

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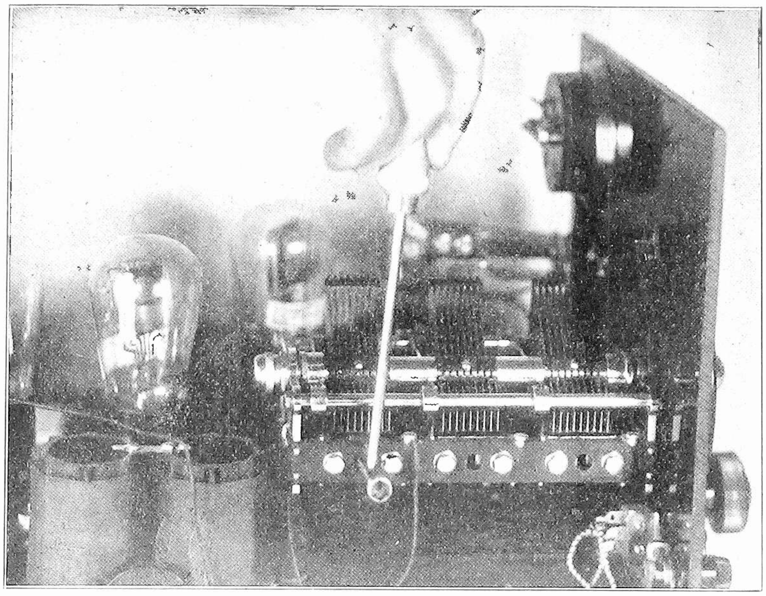
BALANCE MULTI-CONDENSERS



(Hayden)

MANY COMMERCIAL types of multiple condensers are provided with screws which allow the adjustment of the individual sections of the condenser, so that the circuits involved may be balanced up, or have additional balancing condensers. It is important to balance the respective condensers properly, so that results will be obtained in tuning.

Pictures to Be Radioed From Berlin to Vienna

The transmission of pictures by radio has been so far advanced in Germany that it is proposed to establish a regular service between Berlin and Vienna, the Department of Commerce is advised in a report from the Trade Commissioner at Paris, George R. Canty. The full text of the report follows:

"So much progress is reported to have been made in Germany in experiments with the Telefunken-Karolus-Siemens system of transmitting pictures by wireless that the German authorities hope to open a regular public wireless picture service between Berlin and Vienna in the Summer of this year.

"The directors of the German Radio Company, Count Arco and Dr. Schroster, heads of the company's research department, together with Professor Karolus, inventor of the Karolus Cell, have departed for Vienna to make final preparations for the contemplated service.

"Using short commercial wavelengths of about 50 meters, the German Radio Company already has sent about 100 pictures by wireless to Rio de Janeiro, Rome and other cities. The transmission of these pictures is said to have been accomplished with remarkable clearness. Recent intensive efforts of the company, however, have been devoted to transmitting simultaneously pictures from Berlin to Vienna and vice versa. Experiments have now reached a stage, it is reported, where it is believed that the commencement of a public service is only a matter of a short time. At the present time, satisfactory transmissions between the two capital cities can be made in 20 seconds, according to reports.

"The authorities in charge of the projected service are also said to be planning to dispatch telegrams with pictures by means of the wireless apparatus, which is called Karlograph, after the name of the inventor."

All Germany is interested.

Series Filaments Used For Negative Grid Bias

(*Concluded from preceding page*)

The filter condensers ordinarily found in eliminators may not be enough to stop the oscillation, particularly since they are not placed correctly to take care of this type of circuit.

In a transformer coupled amplifier using two good transformers there is a high probability that the circuit will oscillate at a low frequency due to the common resistance of the filaments and the B eliminator. However, if such is the case reversal of one pair of transformer leads should change the frequency of oscillation to a high one, and this oscillation can easily be removed by connecting a condenser of about 1 mfd. across the common impedance.

In a resistance coupled amplifier of three plate circuits, including that of the detector, low frequency oscillation is almost certain to occur. It may be practical to remove it with condensers. It is simple and surer to add another stage of resistance coupled amplification. This will change the frequency of oscillation from a low one to a high one. If there is a large condenser across the output terminals of the eliminator, the high frequency oscillation should never appear.

Different Plate Voltages

It will be observed that the applied plate voltage is not the same for all the tubes when the filaments are connected in series, even when the plate returns are connected to the same point. Thus in Fig. 1 the last tube receives the full voltage of the eliminator, but the next tube forward receives 5 volts less, which is the voltage drop in the filament of the last tube. The detector receives ten volts less, or the amount of the drop in the two succeeding filaments. The two radio frequency tubes receive 15 and 20 volts less than the output voltage of the filter. These voltages for the first three tubes hold when the resistance r is zero. When this has a high value the drop in it should be subtracted from each case from the output of the filter. Suppose the drop in r is 50 volts and the eliminator output voltage is 180 volts. The effective voltage on the plate of the first tube would be 180 less 20 less 50, or 110 volts. The second tube would have 115 and the third tube 120 volts. The first audio frequency tube would have 175 volts and the last the full 180 volts. These differences should be taken into account when selecting the value of the resistance r and the grid bias values of the different tubes.

Since the detector tube can be operated effectively on a lower filament voltage as well as a lower plate voltage than any of the other tubes, it would be desirable to place the detector filament at the extreme left end of the series, that is, farthest away from the negative terminal of the eliminator.

Since the eliminator supplies both the filament and the plate power, it is clear that there is no choice as to the method of returning the plate leads with respect to the polarity of the filaments. The only thing that can be done is to change the order of the filaments. The filament of the tube placed nearest the negative end of the eliminator will always carry the plate currents of the preceding tubes.

Bias from the Filaments

It is also obvious that grid bias voltages can be obtained for the different tubes by suitably connecting the grid return leads to the filament series. Thus the detector grid return no matter where this tube is placed can be connected as shown to get the proper positive bias, or it can be connected to the opposite end of its own filament to get a zero bias. The grid bias of the first tube can be made anything from plus 5 volts to minus 20 volts. The next tube can be given anything down to minus 15 volts. The first audio tube can be given a bias of 5 volts by connecting the grid return to the negative terminal of the eliminator. The last tube alone cannot be given a bias less than zero. Hence for this tube a grid bias battery or biasing resistor should be employed. It is particularly important to give this tube an adequate bias, since its plate voltage is greatest and the signal amplitude in it will be greatest.

A grid bias can be obtained for this tube by placing a suitable portion of resistance R in the negative leg of the filament of the last tube and then connecting the grid return lead of that tube to the negative terminal of the eliminator. But this bias can only be gained by sacrificing some of the plate voltage for that tube. That is no disadvantage if the eliminator is so designed as to take care of this situation. That is, there is no disadvantage so far as plate voltages are concerned but there is in increasing the common impedance. This increase in the common impedance, which is common to both the plate and the filament circuits, may either cause a decrease of the total effective amplification or an increase.

The Motorboat Madness

And Some Sedatives for Anguished Victims

By Herman Bernard

Associate, Institute of Radio Engineers

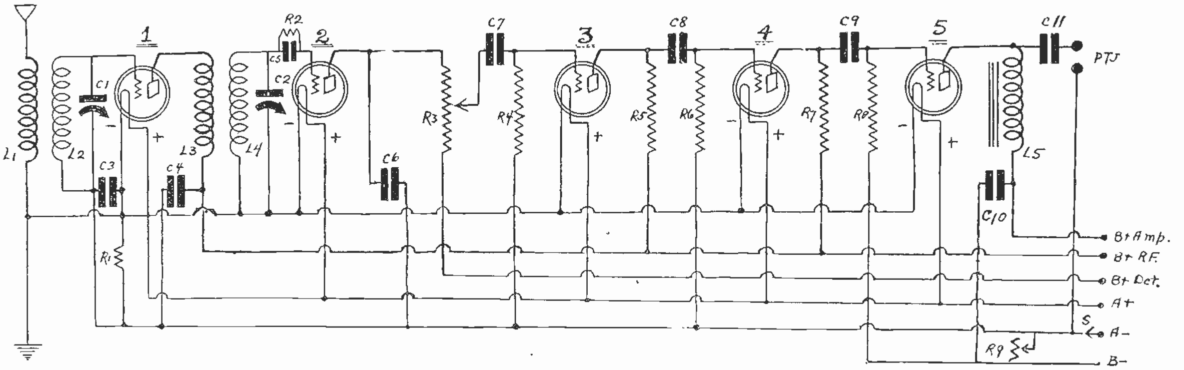


FIG. 1

This circuit did not motorboat, when special constants were used to prevent motorboating. Otherwise put-put was about all that Pete Tinkernight could get out of it, using almost any type of B eliminator, even one with only 250-ohm resistance choke coils in the filter. The motorboating was cured in a few minutes, as explained in the text. Note the excellent method of volume control. It is a 100,000-ohm potentiometer, which keeps the effective detector plate voltage constant, but utilizes as much or little of the drop in this resistor as is required. As an —00A special detector tube is used, which is in the high mu class as a detector, 100,000 ohms will be found to give greater maximum volume than higher resistance for R3, which goes to plate of tube 2.

YOU remember Pete Tinkernight, complacent and dependable citizen, radio enthusiast extraordinary, home-loving, peace-abiding and, above all, sane. Well, something has happened to Peter. His wife complains that he can't eat or sleep and won't work. He flies into a rage at the slightest provocation, in fact, his wife says at no provocation whatsoever, and she is beginning to wonder fearfully about his sanity. He tears at his hair—what little he has left—and gnashes his teeth like the frustrated villain in the old-style melodrama. His distraught wife is sure it isn't women. Pete doesn't drink. He smokes a great deal, that's true, but he doesn't inhale.

The only trouble with Pete, in point of scientific fact, is that his set motorboats! Enough to drive any man out of his senses! Low-frequency oscillation, high-pitched oscillations, squeals, more squeals, plopping sounds, plucking noises, throbbing reverberations. The set simulates rain falling gently on the roof, torrents descending fearsomely on thousands of roofs, hailstorms against barndoors and snowstorms in the Caribbean!

Has a Tough Time of It

And amid this torrent the anguished soul of the painstaking Peter roams woefully, like a disembodied spirit seeking a final place of rest and comfort, but surcease has not been for him. No, alas, his set simply motorboats all the more the greater his frantic zeal to cure the ill. So let us see whether we can be of charitable assistance to the anguished experimenter.

In the first place, what is motorboating?

Ask Pete. He knows. It is essentially a steady frequency pop-pop-pop emanating from a radio receiver, either causing the program to halt for a fraction of a second periodically, or, in cases of less severity, scrambling the program rendition with small undulations of low pitch. Mostly the sound is like the put-put of a motorboat engine, hence the name.

The other type of motorboating is of a higher frequency than the put-put-put and is more like the steady note one gets from overbiased grids, rather in the peanut whistle class. Large by-pass condensers help get rid of this type, and Pete hasn't complained about it lately, so let's not worry.

In between there are various sorts of sounds—let us say of intermediate frequencies—all of which are foreign and should not be admitted under the quota of motorboat immigration, for in late months certainly this quota must have been far exceeded.

Admits He Is Licked

Pete's set comprises a stage of transformer-tuned radio frequency amplification, a transformer-tuned input to the detector, and then three conventional resistance coupled audio stages. That's probably the chief trouble with it—the conventionality of the thing.

Pete also tried the new high mu tubes in the set, but remained otherwise conventional, and was so disgusted with the results, which were doubly accentuated and 100-proof motorboating, that he decided tube manufacturers and radio authors were all wrong, and so was the world at large.

Pete is not a scientist, but rather an experimenter. He has put together perhaps fifty radio sets, by ear and eye, one might say, and all of them worked. Neat indeed is his craftsmanship, and when he solders a joint it stays put. He follows the best advice he can obtain, adds some of his own experience in his construction work where advice is not given in detail or at all, and fares well, but when it comes to curing motorboating, he admits that he is licked. And there are some thousands of others in the same motorboat.

No use to tell the sufferers that the chief cause of motorboating is the common impedance of the receiver and its power supply, particularly in the plate circuits and somewhat incidentally in the grid circuits. No use to tell them that a cure for motorboating would be an external impedance reducer, for there is no such device, as yet, and only one theoretical and very expensive way of making any. They are willing to take just a little of the theoretical medicine, if only they can get good portions of practical advice, constants, above all else.

What It Is

So let us tell Pete and his tribe merely that, in nearly all instances, motorboating is a low-frequency oscillation due to the coupling through the common impedance, and that low-frequency oscillation is not the cause of motorboating, but in itself constitutes the motorboating.

Let us look at Pete's installation. Nothing like a thorough examination of the patient so that a sensible diagnosis can be made. His receiver has C batteries totally eliminated. The voltage drop in a filament resistor is used for the one-volt bias on the radio frequency tube (1) and on the first and second audio tubes (3) and (4). The detector tube is a special detector—in the high mu class, therefore—and takes a zero grid bias, that is, has grid return made to minus filament (not minus A, which is a battery lead). The final tube is a 112, and the negative grid bias is obtained through the drop in a variable resistor connected from B minus to A minus. The diagram of Pete's set is shown in Fig. 1. Note the volume control, a 100,000-ohm Carter potentiometer in the detector plate lead.

Some Good Features

Now, there are some excellent anti-motorboating features about his receiver, some perhaps not properly utilized.

First, steady filament heating is provided. The volume control is not a rheostat in the RF tube filament circuit. That is a good start, if one is seeking to avoid motorboating in direct-coupled audio circuits. The rheostat would be varied from time to time and would naturally increase the bias on the RF tube the less

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the tubes were heated. The utilized resistance of the rheostat would be increased, the voltage drop in the rheostat would be increased, and the increased negative grid bias would increase the grid impedance, decrease the filament emission, and correspondingly increase the plate impedance. As impedance is the resistance a circuit offers to alternating current, we merely imperil our foundations when, at the very beginning, we introduce any method of constantly varying the impedance.

So he uses a fixed resistor, of two-thirds of an ohm resistance, to drop the six-volt A battery source to five volts for the filaments of all five tubes. This resistor he contrived, but it may be a 2-ohm-rheostat, properly set and left thus. The tubes draw 1.5 amperes, hence two-thirds of an ohm (1 divided by 1.5), is exactly right.

Bypass Condensers

This resistor he bypassed with a 1 mfd. condenser, C3, and to make sure that as much stray RF as possible was kept out of the A and B sources, he put another 1 mfd. condenser, C4, from B plus RF to negative A, right near the coil L3, even though a 1 mfd. condenser was placed across the B supply elsewhere (C10). Again, we find the potentiometer is bypassed as to most RF by a .001 mfd. mica condenser, C6. So, up to this point, the audio input, we have found perplexed Pete to be quite scientific, whether he knew it or not. Still, we are not going to satisfy him at all if we tell him everything's all right, for he knows it isn't and, from what his wife confided to us, we are inclined to agree with him. But let us turn on the set and hear for ourselves.

For a fraction of a second after the A battery switch is turned on we do not hear anything. Then comes the familiar rushing sound. The plate current is there, all right. No music yet, for the dials are not turned so that they will bring in a station. As yet we do not desire any reception. Let us listen to the rushing sound. It sounds like gas escaping from a small pipe nozzle, and being turned off entirely every quarter of a second. Surely motorboating, if ever we met it before, and of a frequency relatively high in the more common regions of motorboating. We have been used to a motorboating frequency of one, or of a fractional cycle, very slow indeed, but this is faster. We remove the detector tube. What a difference! For better? No, indeed! Worse, much worse. Greater frequency, greater intensity. Plop, plop, put-put-put, gulp, plop, plop! Let's get that detector tube back in place as fast as possible. Done! Now out comes the first audio tube. Goodness! Faster, stronger is the motorboating.

Some Investigation of Bias

My kingdom for an impedance reducer! None to be had at any price. So let us do the next best thing. Let us alter the impedances—a little later on. Meanwhile, we'll test some more.

We turn the knob of the 400-ohm potentiometer (used as a biasing rheostat), which affects the grid bias of the final audio tube. This is a 112 tube, by the way. Changing the position of the arm, hence the resistance, seems to have no effect on the intensity of the rushing sound. This rushing, by the way, is a healthy sound. Only the modulation of it with periodic zipping is the curse. So we get a 0-to-100 milliammeter out of our pocket, for no real radio experimenter ever goes visiting without one of those badges of his hobby, and we notice that it is indeed a fact that varying of the resistance of R9 causes hardly any change in plate current.

Well, wrong bias is always a true friend of motorboating, too much negative bias giving us too high plate impedance, especially with an output tube that can't be classed as strictly low mu.

Well, the very first thing to do is to take out the 2 meg. leak Pete has been using for R8, in the grid circuit of the output tube. In the first place, 2 meg. is often too much, when we consider that it is in series with R9, the bias resistor. Where there is such a great disproportion of resistance in series—the 2,000,000 ohm leak being 50,000 times as great as the biasing resistor—the bias resistor hasn't much chance to function.

Use of Smaller Leak Resistor

So we reduce the grid leak to .1 meg., knowing that this will affect the low-frequency amplification of the circuit, but we desire that motorboating be cured. And we find that indeed an improvement has been brought about. The biasing resistor sure does work, and when it is properly set it is never touched again.

If we cannot change the plate current considerably, indeed almost reduce it to zero, by using maximum resistance in R9, we will put a 50,000-ohm leak in the final grid circuit, if need be, for we are going to get Pete out of his trouble.

LIST OF PARTS

L1L2, L3L4—Two RF transformers.
C1, C2—Two tuning condensers of capacities to match the coils.
R1—One fixed resistor, 2-3-ohm.
R2—One 5 meg. grid leak.
R3—One 100,000 ohm Carter potentiometer.
R4—One 2 meg. grid leak.
R5—One .1 meg or .25 fixed resistor.
R6—One 2 meg. grid leak.
R7—One .2 or .25 meg. fixed resistor.
R8—One .1 or .05 meg. grid leak.
R9—One 400-ohm potentiometer, used as a rheostat for bias.
C3—One 1 mfd. fixed condenser.
C4—One 1 mfd. fixed condenser.
C5—One .0001 or .00025 mfd. grid fixed condenser.
C6—One .001 mfd. fixed condenser.
C7, C8, C9—Three .1 or .25 mfd. fixed condensers.
C10—One 1 mfd. fixed condenser.
C11—One 4 mfd. fixed condenser.
PTJ—Phone tip jacks.
S—One A battery switch.
Five sockets.
Two dials.
One 7x21-inch front panel.
One 8x20-inch baseboard.

We glance over at Pete's speaker and notice it is of a make and type with which we are familiar. Measured in our laboratory we found one like it to have a cut-off of 85 per cent. at 100 cycles, so we are not worrying any too much about the small value of leak we just put in that final grid circuit.

We listen to the rushing sound and it seems to be uninterrupted. But we notice, as we noticed all along, that the milliammeter needle is swinging to left, to right, to left, to right, pendulum fashion. Not so fast as before, nor with such a wide sweep, but it does move over a scale of 6 milliamperes. Still some motorboating. This is of the inaudible kind. You have to read it on the milliammeter which is either in the plate circuit of the last tube (as in this case) or in the B minus lead.

Test of Reception

Now let us tune in a station.

Ah, that's pretty good. Not all that could be expected, but certainly an improvement. Even Pete admits that. It's hard for him to admit it, because he spent so many painful hours working over the set, to cure the trouble, that he doubted that anybody could even improve reception in only a few minutes. But now, if ever, is the time to be modest.

The 112 draws the same filament current at the same filament voltage as does the 71 tube. We know that the 71 is a low mu tube, which means that it has a low plate impedance. We have just done something about that impedance matter by getting the right bias, and choosing the most satisfying leak value for R8, and now we'll get a plate impedance as low as we can in any of the popular tubes of the day. The 400-ohm potentiometer has enough resistance at 30 or 40 milliamperes total plate current to give us the newer and greater negative grid bias, and, fortunately again, Pete has a B eliminator rated at 180 volts at 60 milliamperes. So there's enough of everything to go 'round. We put the 71 tube in socket 5, the volume is much less, the quality is better, the piano sounds fine—a favorite ear test of ours—and we get a reading of 37 milliamperes in the 71 plate circuit. We have something in excess. The needle moves very slowly and very little, and only over the linear width represented by a reading of one single milliampere! And the music comes in so well that Pete is dancing around like a sane man. Instead of pulling out hair we might expect him to be pushing hair into his scalp, he is that sane!

The Final Touches

Well, it looks as if the fight were over. But wait a minute. That choke coil in the output is of the type used in B eliminators for filtration. At 1,000 cycles its inductance is 30 henrys. Not so good. We like fine quality, better volume. It is surprising how little volume some folk get when they use a 71 tube. Naturally the tube amplifies only a little—less than half as much as a mere —01A tube—and we expect less volume, being willing to sacrifice it for the better quality, especially on strong signals. But we don't want to suffer the extensive volume reduction that has just greeted our ears. So we replace the choke coil with one that has an inductance of more than 800 henrys at 1,000 cycles. Such a one is hard to find, as a plain choke coil, but we use the secondary of a General Radio 1-to-6 audio transformer as a test. We tell Pete that the wire is fine and may not stand the heavy current for many years, but assure him that the inductance is all there—some 876 henrys—and the distributed capacity not too bypassy, although the direct current resistance is great, and cuts the effective plate voltage and plate current almost in half.

But we had some excess, so we don't care. Even the 5,000-ohm DC resistance of the new choke coil L5 does not worry us.

Some day Pete can leisurely look around for an output choke coil that has a high inductance—at least 100 henrys—and remove the improvised one.

"Seems to Have Cleared Up"

"Gosh, I never knew volume would go up and tone quality would improve so much when the inductance of the output choke coil was increased," says Pete. "And imagine, the plate current in the last tube was almost cut in half, for its 21 mills."

"And how about motorboating?" we inquired

"The set did motorboat a little recently, but that trouble seems to have cleared up," observes Pete.

"Yes," we tell him, "and your isolating condensers are .5 mfd. each, which is rather high, as .25 or .1 will do. But let's see if we can't keep that needle perfectly still, even if we replace that .5 mfd. output condenser (C11) with one of 4 mfd. That's better. Helps along the low notes. Needle still quiet."

"Now, how about trying high mu tubes?" Pete asks. "They have a mu of 30 and give an effective amplification of 20. Tubes 3 and 4, now —01A, can be replaced by the high mu tubes."

"No, not tubes—just one tube. Put a high mu tube in the detector, with maximum plate voltage applied, or in the second AF stage, socket 4, and you'll be all right."

The Effect of the Return

Grid and Plate Connections Analyzed

By Neal Fitzalan

THERE are several ways of connecting the grid return to obtain different grid bias values. One way is to connect it to the minus end of the filament. The bias is then zero, since the minus end of the filament is taken as the datum point from which to measure filament, plate and grid voltages. This point is indicated by (1) in the diagram. When the grid return is connected to this point the grid goes positive during half of the input cycle, with respect to the negative end of the filament but not with respect to the filament as a whole. Nevertheless the grid then takes current and this may cause distortion.

The usual way of connecting the grid return is to connect it to the negative terminal of the A battery as indicated by (2). This places a negative bias on the grid equal to the voltage drop in the resistance R between the negative end of the filament and the negative terminal of the battery, because point (2) is the most negative point in the entire A circuit. If the filament current is I amperes and the resistance is R ohms, then the voltage drop in the filament resistor is RI volts, which is the bias on the grid of the tube.

Extent of Swing

When the grid return is to point (2) the input voltage can swing with an amplitude of RI volts before the grid goes positive with respect to any point of the filament and hence before any grid current will flow.

A hydro-mechanical analogy will help to make it clear why the negative end of the filament battery is the most negative point in the circuit or the point of lowest potential. Let the A battery be a pump which forces water from a low tank at (2) to a high tank at (3), and let the filament circuit be a pipe line leading from the upper to the lowest tank. A current of water will flow through the pipe from the upper to the lower tank as long as the pump is working. The direction of the water flow will be from plus to minus, which naturally is also the direction of the filament current. Therefore the Amperite will be the lower portion of the pipe line and also point (1) will be higher than point (2). Just as the lower tank is the lowest point in the water circuit so the negative end of the A battery is the lowest point in the electric circuit.

If the grid return is connected to the positive end of the filament battery, or at point (3), the grid bias is positive and equal to the voltage drop in the filament. Thus the actual bias depends on the type of tube used. In the —01A the bias would be 5 volts and in the —99 it would be 3.3 volts. When this connection is used the grid takes current and distortion is likely to be introduced. When the tube is used as a detector, this distortion is utilized.

Variation of Plate Return

The plate return can also be connected in several ways with somewhat different results. When the negative end of the plate battery is connected to the negative end of the filament the plate voltage is equal to the voltage of the plate battery alone, that is, when no plate current flows, or when there is no load impedance. When the negative of the plate battery is connected to the positive end of the filament battery the effective plate voltage under the same conditions is the voltage of the plate battery plus the voltage drop in the filament. Thus if 45 volts constitute the B source and the A voltage drop in the filament is 5 volts, the total plate voltage is 50 volts. When the negative of the plate battery is connected to the negative of the filament battery the effective plate voltage is the voltage source less the drop in the filament resistor. Thus if the voltage source is 45 volts and drop in the filament resistor is one volt the effective plate voltage is 44 volts.

It is usually recommended that the plate return be made to the negative end of the filament battery. That gives the lowest effective plate voltage. The plus A return gives the highest effective plate voltage and the greatest volume.

One point should be made in connection with the flow of plate and filament current when B minus goes to A plus. In the positive leg of the filament, the filament and plate currents are opposed to each other. This naturally decreases the heating in that end of the filament. In the negative leg the case is reversed. The plate and filament currents are in phase and hence that end of the filament is heated more than normal.

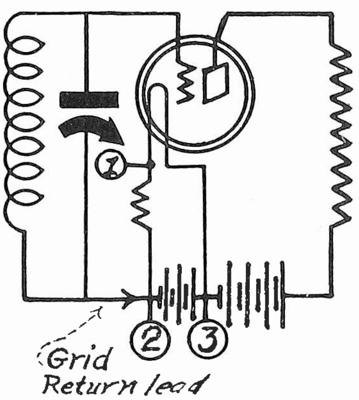


FIG. 1

Circuit illustrating the method of connecting the grid and plate returns to get a negative bias and maximum effective plate voltage. All three possible points of connection are designated (1), (2) and (3).

Iceland Joyously Joins League of Fan Nations

Iceland is now one of the most ardent radio fan nations. This island, which touches the Arctic Circle on the north, but is made habitable by the warming influence of the Gulf Stream on the coast is probably the farthest north in radio enthusiasm.

A 500-watt transmitting equipment of standard Western Electric design, such as is familiar in the United States, was installed at Reykjavik, Iceland's capital by Standard Electric Atkieselskap of Oslo, an associated company of the International Standard Electric Company.

It was impossible to erect a new building and new aerial masts during the winter, and the broadcasting station was therefore installed in spare apartments in the principal commercial radio telegraph station at Reykjavik.

Sloping Cage Aerial

This necessitated a rather novel arrangement of the new aerial, so that it would not conflict with the 600 and 1,800 meter aerials of the radio telegraph transmitters. A sloping cage was swung from one of the masts to the station building.

Iceland had only two movie theatres and a few choral societies and bands. The promise of the new broadcast entertainment aroused all the more interest for that reason.

"With all the disadvantages," says Keith H. Thow, the installing engineer, "of severe climatic conditions, isolation of towns, difficulties of travel and lack of entertainments, it seems likely that broadcasting will become of greater utility as a public service in Iceland than in any other European country."

Aurora Interferes

Iceland, however, has her own radio problems. The mountains and glaciers of the interior and the frequent activity of the aurora borealis interfere with reception. In the Summer there is almost uninterrupted daylight from June through August, and consequent poor results in radio broadcasting and receiving.

When the new station was ready for testing, no public announcement was made. But so rapidly does news spread in Iceland that everyone had heard of the tests within a few hours, and more than a hundred crystal receiving sets were sold in Reykjavik the next day.

In the absence of professional artists, except for occasional visitors, the programs are supplied by amateur talent. Reykjavik has two or three excellent male voices and mixed choral societies and a number of talented soloists. On the instrumental side there are amateur brass bands and orchestras, and it is also proposed to broadcast dance music by the small orchestras playing at the chief hotel and cafe.

Professors Lecture

The level of education is extremely high, and as a result lectures on subjects of real interest by professors of the colleges, by members of Parliament and others are assured of eager reception. Services at the cathedral are also broadcast, and since the cathedral is invariably packed at least an hour before the service commences, the opportunity of those unable to gain admission to hear by radio in their own homes is enjoyed.

The Iceland Broadcasting Company was financed by six prominent trawler owners and business men of Reykjavik and by public subscription. Revenue is derived from an annual license fee and a royalty on radio receiving sets and certain parts.

Physical Pitch Makes Acoustic Figuring Easy

By Babson J. Hood

When discussing musical tones it is customary to speak of their pitch or frequency. Both these terms mean essentially the same thing, the number of complete vibrations per second with the sound-producing body or the air is executing.

In scientific discussions it is customary to use a musical scale in which middle C has a pitch of frequency of 256 complete vibrations per second. The entire scale is built around this note. The main reason for using this number as the base is that it is a power of 2, more particularly the eighth power of 2. If the number 2 be multiplied by itself eight times the result is 256. Since the musical scale progresses by factors of 2 this is a very convenient base, because nearly all of the notes in any octave will be whole numbers which bear a simple relationship to the C in the middle octave. The advantage of this is simplicity in mathematical calculations and representations.

Musicians for the most part use a different pitch which is based on A being exactly 435 complete vibrations per second. This is known as the International pitch, because musicians the world over have by agreement selected this pitch as standard for their purposes. The International pitch is a little higher than the physical pitch, the ratio for C being 258.652 to 256, or 1.0137, which is constant throughout the scale.

Makes Figuring Complex

The disadvantage of the International pitch from a scientific point of view is that very few of the notes in the scale can be expressed as a whole number. Only the A and its octaves can be so expressed. All the others can only be expressed accurately by complex fractions. Of course, this fact does not offer any difficulty to a musician in tuning his instrument. Some of the best musical artists possibly do not even know that sound consists of vibrations in the air.

Just why musicians use the pitch based on A being 435 is not easy to see. Perhaps it is simply a habit. Perhaps some ancient violin happened to be tuned to that when it was retrieved from the dusty recesses of the attic. Perhaps it is an arbitrary mean between widely varying pitches advocated by different schools of music. Perhaps it sounds better to those who are capable of judging music. But the fact is that although 435 is the standard pitch, no two renditions of the same selection are ever played in the same pitch. The standard form changes with temperature.

When discussing the performance of audio amplifiers and speakers physical pitch is used because it is simpler to deal with mathematically, and the scale is laid off in octaves rather than in frequencies because that is the way that musical intervals are appreciated by the ear. Equal weight is given to equal musical intervals rather than to equal frequency difference.

Easy Method

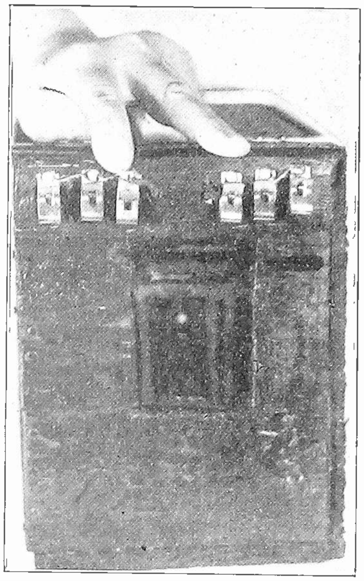
The method of doing this is very simple. Since middle C is a power of 2 so is every other C in the scale. Middle C or 256 is the eighth power of 2. The octaves of C then are the ninth, tenth, eleventh, twelfth and so forth. The octaves below middle C would be the seventh, sixth, fifth and fourth powers of 2. The nine octaves more than cover the usual musical scale. The fourth power of 2 would be 16 cycles on the physical pitch, which is the lower limit of the organ as well as the lower limit of audibility. The twelfth power of 2 gives approximately the upper limit of the piccolo. Some organs go as high as the fourteenth power of 2, or to 16,384 cycles per second. This high frequency is not audible to many people, and it is not a musical note to anybody.

The range of modern musical instruments and voices is interesting. The bass viol dips deepest into the thunderous tones while the bass tuba does not fall much behind. Very few radio receivers and speakers are able to reproduce these low notes with full volume and consequently their contribution to the pleasing sound ensemble is lost. One test of a good radio receiving system is the degree to which these low notes are brought out. Although the poorer types of receivers do not bring out the low notes themselves, they do bring out the overtones of these notes, and these overtones differ by the pitch of the fundamental. The difference is reproduced in the ear and a kind of fundamental is heard, even though the receiver and speaker are not able to bring out the original. Although it is present subjectively it does not give the tone the same richness of the original.

CARE IN GROUND CONNECTION

Many battery chargers employ single winding transformers for supplying power to the rectifier device and in turn to the battery. If you have such a charger and a receiver, in which one of the A battery terminals is grounded, be sure to disconnect the ground from the battery terminal, since one side of the line is also grounded and you are likely to ground the other side through the battery, thereby causing a short circuit. A large fixed condenser should be connected between the ground post of the set and the actual ground lead-in.

A CONSOLE BATTERY



(Hayden)

WHEN PLACING a storage battery in a console, you may find that the posts of the battery are so close to the top of the compartment that they are difficult to get at for connections. To remedy this, place the battery in a wooden case, provided with the proper ventilation holes. Fasten six clips to the front. On the left-hand side are three clips, connected to the negative post of the battery. Place three more clips on the other side and connect them to the plus post of the battery. One of each set of clips are for trickle charger, another for the set, and a third for B minus. In any event one post will not be used, but the option is important.

Intermediate Frequency Answers Core Question

Air core or iron core intermediate frequency transformers—which shall it be for the Super-Heterodyne?

The question is usually answered when the intermediate frequency is selected. If a low frequency (high wavelength) is chosen for the intermediate amplifier, iron core is usually considered the better. Three of these transformers are usually employed in conjunction with one tuned air core filter transformer. The reason for using iron core transformers when the intermediate frequency is low is that with them the selectivity of this part of the circuit is not excessive. If all the transformers in the circuit were air core and accurately tuned to the one low frequency, the selectivity of the receiver might be so great that most of the higher audio frequencies would be tuned out.

When the intermediate frequency is higher (wavelength lower), iron core transformers become inefficient on account of the enormous eddy current and hysteresis losses in the core material. Even when the laminations in the core are made very thin and are well insulated from one another these losses are great. This not only cuts the amplification but also the selectivity.

It should be remembered that the higher the intermediate frequency the greater must be the selectivity of the circuits in order that the effective selectivity of the receiver shall remain at some constant value. For this reason as the intermediate frequency is increased it is necessary to use air core transformers and tune them to the same intermediate frequency. To prevent the selectivity of the receiver as a whole from exceeding the desired value, the transformers often are either slightly detuned or the wire used in winding them is made fine.

When the intermediate frequency used lies between 20 and 35 kilocycles it can be said that iron core transformers with one air core tuned filter should prove highly satisfactory. For frequencies between 35 and 60 kilocycles air core transformers with fine wire and approximate tuning should prove better, while for frequencies above 60 kilocycles, more accurate tuning and heavier wire should be used.

Another fact which enters into the choice of type of transformers is the space available. If the space is limited it is desirable to use iron core transformers because such transformers do not interact as much as air core transformers, and consequently they can be crowded without endangering the stability of the circuit. When air core transformers are used in crowded places it is necessary to place them at certain agles and to neutralize electrostatic coupling in order to prevent self-oscillation.

Making Supers Efficient

Trouble Cures Prescribed for Baffled Fans

By Capt. Peter V. O'Rourke

Contributing Editor

[How to build the De Luxe Victoreen Portable was described in the May 21 and 28 issues. Efficiency data, applicable to all super-Heterodynes, are given herewith, with the Victoreen as the basis.]

IN considering the problem of obtaining maximum results from the De Luxe Victoreen Portable let us begin with the antenna circuit. Here may reside the cause of failure of many sets. Does the signal intensity respond to small changes in the setting of the modulator tuning condenser or does it not make much difference where the dial is set, so far as the strength of the signal is concerned? If it responds all is right, but if it does not there is something the matter with the tuned circuit. There is either an open circuit or there is a short. Either trouble may arise as a result of shaking of the set. It is well to go over the circuit carefully to see that the coils are properly connected and that there are no loose connections. Nuts and screws have a habit of working loose as the set is shaken or as the temperature varies. Tighten all to make sure that they are not to blame for poor results.

Does the set squeal when the first condenser dial is turned? This is indicative of oscillation in the modulator or the first tube. To remove squeal, the filament of that tube can be turned down a little or the plate voltage on the tube can be reduced.

Sometimes all the tubes light but the set is as silent as the tomb. What is a cause of this condition? Most frequently it is due to failure of the oscillator tube. Its filament emission may have become played out to a point where the oscillator will not function. A new and better oscillator tube should remedy this condition immediately without any other changes in the set. However, if another tube is not available, the old tube may be induced to pump life into the set by increasing the filament temperature, by increasing the plate voltage, or by switching tubes, putting the removed one in the audio circuit.

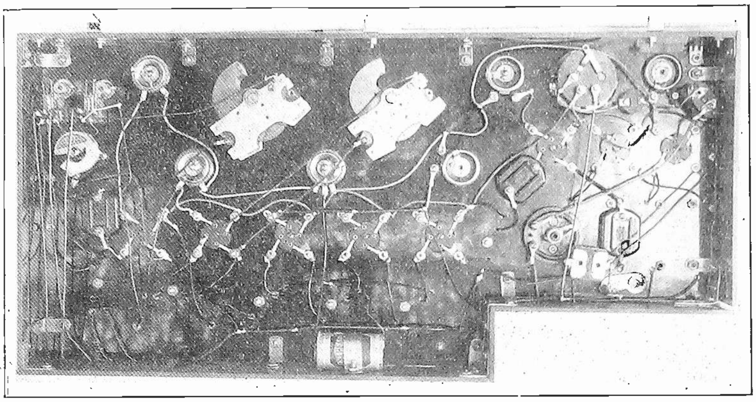
Oscillator Circuit Test

Of course, failure to oscillate may well be caused by a defect in the oscillating circuit itself. That is, the oscillating coil external connection may have developed an open by the corroding of a contact or by the shaking loose of a nut or a screw. Go over all joints pertaining to the oscillator to make sure that none is defective. The same applies to the condenser connected across the oscillating coil, to the tickler terminals and to the pick-up coil terminals.

If the set still refuses to function after all these contacts have been made perfect, the cause of failure may be found in the tube contacts with the socket. Quite often corrosion takes place here which forms a non-conducting layer between the terminals, or dirt may work in to cause the same trouble. Sometimes the springs become weakened to such an extent that electric contact becomes defective. Very often when this is so the fault lies in the filament circuit, that is, the prongs make such poor contact with the springs that not enough filament current flows in the tube to make it oscillate. Having found the location of the cause it is easy to remedy.

Too Much Squealing

Does the receiver squeal profusely when the oscillator dial is turned, even when there are no stations to be received? This condition indicates that the intermediate frequency amplifier oscillates, as well as the oscillator proper. Clear signals are impossible as long as self-oscillation occurs in the intermediate frequency amplifier. The cause of oscillation in this portion of the circuit of course is regeneration. To stop the oscillation the regeneration must be decreased or eliminated completely. The procedure in going about this depends on how the regeneration takes place It may be caused by improper placing of the intermediate frequency transformers. In that event the remedy is to place them farther apart or to change the angle which they make with the line joining there centers. Neutralization in this case may help the trouble or it may make it worse, depending on whether the troublesome coupling is capacitive or inductive If neutralization fails or if rearrangement is not practical there are still other ways of stopping the oscillation. One of the simplest ways is to connect a resistance in series with the plate lead. one in each plate circuit of the intermediae amplifier. Sometimes a small resistor of a few hundred ohms placed in series with two consecutive plate leads will stop the oscillation. Reducing the plate voltage on the intermediate tubes has the same effect, but if the trouble is very bad the voltage has to be reduced so much before oscillation will stop that the amplificaion will be low.



(Alter)

BOTTOM VIEW of the sub-panel of the Victoreen De Luxe Portable.

B Battery Resistance

It is probable that in many cases the oscillation is caused by the resistance of the B battery. A new battery should then prove an efficient and simple remedy. A 1 mfd. condenser placed across that part of the battery which is serving the intermediate tubes will also remove this cause of oscillation without necessity of a new battery. The condenser will prove the least expensive in the long run, since it will enable the use of a battery much longer with satisfactory results.

Often there is an audio frequency howl in a receiver which is caused by defective tubes. This occurs when the speaker is placed too close to the detector tube. The tube itself has a certain frequency of oscillation, which can be heard when tapping it with a pencil, or even when tapping the table on which the set stands. At this frequency the set as a whole is very sensitive and unstable. If the speaker is placed too close, or at a certain distance away from the detector tube, the circuit will start to oscillate. The slightest jar will set it going.

May Originate at Studio

The dry cell tubes of the 99 types are particularly bad in this respect. It is not necessary that the jar which starts the detector going originate at the receiver end. It can just as well start at the transmitting studio. For example, if some one speaks into the microphone with a frequency at or near the natural frequency of the tube, the loudspeaker will give back to the detector tube the necessary starting impulse and the set will begin to oscillate.

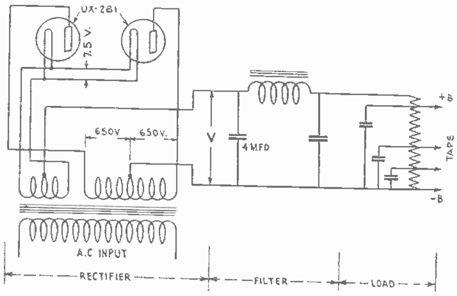
The remedy for this type of trouble is to protect the detector tube from mechanical oscillation and from the loudspeaker. This is not always easy to do. Enclosing the tube in a closed box which will exclude the sound from the loudspeaker is fairly effective. But the safest method is to remove the speaker from the tube to a distance of several yards. Still, distance alone is not enough It is necessary to find a particular distance. or one of several particular distances, depending on the frequency where the trouble occurs. It often happens in the vicinity of 1,000 cycles. If that is the frequency, the circuit may oscillate violently in one position of the speaker and become silent if the speaker is moved 7 inches toward or away from the detector tube, that is, by moving it one-half wavelength of the sound wave of oscillation. The silent positions can readily be found by experiment.

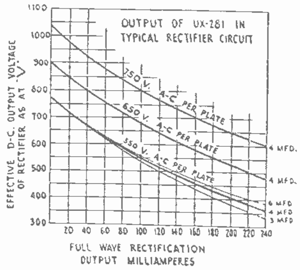
Double Trouble

In some cases, however, and particularly when the speaker is too close to the detector, the tube will sometimes oscillate at two frequencies. If the silent position is found for one of these. chances are that this will be the position where the set oscillates freely at the other. Then there is nothing to do but to remove the speaker as far away from the tube as possible, or perhaps to place a sound screen between the two.

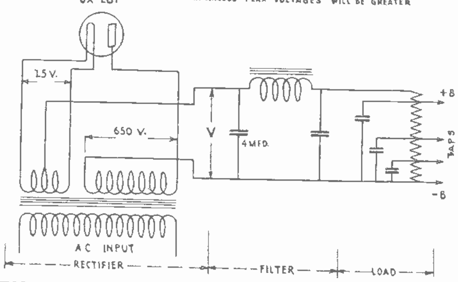
Reversing the leads to the loud speaker is equivalent to moving the speaker half a wavelength.

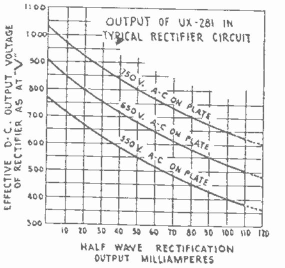
R. C. A. Has 2 AC Tubes; Also New Rectifier Pair





A-C VOLTAGES SHOWN ARE RMS VALUES. INSTANTANEOUS PEAK VOLTAGES WILL BE GREATER





THE circuit diagram for the full-wave rectifier, using two of the new 281 tubes, is shown at top left, with the output voltage-current chart at its right. The voltages printed on the curved lines are input. Below is the half-wave rectifier, using only one of these tubes, with the chart at right.

New tubes which with the use of a small step-down transformer will eliminate A batteries from receiving sets especially designed to accommodate them, and improved rectifier tubes for use in eliminating B batteries, or in special circuits to do away with A batteries, will soon be placed on the market, according to an announcement by E. E. Bucher, general sales manager of the Radio Corporation of America. These new tubes, numbering four in all, are the result of ceaseless research and experiment extending over a number of years, on the part of the Radio Corporation and its manufacturing associates, the General Electric Company and the Westinghouse Electric & Manufacturing Company..

"On or about July 1," reads Mr. Bucher's announcement, "there will be introduced two AC types of Radiotrons having operating characteristics similar to those of the 201A type and which insofar as performance is concerned give the same results obtainable from the 201A or 199 types of tubes, but in which unrectified current obtained from a step-down transformer eliminates the usual A battery. These are to be known as types UX226 and UY227.

Two Rectifiers First

"A month prior, on about June 1, the Radio Corporation plans to introduce two new and improved Radiotron rectifiers of the filament type for use in B battery eliminators, or, in special circuits for A battery elimination employing series filament drive. These tubes will be known as types UX280 and UZ281.

"The new AC Radiotrons will not be immediately applicable to the present types of receivers," according to Mr. Bucher, "and they are not to be considered as taking the place of any of the present types of standard vacuum tubes produced and marketed by the R. C. A. To accommodate the new AC tubes in the prevalent types of broadcast receivers, it would be necessary to make radical changes in design, and in many cases it would be entirely impracticable. The new Radiotron rectifiers, on the other hand, are applicable to many existing radio rectifying devices without further adaptation. They will give outstanding performance in battery eliminators especially designed for their characteristics."

Following is a general description and detailed specifications of the new Radiotrons and their fields of practical application. The UX226 is a 1½ volt AC filament type, drawing current of 1.05 amperes, and intended for radio frequency and audio frequency amplification in circuits especially designed for its use. The filament is energized from an AC lighting source through a suitable step-down transformer. The operating characteristics of UX226, other than the method of energizing the filament, are generally similar to those of the 201A. UX226 is not recommended as a detector. It employs the standard UX base.

Radiotron UY227 is an AC heater type in which the electron emitting element (cathode) is made active through an independent internal heating element requiring 1.75 amperes at 2½ volts, AC. It is primarily intended as a detector tube in receiving sets where the radio-frequency and audio-frequency stages employ the UX226 tube, although it may be employed for radio-frequency and audio-frequency amplification as well. UY227 employs a special five-prong base.

Application of AC Tubes

The new amplifier and detector tubes will be welcomed by amateurs and experimenters and it is likely that newly designed sets will employ the UX226 in all RF sockets and in the first AF stage, UY227 in the detector stage, and one of the power amplifiers in the last audio stage, i.e., UX112, UX171 or UX210. The requisite low-voltage supply for the filament may be obtained from an independent step-down transformer or from additional low-voltage windings on the usual B or plate supply transformers.

Characteristics of UX226

Plate Voltage	90	135	135	180	Volts
Negative Grid Bias	6	12	9	13.5	Volts
Plate Current	3.7	3	6	7.5	Milliamperes
Plate Resistance (AC)	9,400	10,000	7400	7000	Ohms
Mutual Conductance	875	820	1100	1170	Micromhos
Amplification Factor	8.2	8.2	8.2	8.2	....
Max. Undistorted Output	20	60	70	160	Milliwatts
Max. Overall Height	4-11/16"	Max. Overall Diameter			1-13/16"

Characteristics of Radiotron UY227

Plate Voltage	90	135	180	Volts
Grid Voltage	6	9	13.5	Volts
Plate Current	3	5	6	Milliamperes
Plate Resistance (AC)	11,300	10,000	9,400	Ohms
Mutual Conductance	725	820	870	Micromhos
Amplification Factor	8.2	8.2	8.2	....
Max. Undistorted Output	20	55	140	Milliwatts
Max. Overall Height	4-11/16"	Max. Overall Diameter		1-13/16"

The New Rectifier Tubes

UX280 is a full-wave rectifier designed for rectifying apparatus and circuits requiring greater DC output than that afforded by the UX213. UX280 gives DC output current of 125 milliamperes. It may be employed interchangeably in radio devices designed for UX213. The increased DC

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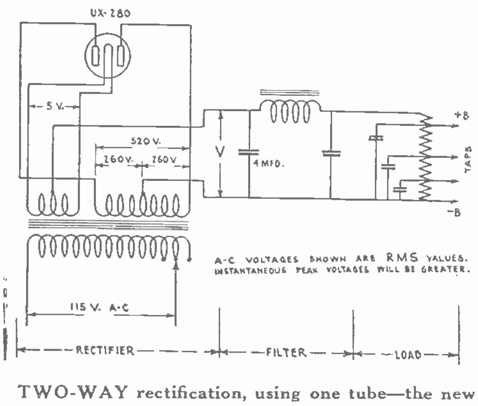

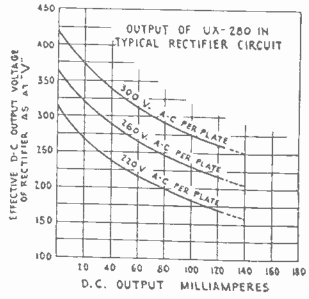

TWO-WAY rectification, using one tube—the new 280—is exemplified above.

Purpose of the Valves Told in a Nutshell

AC Tubes for Receiver

UX226—Filament 1½ volts AC, at 1.05 amp. For RF and AF. Not for detection. Regular X base.

UY227—Uses independent internal heating element, requiring 1.75 amp at 2½ volts AC. Primarily a detector in AC sets, though useful for RF and AF, too.

Rectifiers

UX280—Full wave rectifier with DC output current of 125 mils.

UX281—Half wave rectifier, DC output usually 110 mils.

(Concluded from preceding page)

output of UX280 will, however, be secured only in circuits especially designed for it. This tube has a maximum overall height of 5⅝ inches and a maximum overall diameter of 2 3/16 inches.

UX281 is a half wave rectifier similar in external appearance to the UX216B, although of increased physical dimensions. UX281 is interchangeable mechanically and electrically with the UX216B in all radio rectifying devices primarily designed for the UX216B. In circuits especially designed for UX281, a DC output current of 110 milliamperes is available.

Both of the new Radiotron rectifiers are of the hot cathode type, equipped with a new, ribbon oxide-coated filament which insures great ruggedness and long life.

Application of Rectifier Tubes

The new Radiotron rectifiers, UX280 and UX281 are immediately applicable to devices which heretofore employed UX213 and UX216B, such as the R. C. A. Duo-Rectron, the 104 Loud Speaker and the radio-phonograph combinations of the phonograph companies equipped for AC drive. It is expected that the new rectifier tubes will attain great popularity in battery eliminating devices, particularly as they do not necessitate the more costly smoothing out condensers required by some types of rectifiers, which have high initial break down or "peak" voltages.

The combination of the new AC tubes, UX226 and UY227, a power tube in the last audio stage, such as UX171, and one of the new rectifiers, UX280 or UX281, in a radio receiver especially designed to accommodate these new tubes, provides complete AC socket operation, eliminating all batteries or liquid containing devices. The requisite voltages for operation of the filament circuits of the various tubes can be obtained by equipping the power transformer, which usually provides the plate or B current, with special low-voltage windings and suitable taps.

Prefers Its AC Drive

Although the new AC tubes and the new rectifier tubes when employed in correctly designed circuits give satisfactory AC socket operation with most types of loudspeakers, nevertheless, the Radio Corporation has found no satisfactory substitute for the method of AC drive which it employs in Radiola 28 in combination with Loudspeaker 104; for the deep bass response of the Loudspeaker 104, from which it derives much of its tone quality, calls for an AC power supply system in which AC ripple has been reduced to the very minimum. This result is obtained in the 28-104 system of socket power operation, in which the filament current for the UX199 tubes used in this set is obtained from the same source that provides the B current or plate supply for the receiver and the loudspeaker. Through this method, direct current, substantially free from ripples, is supplied to the filaments of the UX199 tubes.

Removing a Tube Leaves AF Coupling Unchanged

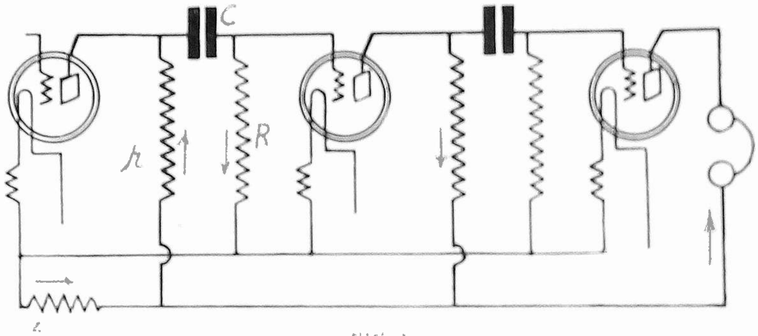

FIG. 1

With the first AF tube removed from a three-stage resistance coupled AF circuit the coupling impedance is still common, current flows and motorboating continues

The main difficulty with resistance coupled amplifiers is their tendency to oscillate at a low frequency. It has been shown many times in Radio World that this oscillation is caused mainly by the common impedance in the plate circuits of the tubes and to some extent by the common grid impedance. It has also been shown that amplifiers having an [illegible] plate circuits in the same common impedance, such as the resistance of the B eliminator, [illegible] oscillate at low frequencies and that amplifiers having an even number [illegible] are stable at low frequencies but will oscillate at high frequencies, unless there is a large [illegible] across the common resistance. [illegible] amplifiers when they are [illegible] when all the plate [illegible] [illegible]

[illegible]

Stop-Watch is Switch For Programs at KFI

Los Angeles.

Considerable interest has been aroused by the lightning speed with which KFI switches from its main studio to its various remote control points, and back again, according to Curtis Mason, technician at KFI. Certain secret code words are given and signal flashed by the announcer in the KFI studio so that the announcer at the remote control point knows that in exactly fifteen seconds he will have the air and must start talking.

"The announcements are timed to the second, and the instrument board is set with an alarm stop-watch attachment," explains Mason, "so that when one announcer gives the warning to 'stand by' for a program from the Aeolian studio, for instance, the current is then switched, a light flashes, and the other announcer remarks that this is the Aeolian Studio."

"The stunt required a great deal of tedious rehearsing to perfect, but the result is an absolute elimination of annoying pauses for switch-overs."

DIRT KILLS OSCILLATION

An accumulation of dirt on both the socket prong and tube terminal frequently prevents the tube from oscillating.

New Series of Talks Begin by Lawrence

A new series of talks [illegible] by David Lawrence [illegible] has been begun by the National Broadcasting Company [illegible] broadcast through its Red Network each Wednesday evening at [illegible] Eastern Daylight Saving Time.

Mr. Lawrence's broadcasts [illegible] talks [illegible] The new series of Wednesday evening talks will be somewhat different. Mr. Lawrence plans to discuss the workings of [illegible] administration of government [illegible] Mr. Lawrence's object in these interesting talks is to bring the people of the country closer to their government so that they may be better acquainted with its functions and may use it more effectively.

The talks, which are of eight minutes duration, are transmitted through WEAF, New York, WGR, Buffalo, WRC, Washington, D. C., KSD, St. Louis, WGY, Schenectady, WMAQ, Chicago, WFI, Philadelphia, and WCAE, Pittsburgh.

ELIMINATOR CHOKE COILS

When purchasing choke coils for your eliminator, be sure that they are of the proper current carrying capacity for the rectifier device to be employed.

TRF Set Outclasses Super-Het in Plane Test

Washington.

Details of the recent airplane radio experiments conducted by the Bureau of Standards on a Ford all-metal three-engine plane, in which two-way telephonic conversation was maintained with offices in Washington and the conversations rebroadcast for the benefit of the listening public, were recounted in an official statement made public by the Bureau of Standards.

Not only was the telephony experiment a success, as set forth in the May 28 issue of RADIO WORLD, but various broadcasts could be picked up by the specially installed set in the plane, and it was found that the ignition of the plane did not prevent reception, according to the statement.

"Through the courtesy of the Ford Motor Company, the Bureau of Standards was enabled to install and test radiophone transmitting and receiving equipment, and radio beacon receiving equipment on the Ford three-engine-all metal airplane sent to Washington during the week of the All America Aeronautical Exhibition," said the statement.

No Ignition Noises

"It was found on a preliminary flight made April 30 that ignition interference was not sufficient to prevent radio reception. The ignition wiring on this airplane was not shielded, but the all-metal construction served as effective shielding.

"Installation was accordingly made on all the radio equipment and a flight was made at 5 p.m. Successful two-way telephone conversation was carried on, and the beacon course flown from Bolling Field to College Park and return. No ignition noises whatever were noticed on the receiving set used for radiophone reception. This set was a modified Radiola 20, built into an aluminum box. Considerable ignition interference was picked up on the Signal Corps Super-Heterodyne receiver.

"Through the courtesy of Mr. Mayo, chief engineer of the Ford Motor Company, Mr. H. Pratt, of the Bureau's radio staff, was on board the airplane on its return trip to Dearborn, Mich., on May 7, to make a distance test of the radio telephone and beacon. The beacon at College Park was orientated on Bellefonte, Pa., which was on the route to be flown from Washington to Buffalo, thence to Dearborn via the north shore of Lake Erie.

2-Way Talk Up to 100 Miles

"Two-way phone conversation of a satisfactory nature was had with Washington up to a distance of 100 miles. Unsatisfactory phone conversation was maintained for about 25 miles further. For the next 25 miles the plane telephone could not be interpreted at College Park (the Washington station of the Bureau of Standards), but College Park was heard on the plane, however, with poor intelligibility. ICW telegraph on the telephone frequencies was used up to a total distance of about 225 miles, but the last 25 miles of this was unsatisfactory, owing to the fading of signals.

"The passengers on the plane, shortly after leaving Washington, requested the sending of several telegrams. After communication was established the telegrams were phoned from the plane to College Park, from which point they were phoned to the telegraph company. Some telegrams from Buffalo and other points for persons aboard the airplane were also delivered by the reverse procedure. By this time the plane was about 100 miles away, and the ground reception was being somewhat interfered with by the beacon. The beacon was cut in for brief intervals up to the 100 miles and the interlocking dash received.

Telegrams Bring Greeters

"Upon arrival at the Buffalo air port it was learned that some of the telegrams sent and received via the radiophone between the airplane and Washington resulted in the party being met by several of their friends who otherwise would not have been able to make suitable arrangements, demonstrating the practical utility of radiophone airplane communication other than its primary purpose as an aid to navigation.

"The construction of the Ford airplane, having its cabin built with sound-proofing materials, was very favorable for radio work. Noise conditions permitting conversation between passengers without effort make the problem of radio talking and reception quite easy as compared with the usual open cockpit situation in small airplanes.

"Not only are the helmet and closely fitting earpieces in it replaced by an ordinary set of headphones, but the voice from the plane is received on the ground unaccompanied by the usual engine and wind noises. In the experiments in the Ford plane, five sets of headphones were installed, the pilot having one set, the radio observer one set, and three being in the main cabin. In this way all of the occupants were able to enjoy listening to the received radio signal picked up.

Heard Baseball Scores

"After leaving Buffalo, the afternoon program of the local broadcasting station was picked up, and shortly afterward station WTAM at Cleveland was tuned in because of a more interesting program. While on this lap of the journey several other unidentified broadcast stations were heard, and telegraph signals from several lake steamers also received.

"Thus, in addition to the radio test made with Washington on the first stage of the journey, entertainment and baseball scores were provided by radio on the last stage and up to the time of arrival at the Dearborn airport of the Ford Motor Company. The trip began at 11 a. m., at Washington, a stop of two and one-half hours was made at Buffalo, and Dearborn, Mich., was reached at 7.30 p.m."

CLEAN BATTERY TOP

Immediately after charging your battery, clean around the top of the battery. Acid sprayed about during the charge may thus be prevented from seeping through and injuring the cells. With trickle chargers this should be done every other week.

BRITISH APPOINT WOOD

London.

Sir Henry Wood, friend of Walter Damrosch and leading British musician, has been engaged by the British Broadcasting Company as director of music.

CARTRIDGE RECTIFI

THE DIMINUTIVE cartridge shown a rectifier, which can be used in A battery tion is obtained by close association of tw with a non-conducting substance betwee matically tapered by the new Raytheon trickle ch

Higher Powe Sanctioned i

Washington.

Permission to use higher power output during the daytime than that specified for night broadcasting will be granted certain stations to facilitate wider and better reception of radio programs, the Federal Radio Commission announced, in making public its General Order No. 10. The full text of the order follows:

"For the purpose of facilitating wider and better reception of daytime service programs, such as those of educational and religious institutions, civic organizations and distributors of market and other news, the Federal Radio Commission will consider applications from holders of broadcasting station licenses, for the use, between the hours of 6 A. M. and 6 P M. local time only, of a larger power output than is authorized by such licenses.

"Applications for this daytime privilege must be made to the Commission in writ-

50,000 Watts Average

The average station of the near future will use 50,000 watts power, in the personal opinion of Radio Commissioner Bellows.

"As far as interference is concerned," said Commissioner Bellows. "I don't think a 50-kilowatt station causes any more trouble in that respect than a 5-kilowatt station. If you were to locate a 5-kilowatt station in Chicago, you could not put another station on the same wave length any-

TAPERS CHARGE

is the new Raytheon 2½-ampere
;ers or A eliminators . Rectifica-
allic conductors, pressed together
n. Rapid rate charging is auto-
, which is not recommended for

n Daytime Vew Order

and shall specify the maximum day-
power to be used, the approximate
ne broadcasting schedule, and the
ns why, in the applicant's estima-
the granting of such privilege would
the interest, convenience or neces-
f the public.
each case where such privilege is
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otify the Radio Division of the De-
ent of Commerce, requesting this
on, through the Federal Radio Su-
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by such station, both day and

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A. M. will be held cause not only
mediate withdrawal of the daytime
privilege, but for reduction of the
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on, Says Bellows

else in the United States. And the
vould hold with a 50-kilowatt station.
et far more complaints from New-
nd New York of interference from
stations than from the 50-kilowatt
WJZ at Bound Brook, N. J.
00-kilowatt station located in a resi-
listrict in a city causes more trouble
50-kilowatt station properly located
country. What do I mean by proper
—25 or 50 miles."

Music Cues Recorded on Double Blackboard

Pittsburgh.

Proof that radio programs are becoming more and more involved in technique is contained in the recent expansion of the cue system of the KDKA Little Symphony Orchestra. The large slate which for two years was capable of holding all the orchestral cues for a program has been replaced by a big, double-faced blackboard, on which as many as forty cues can be recorded.

This advance in complexity of radio broadcasting has been caused by the advent of "radiotales," continuities based on musical compositions and radio stories colored and given atmosphere by musical backgrounds.

Victor Saudek, director of the KDKA Little Symphony Orchestra, was the first radio conductor to solve the difficult problem of silently giving his orchestra the proper cues at the right time. Faced with the necessity for having his musical continuities perfectly joined together, and yet unable to rehearse every orchestral presentation carefully, Mr. Saudek resorted to the slate as a direct aid to the baton in conveying to the musicians the proper order of parts.

The Lay-Aside Cue

In arranging a concert of consecutive pieces, it is necessary only to place the music sheets one after the other in proper order. This is known as "rotating." But problems quickly present themselves when a program arrangement calls for frequent repetitions.

Ordinarily, in a program introduced by a popular ballad, such as "Love's Old Sweet Song," the folio of that piece would be laid underneath and the succeeding numbers would be piled on top of it. But if it is required that snatches of the lovable old ballad be repeated at another point in the continuity, some cue must be arranged whereby the orchestra members will be warned to lay the piece aside for use again.

To meet the increased demands, however, Mr. Saudek found a much larger board was required.

The board now installed in KDKA's downtown studio is of ample size to instruct a small class, and serves efficiently as an order board for the musicians who nightly assemble before it.

To save space, Mr. Saudek has devised a scheme of abbreviation. For atmosphere, he has designated the abbreviation "AT," followed by the name of the piece. Such a sign informs the musicians that they are to play the piece loud enough to be heard on the air, but not with sufficient volume to interfere with the announcer's voice.

A violin solo would be marked "Vio Solo;" a quartet of brass instruments, "brass 4tet;" symbols of musical significance such as the dal segno and coda by their own marks; ensembles according to their composition, such as strings, woodwinds, brasses, etc.

Avoided Chaos

Frequently a radiotale is built almost entirely around one piece of music. In such an instance, several different parts of the piece are played at different times. The complete number usually comes in for complete rendition at beginning and end.

The arrangement of cues on the blackboard has saved Mr. Saudek from more than one potential embarrassing situation. He recalls one evening in particular when one of the first violinists, becoming confused in some way, looked pleadingly but silently at Mr. Saudek for guidance. The tension was felt by all the players, and for a moment it looked as if the "whole band" would blow up. But Saudek repossessed the field by waving his baton quickly at the correct cue, and the players at once fell into their proper positions.

Power Racket Dimmed By Speech Amplifier

An unusual experiment in the amplification of a speaker's voice above the roar of machinery was undertaken recently by the Brooklyn Edison Company on the occasion of the opening of its great new generating station. The test proved successful to a remarkable degree.

The experiment was made in the large turbine room, 387 feet long, 97 feet wide and 122 feet high. At present the plant has a capacity of more than 300,000 horse power. One of the most impressive features is the 107,000 horse power No. 4 generating unit, the largest electric generating unit now in operation anywhere. With the machinery in operation, it was necessary for two persons engaged in conversation to raise their voices to a shout.

For the formal opening, the room was equipped with a Western Electric public address system. Five sets of loud speakers, four in each set, were hung from the ceiling, extending the length of the room.

A sound-proof, glass enclosed booth, equipped with a microphone, was set up just in front of the machinery. President M. S. Sloan of the Brooklyn Edison Company made his address from this booth, and his audience of more than 2,000 heard every word.

Despite Injured Leg, Gov. Fuller Broadcasts

Boston.

Governor Alvan T. Fuller of Massachusetts, with a broken tendon in his leg, limped to the WBZ microphone rather than disappoint a radio audience expectantly awaiting his message. Refusing to yield to intense pain or to the protestations of his wife and personal physician, the Governor went to the studio and spoke for eight minutes.

The Governor fell while walking at the Longwood Country Club with friends, just before his scheduled radio speech. For the next two weeks he was confined to his Beacon street home, being unable to visit the State House.

London Programs Heard In India and Australia

Utilizing the short wave station at Eindoven, Holland, as the connecting link, programs broadcast from London were heard in India, South Africa and Australia.

A broadcasting station in Sydney, Australia, rebroadcast these programs for more than three hours. Stations in Cape Town, and Durban did likewise.

Meters, Tubes and Relays Form Maze at Stations

The transmitters of WEAF and WJZ, New York terminal points of the National Broadcasting Company's Red and Blue Networks, may be likened to the power plants of great electric lighting companies. The same idea of unfailing service is the guiding spirit which actuates both types of plants.

The super-power transmitter of WJZ is located at Bound Brook, N. J., while WEAF's transmitter is housed in the Bell Telephone Laboratories at 463 West Street, New York City. A new transmitting plant will shortly be ready for WEAF, located at Bellmore, Long Island.

The analogy to power plants is emphasized in the appearance of the two transmitters. To one not possessed of detailed technical knowledge of radio, the impression is that of a huge and complicated electric machine in which giant vacuum tubes take the place of the enormous generators with which power stations are equipped. Closer inspection of the transmitting apparatus gives an observer the idea that here the three-element vacuum tube, the basis of all broadcast development, is truly glorified.

Enormous Tubes

Giants of the tube family, some of them more than two feet high, stand in ranks, brilliantly lighted if they are carrying a program across miles of space, but seeming just as awsome when they are not in use. Insulating panels bearing switches, dials, meters and other apparatus reach half-way to the ceiling, awaiting only the touch of a skilled operator's hands to provide perfect control of the huge tubes which start the music and speech on their way to thousands of similar but smaller tubes in receiving sets miles away.

A half-hour before a broadcast period is to be heard from either WEAF or WJZ, the stations' transmitter is placed on test on a "dummy" antenna, consisting of large banks of electric lamps lighted by radio frequency energy and providing the equivalent of the actual radiation system. Frequency measurements are then made throughout the entire transmitter, insuring that every portion of the apparatus is functioning properly.

At the transmitter, the broadcasting station has its final opportunity to regulate its programs. Once the music and speech have passed into the antenna, no control may be exercised. Metallic masses may partially absorb the transmitted energy, various structures may bend or deflect the radiated wave and other elements over which the station has no regulation may affect the transmission. For this reason, extraordinary care is taken throughout the transmitting apparatus to make sure that the program is fed into the antenna system in perfect condition.

Automatic Signal

When a broadcast period is ready to go on the air, a signal is received at the transmitter from the studio. Immediately, the carrier wave is fed into the antenna, and this fact is in turn signalled back to the studio. In the case of WEAF, this signal is automatic, since the carrier wave energizes a coil which operates a relay in the control room, illuminating a green light on the announcer's control box in the studio.

While the program is on the air, meters which register voltages and currents in various parts of the transmitting apparatus are carefully checked, usualy at fifteen-minute intervals. This enables operators to keep an exact check on the condition of the vacuum tubes and to forestall breakdowns. Before their functioning is impaired, tubes will indicate approaching trouble by developing peculiar characteristics. Immediate replacement of tubes at this time, an instantaneous matter in the transmitters of WEAF and WJZ, in practically all cases eliminates the possibility of breaks in the program.

The enormous heat generated by the filaments of these large tubes requires that they be water-jacketed to maintain a uniform temperature at which they function normally. So, in addition to the various electrical readings, the pressure of the water and its temperature must be continually watched.

Operators who are entrusted with the regulation of a modern broadcast transmitter must be extremely reliable and they must possess a pride in their work. Interruptions of programs are rigidly logged at all National Broadcasting Company stations and the exact causes of such breaks are ascertained. As the result, keen competition exists between operators.

Two Stand Watch

As a rule, two operators compose the watch at the transmitter. One of them occupies himself with the transmitter proper, while the other listens-in on the 600-meter ship communication channel so that the station may be shut down immediately in case an SOS signal is heard. For while it is a matter of pride that the station be kept continuously on the air, it is equally important that broadcasting be discontinued if a signal of distress is being sent out by a vessel at sea.

Broadcast listeners who have difficulty in separating programs from their local stations will probably be interested to known that at WEAF and WJZ, this 600-meter watch is constantly maintained directly beneath the stations' antennas, in spite of the fact that WEAF operates on 491.5 meters and WJZ on 454.3 meters. So efficient is the receiving equipment that in addition to hearing nearby ships and coastal stations, the 600-meter "watchman" usually listens to vessels in South American and European waters and code stations in these same localities during the course of an evening.

Due to the high voltages necessary in high-powered transmitters, work in this branch of broadcasting is not entirely free from danger. Operators must exercise great caution while going about their duties, and one requirement made of them is that they be versed in first-aid methods useful in cases of electric shock.

Extreme precautions at WEAF and WJZ have prevented fatal accidents, in spite of the fact that both of these National Broadcasting Company transmitters use high power.

WOW to be Hooked Up To Red and Blue Nets

Permanent wire connections will be installed by October 1, enabling WOW, Omaha, Neb., the broadcasting station owned and operated by the Woodmen of the World Life Insurance Association (526 meters, 570 kilocycles) to become associated with both the Red and Blue Networks of the National Broadcasting Company.

The arrangement will afford this section of the Middle West an opportunity to receive these programs with the greatest clarity.

FLOOD TRAFFIC PUTS AMATEURS ON SLEEP DIET

Hartford, Conn.

With flood waters from the Arkansas White, Red, St. Francis, Mississippi and other rivers half covering the states of Arkansas, Louisiana and Mississippi, radio amateurs in that section tirelessly stood watch day and night to be of service to the flood victims, according to reports received here at the national headquarters of the amateur association, the American Radio Relay League.

Although their respective cities were completely isolated, John E. Mitchell of Havana, Ark., operating 5CK, and R. Disheroon of Hot Springs, 5JB, are kept in constant touch with amateurs outside the flooded area, handling thousands of words of news for the press associations as well as many personal radiograms from residents of the devastated cities to their relatives throughout the country.

Offers Official Aid

E. R. Arledge, of Pine Bluff, Ark., 5SI, also handled many words of press news together with many army Red Cross relief messages. Dr. L. M. Hunter, 5AW, and W. L. Clippard, Jr., 5AIP, both of Little Rock, were in constant touch with the amateurs in Havana and Hot Springs.

K. G. Seibold, 5QJ, of New Orleans, La., wired Adjutant General Toombs, in charge of the flood situation in that district, that all stations in the affected localities were willing to do everything in their power to aid the relief work. C. A. Frietag, 5UK, also of New Orleans, was in constant contact with 5AGS, the station of H. W. Moffat at Meridan, Miss., and with 5AEN, operated by H. T. Duson at Crowley, La., thus offering another reliable path for messages to enter and leave the flood zone.

On Duty Day and Night

J. W. Gullett, 5AKJ, of Meridan, Miss., H. L. Treft, 5API, of Cleveland, Miss., and Moffat at Meridan were all on constant watch for opportunities to assist. Although radio conditions were exceptionally poor the amateurs managed to keep communication open at all times between Meridian, Memphis, Cleveland, New Orleans, Shreveport and Plaquemine, with the result that much information passed in and out of the danger zone which would be blocked otherwise.

Clippard, Frietag and Gullett are Section Communications Managers of the American Radio Relay League.

Many amateurs remained day and night at their sets in order to be on the job in case they are needed.

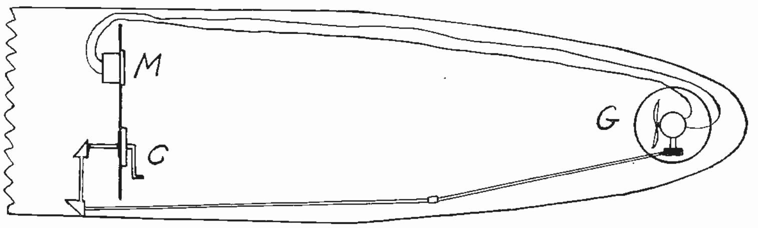
Condition of the Roads Sent Out for Autoists

Pittsburgh.

The condition of the principal highways of New England and other eastern districts was broadcast by KDKA. The information was gathered by the American Automobile Association through its local member, the Pittsburgh Automobile Club, by courtesy of the Gulf Refining Company.

It is notable that a corporation manufacturing motor oil and gasoline should take over the expense of broadcasting important highway information. This series of road talks is presented six nights of the week.

Lindbergh Guided to Paris By An Inductor Compass



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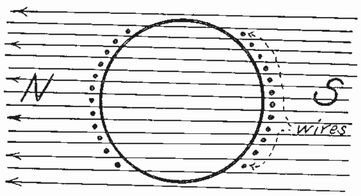

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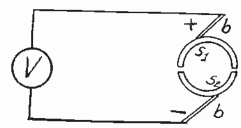

2

FIG. 1—Armature containing a large number of wires rotating in the earth's magnetic field, illustrating the principle on which the earth inductor works.

FIG. 2—Commutator segments S1 and S2, which are normally attached to the shaft of the armature, and the brushes bb, which take off the current or potential generated by the rotating armature. V is the voltmeter which measures the potential generated.

FIG. 3—Schematic plan of airplane fuselage with the earth inductor installation. Generator G is installed in the extreme rear end away from engine. The indicating meter M and the control crank C are placed on the instrument board in front of the pilot. The meter is connected electrically and the controller mechanically to the brushes on the generator.

By Brunsten Brunn

MARINERS have for years used the magnetic compass to guide them across the oceans when weather conditions prevented them from "shooting" the sun or the stars. Aviators at first employed the same device for guiding them on long journeys in and above the clouds. But the magnetic compass was not so satisfactory for their purpose as it was for the mariners. Sudden changes in direction and altitude threw the compass needle out of its true direction and reliable readings could not be obtained.

It was necessary to develop some other device whereby an aviator could determine the direction of his plane when light and weather conditions prevented direct view.

Works on Magnetic Principle

Such a device was found in the earth inductor compass. Since this instrument was perfected, about three years ago, all airplanes starting out on long journeys have been equipped with it. It was used by the round-the-world flyers in 1924, by the good will flyers to South America recently, and by Capt. Charles A. Lindbergh in his non-stop flight from New York to Paris.

The earth inductor compass has one thing in common with the magnetic compass: it makes use of the earth's magnetic field. Aside from this one fact there is no point in common with the two forms of compass. The old form of compass depends for its operation on the fact that a magnetized bar of steel will align itself parallel with the magnetic field of the earth.

The earth inductor compass works on the same principle as a magneto, with the exception that in the earth inductor the earth's magnetic field is used instead of a permanent magnet of steel. A coil of wire is rotated rapidly in the earth's field and the electric potential thus generated is measured on an ordinary voltmeter.

How It Works

The earth inductor is nothing new. It has been stock equipment in every physical laboratory and nearly all students of physics have experimented with it. It was usually employed to determine the relative values of the vertical and horizontal components of the earth's magnetic field, and hence the angle of dip of this field.

The principle of operation of the earth inductor can be understood with the aid of Fig. 1. Let the horizontal parallel lines NS represent the magnetic field of the earth. Let the circle be a cylindrical frame carrying a coil of a large number of turns of fine wire similar to the rotor of a variometer or the armature in a magneto or generator. Now let the coil spin rapidly around a vertical axis. The turns of wire cut the lines of magnetic force and thereby an electric potential is generated. This potential can be measured with a voltmeter connected to the terminals of the coil. Its magnitude depends on the strength of the earth's field, on the number of turns in the coil and on the rate of rotation of the coil.

The electric potential generated by this earth inductor will be alternating and the frequency will be equal to the number of revolutions of the rotor or armature. It is necessary to rectify it so that direct current voltmeter can be used to measure the voltage. For this purpose an ordinary commutator is used. The coil terminals are brought to commutator segments as shown in Fig. 2, which are attached to the shaft of the armature. Contact brushes sweep over these commutator segments as the rotor spins. Although the potential of the two segments alternates, the potential at the brushes will always be in the same direction. Hence if a direct current voltmeter is connected to the brushes, a steady unidirectional deflection will be obtained, although the voltage will be pulsating.

Variation in Voltage

The potential generated in the coil is maximum when the wires cross the magnetic lines of force at right angles, and it will be zero when the average turn sweeps parallel with the lines of force. To get maximum indication on the voltmeter, therefore, the brushes must be set so that the commutation from one to the other occurs at the instant that the voltage is zero.

If the comutation occurs when the voltage is maximum there will be no indication in the meter. Intermediate adjustments of the brushes with respect to the field will give intermediate values of deflection on meter, and the reading will be plus or minus according to which side of the zero the brushes are set.

Now, if a permanent magnet, fixed in position, were used, as in the magneto, any adjustment would remain. But when the magnetic field of the earth is used, the reading depends on how the brushes are placed with respect to this field, and this does not remain constant as the airplane turns.

Zero Adjustment

The zero adjustment can be brought about by turning the brushes while the plane is turned in a given desired direction. If the plane then turns out of this direction there will be an indication on the meter. The direction of the deflection will depend on the direction in which the plane deviates from the course set, and the amount of deviation will be proportional to the deflection of the meter as long as the deviation is small.

As the earth inductor compass is installed and adjusted the maximum indication is obtained when the brushes point north and south, and zero indication when they point east and west.

The plan of the installation is shown in Fig. 3. The generator G, or earth inductor proper, is placed in the extreme rear of the fuselage, where the earth's field is least affected by the engine of the plane. It is driven by a windmill motor which projects above the top of the fuselage. he armature spins about a vertical axis and it is mounted in gimbals so that its operation will not be affected by rolling and pitching the plane.

Meter in Front of Him

The indicating meter, M, is placed on the instrument board in front of the pilot and it is connected by means of a pair of wires to the brushes of the generator. The position of the brushes with respect to the field can be controlled from the instrument board by means of a crank, C, which is mechanically connected to the brushes with a suitable coupling. A dial at C indicates how the brushes are placed.

If an unknown direction is to be determined the crank is turned until the voltage indication is zero and the direction desired is read on the control dial.

The usual way of steering a ship with the earth inductor compass is to set the brushes so that the indication is zero when the ship is pointing in the desired direction and then hold it so that the indication remains zero. Any deviation will be shown by a deflection on the meter in one direction or the other.

The earth inductor compass was invented by Maurice Titterington of the Pioneer Instrument Company, Brooklyn, N. Y.

A THOUGHT FOR THE WEEK

OF course anybody could go on a vacation in the valley or the mountains without taking along a radio set. So could anybody go without a toothbrush or the determination to have a good time—but what's the use?

SIXTH YEAR

RADIO WORLD

The First and Only National Radio Weekly

Member, Radio Publishers Association

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

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

Movie Concern Plans To Chain Up Stations

The Paramount-Famous Lasky Corporation, a motion picture concern, is planning to promote a new chain station system, composed of about a dozen existing stations. The company's latest motion pictures will be dramatized and advertised over the air. Other entertainment will also be sponsored. KMOX, St. Louis; WHT, Chicago, and WMAK, Lockport, N. Y., are some of the stations which have been mentioned.

FRENCH STATION AT EQUATOR

Completing the intercommunication system between the French colonies and the mother country, which was started in 1911, a new radio station was opened at Brazzaville, Equatorial Africa. Other stations are located in Bamako, western Africa; Tananarive, Madagascar; Saigon, Indo-China, and Bjibouti, Somaliland.

MARCH of EVENTS

CAPT. CHARLES LINDBERGH flew from New York to Paris without benefit of radio communication. Many wondered whether he could succeed, the reasons varying, but he answered all of them quite emphatically by his performance. He made a non-stop flight in his Ryan monoplane, the Spirit of St. Louis, and for his navigation depended largely on an earth inductor.

What good radio equipment would have done him is hard to imagine. The information he desired most was something that he could not obtain—the weather conditions ahead of him and behind him. Just once, when he ran into a sleet storm, he wondered for a moment whether he should turn back, but he did not know if the weather behind him was better or worse, so he kept on.

Being alone, he was both pilot and navigator. Two things he needed most were safe weather and wakefulness. If enough sleet had weighted his wings he would have been down in a few minutes, but fortunately he was able to ride high, escaping the severest part of the sleet storm at 10,000 feet.

When he reached Paris he was in doubt as to the identity of the field he supposed was Le Bourget, the destined landing place, the same airdrome from which Nungesser and Coli started on their tragic journey. Floodlights and searchlights burned simultaneously, a practice that does not prevail in the United States, so he was confused for a while, but dipped low enough, after encircling Paris three times, to see the headlights of the many automobiles on the field, so he identified the field that way. Meanwhile, however, he had attempted communication with the field by dots and dashes, but as he evidently used a flashlight, and the field was brightly illuminated, those below did not see his code signals.

And so ended the greatest single-handed feat in history.

BUT there was a radio aspect, and a thrilling one, in that stations sent out bulletins of the progress of the flight. Several suggestions have been made lately that stations need editors. WJZ and WEAF, for instance, had planned to send out half-hourly reports, but found quickly that the public demanded at least one report every five minutes. And the public won. Any news editor could have forewarned these stations.

The broadcasters depended largely on news service, often with the assistance of newspapers, for word of Capt. Lindbergh's progress. Fortunately the news given was much more reliable than that which at least one New York afternoon yellow journal published, for that paper was on the street announcing Capt. Lindbergh's arrival in Paris more than two hours before he actually got there. This was the same paper that announced a few weeks previously that Nungesser and Coli were "outside the city," meaning New York.

It seems that some papers need editors more than do the broadcasting stations.

RADIO again came into play when Capt. Lindbergh talked to his mother—Paris to Detroit—while he was in the midst of an hilarious reception from the French populace and officials, a reception not a bit more than what he deserved.

TRANSATLANTIC flights are destined to be more numerous and many of them, even in the early stages, will be surprisingly successful. Planes soon will go frequently not only from New York to Paris but to Egypt and beyond. For commercial work multi-motors will be needed, as passenger safety will demand them. And there will be more than one pilot aboard. Such trips, however, will be made with the aid of radio, for only when one flies alone is he virtually forced to be incommunicado.

RADIO sets on planes—both receivers and transmitters — run toward the short waves. Nevertheless, regular broadcast reception has proven successful, as in the Ford plane in the recent test. Stations along the route, from Washington to Detroit, were tuned in, and messages were sent, also, although short waves were used for sending, and a 100-mile range was established successfully for this part of the work.

Commercial flying and radio equipment will go hand in hand in days to come.

RADIO strikes many as being an art that leaped full-grown into prominence and permanence. It did no such thing. It grew slowly. In six years, up to date, the progress was somewhat faster. But there is still room for much improvement. Programs could be better. Happily, they are getting better all the time. It costs a great deal of money to improve them, and smaller stations find this problem exceedingly vexatious. Resourcefulness as well as resources is needed even by large stations, or chains, for that matter, to accomplish anything worth while.

Since the advent of Merlin H. Aylesworth as president of the National Broadcasting Company the public has been treated to a fine example of administration and program improvement. His ability, directing force and idealism have been a great public asset. Now he adds Walter Damrosch to his personnel as musical counsel, to institute a glowing University of the Air, to teach appreciation of finer music, in co-operation with colleges and parents.

And at the same time in England something like the same plan seems to be afoot, the British Broadcasting Company having engaged Sir Henry Wood in a similar capacity.

What better tribute to the permanency and importance of radio than that these two great musicians should devote all their time to radio programs?—*Herman Bernard.*

Ready for Trade Show In Chicago June 13

The first annual radio trade show of the Radio Manufacturers' Association, Inc., which is to be held in conjunction with the third annual Radio Manufacturers' Association convention, during the week of June 13 to 18, at the Exhibition Hall, Stevens Hotel, Chicago, has been heralded by the leading jobbers, dealers, and representatives throughout the country as a great step toward the advancement of the industry.

Nearly 175 manufacturers will be represented at this show, thereby giving the trade an opportunity at an early time to get complete information on the new lines.

Supervisor Gives Up Wavemeter Checking

The managers of many broadcasting stations in the New York vicinity recently filed a complaint with the Federal Radio Commission, stating that they could not be sure whether they are operating on the exact waves, since the Federal Radio Supervisor had ceased checking their wavemeters.

Arthur Batcheller, Radio Supervisor, stated that it was not compulsory for the supervisor to check wavemeters.

"We have discontinued this because we are too busy now," cointinued Mr. Batcheller. "The stations should check their meters by the standard frequency signals broadcast by the Bureau of Standards on schedules announced several weeks in advance. The bureau also measures the waves of certain stations and announces those found to maintain their correct waves. These are known as 'standard frequency stations.'

"Although there is no assurance that these stations stay on their channels, it gives other stations, an opportunity to check their wave meters by tuning in on the transmitters listed as standards."

After searching all over New York, one station's representative found that the meters could be checked in the Navy Building at Stevens Institute of Technology, Hoboken, N. J.

Forecasts of Static Now Made Accurately

The Hydrographic Office of the Navy Department, in collaboration with Naval Communications, Office of Naval Operations, the Division of Radio Research, Bureau of Engineering, and the Bureau of Aeronautics, conducted research work in the study of static which has resulted in showing that some important practical benefits can be derived from simultaneous static observations.

This study has indicated, that by using machines which have been developed to measure static intensity in standard units, it may be possible to plot the highs and lows of static and determine the general static distribution in the same manner as we now plot barometric pressures.

It has been further shown that static centers so plotted have a definite motion of translation relative to the motion of translation of atmospheric structure, and that it is possible by plotting such centers and knowing their progress from present weather forecasting methods to make accurate static forecasts.

Quality Transmitter Ordered in New Zealand

New Zealanders will shortly enjoy broadcasting from a new high quality 5 kw broadcasting station, the building for which is now in course of erection on Mount Victoria, a prominent hill overlooking the harbor of the city of Wellington. This equipment, together with one of the same capacity being installed in Buenos Aires for broadcasting from the Colon Opera House, will be the largest south of the equator.

The Wellington equipment is being ordered from the Australasian Associated Company of the International Standard Electric Corporation, which previously furnished two 500-watt equipments. One of the 500-watt stations is now in operation at Auckland, and the other at Christchurch.

All these equipments are of Western Electric design and of the type installed by the Western Electric Company in leading United States stations.

Free Speech Guarantees Demanded of Stations

By Emanuel Celler

Representative from Brooklyn, N. Y.

I believe in some mild form of private censorship. That seems necessary. The broadcaster, however, must, within due bounds, select what shall or shall not go over his microphone.

But he must, like every newspaper man, edit, and not censor. He should permit the radical, the liberal, the orthodox, the modernist, the fundamentalist, the conservative—all to express their views. He could and should taboo speakers who are boors or bores.

It must be remembered, though, that radio is not limited to parlor entertainment. It is bound to be used for the widest possible discussion of mooted topics.

Not Compelled to Listen

The radio fan is not compelled to listen. That's his remedy. He can tune off and hunt for something more to his liking.

Congress carefully avoided censorship in the Radio Bill. It only prescribed that all political candidates for office have equal radio opportunities, so that if the radio facilities are offered, for example, to a Republican candidate for Congress, the same facilities would have to be open to his Democratic or Socialist opponents.

In the discussion on the bill private censorship was barely considered. Apparently, we of the Congress, did not anticipate some of the clumsy methods of private broadcasting stations.

Surely Government censorship is far better than some of the private censorship indulged in by a number of mealy-mouthed broadcasting station managers.

Wants Both Sides Heard

I don't presume to be able to solve these vexatious problems; but there are several inescapable principles that should govern in the discussion of this matter. First: the broadcaster has received a franchise and the operations over his station are not unaffected by public interest. Second: consequently the public cannot be hornswoggled out of its rights in that regard, and this includes the right to hear both sides of a question, as well as the right to hear the truth, no matter whom or how it hurts.

I have no ready-made remedy that will be a cure-all for the difficulty. I desire, however, to make certain suggestions which might be helpful:

(1) Every station should keep a log or record of all matters of importance that happen at the station, including all protests, and wherever possible there should be deposited in the station copies of all speeches delivered.

Whole Programs Favored

(2) A radio station which contracts to broadcast a certain dinner, function or occasion, either free or for profit, should be compelled to broadcast the entire program, even though the station objects to the views of one or more of the speakers, provided, of course, that the matter broadcast is not unlawful, obscene or slanderous.

Having struck a bargain it must abide by it. It cannot summarily cut off a speaker either because he wears a red necktie or doesn't like baseball or has divorced three wives.

(3) In applications for renewal of licenses, the Radio Commission and the Department of Commerce should take into consideration the liberal or illiberal attitude of the station anent broadcasting both sides of a controversy and the fairness with which programs are selected. For this purpose the log or record of the station shall always be open to the inspectors or accredited officers of the Radio Commission and Department of Commerce.

Controversies on the Air

(4) Each station should permit two or three or even more hours per week for discussion of controversial political and social issues. Those hours could be designated either in the morning, afternoon or evening, at the option of the station.

(5) Our laws of libel and slander may have to be modified to suit peculiar radio conditions. In the case of a newspaper publishing a libel there is strict accountability. That arises from an uncontrolled right to reject or accept the matter to be put into the paper. If you give the broadcaster less control over his program, you must to that extent limit his liability for damages for slander.

Slander Protection

The publisher can see the written word before his paper prints it, and can thus adequately protect himself and omit libelous matter. The broadcaster with reduced power of rejection, cannot anticipate what a speaker will say. He may not be able to prevent the slander.

(6) There should be set up a sort of advisory council or committee in every broadcasting station. The membership thereof should be drawn from men of recognized ability and of standing in their respective communities. All sects, creeds and shades of political and civic opinion should have representation. This advisory board or council could advise with the station owner as to the nature of his programs.

"No International Test This Year," Says Nixon

The international radio broadcasting tests which were a feature of the radio fans's year in 1926 will hardly be repeated in the coming year, Laurence A. Nixon, executive secretary of the International Radio Week Committee announced in a letter to Arthur H. Lynch, founder of the international tests and director of them for several years.

"Broadcasters of the United States are required to make a sacrifice of over $50,000 in commercial time," Nixon wrote, pointing out that very little benefit resulted to the broadcaster, even in the event that the tests were extremely successful, as when hundreds of thousands of people might hear overseas stations, instead of the few thousand who were successful in 1926.

More than a million lines of paid newspaper advertising were printed as a result of the test, Nixon also explained, quoting from the final official report of the International Radio Week Committee which has been dissolved, according to his communication.

* * *

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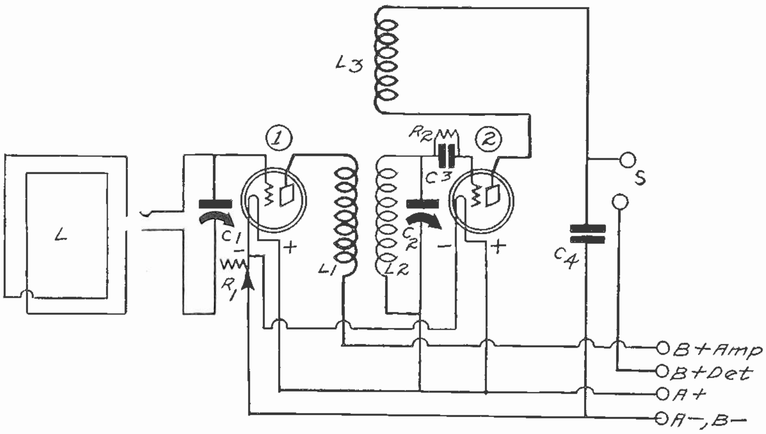

FIG. 538

The circuit diagram Raphael Borden sent in, showing the open grid return he left. at lower jack lead, which prevented him from receiving signals.

I HAVE constructed a two-tube regenerative set, the circuit diagram of which I enclose. When I hook up the loop to the detector circuit, signals can be heard, but when it is hooked up to the first RF stage I can hear nothing but a low annoying drone. A regulation tuner, having a twelve-turn primary (L1) and a fifty turn secondary (L2), both wound on a three-inch diameter tubing with No. 22 double cotton covered wire, no spacing between the two, and a thirty-two turn tickler (L3) wound on a one-and-three-quarter-inch diameter tubing with No. 26 single silk covered wire is used. Across the loop and the secondary windings .0005 mfd. variable condensers (C1 and C2) are shunted. Both filaments are controlled with a ten ohm rheostat. A .0001 mfd. fixed condenser with a 4 megohm grid leak across it is used. For by-passing, a .001 mfd. fixed condenser (C4) is used. To the detector plate I apply forty-five volts, while to the radio frequency amplifier plate, I apply sixty-seven and one-half volts. The loop is a standard model for .0005 mfd. condensers.

(2)—Can an antenna be used on this set?

(3)—If so, please explain how it may be connected.—RAPHAEL BORDEN, Schenectady, N. Y.

(1)—You have an open grid return circuit in the radio frequency portion of the hookup. The rotary plates of C1 should be connected to A minus, B minus post.

(2)—Yes.

(3)—Procure a three-inch diameter tubing. Wind twelve turns. Then leave one quarter-inch space, and wind fifty turns. Use No. 22 double cotton covered wire. Suggest you see the Nov. 6 issue of RADIO WORLD, page 11, on how to hook up the coil and also a double circuit jack for switching in the antenna or loop.

* * *

PLEASE SPECIFY the parts to be used in the three-tube reflex receiver shown on the bottom of page 10 of the Feb. 26 issue of RADIO WORLD.—LOUIS M. GOLD, Yonkers, N. Y.

The antenna condenser C3 has a capacity of .0005 mfd. The primary of the tuning coil L1 consists of twenty turns, tapped every second turn. The secondary of this coil L2 consists of forty-five turns.

Both are wound on a three-inch diameter tubing using No. 22 double cotton covered wire. Allow one-quarter inch space between the windings. LJ is a double circuit jack used for switching from the antenna to the loop, or vice versa. The fixed RFT should have a range of from 200 to 550 meters. The arrow and base are the crystal detector. AFT1 is a four-to-one ratio audio transformer. AFT2 and AFT3 are three-to-one ratio audio transformers. R1 is a twenty-ohm rheostat. R2 and R3 are 1A Amperites. SCJ is a single circuit jack. C2 is a .001 mfd. fixed condenser. S is a filament switch. B plus 1 equals ninety volts. B plus 2 equals forty-five volts. Use a four and one half volt C battery. The -01A type tubes should be used throughout.

* * *

I HAVE a three-tube regenerative receiver. The detector tube is made to regenerate by a variometer. Two stages of transformer coupled frequency amplification are also used. The filament of each tube is controlled by a ballast resistor. Now I find it difficult to control the regeneration with the variometer. Would a rheostat inserted in place of the ballast help to cure this trouble?

(2)—I get WEAF at 65, and WNYC at 70. The lowest wavelength station I get is WOR. What can I do to bring the low wavelength stations in? My antenna is about one hundred feet long.—BERTRAM GURNOT, Albany, N. Y.

(1)—The rheostat would help a great deal. Reduce your plate voltage also. Try a low resistance grid leak. If you have a fixed condenser across the primary of the first audio frequency transformer, take it out. Push the primary farther away from the secondary. Take about three turns off the primary winding.

(2)—Take about fifteen turns off the secondaries. The antenna length is all right.

* * *

I HAVE a five-tube receiver, using an untuned antenna stage, two tuned radio frequency stages, a crystal detector coupled by a tuned coil, and two stages of transformer coupled audio frequency amplification.

(1)—The set works very satisfactorily, except that on one or two points along the dials, the set goes dead. What can this be due to?

(2)—I have a .00025 mfd. variable condenser and a twenty-turn coil, wound on a three-inch diameter tubing with No. 24 double cotton covered wire Could this be used somewhere in the circuit, so that I may have a regenerative set? I am informed that this would increase the distance-getting qualities of my set, and distance is what I would like to get.—RALPH L. KILLINGSWORTH, Catskill, N. Y.

(1)—The plates of one of the variable condensers are touching at those points. Disconnect a lead from each one of the condensers and then test with a battery and phone. A click will be heard at the point of contact between the plates as you revolve them.

(2)—By shunting the condenser across the coil and inserting the combination in series with the plate post of the third radio frequency amplifier, this tube becomes regenerative. This coil is also in series with the primary winding of the last radio frequency transformer, whose secondary is connected in the crystal detector circuit. The installation of this regenerative feature will add to the sensitivity or distance-getting qualities of the seat. The tuning will become more difficult.

* * *

I RECENTLY obtained a seven-tube receiver from a friend. The set has a jack which allows the use of antenna or loop. About a week ago I found that when the loop plug was taken out the set would not work. I went up on the roof to check up the antenna and found it all right. The ground was also found to be all right. When using the loop, the results are excellent. I wanted to use the antenna to get more distance. I would like to have a circuit diagram showing how the jack is connected for loop-antenna operation, so that I may check up the connections in the set, where I am pretty sure the trouble lies. Three stages of tuned radio frequency amplification, a non-regenerative detector and three stages of resistance coupled audio frequency amplification are used. The filaments of all the tubes, except the first, are controlled by ballast resistors, the first being controlled by a twenty-ohm rheostat.—WALLACE THORN, Atlanta, Ga.

On page 11 of the Nov. 6 issue of RADIO WORLD, Radio University columns, such a diagram was shown and also fully explained.

* * *

I BUILT the three-tube reflex, described on page 20 of the November 20 issue of RADIO WORLD, using a baseboard layout. I would now like to rebuild it in a cabinet, but before doing so, am seeking some advice.

(1)—I used both the antenna inductance and midget condenser connecting the grid to the antenna. I found that this gave me very loud signals, but at the same time broad tuning. What could I do to eliminate the broad tuning and still keep the loud signals?

(2)—I have a three-stage resistance coupled audio amplifier, which I would like to use in place of the single transformer stage now used. Will this be all right, or will there be too much distortion?

(3)—Are the input posts of the new amplifier connected to the end of L3 and the B plus 2 post?—JOSEPH KUPPERBERG, New York City, N. Y.

(1)—Disconnect the midget condenser. Then insert it in series with the antenna. Increase the number of turns on the primary of the first coil to thirty.

(2)—The resistance amplifier can be used very successfully.

(3)—Yes.

* * *

LAST MONTH a friend gave me the circuit diagram of a six-tube set, using three stages of tuned radio frequency amplification, a non-regenerative detector and two stages of transformer coupled audio amplification. I built it, and although the set works remarkably well, it is too difficult to tune, due to the four dials. Could I, therefore, replace these single condensers with a pair of double condensers, one to control the first and second RF stage and one for the third RF and detector stage? I use 01A tubes throughout.

(2)—The filament of each tube is controlled by an Amperite. Should I use a rheostat for each pair of tubes? If so, what value?

(3)—Would a tickler coil, inserted in the detector plate, get me more DX?—MARLOW HENDERSON, East Pittsburgh, Pa.

(1)—Yes. It will be necessary to change the connections of the grid leak, which is now shunted across the grid condenser, so that it is connected between the grid and the plus A post.

(2)—No.

(3)—Yes, but it would make the set difficult to tune.

* * *

I HAVE built the Nine-In-Line Super-Heterodyne, described in the April 2, 9, 16 and 23 issues of RADIO WORLD.

(1)—I would like to install a —71 power tube in the last audio stage. Will this necessitate the installation of a choke coil and condenser? If so, will a 30 henry choke and 8 mfd. condenser do?

(2)—The first detector tube is quite critical. Please explain how this may be cured.

(3)—Would a 400-ohm. potentiometer help any?—GERALD F. RIGERS, Portland, Ore.

(1)—Yes, you can use the combination you mention. Be sure you use the proper ballast resistor in the filament circuit.

(2)—A twenty-ohm rheostat inserted in series with the ballast resistor would help cure that. Also the removal of the midget variable condenser would help. The terminal of the pickup coil L3 which is now connected to the G post of the socket is brought to the plus F post. The small variable condenser is then taken out. This leaves the plate of the tube connected only to the P post of the first iron core intermediate frequency transformer. The grid post of the socket, which is now connected nowhere, is brought to the stationary plate post of the variable condenser. The center tap of the loop is not used, when this midget condenser is taken out.

(3)—No.

* * *

LAST WEEK I received a circuit diagram of a five-tube set of the tuned RF type from my cousin. I am going to build this set, and would therefore appreciate some dope on it.

(1)—The plate leads of the RF, detector, first AF and second AF tubes, are each run to separate B posts. No information is given on the voltage to apply. It says, though, to use -01A tubes throughout. Will you please tell me what voltages to use?

(2)—The filaments of both radio frequency tubes are connected to a ten-ohm rheostat. Is that all right?

(3)—In series with the grids of the first and second radio frequency tubes, four-hundred-ohm fixed resistors are inserted. What are these for?

(4)—I have three Mar-co Illuminated Controls. A panel layout for this receiver would be much appreciated. Binding posts are used on the out-put.—SIDNEY GREEN, Bronx, N. Y. City, N. Y.

(1)—Apply sixty-seven and one half volts to the radio frequency plates; forty five volts to the detector plate; ninety volts to the first audio tube plate, and one hundred and thirty-five volts to the last audio plate.

(2)—Yes.

(3)—To stabilize the circuit.

(4)—A panel layout for this set is shown in Fig. 539. A seven inch high, twenty-four inch wide panel should be used. The filament switch is placed near to the control on the extreme right. The radio frequency rheostat is put between first and second control, towards the right.

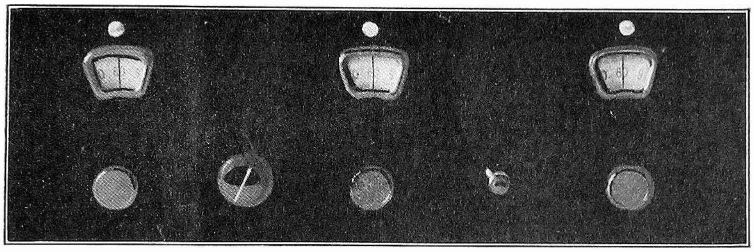

FIG. 539
The suggested panel layout for Sidney Green's five-tube tuned RF receiver.

* * *

I HAVE a one-tube reflex, using the tube both as a radio and audio amplifier in a regenerative circuit with a crystal detector. I would like to supplant the detector with a tube. Please explain how this can be done. A three-circuit tuner is used in the tube circuit and a tuned coil in the crystal circuit.—CY KESSLOFF, West N. Y., N. J.

The stationary plate post of the variable condenser and the end of the secondary winding, now connected to the crystal detector, are brought to a terminal of a .00025 mfd. fixed condenser and a 2 megohm grid leak. The other terminal of this combination is brought to the G post of a socket. The other terminal of the winding and the variable condenser are brought to the plus F post on the socket, the connections to the primary of the audio transformer being broken. The minus F post of the socket is brought to a terminal of a ballast resistor, the opposite terminal of which is brought to the minus A post. The other lead of the crystal detector is broken. You will note that you now have both connections to the primary of the audio transformer broken. The plate post of this new socket is now brought to the P post on the audio transformer. The B post on the transformer is brought to the B plus 45 volt post. The F plus post of this socket is connected to the F plus post of the other socket, which also goes to the plus A post of the battery. Suggest you see page 13 of the Aug. 28 issue of RADIO WORLD for diagram.

* * *

I WISH to build the four-tube circuit shown in the Radio University columns of the May 14 issue of RADIO WORLD.

(1)—Could a double condenser be used to tune both RF stages?

(2)—Could a ten-ohm rheostat be used to control the filaments of both radio frequency tubes?

(3)—Could a 2,000-ohm variable resistance be used somewhere in the circuit to control oscillations?—WALTER McDONALD, Los Angeles, Calif.

(1)—It would work better in the second radio frequency and detector stages. You should place small variable condensers, having a capacity of approximately 50 mmfd., across the secondaries of the coils in these circuits, so that you can balance up the circuits.

(2)—Better use this rheostat to control the filaments of the second radio frequency and detector tubes, allowing the filament of the first radio frequency tube to be controlled by a separate rheostat.

(3)—Yes, in series with the RF plate lead, or B plus 2 lead.

* * *

WILL A three-tube reflex receiver in which the first and second tubes are reflexed, while the third tube which is a regenerative detector, be difficult to control?

(2)—Could the audio frequency transformer in the second reflex stage be placed in a standard stage of audio frequency amplification to reduce the criticalness? How would this be done?—MORRIS H. ANDERLOAN, Kansas City, Mo.

(1)—Yes.

(2)—Yes. It would to a great extent. The terminals that are now brought to the grid circuit of the second tube from the audio transformer are broken. The G post of this transformer is brought to the G post of a new socket. The F minus post is brought to the minus post of a four and one half volt C battery. An Amperite 1A is inserted in series with the filament of the new tube socket. The F plus post is connected to the F plus posts on the other sockets. The plate post of the new socket is brought to the top terminal of a single circuit jack. The bottom terminal of the jack is brought to the one-hundred-thirty-five volt post. The end of the primary coil in the plate circuit of the second tube, which now goes to the top terminal of a single circuit jack on the output, is brought direct to the B plus post.

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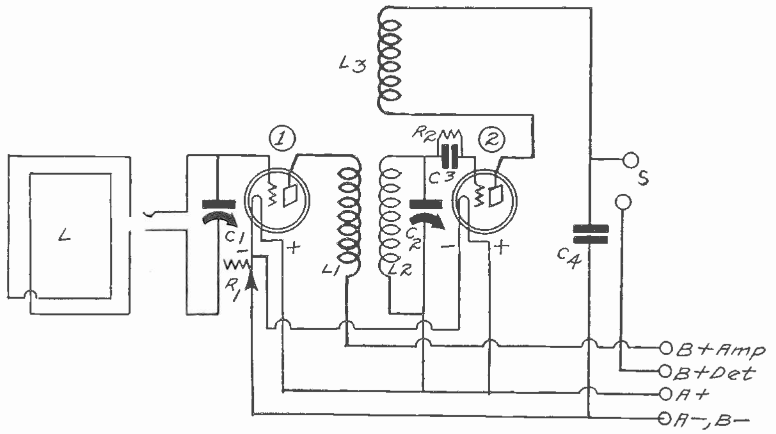

FIG. 538
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I HAVE constructed a two-tube regenerative set, the circuit diagram of which I enclose. When I hook up the loop to the detector circuit, signals can be heard, but when it is hooked up to the first RF stage I can hear nothing but a low annoying drone. A regulation tuner, having a twelve-turn primary (L1) and a fifty turn secondary (L2), both wound on a three-inch diameter tubing with No. 22 double cotton covered wire, no spacing between the two, and a thirty-two turn tickler (L3) wound on a one-and-three-quarter-inch diameter tubing with No. 26 single silk covered wire is used. Across the loop and the secondary windings .0005 mfd. variable condensers (C1 and C2) are shunted. Both filaments are controlled with a ten ohm rheostat. A .0001 mfd. fixed condenser with a 4 megohm grid leak across it is used. For by-passing, a .001 mfd. fixed condenser (C4) is used. To the detector plate I apply forty-five volts, while to the radio frequency amplifier plate, I apply sixty-seven and one-half volts. The loop is a standard model for .0005 mfd. condensers.

(2)—Can an antenna be used on this set?

(3)—If so, please explain how it may be connected.—RAPHAEL BORDEN, Schenectady, N. Y.

(1)—You have an open grid return circuit in the radio frequency portion of the hookup. The rotary plates of C1 should be connected to A minus, B minus post.

(2)—Yes.

(3)—Procure a three-inch diameter tubing. Wind twelve turns. Then leave one quarter-inch space, and wind fifty turns. Use No. 22 double cotton covered wire. Suggest you see the Nov. 6 issue of RADIO WORLD, page 11, on how to hook up the coil and also a double circuit jack for switching in the antenna or loop.

* * *

PLEASE SPECIFY the parts to be used in the three-tube reflex receiver shown on the bottom of page 10 of the Feb. 26 issue of RADIO WORLD.—LOUIS M. GOLD, Yonkers, N. Y.

The antenna condenser C3 has a capacity of .0005 mfd. The primary of the tuning coil L1 consists of twenty turns, tapped every second turn. The secondary of this coil L2 consists of forty-five turns.

Both are wound on a three-inch diameter tubing using No. 22 double cotton covered wire. Allow one-quarter inch space between the windings. LJ is a double circuit jack used for switching from the antenna to the loop, or vice versa. The fixed RFT should have a range of from 200 to 550 meters. The arrow and base are the crystal detector. AFT1 is a four-to-one ratio audio transformer. AFT2 and AFT3 are three-to-one ratio audio transformers. R1 is a twenty-ohm rheostat. R2 and R3 are 1A Amperites. SCJ is a single circuit jack. C2 is a .001 mfd. fixed condenser. S is a filament switch. B plus 1 equals ninety volts. B plus 2 equals forty-five volts. Use a four and one half volt C battery. The -01A type tubes should be used throughout.

* * *

I HAVE a three-tube regenerative receiver. The detector tube is made to regenerate by a variometer. Two stages of transformer coupled frequency amplification are also used. The filament of each tube is controlled by a ballast resistor. Now I find it difficult to control the regeneration with the variometer. Would a rheostat inserted in place of the ballast help to cure this trouble?

(2)—I get WEAF at 65, and WNYC at 70. The lowest wavelength station I get is WOR. What can I do to bring the low wavelength stations in? My antenna is about one hundred feet long.—BERTRAM GURNOT, Albany, N. Y.

(1)—The rheostat would help a great deal. Reduce your plate voltage also. Try a low resistance grid leak. If you have a fixed condenser across the primary of the first audio frequency transformer, take it out. Push the primary farther away from the secondary. Take about three turns off the primary winding.

(2)—Take about fifteen turns off the secondaries. The antenna length is all right.

* * *

I HAVE a five-tube receiver, using an untuned antenna stage, two tuned radio frequency stages, a crystal detector coupled by a tuned coil, and two stages of transformer coupled audio frequency amplification.

(1)—The set works very satisfactorily, except that on one or two points along the dials, the set goes dead. What can this be due to?

(2)—I have a .00025 mfd. variable condenser and a twenty-turn coil, wound on a three-inch diameter tubing with No. 24 double cotton covered wire. Could this be used somewhere in the circuit, so that I may have a regenerative set? I am informed that this would increase the distance-getting qualities of my set, and distance is what I would like to get.—RALPH L. KILLINGSWORTH, Catskill, N. Y.

(1)—The plates of one of the variable condensers are touching at those points. Disconnect a lead from each one of the condensers and then test with a battery and phone. A click will be heard at the point of contact between the plates as you revolve them.

(2)—By shunting the condenser across the coil and inserting the combination in series with the plate post of the third radio frequency amplifier, this tube becomes regenerative. This coil is also in series with the primary winding of the last radio frequency transformer, whose secondary is connected in the crystal detector circuit. The installation of this regenerative feature will add to the sensitivity or distance-getting qualities of the seat. The tuning will become more difficult.

* * *

I RECENTLY obtained a seven-tube receiver from a friend. The set has a jack which allows the use of antenna or loop. About a week ago I found that when the loop plug was taken out the set would not work. I went up on the roof to check up the antenna and found it all right. The ground was also found to be all right. When using the loop, the results are excellent. I wanted to use the antenna to get more distance. I would like to have a circuit diagram showing how the jack is connected for loop-antenna operation, so that I may check up the connections in the set, where I am pretty sure the trouble lies. Three stages of tuned radio frequency amplification, a non-regenerative detector and three stages of resistance coupled audio frequency amplification are used. The filaments of all the tubes, except the first, are controlled by ballast resistors, the first being controlled by a twenty-ohm rheostat.—WALLACE THORN, Atlanta, Ga.

On page 11 of the Nov. 6 issue of RADIO WORLD, Radio University columns, such a diagram was shown and also fully explained.

* * *

I BUILT the three-tube reflex, described on page 20 of the November 20 issue of RADIO WORLD, using a baseboard layout. I would now like to rebuild it in a cabinet, but before doing so, am seeking some advice.

(1)—I used both the antenna inductance and midget condenser connecting the grid to the antenna. I found that this gave me very loud signals, but at the same time broad tuning. What could I do to eliminate the broad tuning and still keep the loud signals?

(2)—I have a three-stage resistance coupled audio amplifier, which I would like to use in place of the single transformer stage now used. Will this be all right, or will there be too much distortion?

(3)—Are the input posts of the new amplifier connected to the end of L3 and the B plus 2 post?—JOSEPH KUPPERBERG, New York City, N. Y.

(1)—Disconnect the midget condenser. Then insert it in series with the antenna. Increase the number of turns on the primary of the first coil to thirty.

(2)—The resistance amplifier can be used very successfully.

(3)—Yes.

* * *

LAST MONTH a friend gave me the circuit diagram of a six-tube set, using three stages of tuned radio frequency amplification, a non-regenerative detector and two stages of transformer coupled audio amplification. I built it, and although the set works remarkably well, it is too difficult to tune, due to the four dials. Could I, therefore, replace these single condensers with a pair of double condensers, one to control the first and second RF stage and one for the third RF and detector stage? I use 01A tubes throughout.

(2)—The filament of each tube is controlled by an Amperite. Should I use a rheostat for each pair of tubes? If so, what value?

(3)—Would a tickler coil, inserted in the detector plate, get me more DX?—MARLOW HENDERSON, East Pittsburgh, Pa.

(1)—Yes. It will be necessary to change the connections of the grid leak, which is now shunted across the grid condenser, so that it is connected between the grid and the plus A post.

(2)—No.

(3)—Yes, but it would make the set difficult to tune.

* * *

I HAVE built the Nine-In-Line Super-Heterodyne, described in the April 2, 9, 16 and 23 issues of RADIO WORLD.

(1)—I would like to install a —71 power tube in the last audio stage. Will this necessitate the installation of a choke coil and condenser? If so, will a 30 henry choke and 8 mfd. condenser do?

(2)—The first detector tube is quite critical. Please explain how this may be cured.

(3)—Would a 400-ohm. potentiometer help any?—GERALD F. RIGERS, Portland, Ore.

(1)—Yes, you can use the combination you mention. Be sure you use the proper ballast resistor in the filament circuit.

(2)—A twenty-ohm rheostat inserted in series with the ballast resistor would help cure that. Also the removal of the midget variable condenser would help. The terminal of the pickup coil L3 which is now connected to the G post of the socket is brought to the plus F post. The small variable condenser is then taken out. This leaves the plate of the tube connected only to the P post of the first iron core intermediate frequency transformer. The grid post of the socket, which is now connected nowhere, is brought to the stationary plate post of the variable condenser. The center tap of the loop is not used, when this midget condenser is taken out.

(3)—No.

* * *

LAST WEEK I received a circuit diagram of a five-tube set of the tuned RF type from my cousin. I am going to build this set, and would therefore appreciate some dope on it.

(1)—The plate leads of the RF, detector, first AF and second AF tubes, are each run to separate B posts. No information is given on the voltage to apply. It says, though, to use -01A tubes throughout. Will you please tell me what voltages to use?

(2)—The filaments of both radio frequency tubes are connected to a ten-ohm rheostat. Is that all right?

(3)—In series with the grids of the first and second radio frequency tubes, four-hundred-ohm fixed resistors are inserted. What are these for?

(4)—I have three Mar-co Illuminated Controls. A panel layout for this receiver would very much be appreciated. Binding posts are used on the out-put.—SIDNEY GREEN, Bronx, N. Y. City, N. Y.

(1)—Apply sixty-seven and one half volts to the radio frequency plates; forty five volts to the detector plate; ninety volts to the first audio tube plate, and one hundred and thirty-five volts to the last audio plate.

(2)—Yes.

(3)—To stabilize the circuit.

(4)—A panel layout for this set is shown in Fig. 539. A seven inch high, twenty-four inch wide panel should be used. The filament switch is placed near to the control on the extreme right. The radio frequency rheostat is put between first and second control, towards the right.

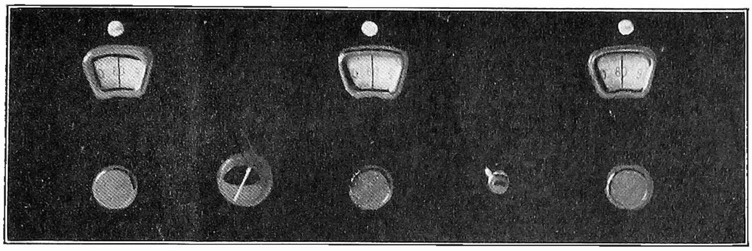

FIG. 539
The suggested panel layout for Sidney Green's five-tube tuned RF receiver.

* * *

I HAVE a one-tube reflex, using the tube both as a radio and audio amplifier in a regenerative circuit with a crystal detector. I would like to supplant the detector with a tube. Please explain how this can be done. A three-circuit tuner is used in the tube circuit and a tuned coil in the crystal circuit.—CY KESSLOFF, West N. Y., N. J.

The stationary plate post of the variable condenser and the end of the secondary winding, now connected to the crystal detector, are brought to a terminal of a .00025 mfd. fixed condenser and a 2 meg-ohm grid leak. The other terminal of this combination is brought to the G post of a socket. The other terminal of the winding and the variable condenser are brought to the plus F post on the socket, the connections to the primary of the audio transformer being broken. The minus F post of the socket is brought to a terminal of a ballast resistor, the opposite terminal of which is brought to the minus A post. The other lead of the crystal detector is broken. You will note that you now have both connections to the primary of the audio transformer broken. The plate post of this new socket is now brought to the P post on the audio transformer. The B post on the transformer is brought to the B plus 45 volt post. The F plus post of this socket is connected to the F plus post of the other socket, which also goes to the plus A post of the battery. Suggest you see page 13 of the Aug. 28 issue of RADIO WORLD for diagram.

* * *

I WISH to build the four-tube circuit shown in the Radio University columns of the May 14 issue of RADIO WORLD.

(1)—Could a double condenser be used to tune both RF stages?

(2)—Could a ten-ohm rheostat be used to control the filaments of both radio frequency tubes?

(3)—Could a 2,000-ohm variable resistance be used somewhere in the circuit to control oscillations?—WALTER McDONALD, Los Angeles, Calif.

(1)—It would work better in the second radio frequency and detector stages. You should place small variable condensers, having a capacity of approximately 50 mmfd., across the secondaries of the coils in these circuits, so that you can balance up the circuits.

(2)—Better use this rheostat to control the filaments of the second radio frequency and detector tubes, allowing the filament of the first radio frequency tube to be controlled by a separate rheostat.

(3)—Yes, in series with the RF plate lead, or B plus 2 lead.

* * *

WILL A three-tube reflex receiver in which the first and second tubes are reflexed, while the third tube which is a regenerative detector, be difficult to control?

(2)—Could the audio frequency transformer in the second reflex stage be placed in a standard stage of audio frequency amplification to reduce the criticalness? How would this be done?—MORRIS H. ANDERLOAN, Kansas City, Mo.

(1)—Yes.

(2)—Yes. It would to a great extent. The terminals that are now brought to the grid circuit of the second tube from the audio transformer are broken. The G post of this transformer is brought to the G post of a new socket. The F minus post is brought to the minus post of a four and one half volt C battery. An Amperite 1A is inserted in series with the filament of the new tube socket. The F plus post is connected to the F plus posts on the other sockets. The plate post of the new socket is brought to the top terminal of a single circuit jack. The bottom terminal of the jack is brought to the one-hundred-thirty-five volt post. The end of the primary coil in the plate circuit of the second tube, which now goes to the top terminal of a single circuit jack on the output, is brought direct to the B plus post.

R. C. A. Licenses Crosley, Ending Long Litigation

Stabilization of the radio industry received marked impetus when it became known that Powel Crosley, Jr., president of the Crosley Radio Corporation, had entered into an agreement with the Radio Corporation of America whereby Crosley is licensed under many of the radio patents held by R. C. A., General Electric, Westinghouse Electric and Manufacturing Co. and the American Telephone and Telegraph Co.

The agreement entitles Crosley to the use of more than 100 basic patents, except those covering the principle of the Super-Heterodyne and super-regeneration. All future laboratory developments of R. C. A. and its associated companies in the field of tuned radio frequency receivers will be available to him.

Overtures were made to Crosley by R. C. A. interests some months ago. Culmination of recent litigation clearing up the patent situation is said to have prompted Crosley, who also controls Amrad Radio Corporation of Boston, and who is interested in DeForest Limited of Canada, to take this step.

The contracts are said to provide for a 7½ per cent royalty based on sales. More than $500,000 dollars already has been paid to R. C. A., by the Crosley corportion, it was said.

"Just as the Federal Radio Commission is clearing up broadcasting, so will a clearing up of the patent situation help the engineering and manufacturing side of the industry," Mr. Crosley said. "I have always recognized patent rights and have always paid royalties on patents. Although this alliance with R. C. A. involves paying somewhat more, I feel that through elimination of costly litigation the public will benefit most."

NEW CORPORATIONS

Paratone Manufacturing Co., N. Y. City, N. Y., $20,000. (Atty., D. H. Brown, 15 William St., N. Y. City)

Fox Sues DeForest; Wants $100,000 Back

Dr. Lee DeForest, inventor of the three-element vacuum tube, is being sued by William Fox, president of the Fox Film Corporation, to recover $100,000, which in October, 1926, Mr. Fox states he paid to Dr. DeForest for an option on the majority voting stock of the DeForest Phonofilms, Inc. It is alleged by Mr. Fox that Dr. DeForest at that time stated that the DeForest Phonofilms, Inc., was the sole and exclusive owner of the patents, whereas he had really signed up with the DeForest Radio Telephone and Telegraph Company, who had assigned the patents to the Western Electric Company, for a seven-year period, beginning March 16, 1917.

Dr. DeForest states that Mr. Fox simply did not exercise his option, and also that Mr. Fox knew all the time that the Western Electric Company had been assigned certain patents, these patents, however, having nothing to do with talking pictures, all concerning radio only.

Sterling Announces Two New Power Units

Among the new developments of the Sterling Manufacturing Co., Cleveland, are two new power units. These will be shown at the R. M. A. Show at Chicago, June 13 to 18, together with the full line of other Sterling radio products at booth 68. The first is an entirely new A light socket power unit using the latest development in Raytheon A rectifier, the 2½ ampere cartridge. It is universal for sets using from three to ten large tubes; there is no hum, due to the two-stage filter of large capacity. An indicator shows point of highest operating efficiency with adjustment control. An internal automatic switch gives instant control from set when used with B supply or batteries. It is small in size, no larger than the average A battery and economical, only 60 watts at maximum load.

The other is a perfected light socket power team for Radiolas 25 and 28. This is built to R.C.A. standards and gives a continuous supply of filtered current. There is no trickle charging and no external wires. It is fully automatic in operation and can be installed almost instantly with the specially spaced power cable.

Among other Sterling products to be shown will be the line of well-known Sterling meters, including pocket and panel mounting types, with two new panel meters having the push-button feature. Chargers of all kinds, B power supply units, tube reactivators, rheostats, potentiometers and audio transformers are also made by this company. Many fans do not know that the Sterling full-range audio transformers are among the high class tone producers. A handsomely illustrated booklet illustrating the full line will be sent to fans and dealers on application to the Sterling Mfg. Co., 2831 Prospect Avenue, Cleveland, Ohio.—J. H. C.

Davega is Sued Over Patent on Box for Sets

Hundred of radio manufacturers shipping a total of several million of radio sets each year are vitally concerned in the outcome of the suit brought in the United States District Court for the Southern District against Davega, Inc., by the Air Cushion Shipping Container Corporation of New York City. It is alleged in the complaint that Davega, Inc., sold and shipped a radio set enclosed in a shipping case which infringed the patents held by the Air Cushion Corporation.

That a great number of manufacturers, dealers and jobbers are now infringing these patents was alleged by an official of the Air Cushion Corporation. He added that it has been decided to bring suits against all of these.

The PeQuot Manufacturing Corporation of Glendale, Queens, N. Y. are the Eastern licensed manufacturers, while the Downey Box Company of Kansas City, Mo., hold the Western license. It was said by a representative of the corporation that negotiations are under way looking toward the licensing by a number of additional box manufacturers.

Good Back Numbers of RADIO WORLD

The following illustrated articles have appeared in back issues of RADIO WORLD: 1926-1927:

Oct. 9—A Practical "A" Eliminator, by Arthur H. Lynch. Building the Equamatic, by Capt. P. V. O'Rourke.

Oct. 16—The Bernard, by Herman Bernard. How to Box an "A" Supply, by Herbert E. Hayden.

Oct. 23—The 5-tube P. C Samson, by Capt. P. V. O'Rourke. Getting DX on the Bernard by Lewis Winner.

Oct. 30—The Singletrol Receiver, by Herbert E. Hayden. How to Get Rid of Squeals, by Herman Bernard.

Nov. 6—Reduction of Interference, by A. N. Goldsmith. Variations of Impedances, by J. E. Anderson

Nov. 13—The 4-tube Hi-Power Set, by Herbert E. Hayden. A Study of Eliminators, by Herman Bernard.

Nov. 20—Vital Pointers About Tubes, by Capt. P. V. O'Rourke. The 4-tube Diamond of the Air, by Herman Bernard.

Dec. 4—The regenerative 5-tube Set, by Cap. P. V. O'Rourke. The 8-tube Lincoln Super, by Sidney Stack.
Winner's DC Eliminator, by Lewis Winner.

Dec. 18—Selectivity on One Tube, by Edgar Speare. Eliminating Interference, by J. E. Anderson.

Dec. 25—A New Coupling Device, by J. E. Anderson. Function of Eliminators, by Herman Bernard.

Jan. 1, 1927—The 2 Tube DeLuze Receiver, by Arthur H. Lynch. The Twin-Choke Amplifier, by Kenneth Harkness.

Jan. 8—Tuning Out Powerful Locals, by J. E Anderson. A Choice Superheterodyne, by Brunsten Brunn. The 2-Tube De Luxe Receiver, by Arthur H. Lynch (Part 2).

Jan. 15—The DeLuxe Receiver, by Arthur H. Lynch (Part 3) The Simple Meter Test Circuit by Herbert E. Hayden. The Superheterodyne Modulator Analyzed, by J. E. Anderson.

Jan. 22—The Atlantic Radiophone feat, by Lewis Rand. An Insight Into Resistors, by J. B. Anderson. A Circuit for Great Power, by Sidney Stack.

Jan. 29—The Harkness KH-27 Receiver (Part 1), by Kenneth Harkness. Use of Biasing Resistors, by J. E. Anderson.

Feb 5—5-Tube, 1 Dial Set, by Capt. P. V. O'Rourke. The Harkness KH-27 (Part 2), by Kenneth Harkness. What Produces Tone quality, by J. E. Anderson.

Feb. 12—Phone Talk Put On Speaker, by Herbert E. Hayden. All Batteries Eliminated, by Herman Bernard The Harkness KH-27 Receiver, by Kenneth Harkness (Part 3). Conclusion.

Feb. 19—The 6-Tube Victoreen, by Herman Bernard (Part 1.) The Big Six Receiver, by Wentworth Wood. "B" Eliminator Problem, by Wm. P. Lear. The Phasatrol Circuit, by Capt P. V O'Rourke The 6-Tube Victoreen, by Herman Bernard (Part 2). Conclusion.

Feb. 26—The 5-tube Diamond in a Phonograph, by Hood Astrakan. How To Read Curves by John F. Rider. Proper Tubes for 5-Valve Receiver, by J. E. Anderson.

Mar. 5—Introduction of 4-tube Universal, by Herman Bernard Discussion on DX, by Capt P. V O'Rourke Sensible Volume Control, by Chas. Gribben.

Mar. 12—Ten Tell-Tale Points, by J. E. Anderson How To Figure Resistors, by Frank Logan. The 4-tube Universal, by Herman Bernard. (Part .)

Mar. 19—Psycho-Analyzing Circuits by Thomas L. McKay. The Universal by Herman Bernard (Part 2) How To Use a Wave Trap, by James H Carroll.

Mar. 26—The Universal, by Herman Bernard. (Part 3). Flow of Current in a Vacuum Tube, by Radcliffe Parker. Broadcasting Hypnotism.

April 2—Facts Every Experimenter Should Know, by J. E. Anderson. A Ship Model Speaker, by Herbert E. Hayden. The 3 tube Compact, by Jasper Henry. The Nine-in-Line Receiver, by Lewis Rand (Part 1.)

April 9—A 5-tube Shielded Set, by Herbert E. Hayden. The Power Compact, by Lewis Winner. The Nine-in-Line Receiver, by Lewis Rand. (Part 2.)

April 16—The Schoolboy's Set, by Wally Frost The Melo-Heald 11-tube Set, by Herbert E Hayden. The Nine-in-Line Circuit (Part 3), by Lewis Rand.

April 23—The Melo-Heald Set, by Herbert E Hayden (Part 2). The Nine-In-Line, by Lewis Rand. (Conclusion). How Frequencies Are Cut-off, by J. E. Anderson.

April 30—A 1-tube Portable, by Jasper Jellicoe. A Ship Model Receiver, by Smedley Farnsworth. A Double Three Foot Cone, by W. H. Sinclair.

May 7—The Adams-Griffin 6-tube Set, by Dana Adams-Griffin (Part 1). A 2-tube Portable, by Hood Astrakan. How to Improve Super-Heterodyne Sets, by John L. Barrett.

May 14—A 3-tube Portable, by Herbert E. Hayden. The Adams-Griffin Receiver, by Dana Adams Griffin. (Conclusion).

May 21—The Victoreen Portable Receiver, by Capt. P. V. O'Rourke. A Low-Pass Filter, by J. E. Anderson.

May 28—The Console Cone, by Thorvald Larsen. The 3-tube Reflex by Edgar B. Francis. The Victoreen Portable Receiver, by Capt. P. V. O'Rourke. (Part 2).

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Simplex Socket Set Omits All Batteries

The new Simplex six-tube all electric, light-socket radio, is the product of The Simplex Radio Company, Sandusky, Ohio, and was designed by M. B. West, formerly in charge of radio activities in the United States Navy.

Complete elimination of all batteries has been accomplished by the use of the new alternating current three-volt tubes.

Power is supplied from the light socket through a built-in power supply employing a Raytheon tube for rectification, and a step-down transformer delivering three volts of alternating current to the filament of the tubes, the B and C supply being handled through a specially designed filter circuit, the entire power supply built in as a part of the radio set. The single control with dial calibrated in wavelengths, is maintained and the entire assembly is housed in a cabinet with detachable legs.

The three stages of low ratio transformers used in the amplifying circuit create a particularly pleasing tone quality. Volume control is by voltage variation on radio frequency plates, the plate current drain being nineteen mills.

A built in light-socket aerial is provided.

Harold Stein Honored On His 33d Birthday

Harold Stein, of Foto Topics, pioneer radio photographer, on the occasion of his thirty-third birthday, had many notables at his studio, 265 West 54th Street, New York City.

Present were: Merlin H. Aylesworth, president of the National Broadcasting Company; G. W. Johnstone; Geo. McClelland; Roger McAdam; Graham McNamee; Ernest Hare and Billy Jones, (Happiness Boys); May Singhi Breen and Peter De Rose; Wendell Hall; June Lee; Mack and Dennie; Roger Wolfe Kahn; Major Edward E. Bowes; David Casem; Julia Shawell; Stella Karn and Natacha Rambova.

THE 4-TUBE DIAMOND

How to build this very efficient circuit described by Herman Bernard in the November 20, 1926, issue of Radio World. Send 15c for a copy. Blueprint of 4-tube Diamond, $1.00 extra. Send $1.15 and get both. Or send $6 for a year's subscription to Radio World, and get both the blueprint and the Nov. 20 issue FREE. Radio World, 145 West 45th Street. N. Y. City. —Adv.

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RAINBAULT TAKES ON WALBERT

The John P. Rainbault Co., 50 Church Street, New York City, has been appointed Eastern representive of the Walbert Manufacturing Co., 1,000 Fullerton Avenue, Chicago. Rainbault also is representative for Balkite and Magnavox.

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