RADIO WORLD
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How Air Waves Run A Plane from Distance

RAPID strides are being made in remote control by radio. Thus automobiles have been run on numerous occasions without any human control on board but controlled entirely by radio waves transmitted from a distant point. Similarly ships have been steered by radio waves. Aerial torpedoes have been successfully steered and exploded at the desired place by radio waves sent from a distance. Now we have the wireless airplane, a plane which is steered and operated automatically by radio waves sent out from a distant transmitting station.

In the remote control of mechanisms such as those in an airplane there are no revolutionary principles involved.

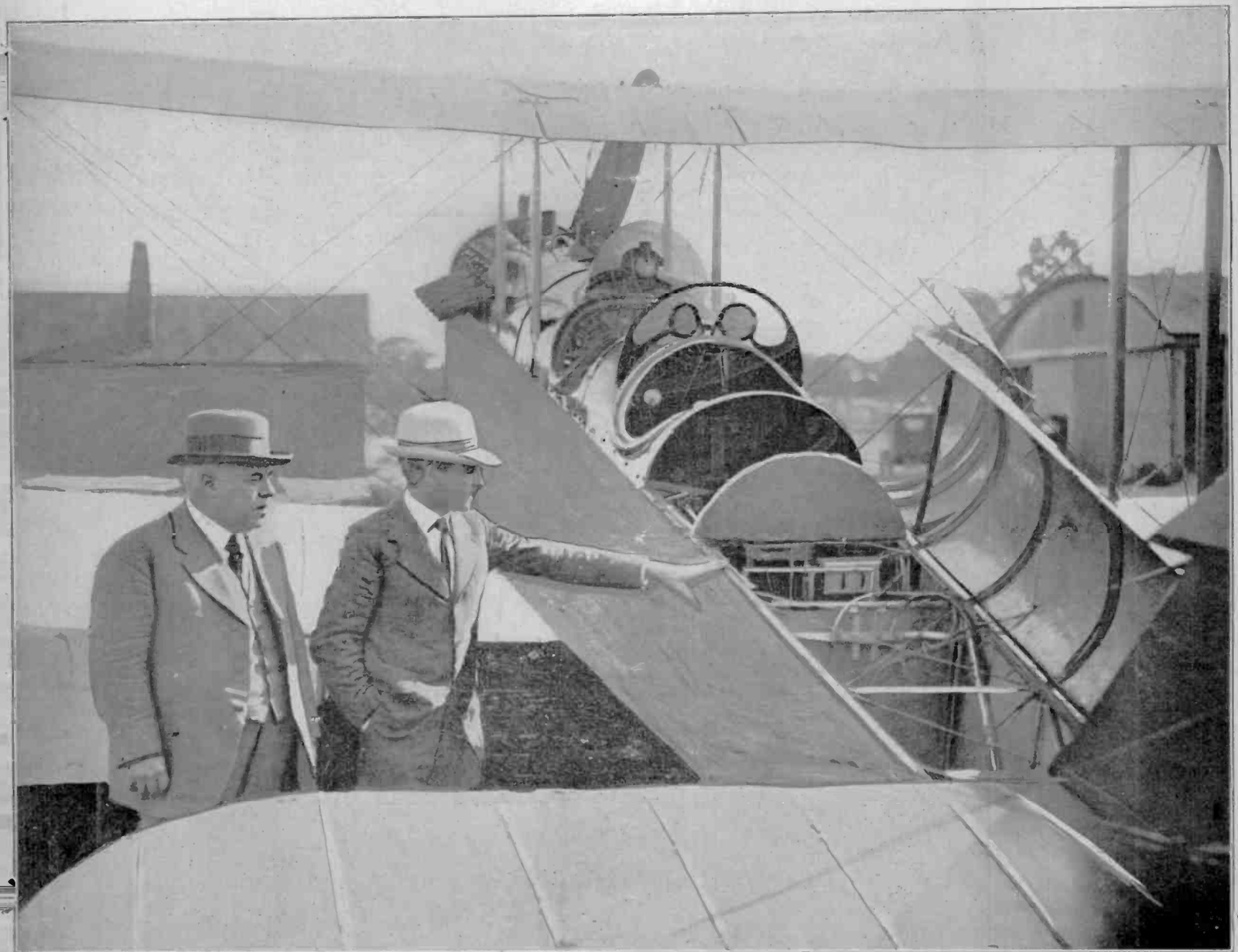
The controls of the plane are handled in the same way that a receiver is operated. Suppose it is desired to elevate the ship. A radio receiver is there to do the job. This receiver is tuned to a certain frequency. When that frequency is sent out by the control station the receiver picks up the signal, amplifies the current until the power is enough to do the work required for moving the lever which controls the elevator. In the same way any number of operations can be performed on the unmanned plane.

If there are enough receivers, or enough methods of working a limited number of receivers, a plane can be controlled completely from a single point on the ground. Its motor can be started and stopped, it can be accelerated or retarded. The plane can be dipped, elevated, banked, turned, and so on. There is not one operation that cannot be performed from the ground with the aid of radio waves provided that the plane is suitably equipped.

It is conceivable that a radio-operated plane could ride from New York to Paris with no human being aboard.

It is not readily apparent that any useful results could come from work of this kind. No one would care to trust his life to a radio-controlled airplane when his life might depend on a spark of static. It does not even seem likely that anybody would trust his important mail to anything so uncertain. There are too many links between the operator and the operated. But there are many applications of the wireless plane which might become useful, notably in war. A bombing plane can be sent up and over the enemy without a human being on board. The bombs could be dropped on the enemy wherever and whenever desired, and counter attacks would endanger only the attackers.

Nobody Aboard Craft in Long Journey By Air



DR. JOHN H. DELLINGER, (right) Chief, Radio Laboratory, Bureau of Standards, and Dr. George K. Burgess, (left) director of the Bureau, inspecting a radio plane. (*Wide World*)

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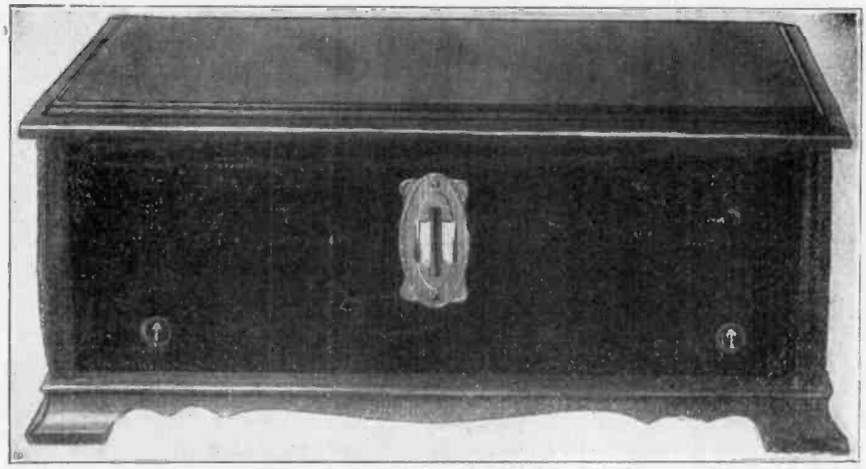

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The Horn Effect from Cones

How Placement of Speaker Governs Operation

By H. B. Herman

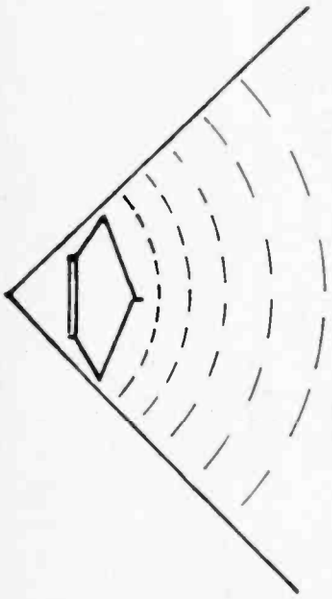


FIG. 1

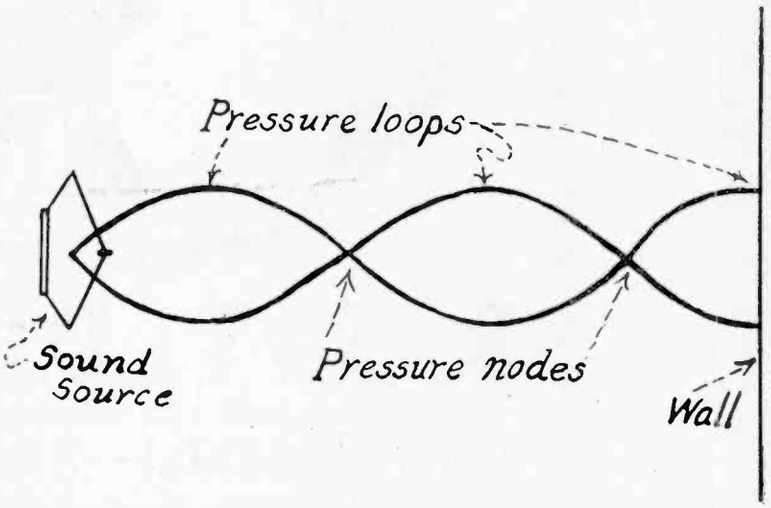


FIG. 2

When a cone speaker is placed in a corner the waves travel out in much the same way as from a horn of large dimensions. The sound is directed (Fig. 1). When a speaker is placed in a confined place where the sound waves can be reflected by walls or other large surfaces standing sound waves are set up. Pressure loops and nodes are formed. (Fig. 2). A pressure loop is always formed next to the wall and a pressure node always at the speaker. Considering the motion of the air, a velocity node is always formed at the wall and a velocity loop at the speaker. This effect is noticeable for high frequencies. An ear placed at a pressure loop will hear the sound but placed at a pressure node it will hear nothing.

WE have often heard that cone speakers should be placed in certain positions relative to walls and objects in the room. In this or that position the sound from the speaker is greater than in any other position.

It is a fact that the position of the speaker with respect to its surroundings has a great deal to do with the sound that is heard. It is also true that what is heard depends, naturally enough, on the position of the ears that listen to the speaker. What affects the intensity of the sound as it is heard in any given position?

In the first place the sound travels outward from the point of origin equally in all directions, unless it meets with obstacles which will force it along certain directions. When sound travels out from the point of origin without interference the intensity varies inversely as the square of the distance away from the source. For example, if the intensity of a sound one yard away from the source is unity, at a distance of two yards it will be only one fourth as strong, at three yards it will be one ninth as strong and so on.

Echo Effects Ever Present

Another thing that affects the intensity of sound at any given point is the interference of reflected sound waves, that is, the echoes. Every surface of considerable extent in comparison with the wavelength of the sound reflects the sound wave. The reflected wave, or echo, comes back and combines with the direct wave. Sometimes the combination is such as to decrease the intensity of sound at any point, sometimes to increase it. In nearly every case the reflected sound wave makes the combined wave less intelligible, that is, it causes distortion.

This is well shown in certain auditoriums in which the so-called acoustics are bad. For the higher pitched sounds the effect of this interference is quite noticeable. Standing waves will be formed in the air. In one point the sound is very intense and a short distance away from that point the sound cannot be heard at all. The distance between the maximum and minimum is one half wavelength.

Division of Whole Room

The whole room is broken up into loops and nodes of this kind and they can easily be detected by moving the ear slowly away from the sound source. Very close to the reflecting wall the sound will be a maximum.

Another phase of this subject concerns the speaker itself. A cone or other open radiating surface sends out waves from both sides of the vibrator. These two waves are 180 degrees out of phase. If the wave which is radiated backwards comes around the radiating surface and joins the forward wave, which it will do some distarce in front of the cone, the two waves are going to neutralize each other. Of course complete neutralization will not take place because the backward wave will be much weaker than the forward. But it will cause a great diminution in the intensity of the sound. Close to the speaker and in front of it this effect cannot be noticed because the backward wave has not had time to come around and interfere.

Marked difference can be noted by placing the cone in various positions with respect to walls and other large reflecting surfaces. If the cone is placed in a corner the two right angled walls will act as a wave director or projector.

Sounds Like Big Horn

The effect will be somewhat like the effect of a very large horn. Sound forward of the cone is increased.

When the radiation of sound back of the cone is prevented by some form of housing there is not so much interference. This, however, does not mean that the quality will be better. The housing usually forms a cavity which has natural periods of vibration which lie in the audible range. These will introduce resonance peaks into the radiated sound which may cause considerable distortion.

Nearly all horn speakers as well as speakers built into consoles are of this type.

Tone Quality's Funny Side

Education Must Overcome the Tin Ear Menace

By Tim Turkey

TONE quality—what is it? Can it be what it is believed to be, or must it be what it really is? Is it something we judge by what we see or by what we hear? Do nine-tenths of us know what we are talking about when we discuss tone quality, or is every rule of acoustical science wrong and every happy-go-lucky fan right?

Take the case of a friend of mine, whom I shall call Eddie Fawcett. He has a radio receiver. Built it himself, and proud of it. He says that his set produces enough volume to deafen you. He has to turn down the rheostat to save his own ears. And yet—mark this well—there is not a trace of distortion even on the loudest notes. He uses no power tube in the last stage, but has two old-fashioned audio transformers and 90 volts on the output. Ninety volts? Yes, he says so himself, and points to his two series-connected B batteries, 45 volts each, to prove he's right.

His speaker, a horn popular in other days, and somewhat shaky from long use, is connected with one terminal to the plate of the last tube and the other to the 90-volt post of the B block.

"Sweet as a Bell!"

"My horn sounds as sweet as a bell," he said, branching from a discussion of the set to a talk on the reproducer. He doesn't know bells are among the worst distorters known to acoustics. "I don't believe in these schemes to sell parts and accessories—impedance arguments, output devices, power tubes, special kind of cones and high voltages with C biases big as your fist. There's nothing to it, and to prove my case, all I need do is have you listen to my set."

Inevitably he got back to a discussion of his receiver, and continued along this line:

"Why, my set brings in speech so faultlessly that you can understand everything that's said. You can even hear the singers breathing before the microphone—breathing, not merely singing. The lowest notes come through something grand—organ notes and all—while the high notes are not distorted a bit. A soprano sounds just like a soprano. Everything's just fine and I wouldn't swap my set and equipment for any other on the market, no matter what the price."

The Demonstration—Then What?

Then Eddie extends an invitation. You visit him. You listen to the set. If you are polite, and you really should be, at least you sit there in silence. That will perturb him somewhat, for he's all set for encomiums galore.

"Well," he asks, "what do you think of that, eh?"

You know that you are expected to say: "That's sure some set." Be polite, if you will, and say it. Or say it and mean it, for you may know no more about it than Eddie does. Or tell him that you really believe that there's room for improvement. Even that is diplomatic, the suggestion that some improvement could be contrived. Were you to strip your answer of all social softness you would have to tell him that his set distorted wretchedly, that you could not possibly enjoy listening to such a hideous contraption, and that he would do you a kind favor if he would turn it off.

This would be harsh, although perhaps not ill-deserved. Most persons, like yourself, even if they are grossly offended by the wretched reception wished upon them, will speak kindly when giving an opinion to a host. There are many reasons. Consideration for the feelings of others is one reason. Utter futility of trying to convert the misguided noise fiend is another. A challenge to improve it, if you can, is still another. To accept this challenge means much work on your part, and all at your expense, winding up inevitably with Eddie's comeback that his old set was much better.

Kid Him Along

So what are you going to do about it? Nothing. Tell him his set sounds fine, but that you understand that there are some $1,000 sets on the market that are as good, but possibly no better. Keep him happy. He has become so used to the distorting noise-box that defaces his parlor that nothing can dissuade him from it, and no true friend should try to do so.

Appreciation of tone quality, or the true recreation of what is produced at the studio, has so much to do with music that one must have an ear for music before he requires scientific tone quality, i.e., realism. The persons musically inclined can get little satisfaction out of a receiver that suppresses the low notes, or out of a speaker that cuts them off, although the set delivers them as far as the speaker input. There are bass viols, bassoons, tubas and other low-note instruments in orchestras that are never heard as such in 80 per cent. of the radio installations in the United States. But the funny part of this is that the listeners do not miss these notes, so why should you and I worry about somebody else's troubles, when you and I are the ones who fancy the troubles, and they really do not exist?

The Tin Ear Menace

The ear is a thoroughly unreliable piece of mechanism, and I am thoroughly disgusted with its treason to the cause of true art. That a person should possess an ear that misguides him so that he thinks distortion is quality and that quality is bosh, is one of the sad facts of nature.

What is needed is a campaign of musical education, but so many of us are adults, and musical education requires more time than we could ordinarily devote to it, that we will have to rely on the radio to furnish it. And that is another sad point. How can we learn the value of musical and vocal realism if the lessons are reproduced from a receiver that takes all the realism out of the music and speech as well?

It would seem, at first blush, that all the pains that technical educators have gone to, all the experiments and developments of coil and resistor manufacturers, all the work of acoustical laboratories and research engineers, have been almost in vain, because they are trying to sell tone quality when there is no market for it. Or, rather, they are trying to sell a product to a man who says he has that product already, although he is wrong about it, and won't be convinced.

The -10 Tube Will Be Elected

To hear anybody try to compliment a receiver by saying that every word spoken can be understood is one of the richest jokes ever perpetrated in the name of radio. To boast that even the breathing of the artist can be heard is another one of those contributions for the humor column, although submitted in ignorance to the musical critic. Anybody who assumes that deafening volume can be achieved without distortion, no matter what system is used, is badly misinformed.

Even general broadcasting can not be received without serious distortion unless high plate voltage is used on a power tube in the last stage of the receiver, and even then the set should have an antecedent volume control if for no other reason than to prevent overloading of the last tube, or the next to the last one (due to erroneous absence of grid bias, so that this grid swings positive.)

Public Should Know Better

As things stand today the 112 is the most popular power tube, with the 71 gaining in favor, for its maximum undistorted output is considerably larger, under properly voltaged conditions. But the power tube that will be the most popular one is the 310 or 210, which requires an exceedingly high plate voltage —400 volts being a good start—but produces results that will make an impression even on the Eddie Fawcetts with their general purpose tube in the output and only 75 volts effective on the plate. The 90 volts that are assumed to reach the plate get there with 15 of their number missing, these being dropped on the way. Technically it is expressed as the voltage drop in the DC resistance of the winding of the speaker magnet coil.

It is obvious that the improvement in audio circuits and in quality generally—both at the station and at the receiving end—has outpaced the public itself. Quality is better than it need be, to satisfy the many. Proof of this is that a million factory-made receivers of distorting performance (but fool-proof) can be sold to the American public and they can be made to like it.

But the era of improvement of musical appreciation, hence demand for tone quality, is here, having made a modest dent on skulls, but there is so much still to accomplish that if the public's ear remains untaught much longer some philanthropist had better establish a Chair of Distortion at our leading college, if any.

Penalty Suggested

Persons who rave about the tone quality of rank receivers ought to be made to listen to good ones for hours on end, and these sets will most likely be home-made, for the tone quality idea has been correctly stressed for a year in fan-made sets. Factory-made receivers followed slowly in line. Some of them today are as good in tone quality as that of any set made by a kitchen table engineer. In other words, some of the manufacturers have put money into the audio end of the sets, and not relied on audio transformers that cost 89 cents each in quantity. Contrast this with the fact that the manufacturer of one of the best audio transformers, popular with discriminating home constructors, pays $1.89 for the core laminations alone, the wire costing him perhaps 60 cents more!

The Mellowing Influence

Distorting Devices That Fool Many Persons

By J. E. M. Chisholm, Jr.

THE haphazard use of by-pass condensers and series choke coils should be carefully avoided if quality is an object in the receiver. We hear recommendations about connecting a condenser across the loudspeaker terminals to make the tone mellow, and similar suggestions for putting condensers across the coupling impedances and transformer windings. The size of recommended condenser is always between .0005 and .005 mfd.

Now, if by-passing is the way to obtain mellowness and if this in turn is a desirable quality, why should one limit the size to condensers of .005 mfd? A much greater mellowness can be obtained by connecting a 5 mfd. condenser across the loudspeaker terminals, or across the line anywhere. It has a wonderful mellowing effect!

After having introduced this mellowness by connecting large by-pass condensers across the line here and there, the perpetrator complains that speech is unintelligible on the loudspeaker and that sopranos do not sound natural. The fault, of course, is not with the receiver. Has not that been endowed with the acme of mellowness? No, the fault lies with the transmitter. The modulation is faulty. Or the trouble might be blamed on the weather!

Another Mellowing Influence

Connecting condensers across the line is not the only way of setting mellowness. It can also be brought about by connecting choke coils in series with the line. Just as condensers by-pass high frequency currents when the condensers are put across the line, so the choke coils will suppress them when they are connected in series with the line. When both series choke coils and shunt condensers are used a high degree of mellowness can be assured. In fact, so complete can the mellowness be made that only the basses can be heard.

Now, if both shunt condensers and series choke coils are not enough to mellow the signal they can be greatly aided by an excessively selective tuning system. Each tuned circuit can be made of a low-loss coil and a low-loss condenser, and some regeneration can be added besides. Then on top of that the receiver can be made into a Super-Heterodyne with highly selective circuits in the intermediate filter. The mellowness will be very great.

Now that mellowness has been achieved in a very high degree, the quality should be highly pleasing, and mellow. The fact that speech is unintelligible is of no importance, neither is the fact that nothing but the tuba can be heard!

Tuba or Not Tuba?

But can the tuba be heard? Not on many sets. The use of too small stopping condensers in direct coupled circuits, low values of grid leak resistances, high ratio, low inductance audio transformers, and low inductance coupling impedances prevent the amplification of the low notes. Hence when the tone has been mellowed in the majority of sets, nothing is left to listen to. Of course, no offense is given to the ears.

Another thing that militates against the high notes and thus aids in making the received sound mellow is the shunting effect of the grid circuit in resistance coupled amplifiers. The impedance of the grid circuit of a vacuum tube is supposed to be infinite, but it is not. There is some capacity between the electrodes. The actual capacity is very small but the effective capacity may be quite large. It depends on the actual capacity, on the frequency, on the mu of the tube and on the resistance in the load of the tube. The higher all these are, the higher is the effective capacity of the input or grid circuit.

May go as High as .0005 mfd.

The plate to grid capacity of the tube may not be greater than 5 to 25 mmfd., but the effective capacity in resistance coupled circuits with high mu tubes may go up as high as .0005 mfd. This capacity is in shunt with the line and acts as a by-pass condenser. Consequently the amplification of the high frequencies will not be as great as that of the low. If there are three stages in the amplifier there will be three of these shunt condensers, and if each one is effectively .0015 mfd. the total shunting effect will be that of a condenser of .0015 mfd. This is large enough to cause considerable mellowing of the signal.

This by-pass effect is unavoidable and hence the distortion resulting from it must be either tolerated or compensated. But since there already is an effective shunt condenser there is no sense in putting others across the line.

New Cone is Fastened Directly to Magnet

A glance at the structure of the speaker revealed in Fig. 1 shows a unit built along unconventional lines. A closer study of the structure will show that the speaker has been built in accordance with well-founded electromagnetic lines. This is not merely one of those units that deviate from approved design just to be different and which succeed in getting clear away from sound practice. The man responsible for the unit—a Frenchman—not only understood the subject but he applied his knowledge in an ingenious way. And the simplicity of the idea causes everyone to ask: "Why didn't I think of that before?"

The idea of the inventor of this unit was to get away from small moving parts, and thereby eliminate some of the causes of distortion and extraneous noises. With that idea in mind he made one of the prongs of the permanent magnet the armature and he connected the sound radiator directly to it without any coupling rod. That simple device eliminated several small parts which do not contribute much to the operation of the speaker but sometimes a great deal to the noise it makes.

Uses Only one Spool

A single spool is used in the construction and this spool is wound around a pole extension piece attached to one of the poles of the magnet. The pole-piece is so adjusted by means of a screw that it is in close proximity to the pole used as the armature, and also carries the cone. The signal current passing through the spool changes the magnetization of the magnet and thus changes the pull of one pole on the other. One of the poles is fixed and only that pole which carries the cone is free to vibrate. The varying pull on the armature pole will cause this pole to vibrate in accordance with the varying current in the spool.

Attention is called to the rigidity of the assembly. First there is a large cast-iron base. Then there is a metallic dye-cast pedestal, and finally there is another metallic casting holding the magnet. All of these are bolted solidy together. This rigidity of assembly has a great deal to do with the efficient operation of the unit.

The type of construction exemplified in this unit will favor one or more frequencies more than others.

Has a Definite Fundamental

The magnet is in reality a tuning fork which has a very definite fundamental frequency of vibration as well as a number of higher natural frequencies of vibration. If the response is to be the same for all frequencies the response peaks must be reduced and the magnet must be driven at all frequencies, that is, it must not be resonated at any frequency.

The only natural frequency of response that will give much trouble is the fundamental. This can be placed at any desired position in the tonal scale by adjustment.

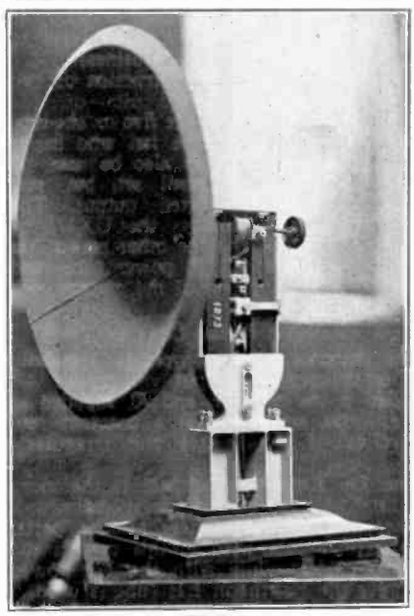


FIG. 1

(F. M. Delano)

A new type of loudspeaker developed by an inventor in France. One prong of the permanent magnet is used as the armature to which the cone or sound radiator is attached. A single coil of wire carrying the varying signal current actuates the armature. A large thumb set-screw is used for adjusting the distance between the pole piece and the armature prong. A high degree of quality is claimed for this type of speaker on the ground that the number of small parts has been reduced to a minimum.

Compactness in Eliminators

Power Amplifiers in 171 and 210 Models

By Robert Frank Goodwin and Stuart Bruno

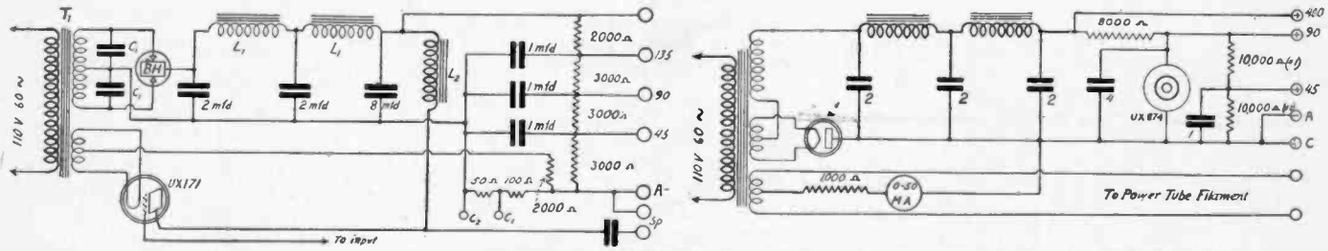


FIG. 1

Circuit diagrams of the combination B eliminator and power amplifier (at left) and the high power B eliminator appear above. The one at left employs the Raytheon tube in the eliminator and a 171 or 371 power tube in the amplifier. The one at right employs the half-wave filament rectifier tube, 216B or 316B, in the eliminator and a 210 or 310 power tube in the AF portion. In both systems the filaments of the power are supplied with AC. In the Raytheon eliminator, 180 volts are obtained, while in the filament type eliminator 400 volts are obtained. Provision is made in the eliminators for C bias for the power amplifier tubes. In the filament type eliminator, a voltage regulator to keep the voltage at 90 steady, is employed. In this eliminator a milliameter is directly incorporated. The same may be done in the Raytheon, placing it series with the B minus lead. C1 and C2, the buffer condensers across the high voltage winding in the transformer T1 used in the Raytheon eliminator, are incorporated within the unit.

A FEW months ago building a B battery eliminator and power amplifier involved quite a bit of tedious labor. The fan found that the eliminator required quite a number of individual parts and a great amount of labor would be involved in laying out the parts and wiring. He also found that a considerable amount of time was wasted shopping for the different parts, since the parts of as many as ten different manufacturers would be included in the design and construction of the eliminator. Now we have come to a point where all this is made unnecessary. The fan merely goes to his dealer and buys three compact units, a small number of individual parts. and the eliminator is assembled in about 45 minutes time at the most, with twelve to fourteen wires in the whole business.

We will describe the construction of two power amplifier B eliminator units—one for the fan who has the average five or six-tube receiver, the other for the fan who has a larger set, and which can also be used by the man who has a small set, but who wishes greater undistorted output. The smaller eliminator employs the UX171 or CX371 power tube and the other makes use of the UX210 or CX310 power tube, and also incorporates the use of the voltage regulator tube.

Voltage Rates Constant

The function of the voltage regulator tube is to keep the output voltages of 45, supplied to the detector, and 90, supplied to the external amplifiers, at a constant rate regardless of line surges and irregularities.

The 210 eliminator compact is the more expensive of the two, since it delivers a greater output and requires heavier parts. The rectifier tube used in this case is the 216B or 316B, while with the 171 power compact the Raytheon BH tube is used.

The high output voltage is divided into its proper values by the use of a fixed tapped resistance. Since the voltage is known and will be the same provided we use the parts mentioned, all variable controls are eliminated, the fixed resistance of a predetermined value, taking care of this feature. Both types of eliminators are extremely economical to operate and consume less current than the average 50-watt house lamp.

The initial cost of either of the two eliminators can be reduced somewhat by excluding the power amplifier, but this is not good economy. The output of a type A tube can never compare with that of a power tube. The 71 power tube has a maximum undistorted power output of fifty times that of the 201A under their normal operating conditions. So, with a 201A tube, while the note of a violin would be reproduced quite faithfully, even though of low or bass frequency, reproduction would not sound true if the bass note of an organ were sounded, due to the larger expenditure of energy required by the heavier instrument. The power tube in this case would stand up beautifully clear of any distortion.

Theory of the Eliminator

One does not have to be engineer or genius to construct either of the eliminators about to be described.

A simple explanation of what happens in a B eliminator will be appropriate and we believe interesting. Current delivered from the house mains is in most cases alternating. This changes its polarity from negative to positive at the rate of 120 times per second (since rate of change equals twice the frequency) and were we to apply this alternating voltage to the plates of our tubes all we would hear would be a continuous roar. Since the ordinary receiving tube requires a steady positive potential on its plate, and the current would alternate from negative to positive, this would mean that dividing the second into 120 periods, the tube would function for only sixty positive periods and would be inoperative sixty negative periods. Hence we must use some means of changing this alternating current to a direct current, i.e., or rectify it.

A radio tube functions only when the potential applied to its plate is positive, which is the principle of the standard rectifier tube. Using a transformer to step up the alternating voltage to a desired quantity, we connect the vacuum tube or rectifier in the circuit in such a way that the ouput will be a direct current.

Filter Fills the Gap

Since the receiving tube requires a steady unfluctuating direct current and the current delivered from the rectifier would be of an intermittent nature, we must use a filter system to fill the gaps and deliver a smooth direct current. Most filters are composed of a series of choke coils and condensers of a calculated value to do this smoothly. Connecting the choke coils in the circuit would eliminate the peaks and flatten out the curves, but we still have the gaps to be filled.

Now, connecting the condensers in the circuit will fill these gaps, due to the fact that the condenser will take a charge and deliver this charge back into the circuit just in time to fill these gaps. And we have as a result a practically pure direct current in the output.

Using a vacuum tube as a rectifier, we have half-wave rectification. When using the Raytheon tube as a rectifier, both halves of the cycle are rectified, but the current carrying capacity of this tube is not as great as the vacuum tube 216B. The action of the filter is the same as described, except for the fact that the large gaps are not present, and the filter system need not be so elaborate.

We will describe the construction of the 171 Power Pack B eliminator. First secure a baseboard 7½ by 16½ inches. This is to be less than one-half an inch thick. Secure a piece of wood to each end, to raise the baseboard about ¾-inch from the table. All the binding posts are mounted on a strip of rubber or Bakelite. This strip is to be 7 inches long and 1 inch wide. The eight binding posts are spaced evenly on this strip. Mount the binding post strip on one extreme end, raising it up from the baseboard by washers.

Post Markings

The posts are marked. Starting from one end they should read: Speaker Positive, Speaker Negative, C Battery Negative, C C battery Neg., B Battery 135, B Battery 90, Detector and B Battery Negative.

After the strip is mounted, the 50 and 100 ohm resistances are secured to the baseboard with two brackets. Directly behind these resistances the socket for the Raytheon tube is fastened, the grid and plate terminals facing the post strip.

Following this the compact is mounted with the three high voltage posts facing the rectifier tube. The condenser block is mounted directly in front of the compact, with its leads facing the compact. Now the large tapped resistance is fastened to the baseboard in the same way as the other resistances. In back of this place the power tube socket with the two filament leads facing the compact. And finally the output choke and condensor are mounted with the choke to the fore. After all the parts are mounted as suggested we are now ready to wire. The best wire to use is a heavy rubber insulated type used for high tension work. It is best to wire all the short leads on top

The 280 Batteryless System

New Rectifier Tube Adapted to 5-Valve Set

By Brunsten Brunn

IT is not only possible but quite feasible to build a complete receiver operating entirely from AC. One of the simplest is built with 99 type tubes and heating their filaments with direct current obtained from a rectifier-filter circuit capable of supplying 125 milliamperes. The power tube filament can be operated on AC. The circuit diagram of such a receiver is shown in Fig. 1. The rectifier tube is a UX280.

The only changes necessary to adapt a standard five-tube, battery operated receiver to such AC operation refer to the filament circuit and to the grid lead returns. In the first place it is necessary to connect the filaments to the 99 type tubes in series in order that the direct current through the eliminator be kept down to a minimum. The order in which the filaments of the tubes are connected is important. Since the plate currents of some of the tubes in the series flow through the filaments of some of the other tubes, adding to the effective heating current, the tubes which can operate on a high filament current should be placed so that the heaviest current will flow through them and those tubes which require less filament current should be placed so that the least current will flow through them.

Detector Needs Least

Now, the detector will operate best when the filament current is less than 60 mils, the normal value, while amplifiers operate better when the filament current is normal or slightly higher. The filament which is placed farthest away from the negative end of the eliminator will not get any of the plate current from the other tubes. Hence the detector should be placed in this position. As is shown in the diagram the positive end of the filament of the detector is connected to resistor R3, which in turn is connected to the high potential side of the eliminator output. Next in line comes the filament of the first audio frequency amplifier tube, then the second radio frequency amplifier and last the first radio frequency amplifier. The negative end of the filament of the first tube is connected through a ballast resistor to the negative terminal of the eliminator.

The proper grid bias for the various amplifier tubes in the series can be obtained readily. The detector tube gets its positive bias by connecting the grid return to the positive end of its own filament, which is the usual way. The remaining tubes require a negative grid bias, and this can be obtained by suitably connecting the grid returns. The first radio frequency amplifier is not directly in a position to get any negative bias. It is necessary to connect a resistance A1 in its negative filament leg and connect the grid return below it. Only a volt or slightly more is required for the bias. This will be given by a resistance of twenty ohms.

Other Bias Values

The second RF tube can use more negative bias and it is obtained by connecting the grid return to the same point as that of the first tube. This gives it a bias of a little over 4 volts, 3 volts being obtained from the voltage drop in the first tube and one in the resistor A1.

The first audio tube requires a still higher bias and this too can be obtained automatically by connecting its grid return to the same point. This tube then gets a bias of 7 volts, obtained from the drops in two filaments and the drop in A1. The power tube grid bias requirements are taken care of in a different way.

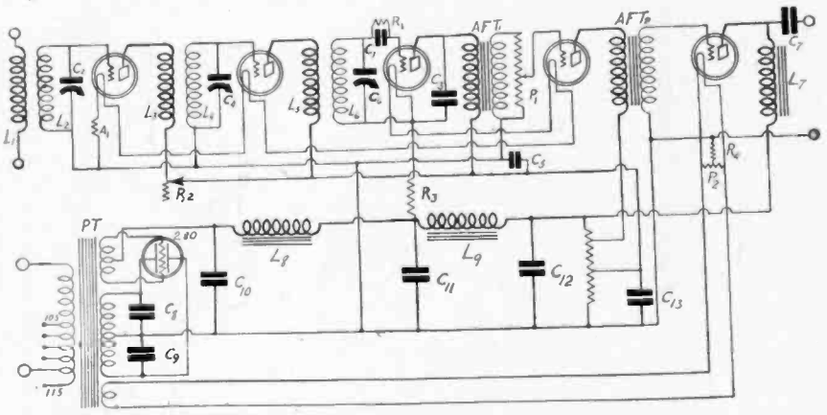


FIG. 1

Circuit diagram of a five-tube receiver, employing four —99 type tubes and one 71 type, which is entirely operated from AC supply line. Filaments of the small tubes are connected in series and heated by 60 milliamperes of rectified and filtered current.

The total voltage drop in the four 99 filaments is about 12 volts. To this should be added the drop in A1, which is little more than one volt. The actual voltage drop in the filament circuit will be little more than the sum of these, or about 14 volts. This voltage is obtained from the output of the eliminator. Since the output is much higher it is necessary to insert a resistor R3 in the positive side of the line to drop the voltage down to the 14 volts required. The value of this resistance depends on the voltage across the eliminator line where this resistor is connected. Suppose that this voltage is 225 volts. The resistance R3 must then drop 211 volts. The current flowing through it is 60 milliamperes. Hence the value of the resistance is 3,517 ohms. A commercial resistor rated at 3,500 ohms and capable of dissipating 15 watts or more should be satisfactory.

Why the Tap-off

It will be observed that the resistor R3 is connected between the two choke coils L8 and L9. This is done because it is not necessary to filter the filament current as thoroughly as the plate current and also because L8 must be wound with heavy wire. L8 need not be greater than from 5 to 10 henrys but is should be capable of carrying continuously at least 125 milliamperes, the sum of the plate and filament currents with some to spare.

The question of plate voltage is not so simple to decide in a circuit of this type. The voltage required depends not only on the negative bias used on each tube but also on the position of the tube in the series. The detector tube is highest up in the scale, as was pointed out before. This, therefore, receives the lowest plate voltage. This is as it should be. The voltage can easily be adjusted to 45 volts. The second radio frequency amplifier is two filaments lower down the scale and therefore it gets 6 volts more on the plate than the detector. That is, it gets 51 volts. The grid bias on the tube is 4 volts, which is about the correct value for the effective plate voltage used on the tube. The effective plate voltage for the first RF tube is 54 volts. The grid bias should be about 5 volts, but this cannot be obtained without a battery. The one volt bias will have to serve. The first audio amplifier is next to the detector in the filament series. Its effective grid bias is 7 volts. This requires a plate voltage of about 90 volts. The plate return lead from that tube is therefore connected to a point on the potentiometer P3 which makes the effective plate voltage on the tube 90 volts.

The Power Tube

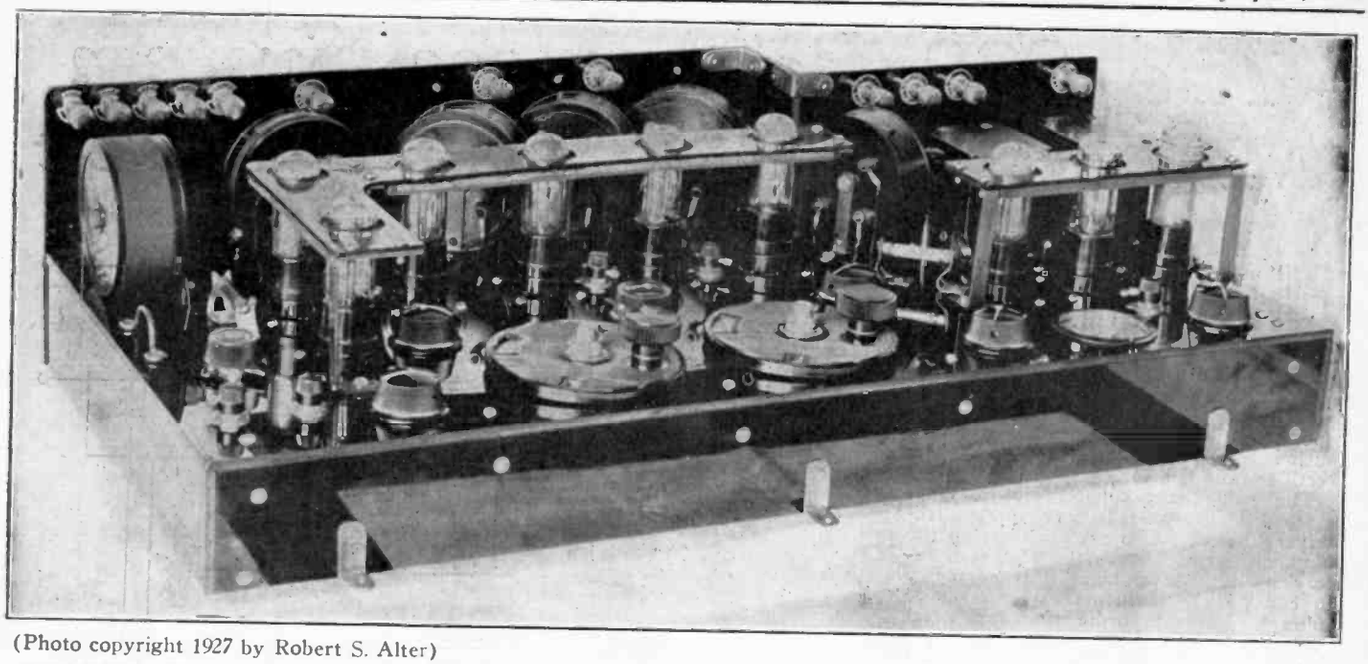
The filament of the last or power tube is heated by means of a separate winding on the power transformer. A five-volt winding is necessary if a —71 type tube is used. A potentiometer of about 200 ohms is connected across the leads of this winding near the tube and the electric mid-point is connected through a resistance R4 to the grid return lead and the negative lead of the eliminator line. The plate current of the last tube flows through this resistance, and the direct current component of this current multiplied by the resistance of R4 gives a negative bias to the tube.

Assuming that the direct component of the plate current is 20 milliamperes and that a grid bias of 40½ volts is required, the resistance of R4 must be 2,025 ohms. This bias also calls for 180 volts on the plate of the power tube. The output voltage of the eliminator, measured on the receiver side of the filter when all the tubes are working normally, should therefore be 220½ volts. This is the sum of the plate and the grid voltages of the last tube.

Since the supply voltage feeding the eliminator may vary from 105 to 115 volts, it is necessary to have some means of adjusting the eliminator so that the output voltage will be constant. This regulator is often included in the primary of the supply transformer. Taps are provided on the primary for applied voltages between 105 and 115 volts.

Volume Control

If the line voltage is low, fewer turns can be used in the primary, thus stepping up the secondary voltage, and when the line voltage is higher a larger number of turns can be used. This method of controlling the output does not involve a power loss. As an additional control of the output a small rheostat of about twenty ohms can be inserted in the primary. The power loss in this rheostat, is negligible.



(Photo copyright 1927 by Robert S. Alter)

THE NINE-TUBE VICTOREEN, operated by Robert S. Alter on a train. Note the tube-steadying shelf. This is lined with sponge rubber. The new XL binding posts are at top rear.

Operating A Set on a Train

Builder of 9-Tube Victoreen Tells Experiences

EDITOR RADIO WORLD:

The writer wishes to express his appreciation of the tremendous amount of publicity which you gave to my formidable Victoreen Portable De Luxe Set in the May 21, May 28 and June 4 editions. These were splendid write-ups.

I am getting letters from all over the country and, many from California, as they seem anxious out there to get sets which will reach East.

As you know, I have been working primarily to develop a set which can be used consistently on a pullman sleeper.

On my return from New York with the set you tested I got interesting results as follows:

From New York to within five minutes of Philadelphia I carried WEAF and WJZ with splendid loudspeaker volume. Both of these then died out. So did WOR. On leaving Philadelphia I picked up WFI and held it for about thirty minutes. After that I could get nothing until near Harrisburg, when I picked up a local. At Harrisburg, strange to say, when the train was standing still, I could not get KDKA, Pittsburgh. Reports from Cincinnati the next day were that KDKA was not received there, either, the night before; possibly it was blanketed.

Great Interest on the Train

The amount of interest shown on the train was tremendous. The car was packed with radio enthusiasts, and I decided then and there that a little more power had to be added to make the set really efficient on a train. I had tried plugging in the electric light socket on the car with Antennela, and grounding to the car frame, but this was not as efficient as the Fiat loop with regeneration. Similarly, an aerial laid down on the floor through the car did not work well. An aerial and a ground alternately plugged into the loop circuit only made matters worse. The loop was by far the best by itself. However, regeneration in the loop was absolutely necessary. The set would have been virtually dead without it.

Since the Victoreen coils were so nice and were so quiet I decided to add a fourth stage of IF with an interstage cut-out switch, permitting the use of third or fourth stages ad lib. This was done with a Yaxley No. 760 midget jack switch.

I am sending you herewith three enlarged photographs of the new Victoreen De Luxe with four stages of IF. I made no mistake in adding this fourth stage. It is just what the set needs to finish the job. Not wishing to disturb the transformers as formerly installed and having a lot of unsightly unused holes, I placed one stage IF underneath the panel as shown. The first lone tube to the left is now the first detector and the one directly behind it is the oscillator. The next four are IF tubes.

Uses By-pass Condensers

You will note that I have inserted the heavy by-pass condensers which you recommended in the audio circuit. These improve the tone immensely. The 1½ volt C battery bias for the IF stages acts oddly. Sometimes, better with than without, and vice versa. I therefore put in the circuit a Yaxley midget jack switch No. 730 to cut this battery in and out. I am glad I did. Mostly, it works better without it and particularly when using four stages IF.

The George W. Walker Company of Cleveland, when sending me the extra IF transformer for the fourth stage, instructed me to run the A plus of the fourth stage transformer (not the input) direct to A plus instead of to the "pot." They claimed that, while this would draw slightly more from the B battery, it would prevent a tendency to oscillation. I find that this holds true and yet does not, depending upon variable conditions. It seems to work well enough when run through the "pot." circuit, provided this is not turned on too far.

You will notice that I have added a tube steadying device. I found on the train that no matter if the set was sitting on a pillow on a cushion seat, the tubes vibrated too much and this interfered with reception. This steadying device consists of 3/32 inch formica to which is shellaced underneath a strip of ¼ inch thick soft sponge rubber. The holes in the formica through which the tubes pass are 1¼ inch in diameter (tube is 1 inch diameter) and the hole in the rubber is ⅞-inch in diameter. This keeps the tubes absolutely steady and free from shock, and is much simpler than adding Bremer Tulley silencers to each individual tube. I believe, however, that the tube is a little too tight in the rubber, and I will probably cut notches in the rubber circle to get a little freer motion.

A Job Shellacing

The shellacing of the cushion rubber to the formica is not so easy, because the shellac does not want to dry under the rubber, even though the two were stuck together when the shellac was very sticky. At first the tubes would pull the rubber away from the formica because the shellac was not bone dry. I overcame this by reshellacing and then heating an iron plate 8 inches wide by 14 inches long by 1 inch thick on the gas stove, getting it good and warm but not hot enough to burn, then laying this tube guide strip, formica side down, on the plate and bearing on top of the sponge rubber with about three pounds of weight on a board, in which position I left the outfit overnight. The heat from the plate went through the formica and cooked the shellac good and hard without burning it. Now the rubber sticks so tight that you have to tear the rubber to get it away from the formica. I believe the set could be lightened up materially by running on 90 volts maximum. There is hardly enough difference with a 135 volt power tube to warrant carrying the extra battery.

The Kodel Radio Company of Cincinnati have just put on the market a small dry B battery recharger which lists at

$10. This runs with one rectifying tube. I bought one and it certainly recharged my portable battery in great shape. These were down to 118 volts and overnight they were back up above 135 volts and only dropped back to 135 volts in a week when not used. This charging outfit could well be carried in one's trunk or handbag and would save much battery expense, besides keeping everything up to snuff.

ROBERT S. ALTER, vice-president and foreign manager, American Tool Works Co., Cincinnati, Ohio.

* * *

Another Train Experience

A factory-made set was placed in the train that carried members of the New York Advertising Club to Denver.

John Yost, Grebe Radio Engineer, reported:

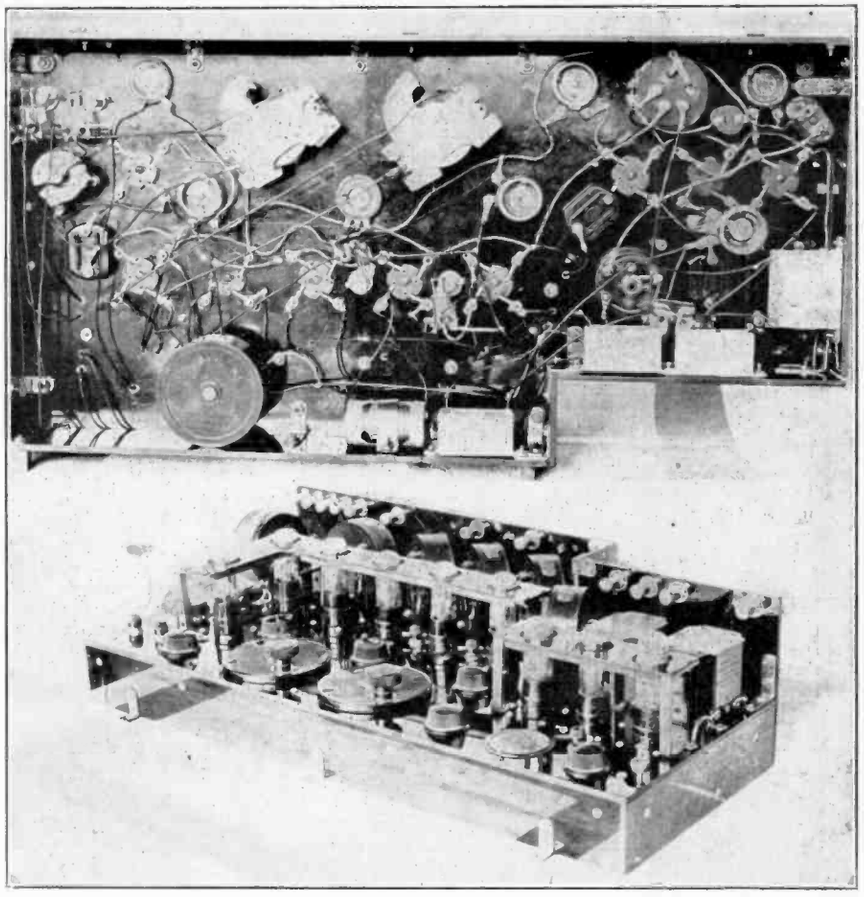
"While the car was in the New York City railroad yards, reception of New York stations was very good. However, as soon as the car entered the tunnel under Park Avenue, bound for the Terminal, no station could be received. The train left the Terminal at 7:20 and as soon as the train emerged from the tunnel reception was resumed.

"We were able to receive WOR and WABC best of all. WEAF and WJZ were only fair. This lasted for about fifty miles out of New York when suddenly everything went dead. For about one hour and fifteen minutes, all reception ceased until we were about thirty or forty miles from Albany at which time we were able to receive WGY, Schenectady, N. Y., KDKA, Pittsburgh, Pa., the Schenectady station being the louder.

"Reception gradually became better as we neared Albany."

WHEN HYDROMETER READS ZERO

Don't expect to get any reading on your hydrometer immediately after you have added water to the acid in a lead battery. The float will sink to the bottom of the barrel because the acid has not had a chance to mix with the water. Consequently only a small quantity of acid is present in the solution tested. After a few hours charging, you will note when the hydrometer is inserted that the float at least moves a bit upward, indicating that the mixing action has begun.



(Photos copyright 1927 by Robert S. Alter.)

THE BOTTOM VIEW of the subpanel, and another top view of the set.

New Wireless Station Is Erected in Peru

A new wireless message station was recently erected in Yurimaguas. Peru, state advices to the Department of Commerce from the Commercial Attache at Peru, C. C Townsend. The new station consists of two iron towers, 150 feet high, with a 1-1-2 kilowatt Marconi transmitting equipment, damped wave, equipped with an internal combustion engine and necessary dynamos. with a Marconi valve receiver. The rate will be 12 centavos (about 4 cents American currency) per word from and to the station, the officials announced.

Super-Sensitive Mike Introduced

Eugene Reisz, German inventor, in the United States on a visit, predicts that his super-sensitive special microphone will be in use by many American broadcasters within a few months.

It has been installed at WABC, first to use this device in the United States. It has been a part of the equipment of European stations for the last year or more.

The Reisz microphone is of the "variable contact" type. In contradistinction to all other microphones of this type hitherto in use, the Reisz microphone has no diaphragm; thus the sound waves impinge directly on the powdered conductor, which is packed between two fixed electrodes in a shallow cavity formed in a marble block.

Uses Powder Composition

The composition of the powder and the manner in which it is packed insure its complete impermeability to sound waves of all frequencies. The whole of the sound energy, which owing to the construction of the marble block takes effect on the powder from one direction only, is effective to vary the resistance between electrodes.

Dissipation of the sound energy, either by oscillations of the marble block or by reflection of the sound waves from the surface of the layer of powder, is rendered impossible by the manner in which the powder is packed. In particular, the size of the marble block, namely 100 x 100 x 75 mm., and the material chosen obviate oscillation.

The direct current resistance of the instrument is approximately 200 ohms and it maintains this mean value whether the powder is subject to the influence of sound waves or not. The maximum current load is 100 milliamperes. With this current value and using a resistance-coupled four tube amplifier with an amplification factor of approximately 7 per tube, it is possible to produce an energy of about 2 watts, which is quite sufficient to control the transmitter.

It's Very Sensitive

As compared with other types of microphones, operating with highly tensioned diaphragms, the Reisz microphone has the advantage of greater sensitivity, as a result of which parasitic noises have been so nearly eliminated as to be negligible. Furthermore, the quality of transmission, especially in the case of low-pitched sounds, is considerably improved. There is, moreover, no need to "color" or rectify the timbre of the sounds with the aid of condensers and inductances, as has hitherto been the case. Voices and music blend with the acoustics of the room and lose none of their natural harmony through reproduction.

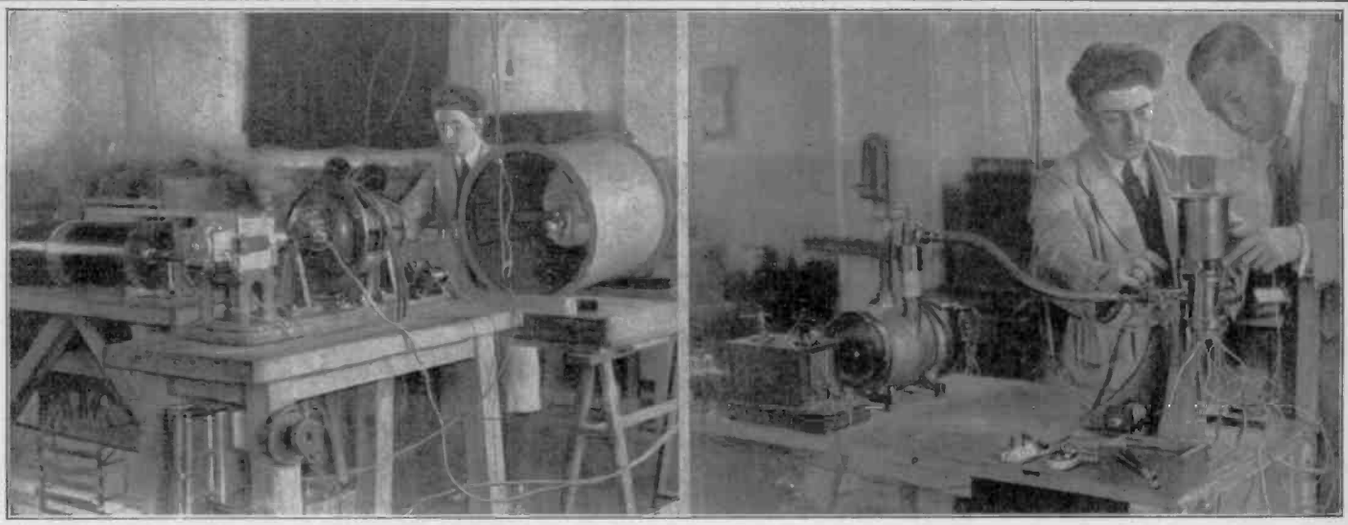
The comparatively high resistance of the apparatus permits, in the case of long-distance transmission, of the microphone being connected directly to the line, so that batteries and amplifiers need only be installed at the broadcasting station.

The Reisz microphone is connected directly to a resistance coupled amplifier, without any intermediate transformer.

The amplifier, comprises also a device which automatically limits the amount of power handled and thus prevents the transmitter from being overloaded when loud sounds are transmitted.

Has Cone Speaker, Too

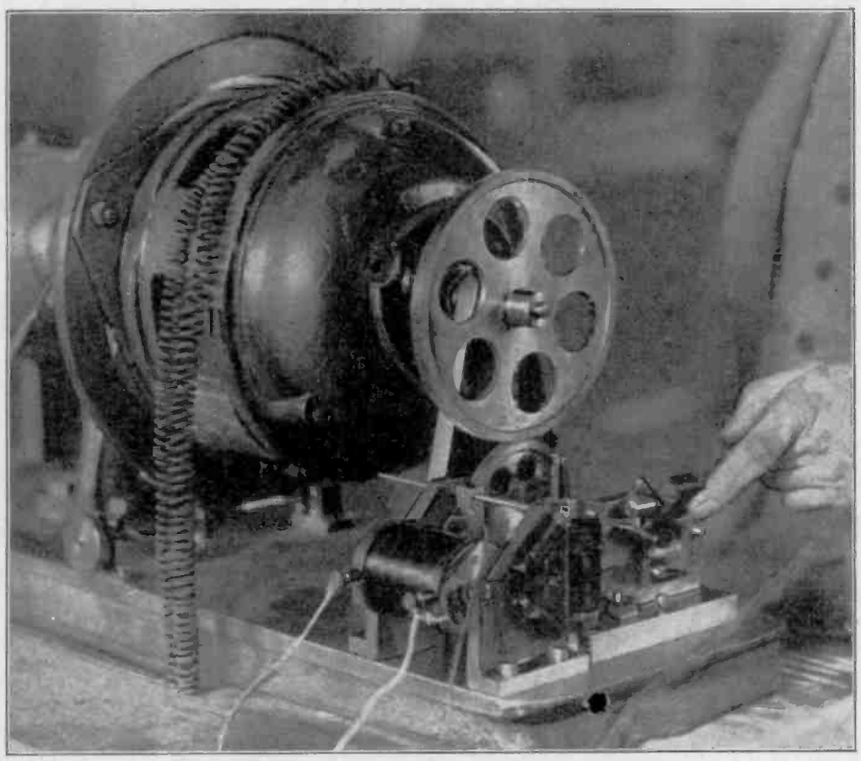
Mr. Reisz, in association with Paul Lieben, designed the first vacuum tube amplifier. Mr. Reisz was in America ten years ago. His present trip is in the interest of the microphone and his headsets and cone speakers. He learned there is only a samll market for headsets here, but he is enthusiastic about his cone speaker. He may be addressed care of Eric H. Palmer, 1610 Times Bldg., New York City.



(Delano)

EDOUARD BELIN'S television transmitter (Fig. 1). At left is shown the arc light which supplies the intense scanning beam. In the center is shown the motor which drives the oscillating mirrors, and at the right is shown the large cylinder in the center of which is placed the photo-electric cell which converts the varying light impulses into corresponding electric current impulses. The heart of the receiving system in Belin's television apparatus is shown in Fig. 2 (right). At right is the cathode ray oscillograph containing the magnets which control the movement of the cathode ray. Fingers point to magnets. At left is the Holweck helicoidal vacuum pump used to keep the vacuum perfect inside the cathode ray oscillograph. The fluorescent screen upon which the picture received is seen is on top of the oscillograph and is shaded by a three-cornered frame.

Belin Pumps Vacuum To Insure Television



(Delano) FIG. 3

Close-up view of the mirror driving gear. Finger points to mirrors.

THE French inventor, Edonard Belin, is making rapid progress with his system of television, telautograph and picture transmission by radio. For television he uses a rapidly moving spot of intense light for scanning the picture to be transmitted. The beam of light, which is obtained from an intense arc light, is focused on the scene to be transmitted, by an optical system consisting of lenses and mirrors. The actual scanning is accomplished by two oscillating mirrors. One sweeps the beam of light across the scene in a vertical direction at the ratio of 600 times per minute and the other sweeps it across the scene in a horizontal direction at the rate of 12,000 per minute.

Thus the scene is covered once every tenth second by 20 scanning lines. The light reflected from the scene is focused on a photoelectric cell, located in the center of the large cylinder shown in Fig. 1. This turns the light variations into corresponding electric current variations.

Uses Oscillograph Reception

For receiving the picture Belin has turned to the cathode ray oscillograph. The current pulses from the receiver are sent through magnet coils which are so placed as to affect the electron stream in the oscillograph. The beam of electrons is made to sweep across the fluroescent screen of the oscillograph in exact synchronism with the original scanning beam. The synchronization is accomplished by the simple means of transmitting two frequencies at which the scanning mirrors are oscillating. Thus the image of the scene is reproduced in exact time and space relation, as well as at the correct light value at every point.

A prime requirement in a cathode ray oscillograph is that the space inside the glass bulb be thoroughly evacuated. To insure vacuum at all times satisfactory a Holweck helicoidal pump is used continuously.

How Pump is Connected

This pump is shown in left in Fig. 2, and it is connected by a tube to the cathode ray oscillograph at right. Belin is in Figs. 1 and 2.

The oscillating mirror which causes the light spot to scan the picture to be transmitted are actuated by gears connected to the motor shown at close range in Fig. 3. The finger is pointing to them.

Many Are Exploring Realm of Television

Television experiments are now going on simultaneously in many different laboratories and different countries. In this country we have E. F. W. Alexanderson of the General Electric Co., Schenectady, N. Y.; Herbert Ives, of the Bell Laboratories in New York City; and C. Francis Jenkins, of Washington, D. C. In England we have the youthful inventor, John L. Baird, who is now heading his own company for exploiting his inventions in television. In France the well-known Edouard Belin has turned his attention to this absorbing subject and has already had notable success. Others are working on the same subject in Germany, Sweden and Japan.

If assiduous cultivation of a fertile and interesting field will yield results it should not be long now before television will be as common as the telephone and the motion picture.

Only two years ago television was sneered at by men now making it work.

Song of Today Contrasted With the Crackles of 1920

Chicago.

During the last seven years of radio activity there have been many developments certainly not looked for by the few who bought or built receivers during the early days of voice broadcasting.

Since the day of the single-circuit tuner and crystal set, broadcasting has changed so that one individual program need not be confined to one studio.

For instance, during the latter part of 1926, KYW experimented several times with the idea of having a soloist sing in one studio to piano accompaniment by another person situated many miles distant. Radio receivers were used at either end, whereby the pianist and singer were able to keep time and stay in tune with one another. To the listener it seemed that both artists were in the same studio.

Mary Garden's Part

On November 15, 1926, when the National Broadcasting Company made its bow to the world over a chain of stations scattered over the country, the program was not given from any one individual studio.

The N. B. C. studios in New York were employed; orchestrations were picked up from several different points in New York, by different orchestras chosen for the occasion; Mary Garden, who by the way, was on KYW's first broadcast on November 11, 1921, was also one of the feature artists of the N. B. C. initial broadcast and she sang in Chicago to the vast network of stations; Will Rogers, the nationally known humorist, spoke to the chain on the same evening in Kansas, and so on.

Leading Men Heard

Since that time it has become common for the N. B. C. to broadcast talks of national importance by the nation's leading men, by picking up their voices over special wires from any point and transmitting it to the key station in New York for redistribution over the chain.

Switch-overs of this sort require but a fraction of a second and no delay or interruption is noticed in the continuity of the musical program. In fact, less time is required to switch from the Chicago or New York studio to Buffalo or Memphis, than is necessary for one artist to relinquish his place before the microphone for the next artist.

The old method of letting the invisible audience know only a second beforehand who the next artist is to be is rapidly becoming passe.

Programs Prearranged

Printed programs are now submitted several weeks in advance to the press, and when that program is to be broadcast, the announcer often reads the names of those who will appear before the mike. Then the program goes on without interruption.

Improvements which have appeared in broadcasting are due not only to better equipment which has come into use. Probably the greatest development has taken place in radio showmanship. Should a half hour of 1920 broadcasting with a phonograph playing important part be followed immediately by a chain of broadcasts featuring prominent concert artists it would be brought forcibly to mind how tremendously have been the changes in broadcasting.

Now a Great Industry

Radio has become one of the great industries. It has grown with greater rapidity perhaps than any other. At the birth of broadcasting as an entertainment medium there were but a few manufacturers of radio receivers. Since then hundreds of factories have sprung up throughout the country, employing thousands of people.

Amplifier in Court Helps Aged Litigants

An audio frequency amplifier, containing a microphone at the input, was recently installed in a courtroom in New York City.

Mrs. Mary E. Clewell, of 1140 Commonwealth Ave., Boston, who brought the action, was 75 years old, and her voice was impaired. William V. Rowe, of Newton Heights, Mass., her step-brother and brother-inlaw, was the defendant. His hearing is affected. Mrs. Clewell spoke into the microphone to give her testimony, while Mr. Rowe listened at the loudspeaker.

ST. LAWRENCE HONORS SARNOFF

Canton, N. Y.

The honorary degree of Doctor of Science was recently conferred on David Sarnoff, vice-president and general manager of the Radio Corporation of America, by St. Lawrence University. The degree was given to him in recognition of his work in the development of radio communication, in both the technical and commercial fields.

ROSS WITH SPLITDORF

Donald Ross, one of the assistants of the late Henry P. Davison, of J. P. Morgan & Company, in the conduct of the American Red Cross during the war, has become vice-president in charge of finance of the Splitdorf-Bethlehem Electrical Company.

ROGERS HEARD AT KNX

Los Angeles

Will Rogers, sage, writer and comedian, entertained at the Advertising Club recently and his remarks went over KNX. This station puts on the Advertising Club programs every Tuesday noon.

(Foto Topics)

CHARLES W. HYNE, manager of the Utica Jubilee Singers, exclusive artists of the National Broadcasting Co., and Miss Anlmira Gilchrist, were married recently and sailed for Europe.

Paradise For Fans, His Idea of Town

Los Angeles.

According to Eberhard Heberlein, his place of residence, Imperial Beach, California, which is a few miles south of San Diego, is a paradise to listener-in. There is practically no static or fading and DX stations roll in without difficulty. It is a rare night that Atlantic Coast stations are not heard with ease. Honolulu and Hawaii are no thrill and Canadian and Alaskan stations are an old story. The receptionists subscribe to Eastern program and choose their entertainment from the nation at large.

A member of KFI's technical staff asked the visitor if he ever had any trouble at all.

"If we do," he replied, "we check our tubes, batteries, and connections, for we have learned that only these things prevent 100% reception."

90% of Jazz Musicians College Men, Says Lopez

Chicago.

Unless the professions increase their financial inducements to college graduates, the jazz band industry is soon going to be overcrowded, declared Vincent Lopez. The popular orchestra leader was playing daily in the balloon room of the Congress Hotel, and broadcasting through KYW.

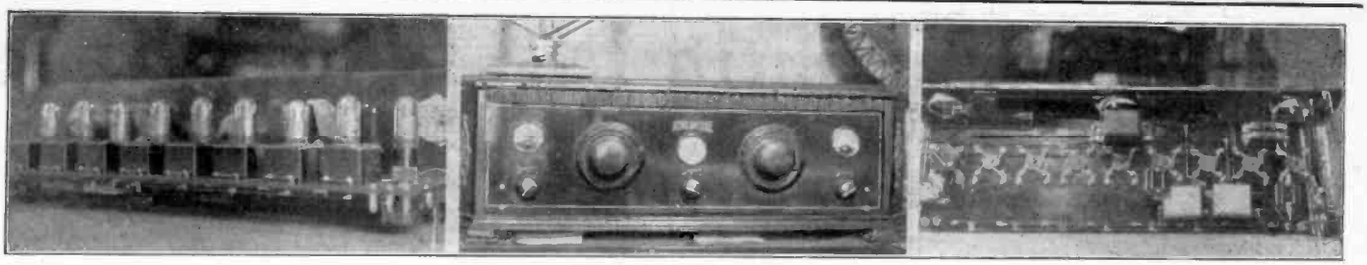
"The best set for the boy who comes out of college these days is the jazz band, so far as salary is concerned," said Lopez. "Last Summer, 300 American undergraduates jazzed their way through Europe. Last Fall several thousand boys got jobs with bands to help pay their way through college. Many of them earned from $100 to $200 a week.

"Unfortunately, the lure of the money is sometimes so strong that some of them forsake their college before they graduate to become jazz musicians. Ten years ago there were no college men in professional dance orchestras. Now it is safe to say that ninety per cent of jazz musicians are men with one, two and sometimes three college degrees.

"Fox trots are easy to learn because of their simple rhythm and in a few months a man can get a full dance repertoire. In a little while, he is able to earn ten thousand dollars a year. What other business can offer such a salary under five or ten years?

"Big business will have to take steps, or rather dig in their pockets a good deal deeper then they do, if they want to get new blood into their business."

Lopez insists that all his musicians be Americans. He believes that foreigners can never get the swing of jazz. The qualifications he requires are initiative, imagination, inventiveness and real optimism.



FIGS. 1, 2 AND 3.
The rear, front and top views.

Suitcase Nine-in-Line A Practical Portable

By James H. Carroll

Contributing Editor; Associate, Institute of Radio Engineers

When my esteemed contemporary, Lewis Rand, brought out the "Nine-in-Line" in the April 2 issue of RADIO WORLD he waxed so enthusiastic over it that my interest was aroused and I have since experimented with this circuit. With the approach of the outdoor season, when I became bombarded with requests for portable circuits, the temptation arose to try to adapt this receiver to this purpose. The result was a set far more powerful than the average portable.

The first step in the effort to make this set portable was to try to make it function with the 99 type tubes. We were warned, as usual, that the transformers would not work with this type of tube; that the impedances would not match, etc. Even the High Frequency Laboratory experts were doubtful and inclined to advise against the experiment. Their research and experiment had been devoted to getting the best results with the six-volt and power tube combinations, requiring full plate and filament voltages. And we must admit that they made a good job of it. The tube experts of our acquaintance were also set against the idea, and the consensus seems to be that there is no demand for the three-volt tube among fans, all supposed to be weaned to the more powerful valve. Yet, it seems strange to me that every time a new circuit comes out he receives many inquiries as to its functioning with the 99 type tube. Personally I like this little fellow, get fine results with his aid and believe that an even larger field is opening for him. However, I went ahead and got results, which is the most important thing. I had to make the Nine-in-Line function with the 99s or give up the idea as a portable.

I made a few slight changes in the wiring diagram. See Fig. 5, then change as follows. The first and second detectors and the oscillator are operated on one rheostat, the left-hand one, looking at the front panel. The centre rheostat operates the four radio frequency tubes. The filament switch position is replaced by the ammeter. A Centralab combination filament switch and 500,000 ohm resistance is the extreme right-hand knob. The two audio tubes are on Amperites, two 99 type being used for the portable. Nine Armor 99 type tubes gave wonderful results for the portable. A power tube may be used in the last stage for those who desire it, as the set is wired this way.

Three Sterling meters are mounted on the panel, giving us at all times a complete check on our voltages for all purposes.

These are all the changes necessary in the diagram.

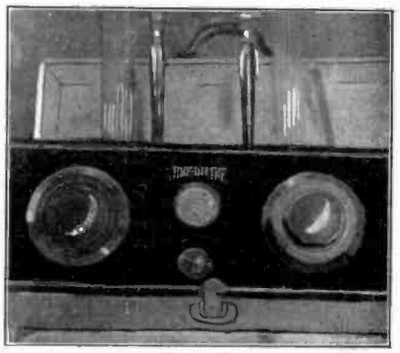


FIG. 4.
The finished set is placed in a suitcase.

LIST OF PARTS

Three H. F. L. H210 Transformers.
Two H. F. L. H215 Transformers.
Two H. F. L. F320 Transformers.
One H. F. L. L430 R. F. Transformer (Oscillator Coil).
One H. F. L. L425 R. F. Choke Unit.
One Yaxley Rheostat, type 125K.
One Yaxley Rheostat, type 16K.
Two Amperites, 199 type (for Portable use).
Two Amperites, one A and 112 for home use.
Two Benjamin S. L. F. .0005 mfd. variable condensers.
One General Radio 50 mfd. microdenser, type 368B.
Two Sangamo .001 fixed condensers.
Two Igrad. 1 mfd. fixed condensers.
One Sangamo .002 mfd fixed condenser.
One Centralab combination battery switch and 500,000 ohm variable resistance.
Nine Benjamin Cle-ra-tone sockets, sub-panel for 3-16 inch base.
One Celeron 7/26 drilled and engraved panel.
One Celeron drilled subpanel.
One pair of Benjamin self-supporting brackets.
One Yaxley complete cable connector plug.
One Yaxley separate cable (this is left connected in portable).
Five Yaxley pup-jacks.
Two Karas Micrometric dials.
One Qualitone loop (for house).
One Bodine DeLuxe Loop (for portable).
One Sterling—0-3 ammeter.
One Sterling—0-50 milliameter, push-button type.
One Sterling—0-7½—0-150 combination voltmeter, push button type.

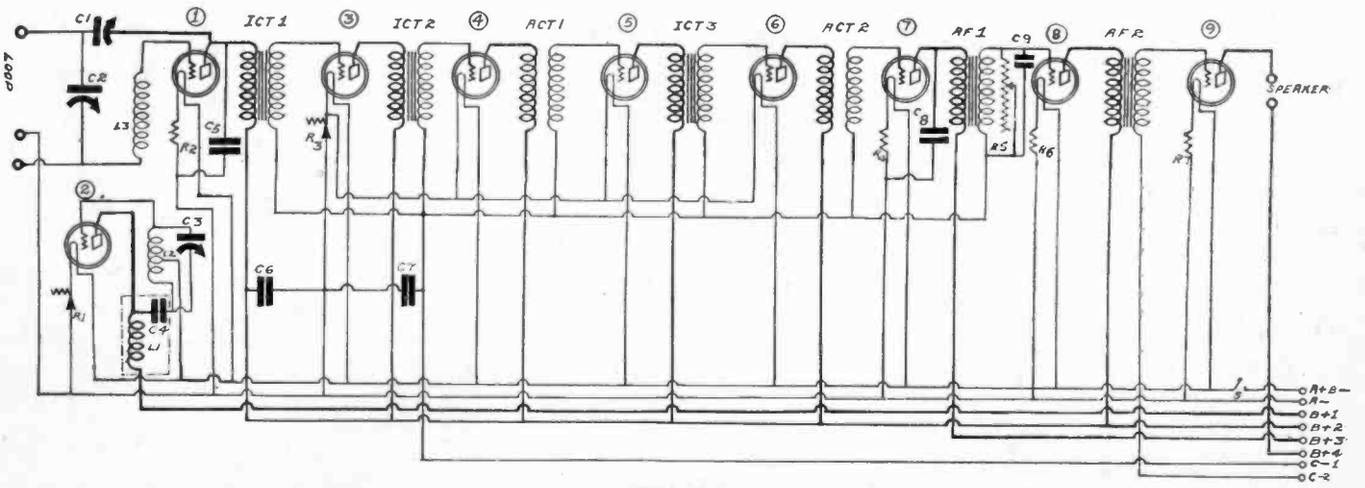


FIG. 5.
Circuit diagram of the Nine-in-Line Super-Heterodyne. The author changed this slightly for portable purposes, as he explains in the text.

This Makes a Good Portable

Four-Tube Design Affords Excellent Sensitivity

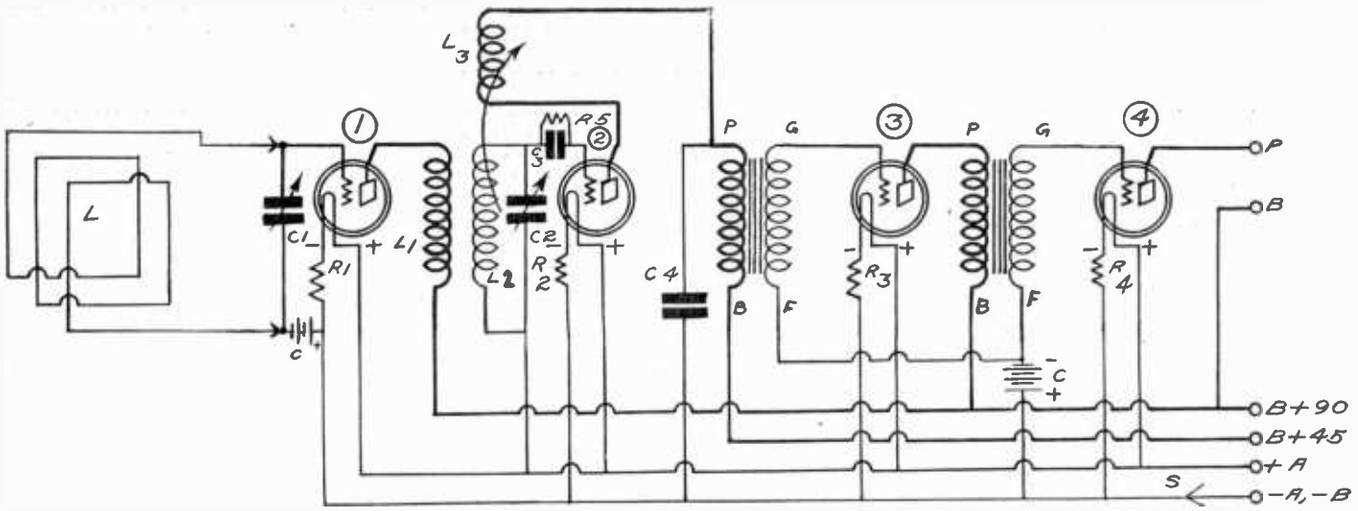


FIG. 1

A circuit incorporating a loop L for picking up signals. For sensitivity the loop is made large in size and inductance and the condenser C1 used for tuning it is correspondingly small. When a loop receiver is used in shielded places much RF amplification is required, and for that reason a regenerative detector is used.

The circuit shown in Fig. 1 can be built by using 100 feet of wire, say No. 18 bare wire, or No. 18 DSC, if you prefer, and winding on a three-foot frame, to constitute L. This is for a .00035 mfd. condenser (C1). For .0005 mfd. use 90 feet. L1 and L2 are primary and secondary of a three-circuit tuner, while L3 is the tickler. A commercial coil may be used, or a home-made one. L1 may be 10 turns on a three-inch diameter, L2 about 45 turns, with ¼-inch spacing between the two. Use No. 22 DCC wire. L3 is wound on a 1¾-inch form 1-inch diameter and has 26 turns of fine wire, say No. 26 double silk covered. C2 should be .0005 mfd. If .00035 mfd, is used put 60 turns on the secondary. R1, R2, R3 and R4 are suitable Amperites, depending on the type of tubes used. C3 is .00025 mfd, with clips, and R5 is a 2 meg. grid leak. C4 is .001 mfd. PBGF are two AF transformers. If the ratios differ, put the lower ratio in the first stage. The negative bias is 1½ volts for the loop circuit and 4½ for the audio circuit, if 99 or—01A tubes are used throughout. For portables use 99s.

Rheostat for First RF Favored to Fix Volume

By John F. Rider

The subject of the best position for the volume control in a powerful multistage radio frequency receiver has been frequently discussed, but very little definite recommendation has been made in the selection of the most advantageous location for this device. Some incorporate it in the audio circuit, others in the detector circuit, and still others in the radio frequency system of the receiver. The same location is not used by all. Some very interesting light is thrown on the subject by A. Bloom, of the Akradyne Radio Corp.

"We had occasion," say Mr. Bloom, "during the development of our new 8-tube receiver, to carry out extensive re search work relative to the position of the volume control. The subject was considered at great length, so much so, that waveform observations were made when the volume control unit was located in the audio circuit, and associated with the coupling devices.

AF Filaments Won't Do

"Filament control in the audio circuit was decided against as being a very prolific source of tube distortion, due to overloading of the vacuum tube occasioned by the reduction in size of the plate current-grid voltage characteristic curve. By maintaining the high value of plate potential and reducing the filament voltage, the tube saturates, and the output signal is badly distorted.

"The shunting of the plate load of one of the audio tubes was found to be unsatisfactory, since the effective impedance of such a combination is lowered to such an extent that energy transfer between the tube and the load on the low audio frequencies is greatly impaired.

"The shunting of the secondary of the audio frequency transformer was found unsatisfactory because it changed the frequency response characteristics of the coupling device. As a matter of fact, its use in all audio systems was avoided, because it did not afford control of the signal output from the detector tube, nor provide control for the prevention of overloading of the detector tube. An overloaded detector tube is a very prolific source of distortion.

RF Rheostat Found Good

"Filament control of the detector tube as a means of volume control also fell short of the mark, since it would still result in tube distortion, as the energy being passed into the detector tube is not diminished when the filament brilliancy is reduced. With maximum input into the detector tube, and reduced filament brilliancy, distortion in the detector tube is unavoidable.

"Then the volume control was placed into the radio frequency amplifying system in the form of the filament brilliancy control of the first radio frequency amplifying tube. This proved the most successful. It afforded full control of the signal input into the detector tube, and a means of eliminating detector overloading.

"Furthermore, it obviated the use of a volume control unit in any position where it would manifest an effect upon the frequency transfer between the tube and the load, plate circuit, and upon the amplifying characteristics of the coupling devise. In this way it is possible to control volume, always operate the audio frequency amplifying tubes at their best, without fear of any alteration signal of waveform, obtain best quality output, and preserve the output waveform of a complex input."

Lore of the Heavens Fascinates the Fans

Due to the success attending KGO's broadcast of an astromoner reviewing the moon during a recent eclipse, Henry M. Hyde arranged a similar enterprise over the General Electric station later, when a comet was visible at 1 a. m.

This early hour has been selected so as to enable listeners in many foreign countries, particularly Australia, to view the Pons-Winnecke comet and at the same time listen to Hyde describe it as it appeared from another point on the globe.

This was the first time Pons-Winnecke could be viewed with the naked eye.

In olden times a great deal of misgivings attended celestial happenings of this kind, and even now, according to Hyde, millions of people will be frightened at the appearance of this comet.

The Pons-Winnecke visits us every six years but even then is over 3,500,000 miles away.

LINDBERGH PLANE SPEAKER. Pictures and explanatory article appeared in Radio World dated June 25, 1927. Sent on receipt of 15 cents, or start your subscription with that number. Radio World, 145 W. 45th St., N. Y. C.

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Portugal Code Station Now Linked With U. S.

Washington.

Establishment of radio service in Portugal is anounced in a statement made public by the Department of Commerce based upon advices from the Consul General, W. Stanley Hollis, at Lisbon. The statement follows:

"The Marconi Radio Company, which has had a force of engineers employed for some months previously around Lisbon erecting sending and receiving stations, has opened its offices for the sending and receiving of messages to and from England and Maderia.

"The compay has continued to perfect its installation and inaugurated a much fuller and amplified service between Lisbon and various points in North and South America and in Africa as well. Radio messages can now be exchanged directly between the Marconi stations in the United States and the one in Portugal."

Vesta Dry Trickle

Vesta Battery Corporation, Chicago, anounce a dry trickle charger, under the Vertrex patents. It rectifies through two dissimilar metals, aluminum and copper sulphite.

Steel Obstructs Radio as Sea Wall Stops Breakers

A striking comparison can be made between the wave shielding effect of a series of sea walls containing small holes and metal obstructions to a wave broadcast from a station.

The high waves coming in from the open ocean will strike the first wall, which will absorb and reflect most of the wave energy. A small portion of the wave energy will get through the openings, but most of this will be absorbed and reflected by the second wall. Only tiny ripples will get through the openings in the second wall. Inside the third there will be a calm as far as the ocean waves are concerned. A water wave detector placed inside such a breakwater would have to be exceedingly sensitive to give any indication of the ocean waves at all.

The case of ether waves in shielded places is not much different from the analogy. A steel structure is an impenetrable concrete wall, so to speak. Windows and streets are little openings, but behind every opening there is another wall of steel. A high hill or mountain is also a partial shield, while valleys and water courses are openings.

Another place where the field strength is weak is inside a steel railway coach. A loop or other antenna placed inside it has little chance. There is steel ahead of it, back of it, on the sides of it, and all around it. There are only small openings on the sides. Little energy gets into these openings and reaches an antenna inside the car.

Even if the station desired is located in a direction at right angles to the railroad, it is probable that the direction from which the signals reach the train is parallel with the road. The rails guide the waves. This decreases the chance of the waves getting through the windows.

If the loop is placed parallel to and near a window, the iron frame will short-circuit the loop and the result is no signal. If the loop is placed exactly at right angles to the frame of the window, there is no short-circuiting effect, but if the waves travel parallel to the road, the loop is set for minimum pick-up, and that case is just as bad.

High Wave Stations Held SOS Hindrance

Commercial traffic on 600 meters, SOS calls and radio compass service on 800 meters are being interfered with by stations operating on the higher wavelengths, according to H. A. Williams, chief radio man at the Naval Radio Communication Office of the Second Naval District, at South and Whitehall Streets, N. Y. City.

"When attempting to receive weak signals, either on the 600 or 800 meter wavelengths, it is frequently necessary to ask broadcasting stations in our vicinity operating near 500 meters to close down temporarily so this important traffic can be sucessfully completed, Mr. Williams continued. "For instance, WNYC always interferes with our operations when they are on the air. If they hear the distress call they, of course, discontinue their broadcasting program at once, so that no interference results. We attribute this interference to the broadness or nearnes of the broadcasting stations, because our receivers, while not of the latest design, are nevertheless good enough to overcome ordinary interference.

"We have recently received orders from the Navy Department in Washington instructing us to compile a list of the broadcasters who interfere, stating whether we attribute this interference to their nearness or the broadness of the transmitted signals. We have already listed several, but cannot give out the information at this time. However, it seems to be known that WNYC is one of the stations.

"It must be understood that all of these higher wave broadcasting stations have willingly cooperated with the distress traffic when they hear these calls, but I understand that very few stations maintain a continuous listening post."

WNYC's director, Christie Bohnsack, stated that he was sure that his station was not interfering with the Navy's transmissions.

In all distress call cases it co-operates to the fullest extent, he said.

McClelland's Pinch Hit

George F. McClelland, who in four years has risen from commercial representative of WEAF to vice president and general manager of the National Broadcasting Company has appeared before the microphone only once. And that occasion was one of high pitch, a never-to-be-forgotten moment when his enthusiasm was afire with an epic battle—the Willard-Firpo fight, July 12, 1923, at Boyle's Thirty Acres. More than half the time entirely forgetting the ever-sensitive microphone at his elbow, Mr. McClelland's spontaneous exclamations carried to thousands the most stirring account of a boxing encounter ever broadcast.

And that radio appearance by Mr. McClelland was a decided surprise to the staff of WEAF and, most of all, to Mr. McClelland himself.

This was in the days before Graham McNamee became a regular staff announcer. Very few fights, or for that matter, few programs outside the studio, had been attempted. Therefore, the broadcast of this bout was an event.

A newspaper sports writer with a fine resonant voice was engaged to depict a "blow-by-blow account of Willard's attempt to come back. This man knew boxing from the ground up and had acquired conspicuous success in broadcasting theatrical programs but fizzled at the fight. McClelland had shown great interest in all details of radio and whenever some new idea was being tried out, Mr. McClelland managed to be in the vicinity.

On this day Mr. McClelland had come to witness the fight as an observer. He had a ringside seat. The announcer and WEAF's operator were the only other representatives of WEAF at the ringside.

To save the day McClelland jumped into the breach and described the fight.

Byrd In Flight Used Standard Navy Set

(Underwood & Underwood)

THE SET used aboard the America was a standard Navy receiver. Lawrence A. Hyland, one of the two constructors of the set, is shown.

Washington.

A standard naval aircraft radio set was used by Commander Richard E. Byrd in his trans-Atlantic flight, and enabled the America to have excellent radio communication virtually throughout the flight, the Department of the Navy announced.

The Navy set, the statement said, was not selected until after very careful study of just what type of radio equipment would be best adapted for a flight over a long period. Various commercial radio equipment as well as Navy sets were experimented with, according to the statement, with the result that it was found that the standard naval set complied excellently with all the requirements.

The Navy Statement

The statement follows:

"As this flight was to be as scientific as possible, Commander Byrd desired to show the world that it was possible for a plane to maintain communication throughout the flight. Various commercial radio equipments as well as the Navy sets were selected for study. In addition a request was made on the Navy Department to outline the requisites of an adequate set.

"As a result of the study made the recommendations made included first, as powerful a radio installation as weight would permit; second, that the frequency band be in the intermediate frequencies rather than in the high frequencies in order to insure communication with all merchant vessels on the international distress wave of 600 meters.

Standard Set Suits

"As a result of extensive surveys it was found that the standard naval aircraft radio set complied excellently with all requirements.

"With the advice of Lieutenant Noville, who came to Washington for the purpose, it was decided to use the standard Navy model scouting plane equipment, and such equipment was made available to Commander Byrd, such procedure being possible due to his being on active duty status in the United States Navy.

"The use of the set was advocated by the Navy to provide a stringent service test, and an opportunity to test the accuracy of naval radio compass stations in taking bearings of the plane while on the flight and further, to provide an opportunity for a service test of naval equipment on aircraft equipped with standard service equipment being able to communicate with foreign radio and radio compass stations.

"For weight-saving purposes the set was modified through the assistance of the radio engineers at the Naval Research Laboratory at Belleview, so that only two frequencies were incorporated, this making possible a reduction of almost 20 pounds through elimination of switching devices and coils.

"The reports of the flight indicate that the America had excellent radio communication throughout almost all of the flight. A daylight range of 1,000 miles and a night range of 1,600 miles was obtained and the Radio Compass Stations were able to plot the position of the plane by means of the bearings of the signals transmitted. Merchant vessels were communicated with along the line of flight and foreign radio stations were also in touch as well as foreign radio compass stations."

Balsa Wood Speakers Attract Wide Interest

The exhibit of the Balsa Wood Reproducer Corporation at the recent Chicago trade show attracted great attention. Lata Balsa Wood was shown in all its forms, including the specially treated and seasoned kits prepared for radio. Tremendous interest was shown by every branch of the radio industry in the Lata Balsa Wood as the newest efficient reproducer of sound waves. A number of large contracts were closed for the installation of Balsa Speakers in cabinets and a large contract was closed by a prominent Chicago manufacturer for the making of a loudspeaker under the Balsa patents and with genuine Lata Balsa Wood.

Factory representatives and first-class jobbing interests were signed up to cover the greater part of the United States and Canada, and a tremendous business was lined up by this company for the coming season. E. Howard Figg, president of the Balsa Wood Reproducer Corporation, was there in person and his indefatigable efforts and genial personality made a great hit with the trade. Great interest was shown in the article on Balsa Wood, written by H. B. Herman and published in the June 11 issue of Radio World, copies being displayed at the show.—J. H. C.

Bombay 12 kw Station To Open Next Month

Washington

Construction of a new 12-kw. broadcasting station for Bombay, India, was announced by the Department of Commerce, based upon advices from William H. Beach, American Vice-Consul at Bombay. Broadcasting will begin in August.

Thus far broadcasting in Bombay has been done by the Bombay Presidency Radio Club, with a low-powered station, operating on 387 meters. It is expected that the opening of the new station will stimulate the sale of radio sets in Bombay.

COMPLETE LIST OF STATIONS

With the new wavelengths, frequencies and power. All the 694 stations in the United States given alphabetically by call letter with the location cited and also the identity of station or stations which share time on the air. Send 15c for extra July 9 issue that contains this complete list. Radio World, 145 W. 45th St., New York

Beam Helped Pacific Fliers

(Wide World)

MRS. ALBERT HEGENBERGER, wife of one of the Pacific fliers, listened to an old-fashioned set for broadcast news of the progress of the Army plane, Bird of Paradise. With her were her two children. The flight's success was aided by a radio beacon, the American sending station being shown in the lower photograph.

When Lieutenants Lester J. Maitland and Albert F. Hegenberger of the Army Air Corps flew to Honolulu from Oakland, Calif., they were guided across the water by a beam of radio waves bridging the Pacific ocean. This bridge was established by two radio stations, one at each terminal. As long as the flyers remained inside the radio beam they could hear signals from one or the other of the two stations, but if they left the radio lane they heard no sginals.

The radio waves were their main reliance in case of poor visibility. However, if the weather was clear they had with them instruments whereby they could navigate by shots at the stars.

At one time in the middle of the ocean they lost the radio beam, either because they strayed outside it or because the intensity of the radio waves from either station was too weak for the receiver to pick up. And this happened at a time when their visual instruments were useless because of cloud and fog. But they got back into the beam again and followed it until they landed safely in Honolulu.

Peck and Whittemore Executives at Parley

Washington.

Lieut. Col. E. D. Peck of the Department of War has been selected as the executive officer of the American delegation to the International Radio-Telegraph Conference, called to meet in Washington on October 4. Laurens E. Whittemore, formerly of the Department of Commerce, was selected as the secretary of the conference.

Radio University

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When writing for information give your Radio University subscription number

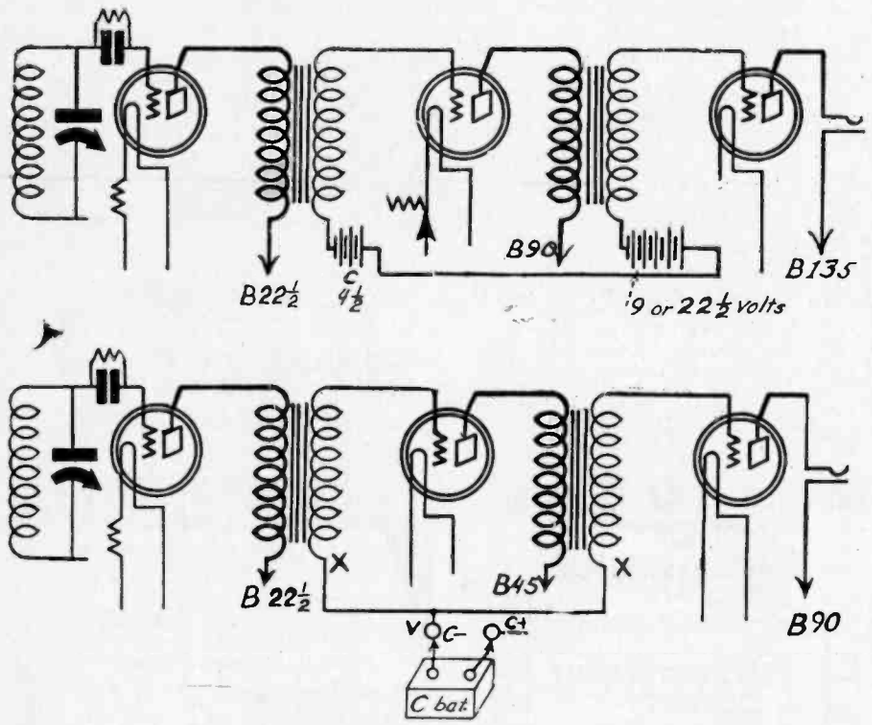

FIG. 551

Circuits illustrating the correct and incorrect way of connecting up C batteries, when using different B voltages, the bottom being the wrong method, and the top the correct way.

THE CIRCUIT that appeared in the Radio University columns of the June 4 issue of RADIO WORLD has attracted my attention and I wish to build it.

(1)—Could a two stage transformer coupled audio frequency amplifier be added to this set?

(2)—What does S mean?

(3)—If I use a C battery, does the minus go to the F minus post of the AFT and the plus of this battery to the minus of the A battery?—MANUEL BAXTER, Cleveland, O.

(1)—Yes.

(2)—This is where the input of the audio frequency amplifier is connected to, or to where a pair of phones may be shunted.

(3)—Yes.

* * *

I WOULD like to build the five-tube receiver diagrammed on page 9 of the June 25 issue of RADIO WORLD.

(1)—Could any type radio frequency coils, with secondaries wound to match variable condensers be used?

(2)—Is it all right to use an eighty-five millihenry radio frequency choke coil in the plate circuit of the detector tube?

(3)—Are the bypass condensers in the RF and detector circuits of the .001 mfd. fixed type?

(4)—Could a ten ohm rheostat be used to control the filaments of the first two radio frequency tube, instead of the ballasts?

(5)—Could all the parts be placed on a baseboard, seven inches wide and twenty-one inches long?—HAL CONNELY, Indiana, Pa.

(1, 2, 3, 4 and 5)—Yes.

* * *

IN REFERENCE to the Suitcase Six, described in the June 11 issue of RADIO WORLD.

(1)—The rotary plates are brought to the grids. Shouldn't they be brought to the grid returns?

(2)—I wish to build this set as a portable and as a set for the home, and therefore would like to know if —10A tubes would work all right, these being used in the set at home?

(3)—Using ninety volts on the plates, is it necessary to use an output transformer?—BERNARD PERLMAN, Tacoma, Wash.

(1)—The condensers specified, which are the Bruno, have their rotor shafts insulated. Using other types of condensers, bring the rotor plate posts to the battery terminals, the stationary posts going to the grids.

(2)—Yes. Be sure and change the values of the ballast resistors.

(3)—No.

* * *

ABOUT A year ago, there appeared a pair of circuit diagrams of crystal detector sets. In one of the sets, the primary of the antenna was connected to the secondary. In the other there was no direct connection. Which of these sets would be the louder and more selective?—JULIUS MARGOLIS, San Antonio, Tex.

The set with the direct contact between the primary and secondary coil will give you much more volume, but will be less selective than the other, which will not, however, give you as much volume.

* * *

IN THE Oct. 16 issue of RADIO WORLD on page 14, there appeared a circuit diagram of a five-tube reflexed receiver. I would like to build this set with only the first tube reflexed, instead of the first two. Please explain how this can be done.—RUDOLPH JUTTER, East Pittsburgh, Pa.

The end of the primary winding in the plate circuit of the first tube instead of being connected to the P post of the second audio transformer, is brought to the P Post of the third audio transformer, or the one in the straight stage of audio frequency amplification. The G and P posts of the second audio transformer are then disconnected. The terminal that formerly went to the G post on this AFT is then connected to the minus A post. The end of the primary winding in the second tube plate circuit, which was connected to the P post on the third audio transformer, is then also disconnected and run to the B plus two or ninety volt post.

* * *

WE HAVE a Federal Type 59 receiver. This, it will be recalled, contains four tubes, one of which is a tuned radio frequency amplifier, the next, an untuned non-regenerative detector and third and fourth audio frequency amplifiers, using transformer coupling. The filament of each tube is controlled by a rheostat of the fifteen ohm type. There are double circuit jacks at the detector and first audio output, while at the last AF output, a single jack circuit jack is used. In the RF circuit, the grid return is made to the arm of a potentiometer, thereby making it variable. I wish to rebuild this set and therefore would like to have the following queries answered.

(1)—Could the potentiometer be taken out? Where should the grid return be made. The —01A tubes are being used.

(2)—Could the untuned RFT in the detector stage be supplanted by a tuned coil to any advantage? How? The primary winding of the other coil consists of twenty turns tapped at every second turn. The secondary consists of forty-five turns. Both are wound on a three and one-quarter inch diameter tubing using No. 22 double cotton covered wire. The windings are spaced one quarter inch. Across this secondary winding, a .0005 mfd. variable condenser is shunted. Across this condenser, a midget tuning condenser having a capacity of .00004 mfd. is shunted.

(3)—Could I do away with the detector and AF rheostats, by using one-quarter ampere ballasts?

(4)—Could I take the second double circuit jack, or the one in the output of the first tube, out? How?—GERALD QUENTON, Jersey City, N. J.

(1)—Yes. Connect the terminal that formerly went to the arm of the potentiometer to the minus A post. The resistance wire terminals are disconnected.

(2)—Yes. Procuring a three and one-quarter inch tubing, and some No. 22 dcc wire, wind ten turns for a primary, skip a one quarter of an inch, and then wind forty-five turns for the secondary. The beginning of the primary winding is connected to the plate post, the end going to the B plus sixty-seven and one-half volt post. The beginning of the secondary winding is connected to the rotary plate post of the new .0005 mfd. variable condenser and to the plus A post. The end of this winding is brought to one terminal of the grid leak and condenser and to the stationary plate post of the variable condenser.

(3)—Yes.

(4)—Yes. The P post of the socket is brought to the P post of the transformer. The B post of the transformer is brought to the B plus Amp. post.

* * *

RECENTLY I hooked up a two-stage transformer coupled audio frequency amplifier using a —99 and a 120 tube. The diagram enclosed shows how I hooked it up. I cannot get any volume. Please show how it should be hooked up, using the —99 and 120 and the —01As.—ELLIOT WASHBURN, Butte, Mont.

The circuit shown at the top of Fig. 551, illustrates the correct way of hooking up the transformers. You will notice that instead of connecting both grid returns to a common C battery, they are connected to separate batteries of different voltages. You had the returns connected together. A much lower bias is necessary at forty-five than at ninety. You had the bias

which should be used on ninety volts only, being used on a tube receiving only forty-five. This caused such a decrease in plate current, that the tube did not operate satisfactorily When using the —99 and —120, use the four and one-half, and twenty-two and one half volt C bias. When using the —01As, use the four and one-half and nine volt bias.

* * *

I CONSTRUCTED a four-tube regenerative set several months ago, consisting of a regenerative detector with a variometer in the plate circuit, and three stages of resistance coupled audio frequency amplification. A rheostat is used in the detector filament circuit, and ballasts are used in the AF filament circuits. The set works all right, but I notice that the portion of the panel where the rheostat is mounted, gets hot. The tube sockets are not mounted near the panel. Could this be due to the resistance wire in the rheostat being unable to pass one quarter ampere, which is what the filament of the tube draws?—RONALD K. WARREN, Haines Falls, N. Y.

Yes.

* * *

A MONTH ago I built a two-tube reflex, using a combination regenerative RF-AF amplifier tube, a crystal detector and one straight stage of audio frequency amplification. A regular three-circuit tuner, with a ten-turn primary and fifty-turn secondary were used. Both coils were wound on a three-inch tubing with No. 22 dcc wire. The tickler had 36 turns on one and three-quarter inch tubing using No. 26 scc wire. Both tubes are controlled by a ten ohm rheostat. I find the set very hard to control. This, I think, is due to the regeneration in the first tube. Could I take the crystal detector out, place a tube here, and make this tube regenerative, instead of the RF-AF tube?—JACOB LEFORT, San Francisco, Calif.

A tube detector with regeneration would work very well. The RF coupling coil can be used in the antenna circuit, while the tuner can be used in the detector circuit. See the July 2 issue of RADIO WORLD page 19, for a circuit showing how to insert a tube in place of a crystal. The rheostat should be placed in series with the minus leg of the filament of the RF tube.

* * *

I HAVE the circuit diagram of a one-tube reflex receiver. Provision is made for a loop, e.g., a double circuit jack. Could this be left out? A tuned RF transformer couples the antenna to the RF tube. A fixed RF transformer couples this tube to the crystal detector.

(2)—Where do you hook in, for audio amplification, using two transformers?—JOSEPH WALLINGER, Chicago, Ill.

(1)—Yes. The beginning of the secondary winding, instead of going to the second terminal from the bottom of the jack, is brought to the rotary plate post of the variable condenser. The end of this winding, instead of going to the next spring, is brought to the stationary plate post of the variable condenser. This connection, is of course, also extended to the G post on the socket.

(2)—The B post of the fixed RFT is connected to the P post of the audio transformer. The B post of this transformer is brought to the B plus sixty-seven and one-half volt post.

Protests Still Futile As Four Meet Fate

Washington.

The applications of four stations in the New York district for assignment to frequencies other than those given them by the Federal Radio Commission were denied, on the ground that no public convenience, necessity or interest would be served. The following petitions were denied:

WBRS, Brooklyn, N. Y., owned by the North American Broadcasting Corporation, assigned 211.1 meters, protested and requested 394.5 meters.

WCGU, New York, owned by Charles C. Unger, assigned 211.1 meters, protested and requested 309.1 meters.

WBNY, New York, owned by the Baruchrome Corporation, assigned 218.8 meters, protested and requested 280.2 meters.

WHAP, New York, owned by the William H. Taylor Finance Corporation, assigned 236.1 meters, protested and requested 280.2 meters.

Oh, How It Hurts!

London.

Hearings of the suit of Andre Messager, French composer, against the British Broadcasting Company, who he states infringed the copyright and injured the reputation of the opera "Les Petites Michus," when they broadcast it, were recently begun. William Boosey, a music publisher and close friend of Messager, said that he thought broadcasting too inefficient to do justice to an opera or other musical ensemble.

He added that it was possible that the broadcast of Messager's opera hurt both the music and Messager.

COMPLETE DETAILS on what ohmage resistances may be used with B eliminators to also obtain C bias, were given by Frank Logan in the March 12 issue of RADIO WORLD. Either send 15c for his issue or begin your subscription with this issue. RADIO WORLD, 145 West 45th St., New York City.

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Station to Rely on Juice to Keep Ice Off Aerial

WNYC, the municipal station in New York City, has a new aerial, protected from ice or sleet by electrical means. The heating principle will be used. It was explained as follows:

"During hours when the station is not transmitting in stormy Winter weather it is planned to energize the actual wires of the aerial with heavy electric currents, which, according to our calculations, should heat the wires enough to melt off ice accumulations or prevent its forming.

"However, our main objective in erecting an entirely new aerial is to permit our operators to comply fully with the Federal Radio Commission's order to maintain the operating frequency within prescribed limits. This means that the rigging must be capable of holding the aerial rigid under all conditions. The wires that form the radiating surface will be as large as overhead trolley cables. They will be suspended separately so that each one may be drawn up to the right tension and secured.

"Thus, by making the aerial as strong as possible mechanically, we should find it possible to maintain a very small frequency variation. At present WNYC operators check the transmitted wave once every fifteen minutes with a crystal-controlled wave-meter. In the future we may inaugurate a system of automatic control.

"We have carried out a great many experiments to find a type and size of aerial suitable for the radio conditions found at City Hall, the fundamental wave of which is approximately 400 meters. Several schemes of aerial excitation have been tried out in the past, with varying results, but we expect the new arrangement to prove most satisfactory."

WBBM Decides to Put Antenna In Suburb

Chicago.

WBBM, for the past two years located in the Hotel Broadmoor, will move its transmitting apparatus to the suburbs, over twenty miles northwest of Chicago and not within any corporate village limits.

The site was chosen by Leroy M. E. Clausing, the station's engineer, as almost ideal for serving the entire country, while the local interference would be negligible.

The studios will remain in the hotel. It is expected that the new apparatus will be in working condition within a month.

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