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Vol. 10, No. 14 America's First and Only National Radio Weekly Illustrated

NEW COUPLING METHOD VARIES THE SELECTIVITY

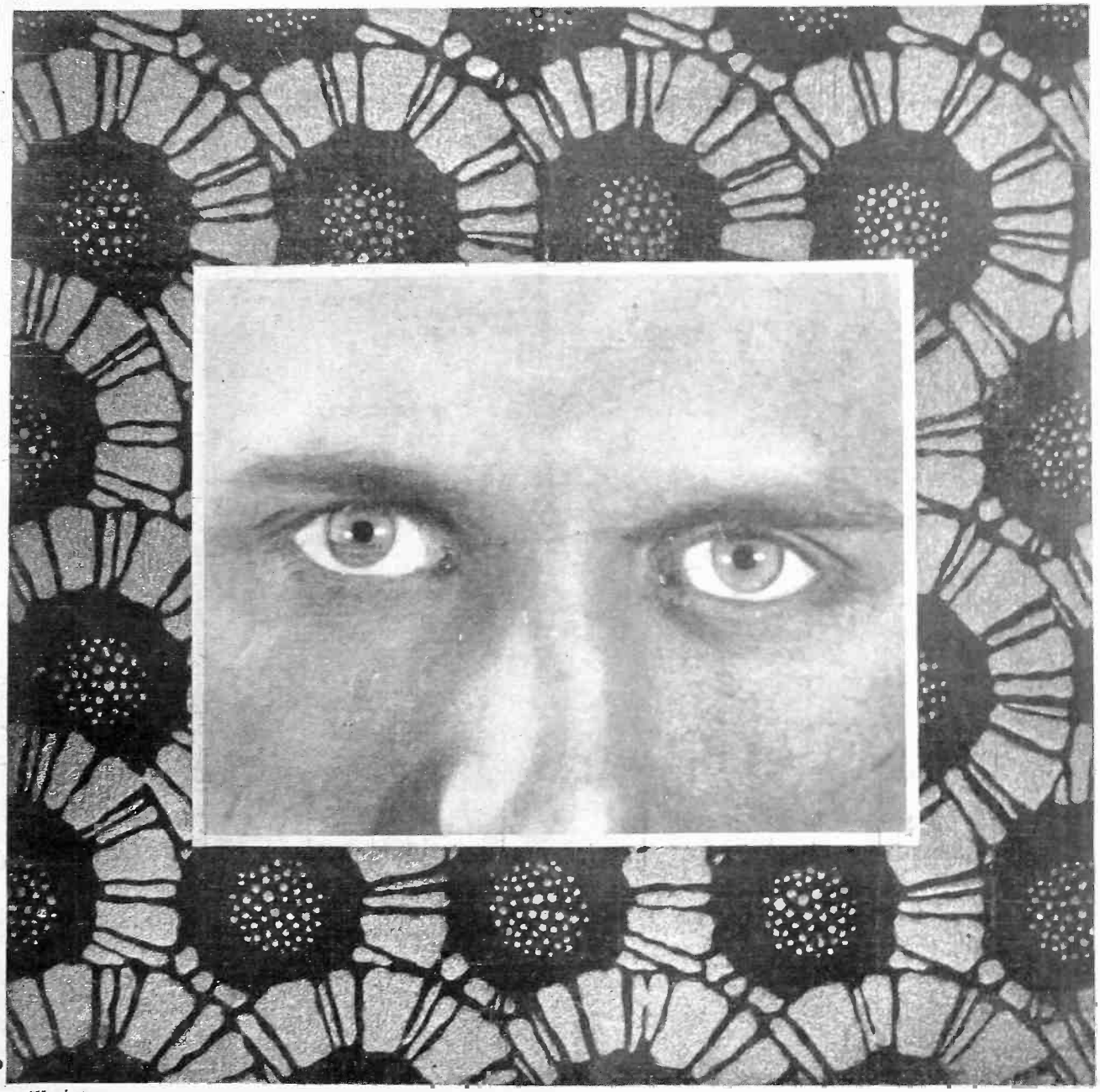
HOW TO MEASURE OUTPUT OF ALL B ELIMINATORS

FADING EASILY CHARTED BY HOME EXPERIMENTERS

FOREWORD on DE LUXE SET

EYES TO RECEIVE BROADCAST SCENES

Turn to Page 20



(Hayden)

Good Back Numbers of RADIO WORLD

The following illustrated articles have appeared in recent issues of RADIO WORLD:

1926:

Mar. 27—An Economical 4-Tube Set, by Edgar T. Collins A Practical B Battery, by Capt. P. V. O'Rourke. Tectron Trouble Shooting, by Lewis Winner.

April 3—How to Get DX, by Capt. P. V. O'Rourke. A Compact B Supply, by Lewis Winner.

April 17—The New 1-Dial Powertone, by Capt. P. V. O'Rourke. The Action of Transformers, by Lewis Winner.

May 8—To Wind a Loop on a Cardboard Frame. How to Reflex Resistance AF, by Theo. Kerr.

May 15—Super-Heterodyne Results Brought Up to Maximum, by Herman Bernard. The Truth About Coil Fields, by J. E. Anderson.

May 22—A Built-in Speaker Set, by Herbert E. Hayden. The Powertone in Operation, by Capt. P. V. O'Rourke.

June 5—Five-Tube Compact Receiver, by J. E. Anderson. A Tester for Tube Circuits, by Spencer Hood. Problems of Portables, by Hugo Gernsback.

June 19—Selectivity's Amazing Toll, by J. E. Anderson. The Light 5-Tube Portable Set, by Herman Bernard

July 3—Set with a 1-Turn Primary, by Herman Bernard. Part 2 of the Victoreen Portable, by H. Bernard. Trouble Shooting Article for The Light 5-Tube Portable.

July 10—A Rub in Single Control, by Herman Bernard. A DX Double Regenerator, by Capt. P. V. O'Rourke. A 2-Tube Dry Cell Receiver, by Samuel Schmalz.

July 17—A Double Duty Loop Aerial, by J. E. Anderson. How to Measure Coupling, by John Rider. A 1-Control Crystal Set, by Smedly Lyons.

July 24—Why the Super-Heterodyne Is the Best Set, by Herman Bernard. A 1-Tube Reflex Receiver, by H. A. Reed.

July 31—What's Best in an AF Amplifier, by Herman Bernard. A 6-Tube Reversed Feedback Set, by K. B. Humphrey.

Aug. 7—The 5-Tube Tabloid, by A. Irving Wltz. The Wiring of Double Jack, by Samuel Lager.

Aug. 14—The Improved Browning-Drake, by Herman Bernard (Part 1). Storage Batteries, by John A. White.

Aug. 21—A New Stabilized Circuit, by E. H. Loftin and S. Y. White (Part 1). The Browning-Drake, by Herman Bernard (Part 2).

Aug. 28—The Constant Coupling, by E. H. Loftin and S. Y. White (Part 2). The Browning-Drake, by Herman Bernard (Part 3)

Sept. 4—The Four Rectifier Types, by K. B. Humphrey. A Simple Battery Charger, by J. E. Anderson.

Sept. 11—The Beacon (3-tubes), by James H. Carroll. The 1927 Model Victoreen, by Herman Bernard.

Sept. 18—The 1927 Victoreen, by Arthur H. Lynch. Eliminator in a Cash Box, by Paul R. Fernald.

Sept. 25—The Lynch Lamp Socket Amplifier, by Arthur H. Lynch. Wiring up the Victoreen, by Herman Bernard.

Oct. 2—The Victoreen (Continued), by Herman Bernard. New Equamatic System, by Capt. P. V. O'Rourke.

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

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

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

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

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

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

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

Nov. 27—The Antennaless Receiver, by Dr. Louis B. Blan (Part 1). Short Waves Yield Secrets, by M. L. Prescott.

Dec. 4—The Regenerative 5-Tube Set, by Capt. P. V. O'Rourke. The 8-tube Lincoln Super, by Sidney Stack. The Antennaless Receiver, by Dr. Louis B. Blan (Part 2). Winner's DC Eliminator, by Lewis Winner.

Dec. 11—The Universal Victoreen, by Ralph G. Burd. Some Common Fallacies, by J. E. Anderson.

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A New Coupling Device

Affords Variable Selectivity and Volume

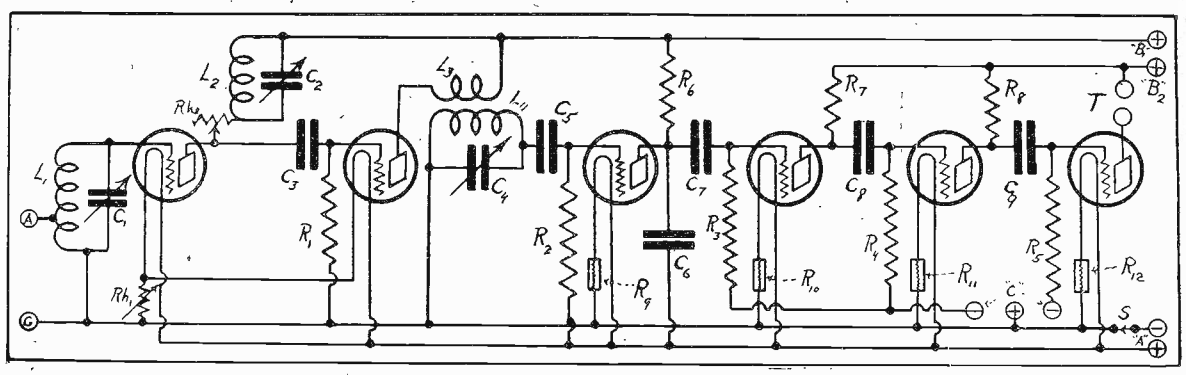


FIG. 1

The novel feature of J. E. Anderson's circuit is the flexibility of the coupling between the first RF tube and the second. It may be impedance, resistance on a combination of both, at will. This affords selectivity variation, due to regeneration control.

By J. E. Anderson
Consulting Engineer

THE object of building the receiver which is about to be described was to get a set worthy of a cone speaker. Quality of reproduction was the paramount object; selectivity and sensitivity were secondary. It was built for the writer's personal use for listening in on the better class of broadcast stations in the New York area. The receiver performs satisfactorily.

A desirable feature of a receiver in which quality of tonal reproduction is paramount is that it should have no selectivity at all. But that characteristic ceased to be a practical possibility the day that Marconi built his second transmitter. Even since then it has been necessary to tune receivers. Selectivity has had a rising market. At the present time when there is a band of wave pirates at large it is imperative to increase selectivity to a point where quality of reproduction of the broadcast music suffers appreciably. But this must be tolerated if the jabberings of the pirates are to be excluded from the rotund precincts of the cone. It is necessary to compromise between quality and exclusiveness until such a time that these ethereal interlopers shall have been banished from space.

Choice of Selectivity

Since the necessity for rather sharp tuning exists, there is nothing to do but make the best of the situation. It is possible to make the circuit moderately selective and so arrange it that the selectivity may be increased as occasion demands. For instance, when receiving a powerful station located nearby it is not necessary to have as great selectivity as when receiving a weak station located at some distance. Also, there are times when certain interfering stations are not on the air, when the desired station may be received satisfactorily with a moderately selective circuit. The solution to the problem, then, is to have a receiver with variable selectivity with which the point of compromise between quality and exclusiveness may be moved as required. That has been done in this receiver.

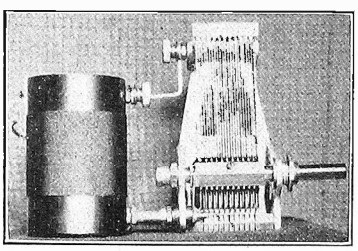
There are three tuned circuits in the receiver, each one having such a selectivity that the combined selectivity is not excessive for good quality. That is, the suppression of the higher audible sounds is not great enough to be perceptible to the keenest ear.

Versatile Coupling

There is still another feature in the circuit which makes it possible to use only two of the tuned circuits in the case there is negligible interference, and when the desired station is strong. This feature is the peculiar type of coupling between the first and the second tube. The coupling device is a parellel tuned circuit in series with a variable high resistance. The coupler may be used either as a straight resistance coupling, as a straight tuned impedance coupler, or as a combined resistance and tuned impedance coupler.

In the parallel tuned circuit case the tuned circuit is detuned and the resistance is set at maximum, or at any value that gives the volume desired. In the resistance coupled case the resistance is set at zero, or minimum, and the tuned circuit is adjusted to resonance. In the circuit diagram the tuned crcuit in question is L_2C_2 and the coupling resistance is

When Rh_2 is set at maximum, the tuned circuit may be adjusted to resonance without starting oscillation in the receiver at any frequency within the tuning range. When Rh_2 is set at minimum the circuit will oscillate at all frequencies covered by the tuner provided all three circuits are accurately adjusted to resonance. To stop oscillations it is only necessary to increase the value of Rh_2.



(Anderson)

FIG. 2

How to mount a coil on the back of a variable condenser.

Choice of Sensitivity

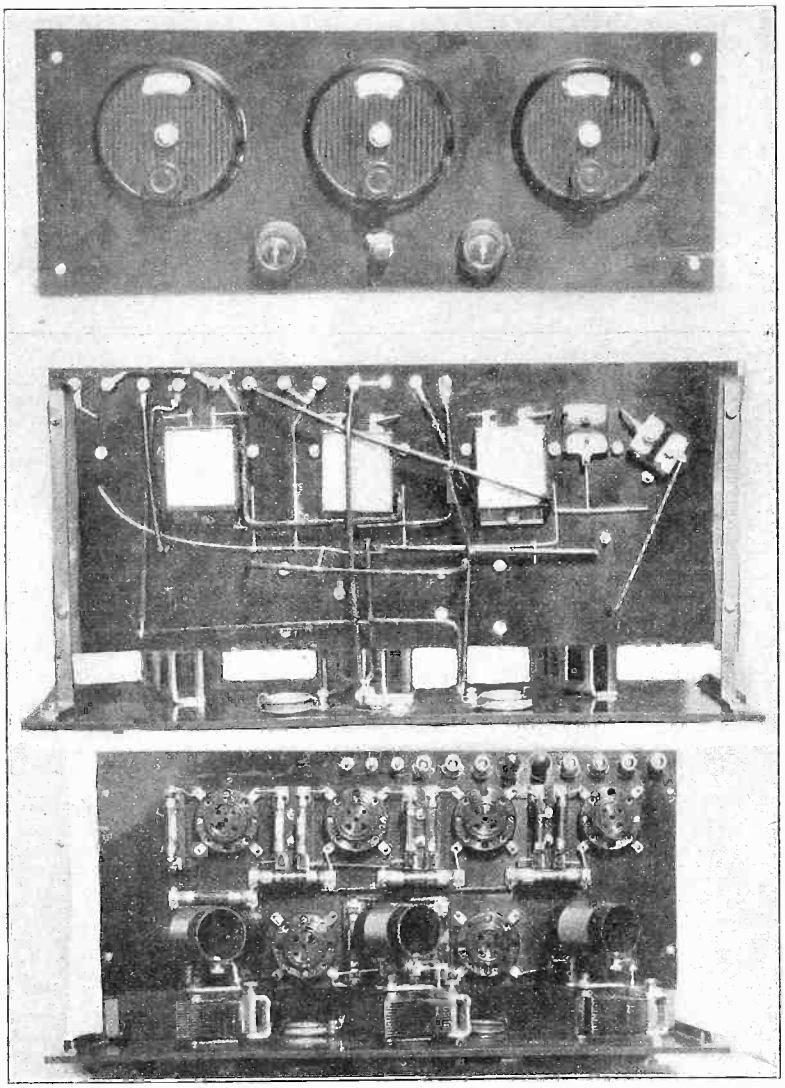
While the resistance is increased the tuned impedance should be kept at or very slightly below resonance. It is possible to operate the set as near the oscillating point as is desired, and therefore both the selectivity and the sensitivity may be varied at will as conditions demand.

The three tuning coils L_1, L_2 and L_4 are wound on bakelite tubing 1.5" in diameter and 2.5" long. The wire used is No. 28 double silk covered. This wire is used for compactness of receiver assembly as well as to limit the selectivity somewhat. A heavier size wire is not necessary to get satisfactory selectivity. The exact number of turns to be used in any given circuit cannot be stated definitely because it depends on the condensers used and on the placing of the coils. However, 80 turns should be wound on all three, and then if the three dials do not tune together turns may be removed from one or two of the coils (to give higher readings) until dial settings are as nearly the same for all as possible. The number of turns may vary between 80 and 76.

The antenna coil L_1 has only one winding, (80 turns), but a tap is brought out

Tone Quality Put First

In Anderson's Personal Receiver



(Anderson)

FIGS. 3, 4 AND 5

The panel view shows the balance of the respective parts. The bottom view of the sub-panel depicts placement of parts and wiring. The top view shows general disposition of other parts.

15 turns from the grounded side, and this tap is connected to the antenna binding post A. Coil L_2 (80 turns), has a single winding without any tap. The coupling coil between the second and the third tubes has two windings, L_3 and L_4. L_3 consists of 15 turns of No. 32 double silk covered wire, but it may well be wound with the same number of turns of No. 28, which is used in L_4.

Two Volume Controls

The tuning condensers used were Bruno straight line frequency, bakelite shaft, .0005 mfd. The tuning coils are mounted directly on the condensers in the manner shown in Fig. 2.

Besides the volume control afforded by the variable resistance Rh_2 and the impedance coupler, there is the rheostat Rh_1. This controls the filament current in the two radio frequency amplifier tubes. Its resistance is 10 ohms, and therefore the filament current in each of these tubes is variable from .3 to .15 ampere when the voltage applied is six ohms. This gives adequate control of volume. It may be pointed out that controlling volume by means of the filament current may be done to good advantage in the radio frequency stages. It saves the B battery by limiting the plate current and it does not affect the quality of reproduction of the set. But controlling the volume in a similar way in the audio frequency amplifier cannot be done without seriously distorting the signal.

The variable resistance Rh_2 has a value of 100,000 ohms. Its minimum value is very nearly equal to zero. Therefore when resistance coupling is used between the first and the second tube, the coupling may be varied from almost nothing up to the usual value employed in audio frequency resistance coupled circuits. This affords a wide range of volume control. This range is considerably widened by the tuned impedance.

LIST OF PARTS

C_1, C_2 C_4—Three .0005 mfd. straight line frequency condensers.
C_3—One mica .001 mfd. fixed condenser.
C_5—One mica .00025 mfd. fixed condenser.
C_6—One mica .0005 mfd. fixed condenser.
C_7, C_8—Two by-pass condensers, .25 mfd.
C_{10}—One by-pass condenser, 2 mfd. Two additional by-pass condensers, 1 mfd. or higher, optional.
Rh_1—One Carter 10 ohm rheostat.
Rh_2—One 100,000 ohm variable resistance.
R_1, R_2, R_3—Three 1 megohm grid leaks.
R_4—One ½ megohm leak.
R_5—One ¼ megohm leak, or a 100 henry choke coil.
R_6, R_7, R_8—Three 100,000 ohm coupling resistors.
Eight pairs of mounting clips for these resistors.
R_9, R_{10}, R_{11}, R_{12}—Amperites to suit tubes used.
S—One Carter filament switch.
L_1, L_2, L_3, L_4—Tuning coils as described.
Six push type sockets.
12 binding posts.
Two 7x18" hard rubber panels.
Three vernier dials.
Two lengths of brass angle ⅜" by ⅜" by 6".
Two lengths of brass strip ⅛" by ⅜" by 12".
A cabinet at least 9" deep.

Values of Constants

The filament currents in the detector and audio frequency tubes are controlled by Amperites. There is no need for varying any of these currents and consequently it is best to use fixed or self-adjusting resistors to limit the currents to normal values.

The grid leak resistors R_1, R_2 and R_3 are 1 megohm units. R_4 is a ½ megohm leak, while R_5 is ¼ megohm. Larger values may sometimes be used for R_5, but when the signal is very loud, blocking of the last grid is likely if the resistor has a value which is too high. In some cases it is necessary to substitute a large value choke coil for R_5, particularly when very loud volume is desired. A choke coil is much more effective in preventing blocking of the grid but it has the disadvantage of cutting down the low notes in the signal.

Each of the coupling resistors R_6, R_7 and R_8 has a value of 100,000 ohms.

The stopping condenser in the grid circuit of the second tube, namely, C_3 has a value of .001 mfd. The next stopping condenser, C_5 is a .00025 mfd. unit, because this serves as the detecting condenser. C_7 and C_8 each has a value of .25 microfarad, while C9 has a value of 2 mfd.

Need of Large Condenser

The larger value is necessary in the last stage to prevent too great a reduction in the volume of the low notes when low values of grid leak resistance are used in that stage. For any given amount of distortion, or transmission, the product of the capacity of the stopping condenser and the resistance of the grid leak should be constant.

The by-pass condenser C_6 in the plate circuit of the detector has a capacity of .0005 microfarad. Two more by-pass condensers may be used to advantage in this

(*Concluded on page* 30)

Voltages of Eliminators

Measured By Inexpensive Means

By Brunsten Brunn

Consulting Engineer

THE output voltage of a B battery eliminator cannot be accurately measured with an ordinary voltmeter such as is commonly used in radio receivers. The reason is that inexpensive voltmeters require a considerable current for their operation. For example, one very common voltmeter has a resistance of 50 ohms per volt. If the range of this meter is 150 volts the total resistance is 7,500 ohms, and the current required for full deflection is 20 milliamperes. This is about the same as the plate current in a 171 power tube.

As long as the voltage source does not contain appreciable resistance this meter may be used to get the correct voltage, but a B battery eliminator contains a high resistance, which is distributed between the rectifier and the filter coils, and the ordinary voltmeter when connected across the output of the filter will not give the correct voltage at all. What is needed to get the correct voltage is a voltmeter which has a very high resistance per ohm, say a thousand ohms per volt. But such meters are expensive.

It is important to know the correct output voltage of a B battery eliminator if the receiver is to be adjusted for optimum results. There is a simple solution to the difficulty.

The Choice of Meters

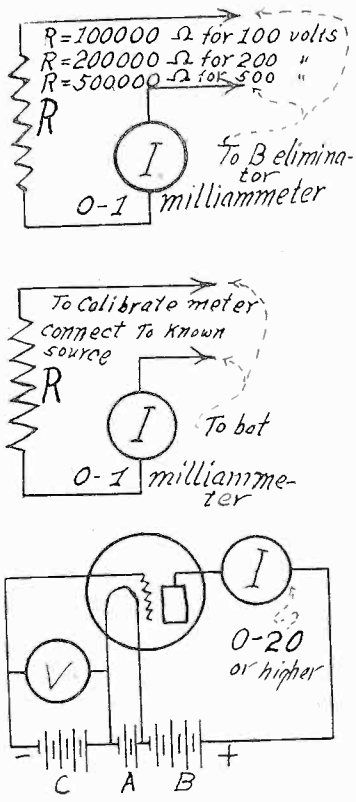
An ordinary voltmeter is simply a milliammeter with a resistance in series with and the combination calibrated in volts instead of milliamperes. The first thing that is needed to make a voltmeter that is capable of measuring the output voltage of B battery eliminator is a sensitive milliammeter, one which has a maximum deflection of 10 milliamperes, or still better one which has a maximum deflection for 1 milliampere. The latter costs a little more, but a great deal more may be done with it. The addition of a milliammeter to the stock in trade of the radio experimeter or broadcast fan is well worth while and should not be regarded as adding to the cost of the high resistance voltmeter.

In favor of purchasing a 0-1 milliammeter it should be stated that its range may be extended to 0-10 or 0-100 by merely putting a resistance of appropriate value across it, such as a small filament rheostat, while the sensitivity of the 0-10 meter cannot be increased to 0-1.

Supposing then, that we have a 0-1 milliammeter to start with. If we connect a 100,000 ohm grid leak in series with this instrument 100 volts will give full scale deflection, and we have a 1,000 ohm per volt voltmeter. (Fig. 1.) If such a meter be used to measure the output voltage of a B battery eliminator, a very close approximation to the correct value would be obtained. In fact, if the resistance of the eliminator is as high as 1,000 ohms, the error in the indicated voltage would be only 1%, the reading being low.

Increase of Resistance

If higher voltages are to be measured with this meter it is only necessary to use a high value of series resistance. If 200 volts is the highest voltage to be measured, the resistance should be 200,000 ohms, or if 500 volts is to be measured the series resistance should be 500,000 ohms. In each



FIGS. 1, 2 AND 3

case the meter would have 1,000 ohms per volt and the accuracy of the meter would be the same for all ranges.

The choice of series resistance is important. If a grid leak rated at a certain value be taken at random, the probability that it has exactly rated value is rather small. If the resistance is not correct the meter will not be accurate. A number of grid leaks should be tried out on a known voltage, and one which has the correct value should be selected for use. If a fixed resistance cannot be found which has the correct value, a variable resistance of adequate maximum value may be used, and the resistance varied until the meter reads correctly. Again, if neither a variable resistance nor a fixed grid leak of the correct value is available, then any high resistance of approximately correct value may be employed provided the meter be calibrated against a known voltage.

Using Known Sources

The known voltage source used in calibrating the meter should have negligible internal resistance. Perhaps the best available source is a high voltage storage battery of the lead plate type. Another good source is an ordinary battery of dry cells provided this battery is absolutely fresh. (Fig. 2.) A DC power line may also be used. In all of these cases the voltage of the source should be measured with the best available voltmeter, then the source should be put across the high resistance and the milliammeter and the current in the meter noted. Then again the source should be checked up to make certain that it did not change during the operation.

When one reading of the milliammeter used as a voltmeter has been obtained for a known voltage, any other voltage within the range of the meter may be obtained by simple proportion. To obtain other ranges of the high resistance voltmeter it is only necessary to calibrate the milliammeter against other resistances, using the same known source of voltage, or some higher source of known voltage.

The above method of measuring the output of a B eliminator is perhaps the simplest, but there are other methods which will give correct readings of the voltage.

The Vacuum Tube Voltmeter

One is the vacuum tube voltmeter. When using this meter the plate current in the tube is measured with a milliammeter, and the voltage which gives this current is read from the plate voltage, plate current curve of the tube. Before this method is available, therefore, the tube used in the meter must be calibrated (Fig. 3). To do this the plate current given by the tube for various known voltages on the plate must be obtained, using a definite filament current and grid bias on the tube. Then the curve is plotted on cross section paper. This curve may then be used to measure any unknown voltage.

When using this meter to measure an unknown voltage care must be taken to see that exactly the same filament current and the same grid bias be used on the tubes as were used during the calibration. The output terminals of the B eliminator are connected in the plate circuit of the tube in the usual way, the plate current is noted, and the corresponding voltage is read off the curve. This is an accurate method and it gives the output voltage under actual conditions, that is, it gives the voltage actually applied to the plate of the tube.

The tube in this case may be one of the tubes in the receiver. In fact all of the tubes may be used in turn to get the actual plate voltage applied to them from the eliminator. The voltage thus obtained is the effective plate voltage and is the voltage to be considered when the grid bias is to be adjusted. Of course each tube must be calibrated when all the other tubes in the receiver are working, otherwise the voltage obtained will not be the correct applied voltage.

Measurement Important

In most cases when a vacuum tube voltmeter is used the plate current will be greater than the 0-1 milliammeter will carry. Therefore it will be necessary to use a meter of higher range or else put a shunt across it as was suggested above.

The importance of measuring the voltage under actual working conditions cannot be over-emphasized. The important thing is the voltage applied to each tube in the circuit when all of the tubes in that circuit are working, and when they are working normally with proper filament and grid potentials. It is possible to measure the output voltage of an eliminator with a vacuum tube voltmeter and actually get the emf of the eliminator. This voltage would not mean a thing unless every resistance in the circuit is accurately known. The output voltage varies

(*Concluded on page 6*)

Functions of Eliminators

And the Adaptation to Receivers

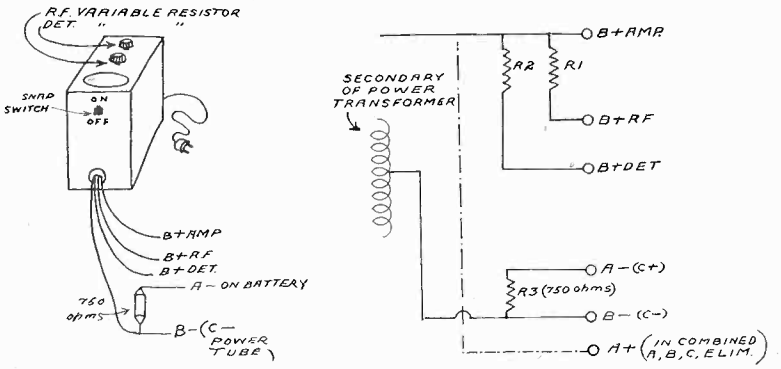


FIG. 1

The output of an eliminator, represented at left by the completed eliminator and at right by a schematic diagram. The resistor, pictorially at left, is likely to be about 750 ohms for most AC eliminators. The B minus lead becomes C minus, too, while A minus is at the other end of the resistor (R3).

By Herman Bernard

Associate Institute of Radio Engineers

BATTERY elimination is the subject uppermost in the minds of the radio buying public today. It is the outstanding question because it applies to all receivers, whether home constructed or factory built, whether already installed or merely contemplated, and because the public wants electrification. It is seeking knowledge, so as to acquire as much familiarity with battery elimination as it now has with receivers themselves.

While it is generally true that a receiver is made for utility in any and all locations, it is not true that all battery eliminators are applicable to all receivers. In some instances some wiring changes must be made in the set, in others particular care must be given to filtering, because the receiver is extremely sensitive and a residual hum may prevail, while in some locations total battery elimination is an impracticality with certain types of sets.

Considering total powerizing or battery elimination, the first question to be considered is the type of current available from the lamp socket or lighting main. It is either alternating current (AC) or direct current (DC). With alternating current almost anything is possible. With direct current the useful voltage can never be anything except less than the original supply, unless a motor generator or equivalent is used, and that is not commercially practical at this time. The original voltage is usually 110, and in some few special instances 220 for DC. If you do not know what type of current you have, ask the lighting company. Also inquire as to the voltage. Only in special commercial instances will the voltage prove to be 220.

90 Volts from 110 DC.

Due to the obstruction to current flow offered by the resistors necessary in the DC eliminator, the actual maximum voltage delivered by the rectifier is around 90. So if you have a receiver equipped with a power tube that requires high plate voltage, heavy current drain and large C bias for efficient operation, you can not apply to it the resultant output of a DC eliminator and expect good results. Likewise, if you have a resistance coupled audio amplifier you can not count on full volume with a maximum plate voltage of only 90. Also with such low voltage a last stage power tube offers no advantage. Current you have aplenty, so that even 5-volt, .25 ampere filament tubes may be heated from the eliminator. A 5-tube receiver, consisting of four type A tubes, at .25 ampere each, and a type 12 power tube, at .5 ampere, draws 1.5 ampere, but the eliminator can be so constructed as to take care of this current drain very nicely, and the plate current drain of say 20 milliamperes to boot, a total of 1.52 amperes.

It is apparent, therefore, that you can not step up DC, but you can insert resistors to reduce the voltage and to carry the required current. These resistors, of whatever form, used solely for voltage reduction purposes, are bound to heat up, even if they are lamps. Hence the console or table in which the eliminator is housed should have holes drilled in the rear for ventilation. About 1 inch in diameter is suggested.

The Choke Coils

If the eliminator uses choke coils, especially if high. A current is passed, one building such a device should make doubly sure that the choke coils will pass the heavy current. Perceptible heat should not be tolerated in them.

While DC eliminators must operate without power transformers, because the current does not reverse its polarity and a transformer would not function, all AC eliminators require a power transformer. This consists of at least a two-winding coil. One inductance is the primary and the other is the secondary. The voltage developed in the secondary may be almost anything, and depends directly on the ratio between the number of turns on the secondary and the number on the primary, granting the same diameters and same kind of wire. A third winding is becoming more and more popular, so that the final audio tube, or the rectifying tube, or both, may be heated by AC from this tertiary coil.

The Rectifier

No rectifier is needed or possible for DC, for that kind of current flows in one direction only, and is not a wave, whereas AC changes its direction of flow, AC is usually 110 volt 60 cycle, which means that the voltage remains the same, but that the direction of current flow changes once every one-sixtieth of a second. This is an audible frequency, as only too many know to their disappointment, because it is familiar as the hum that makes its presence loudly known in some unfortunate attempts to cope with the eliminator problem. But there need be no real hum.

With AC not only is a power trans-

Meters That Measure Rectifiers

(*Concluded from page* 5)

greatly with the current that the eliminator delivers, but the emf remains constant. The output voltage is the difference between the emf of the eliminator and the voltage drop in the internal resistance. The drop is quite great when the current drain is heavy, and the net output voltage is correspondingly small.

The working output of an eliminator delivering a considerable current may be measured quite accurately with an ordinary voltmeter provided the total current is adjusted to have the same value that it has when the circuit is operating; and this includes the current that is required to operate the voltmeter.

Suppose that the circuit takes a total of 35 milliamperes when all the tubes are working normally, and further suppose that the meter requires about 20 milliamperes to cause the necessary deflection of the needle. A high resistance rheostat should then be connected across the meter or across the output of the eliminator so that the total is 35 milliamperes, that is the rheostat should be of such resistance that 15 milliamperes flow through it at the voltage in question. This method of measuring the voltage is not of wide application and is not recommended if accurate values are desired.

A method of extending accurately the range of a sensitive milliammeter to be used in the plate circuits of tubes drawing a heavy current will be of use when measuring the output of a tube. An ordinary rheostat such as is used in the filament circuits of tubes may be used. The range of this rheostat depends on the meter and the range to be employed. A twenty-five ohm unit should prove about right for the 0-1 milliammeter.

Suppose it is desired to double the range of the meter, that is, to make it a 0-2 milliampere instrument. First adjust the current in the meter to maximum deflection when no shunt resistance is used. This may be done with an external series resistance or with a potentiometer for adjusting the applied voltage.

When the deflection is exactly 1 milliampere connect the variable shunt resistance and adjust this until the reading on the meter is exactly .5 milliampere. Full deflection now indicates a current of 2 milliamperes. In the same way the range of the meter may be made 0-4, 0-5, 0-10, or any other desired range.

Care must be taken to see that the shunt across the meter is connected at all times, or the meter is in danger of damage. If the shunt resistance should break or become disconnected while one of the higher ranges is used, all of the current would go through the meter, and in all probability the meter would burn out, or the needle would become bent.

C Bias Through Resistor

Obtainable from Any B Eliminator

former needed, to step up the voltage from the original 110 to say 200 or even much more, as well as down to 5 or 7 volts, but some system of converting the alternating current to direct current is necessary, most particularly because only direct current is useful on the plates of the tubes, the familiar B plus leads. Also the detector tube can not readily be heated by AC, because that tube is so sensitive to picking up the hum, in other words is microphonic. Its elements make it a miniature microphone on account of the characteristic on which the detector tube is necessarily operated, whereby small grid variations become extraordinarily large variations in plate current.

The rectifier most commonly used is a tube, one containing special gas, and operating on the principle that the gas will pass only direct current, where the voltage differences set up in twin elements force the current across the gas. Examples of gas conduction tubes are the Raytheon, which has no filament, and the 213, which has a filament. Besides tubes, electrolytes are used for rectification. An electrolyte requires attention, and this may account for the greater popularity of tube rectifiers, since battery elimination is something made attractive by its convenience, and anything savoring of inconvenience is not within the spirit of the general objective.

The Current Capacity

The tube has limitations, and these affect principally the amperage. It is not possible to draw any more current from the entire unit than the tube itself will pass. One may overload the tube, as is sometimes done in A, B, and C eliminator design for use in conjunction with the 71 type power tube in the final audio socket. The newest Raytheon tube, type BH, for instance, easily passes 85 milliamperes, the rated maximum, at full voltage, and if series connected 99 type tubes are used ahead of the final audio tube, a 71 type, then the filaments of the 99s draw 60 milliamperes (.06 ampere), the plates of say four tubes 16 milliamperes, and the plate of the 71 tube 16 milliamperes, a total of 92. The filament of the power tube need not be considered, as it is heated by AC from the tertiary winding. By suitable biasing of RF tubes this drain may be cut to 88 or so milliamperes, an allowable overload of 3 or so milliamperes.

Hence one may say, broadly speaking, that there is amperage aplenty in the DC eliminator, with a scarcity of voltage, while in the AC eliminator there is voltage aplenty, and a limitation rather on the amperage or current, although there is plenty of current available. Assuming the power transformer to be wound with strong enough wire, the amperage limitation is introduced principally by the rectifying tube, and augmented by the choke coils, which consist of a large number of turns, hence have an appreciable DC resistance. It is advisable to have this resistance as low as possible.

The choke coils, in point of position, electrically follow the tube, and their purpose is really to serve as wave traps, to filter out the hum. In this object they are aided by large filter condensers. For an A, B and C eliminator the conventional condenser triplets would be 2, 2 and 4 mfd., while for a B eliminator or a B and C eliminator they would be 4, 4, and 6, although these values are not adamant. The filter condensers must be able to withstand not only the maximum voltage of the secondary, but much higher voltages, so that a 600 volt duration test is necessary.

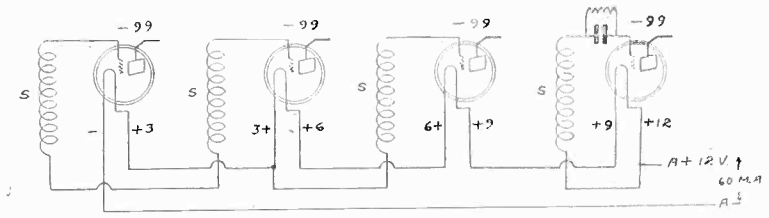


FIG. 2

Series connected —99 tubes, with two grids negatively biased about 3 volts by taking advantage in each case of the voltage drop in the filament. S is the secondary of each RF transformer. The audio tubes may be similarly biased.

The Line Surges

Occasional surges take place in the line and are communicated to the eliminator, and the condensers should be able to withstand these surges, and should be guaranteed by the manufacturer to do so, as determined not simply by flash tests, but by duration tests.

The other condensers used in an AC eliminator are connected between the midtap of the secondary and the ends of the winding. There are two such buffer condenser, and they should stand 1,000 volt shocks. The value is .1 mfd. Naturally here the surges are felt the worst.

Now, the eliminator has been traced to the output, where we have two binding posts, let us say, with a voltage drop of 180 between them. One extreme is the B minus lead, representing zero voltage, and the other is the B plus amplifier, wire representing 180. From this we can easily get intermediate voltages by introducing high resistors, fixed or variable. The smaller the resistance the less the voltage drop, hence the higher the voltage. It is customary to have a resistor to give an intermediate voltage for radio frequency tube plates and also another resistor to bring the voltage still lower, i. e., to detector plate values. R1 and R2 represent these resistors in Fig. 1.

If there is no provision for C battery elimination, and you want to use a 71 power tube, for instance, that requires 40½ volts negative on the grid for a plate voltage of 180, this may be done by introducing a fixed resistor.

Introducing C Bias

At left in Fig. 1 is a pictorial representation of a B battery eliminator. To make it also a C battery eliminator, to avoid the necessity of putting in a large B battery (used as C) and perhaps an extra inversely poled small C battery to get the desired bias, connect the fixed resistor between the B minus lead of the eliminator and A minus (or A plus) on the A battery. All the B current must flow through this resistor, since the current is flowing through the A battery and the B eliminator. Where current flows voltage drops. Hence the 40½ volts or thereabouts may be taken from the eliminator. This, to be sure, leaves you just that much less voltage for the plates, but the problem is simply solved by having a total output of around 200 volts or more, leaving about 160, the necessary bias in that case being about 35. How this resistor is connected is shown pictorially and diagrammatically in Figure 1. You will note that the B minus lead from the eliminator—so marked on the wire or identified by coloration and reference to a code on the container—is used as C minus, while the free end of the resistor goes to A minus or A plus. All the current of the eliminator flows through this resistor, R3, hence B minus is made negative in respect to the A battery, the value of this voltage for biasing depending on the drop in the resistor. What the value of this resistor should be may be determined by calculation. But you do not know the actual total voltage output of the eliminator, because you have not the expensive high-resistance voltmeter necessary to determine this. Ordinary voltmeters will not do, because they have so low a resistance, compared with the resistance of the eliminator, that too much current flows through the meter to enable anything like an accurate reading. The meter has a modified short-circuiting effect upon the eliminator and likely will draw more current itself than the total safe current capacity of the rectifying tube.

As an alternative you may measure the total current flow in the plate circuit of the last tube, using a milliammeter of say 50 full-scale deflection, connected in series with one of the speaker leads. If a minus zero reading is obtained, reverse the connections to the meter. Insert the resistor as shown and watch the needle of the meter. If the needle kicks up, that is, toward higher readings, increase the value of the resistor R3. If it kicks down, decrease the value of the resistor. For such an operation an assortment of fixed resistors would be necessary. Hence a variable one may be used and the arm moved until the needle stands still, even on strong notes. That is the goal in either instance. You still do not know what the plate voltage is, nor the bias, but you do know what the current is. You do know that you are "all set," and that counts more than the missing considerations.

Under this system no other C bias is readily accessible, unless two series connected resistors are used, and the joint employed for the lesser bias. However, the other C biases could be taken within the receiver itself, due either to connection of the grid return to A minus, thus negatively biasing the grid to the extent of the voltage drop in the rheostat or ballast in the negative filament circuit, or by a more elaborate system of grid return connections where series filament hookup is used. (Fig. 2).

Tubes are connected with filaments in series for no other reason than the desire

Motor-Boating Remedies

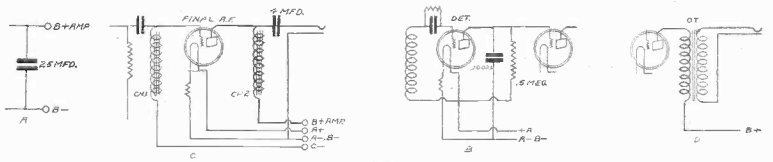


FIG. 3

(A), a large bypass condenser across the eliminator output helps cure motorboating. (B), the detector plate may be brought to A plus, if B minus and A minus are interconnected, to stop detector tube self-oscillation. (C), an audio choke coil in the final AF grid circuit subdues extraneous noises; a similar choke is used for the filtered output. (D), how an output transformer is hooked up.

to limit the current drain of all tubes so connected to the total drain of any one of the tubes. It is imperative that each tube have the same filament current requirements.

Use of 99 Type Tubes.

The 99 type tubes are commonly employed in this fashion, because 60 milliamperes, their filament drain, is within the scope of adapting a B eliminator circuit for A battery elimination. With say a total of 85 milliamperes to play with, and 60 extracted by the filaments of the series connected tubes, you have 25 left for feeding all the plates, including the plate of the last tube, so if you desire to avoid overloading the rectifier tube of the eliminator, you may use a power tube with more modest plate current drain at the available maximum voltage, e. g., a 112 tube.

It can be seen, therefore, that the B battery can be eliminated and the A battery as well, in an AC eliminator no less than in a DC eliminator. The sacrifice is the necessity of using tubes that on the whole will accomplish just a little less than the 5-volt variety.

For total battery elimination it is well to use an A battery eliminator (AC) as a separate unit, to supply 6 volts, as would a storage battery, and with a safety margin of say 2 amperes or more. While such eliminators have not been very abundantly described in the radio press, and are fraught with problems well left to the laboratory at this time, there are a few very excellent factory made A eliminators on the market, and more in the offering. They are just as humless as the good B eliminators which happen to be more plentiful just now than their higher currented but lower voltaged brethren.

In all instances it is advisable to keep the speaker several feet from the installation, and this is particularly true if a separate A eliminator is used. The speaker cords and magnet windings will pick up a hum otherwise not present, and the hum may be made to disappear gradually if you will slowly walk away from the set with the speaker in your hand. Also it suggests the inadvisability of attempting to use self-contained speakers in conjunction with batteryless sets. Standing the speaker on the cabinet of the electrified set is particularly bad practice.

The Trickle Charger

So far we have taken up only the actual batteryless condition—complete elimination, without qualification. If it was a B eliminator it completely eliminated the B battery. If it was a B and C eliminator, or an A, B and C, it completely eliminated each such battery. In the category of other than eliminators, yet something that achieves a desired goal, is the trickle charger and A battery combination. This consists of any suitable storage battery, and it need not be of more than 25 ampere hours or so, used in conjunction with a slow charger. When the set is on, the battery is off charge. When the set is off the battery is being charged all the while. The charging rate is so slow, say .1 ampere, that the process is inexpensive. It is a good method of serving convenience, since it dispenses with the necessity of battery removal, or replenishment at regular intervals.

Normally it would be necessary to turn off the set and turn on the trickle charger, or turn on the set and turn off the charger, but this detail is safely left to the good offices of the relay, which takes care of this automatically and permits the battery switch of the receiver to be the sole custodian of these duties. However, the B eliminator must be turned off separately.

An example of where the switch on the set controls everything is in the case of the separate 6-volt A battery eliminator, which is connected to the receiver at one end and to the lamp socket at the other. A relay in the A eliminator takes care of switching the A eliminator on and off by means of the A switch on the receiver. A plug is provided on the receiver side of the A eliminator relay so that the B eliminator lamp cord is simply plugged in at the A eliminator plug, and not directly at the lamp socket, the one relay thus serving a double purpose. In any other case it is important separately to turn off the current from the main that is feeding the B eliminator.

Troubles Cured

Eliminators are not wholly free from trouble, nor are any other things in this life. However, the present season has seen the development of the eliminator, particularly the B eliminator, to a very fine point. The outstanding trouble is put-putting, like the chugging of the kicker on a motorboat, hence the name "motorboating" as applied to this vice ascribed to eliminators. Its cause is considered to be the common impedance of the circuits, it being well known that this need not reach any very high level before oscillation sets in and distortion appears. Suitable ameliorating agencies are large bypass condensers, particularly a rather preposterously large one across the output, let us say 25 mfd. or thereabouts. (Fig. 3A). Dismissing that inaccessible remedy, let us examine the type of receiver and audio amplifier employed. If the set is of the sort that self-oscillates at radio frequencies, much trouble may be expected, so the best thing to do is to neutralize the set.

If the detector tube is of the special detector type it may be drawing 6 milliamperes and likewise may be oscillating in a fashion not easy to stop without changing the wiring or connections, hence consider the possibility of using only the A battery voltage on the plate of the detector tube. B minus must be joined to A minus, and not to A plus, in such a case, or signals will be noticeably absent. B plus detector connects to A plus. (Fig. 3B) While this suggestion is made as a remedial one, and often results in greatly improved reception, it cures one vice at the expense of cutting down the plate current in the detector tube to a point where it may not be quite sufficient to avoid a little distortion, due to the inability of the plate variations to duplicate, on the greater scale, the grid variations. It is well to note that the A positive connection to detector plate removes the detector circuit entirely from the impedance of the B eliminator, hence there is no common impedance as to this.

Even Works on Resistors

The connection, strange as it may sound to relate it, is satisfactory even with resistance coupled audio frequency amplification immediately following the detector, although the usual .1 meg. plate resistor had better be supplanted with one of the .5 meg. variety, as this considerably increases volume. The voltage drop across the resistor determines the degree of input to the next stage, and the larger value of resistance makes for greater volume, up to the point where the resistances cuts down the plate current to a descending volume.

The motor-boating nuisance, when encountered in conjunction with receivers utilizing resistance coupling, may be wholly cured in many instances by supplanting the final audio stage grid leak with a choke coil of about 60 henrys, (Ch 1 in Fig. 3C), the same sort of choke coil as is used in the eliminator. These chokes are large and heavy and are not to be confused with radio frequency chokes, which are small and light. The audio choke in the final grid circuit offers a high impedance but much lower direct current resistance, and is most effective in the region of the low notes, where the motor-boating nuisance resides. Theoretically this choke, Ch1, might be supposed to injure quality a little, but in getting rid of a distorting and awfully annoying vice it actually improves quality. The secondary of an audio transformer may be pressed into service as a makeshift.

Filtered Output

It is common practice nowadays to use a filtered output from the receiver, either an audio choke coil and fixed condenser combination, Ch2-4 mfd. in Fig. 3C) or an output transformer (or), usually of 1-to-1 ratio. The choke coil should have an inductance of 60 henrys or more, even up to 100 henrys, if you can get one, while the larger the fixed condenser, the better. The most popular value of the condenser is 4 mfd.

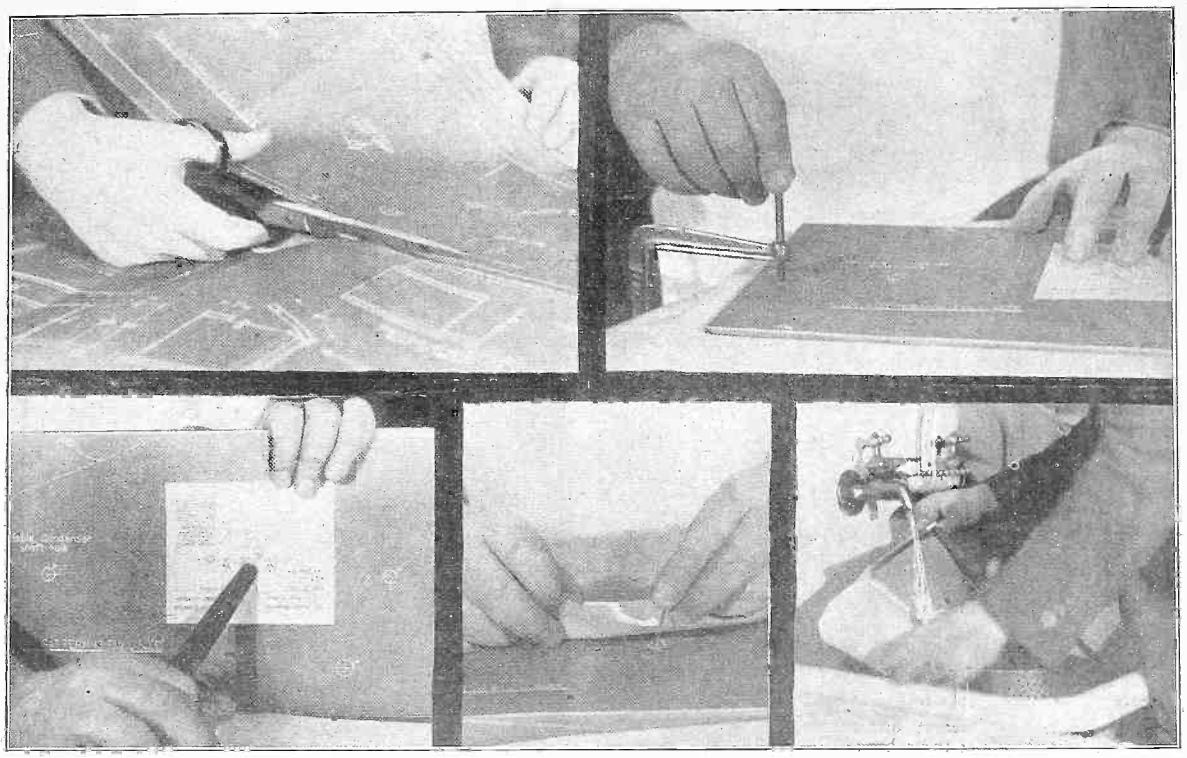
More Anecdotes, Less Music, Depew's Plea

Chauncey M. Depew, once dean of after dinner speakers, formerly railroad president, attorney and United States Senator, announced he is a radio fan.

He expressed great confidence in radio's future. He said that it was a great help to the tired person, who after a hard day's work could come home and rest himself comfortably, listening to the best music and talks one can desire. He said, however, that too much music was being broadcast. He prefers more anecdotes. If it was not for this, his opinions would be much higher.

Mr. Depew is 92 years old.

How to Use Blueprints



(Hayden)

CONSTRUCTIONAL BLUEPRINTS are not difficult to follow or use, if the proper care is exercised. The panel print requires the utmost attention, since all holes must be accurately placed and drilled. A hole drilled a 1-16" out of the way disarranges the whole panel. The first thing that should be done is to cut off the panel print portion, (upper left.) Then paste the print on the panel, making sure that the surface is absolutely even. This can be done with the aid of a flat iron or some other heavy object. For holding the panel down, a small vise should be clamped on both sides of the panel to the table (upper left). If you haven't a punch or scriber, a pair of shears can be used to make the proper marks for the various holes, through the dots on the print (lower left). If you have condensers, having different hole drillings than those specified, paste the template of this condenser over the other condenser markings, making proper dots. After all the marks have been made and the holes drilled, wash the print off the panel with some hot water. Hard rubber or Bakelite will not be affected by the water.

FADING REDUCED BY DOUBLE LOOP

WASHINGTON.

Scientists are putting forth greater efforts than ever before to overcome fading.

Occasionally they are discouraged by slow progress. At other times it seems as if the solution is just around the corner. They believe it will be possible to counteract fading but don't know how long it will take to bring it within the means of the average set owner.

For four years the Radio Laboratory of the Bureau of Standards has been investigating the culprit. His habits, night and day, winter and summer have been plotted charted and studied. Out of it all have come a few theories which are generally accepted.

The most important is that there is a close relationship between fading and the Heaviside layer. It is not believed there is any connection between fading and the weather. Curiously, fading is worse relatively close to a station that at great distances.

Investigations reveal two dips in the volume of reception. Maximum fading occurs at about 100 kilometers from the station. Reception then gets better up to 300 kilometers where fading is again very bad. From there on it is not so pronounced.

Dr. C. B. Jolliffe, of the Bureau of Standards, is optimistic about the future.

"The status of our knowledge of fading," says he, "is considerably better than ever before. We are now able to predict with some accuracy what will happen on the various frequencies. I have no doubt that sometime we will be able to counteract it."

Fading is different on almost every wavelength, but the general rule is that the higher the frequency, the more rapid the fading.

Dr. A. Hoyt Taylor, Chief of the Naval Research Laboratory, at Bellevue, is an authority on high frequency fading.

"Lots of persons must wonder how we are able to use the high frequencies at all if fading is so bad on them," says he. "The fact is that fading is so rapid that it doesn't make much difference in code work. We have records of as many as 100 dips during the transmission of one dash. Telephony, of course, would be impossible with such rapid fading.

"Fading on the high frequencies depends on the distance from the sending station. It doesn't look to me that we'll be able to use the high frequencies for short distance telephonic purposes. On the other hand, it apears as if the high frequencies will be fine for telephoning half way around the world. The reason is simple. At great distances the fading smoothes itself out and is not noticeable.

"By using a combination of loop antennas I am able to reduce fading to some extent. I have found that by setting the loop at one angle, fading is different than from another angle. The secret is to use two loops set at different angles and have them both feed into a differential. Sometimes there is fading on one loop and reception is good on the other. By combining the two I manage to get more of the program."

Dr. Taylor's theory is that fading exists even as close as a mile from a broadcasting station, but that it is not noticeable to the ear at such close distances.

Acceptability of the theory that changes in the Heaviside layer are responsible for fading would seem to make the solution easy for scientists. All they would have to do would be to find some way to compel the layer to remain stationary.

"It's a natural law that we're facing," says Dr. Taylor. "I know that sometime we'll be able to counteract it. At first we thought we might be able to do it with improvements in transmission. But it begins to look as if we'll also have to work on it from the reception end."

Fans are much interested in this.

How to Be a Signal Sleuth

And Test Wave Intensity Variations

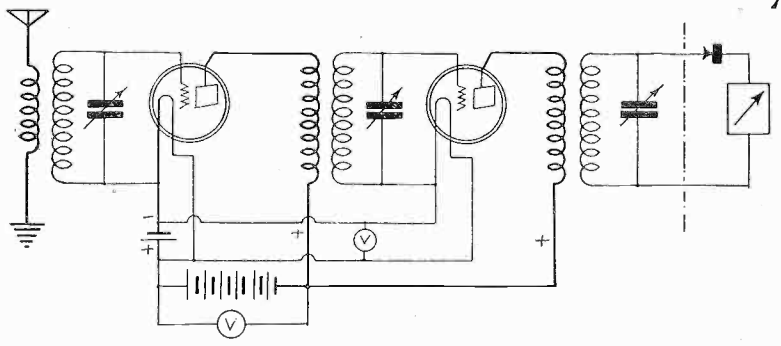


FIG. 1
The circuit diagram of the 2-stage radio frequency amplifier and specially hooked up detector for use in testing.

Received Impulses Measured By the Effect on the Output—Simple Apparatus Used—Most Existing Receivers Can Be Accommodated to the Interesting Testing System

By John F. Rider

Member, Institute of Radio Engineers

THE increased interest displayed by many of the large radio broadcasting institutions in the subject of received signal intensity opens up to the average radio fan an extremely interesting field of experimentation, with very little expenditure of money required for the necessary equipment.

The subject of received signal intensity is gradually becoming of great importance in the study of the enigmatical art of radio transmission and reception, and frequent requests are broadcast by stations who desire information relative to the constancy of their transmitted signal, as received at various points.

Records showing variations and fluctuations of the received signal intensity during different hours of the day, such as several minutes prior to sunset, during sunset and after sunset, bring to light data which are of great interest and aid to the persons interested in the betterment of the art. Observations of received signal intensity during the transition period from day to night in various cities; the effect of a sudden shower, high humidity, etc., are all interesting points of great significance. Perhaps as isolated examples they are not of immediate value, but records of nightly tests made over a period of a month or so will bring to light many peculiar facts and reactions very seldom considered. Bearing in mind all facts, this work constitutes a very worthwhile field of experimentation.

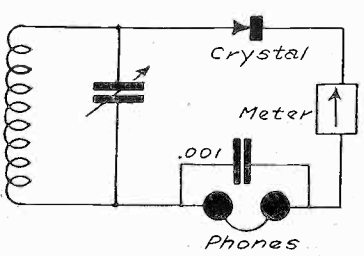


FIG. 2
The diagram of the testing unit.

Simple Equipment

At first glance it would seem as if the equipment necessary for this work is quite elaborate. In fact the major portion of the complete equipment can be found in the home of many experimenters, and what is not on hand can be very easily constructed. In the regular course of this work, as carried out by large institutions, photographic records are made, by causing the electric impulses to actuate apparatus which when utilized in conjunction with other equipment, results in a visible record upon a photographic plate. But for all purposes to which the interested fan can apply these data, photographic records can be dispensed with, and very excellent data obtained with much simpler equipment.

The carrying out of these tests is not difficult work, nor does it require much technical knowledge. To be exact, it is entirely within the powers of the average fan whose radio experience has been the construction and operation of radio receivers. A sample layout of the apparatus used in these tests is given in Fig. 1. Reading from left to right we have a two stage radio frequency amplifier, and the crystal microammeter combination. An examination of the circuit used in the tuned radio frequency amplifier will show that it does not differ from the conventional.

The RF Amplifier

It employs the regular methods as found in practically all radio frequency amplifiers. Insofar as this portion of the unit is concerned, any and all types of radio frequency amplifiers can be used, the more stages the better, since greater sensitivity and selectivity are thus made available.

There is, however, one paramount consideration relative to the choice of these amplifiers, and this is stability. The stability of the entire amplifier unit, inclusive of the tubes, A and B batteries, must be as nearly perfect as it is possible to make them. The reason for this is very obvious. We are to make records of the variation in the input signal as evidenced by fluctuations of the output. If the receiving system is unstable we have no definite proof that a fluctuation in the output, whether it be a decrease or increase, is caused by a variation of the input. But if we are assured of the stability of the amplifying system, it is safe to assume that the output fluctuation was caused by a variation of the input signal. Hence the reason for the filament and plate voltmeters.

Now, a further study of the radio frequency system shows that the connections to it, that is, the filament and plate voltages do not differ from the conventional.

Hence it is possible to utilize the radio frequency portion of a receiver on hand, if accessible. If the various radio frequency stages are shielded, by being enclosed in individual containers, thus rendering the leads and contacts inaccessible, a separate RF unit will be necessary. If access is possible, none of the internal wiring is tampered with or changed in the slightest. The leads from the crystal-microammeter combination are connected to the rotor and stator plates of the variable condenser, connected in the grid-filament circuit of the detector tube. This places the indicating device in shunt with the tuned circuit feeding the regular detector tube of the receiver, since the connection is made to the condenser side of the grid condenser. This is illustrated in Fig. 3.

The Indicating System

This drawing shows how connection is made to a conventional five tube tuned radio frequency receiver, consisting of two stages of tuned radio frequency amplification, detector and two stages of transformer coupled audio frequency amplification. When the receiver is to be used for the entertainment of the family or guests, the crystal microammeter circuit is disconnected, and the receiver operated in the normal manner. When the field intensity tests are to be made, the receiver is left connected as used for normal operation, the crystal indicating circuit is placed in shunt to the tuning condenser as shown, the detector and two stages of audio frequency amplifying tubes removed from their sockets, and the receiver operated in the normal manner. This means that the two stages of radio frequency amplification are being utilized to feed the energy into the crystal microammeter circuit.

Therefore by proceeding as outlined you can utilize the regular family receiver for this work without fear of damaging or dismembering the system.

Having disposed of the amplifying system, we now arrive at the indicating system. This consists as shown, of a crystal and a microammeter or a galvanometer. Much need not be said of the crystal, other than stating that stability and dependability are preferable to sensitivity. For this reason a fixed carborundum crystal detector, without the voltage varying device, is suggested. This detector has been found to maintain its adjustment for very long periods, with very little change in sensitivity, and excellent results can be obtained with it. As to the microammeter or the galvanometer, the choice is dependent upon the purse, since either type of instrument can be obtained at different prices.

The requisites for these instruments are

Intensity Changes Charted

By Meter Placed at Detector Output

Fading Recorded and Plotted on Curves—Insensitivity of the Human Ear Is Proved By Visually Determined Fluctuations That Make No Aural Impression

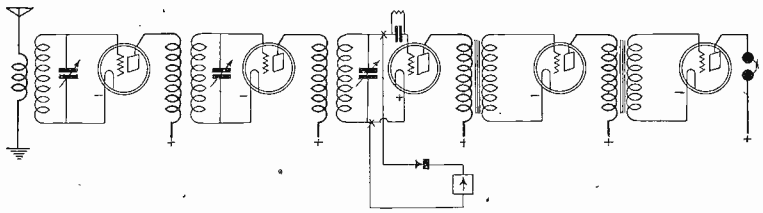


FIG. 3

The circuit diagram of the standard 5-tube tuned RF receiver, with a makeshift connection of the testing unit.

not many; but it is essential that it be a low reading unit and the divisions equivalent to small values of current. The microammeter should have a maximum reading of 500 microamperes with 100 divisions, each division being equal to 5 microamperes. If a lower reading instrument is available, such as a microammeter with a full scale deflection of 200 microameters and 100 divisions, each division being equal to 2 microammeters, it is much preferred. This is the type of instrument I used. As to the galvanometer, the string type is preferable to the student's galvanometer, because of its greater sensitivity, and smaller current values per division.

A Worthwhile Search

Unfortunately this unit is not obtainable as easily as the regular microammeter, although essentially the galvanometer is a microammeter. Search throughsome second hand store dealing in electrical equipment will usually result in the discovery of one of these units, with everything intact. I had occasion to search and found one in perfect condition and at a very reasonabe price.

The operation of the complete system is very simple. This is so although the topic pretends a technical discussion. The receiver system is operated in the conventional manner, and record is made of the deflections shown on the microammeter needle. And since these deflections are independent of the modulation frequency, the fluctuations of the microammeter needle indicates variations in field intensity at the point of reception.

A variation in field intensity at the point of reception, does not necessarily signify a variation in transmission, but if all other local stations are received with constant field intensity at any one point, and fluctuations are noted for one local station, it is quite safe to assume that the fluctuations are due to unsteady transmission. However, the item of prime import is not the quick conclusion of what the cause may be, but rather a record of the reception under different conditions. Do not arrive at conclusions. Wait until a full week or a month of records has been completed. The records may surprise you. You may even find that rainy nights result in greater field intensity at the receiver than clear nights.

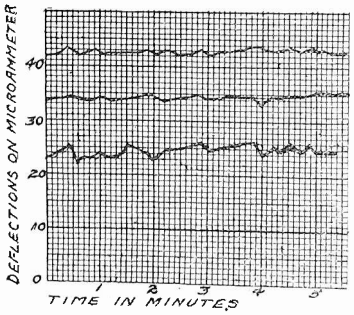


FIG. 4

Graph showing results of local station tests.

The Recording Work

The matter of records and tabulations is entirely up to the person conducting the work. If he desires precise data he will record the deflection each 15 seconds. If the record is to be short, say, of 5 to 10 minutes duration, observations each 10 seconds are not difficult by any means. It would seem that this manual observation and recording during such small intervals is tedious. But it is infinitely simple. Just try it. A few moments, and one is an experienced checker. If, however, the record is to be of greater duration, say 30 minutes, the deflection each 30 seconds would be sufficient.

Herewith are given some curves showing reception from several local stations in New York City, and reception from KDKA, made after observations of the local stations were completed. These records are 5 minutes long. It is evident that station number 3 did not afford constant reception, insofar as the recording devices were concerned. But unsteady reception as indicated by small fluctuations does not mean that there would be noted any changes in the signal intensity perceptible to the ear. The lack of sensitivity of the human ear and the consequent danger of making aural observations are very emphatically illustrated when making these tests, if one connects a pair of phones into the crystal microammeter circuit, and compares aural observations, with the readings obtained from the meter. The ear is a poor second, the results will show conclusively.

Sidelight on Super Power

It will be observed that unless the field intensity undergoes an appreciable change no variance in signal intensity will be noted. Bearing this demonstration in mind one can very easily realize why the use of super power does not necessary result in easily heard increase in received intensity.

The fluctuations of the signal from KDKA, however, were of radical nature, as is shown by the curve, and the changes in the signal intensity as recorded by the ear were very easily noted. But comparing the field intensity variations of locals with that of the distant station (e. g., KDKA), it is obvious that the locals are sufficiently steady for satisfactory reception. As a matter of observation, it was found that variations of fully 20 per cent were necessary before they were noticed by the ear. This figure, of course, does not apply to all observers, since the sensitivity of the human ear differs with individuals.

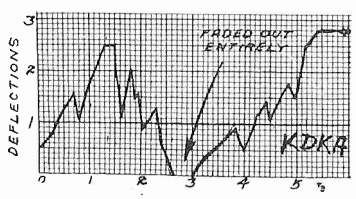


FIG. 5

Graph showing results of KDKA tests.

Referring again to the curve for station KDKA, the fading effect is very evident, being continuous. Yet to the ear, it would seem intermittent, since the small variations would go entirely unnoticed.

One does not appreciate the fun in this work unless he experiences the sensation of making records of various stations.

English Is Held Suitable Tongue For the Universe

By GIDEON WALRUS

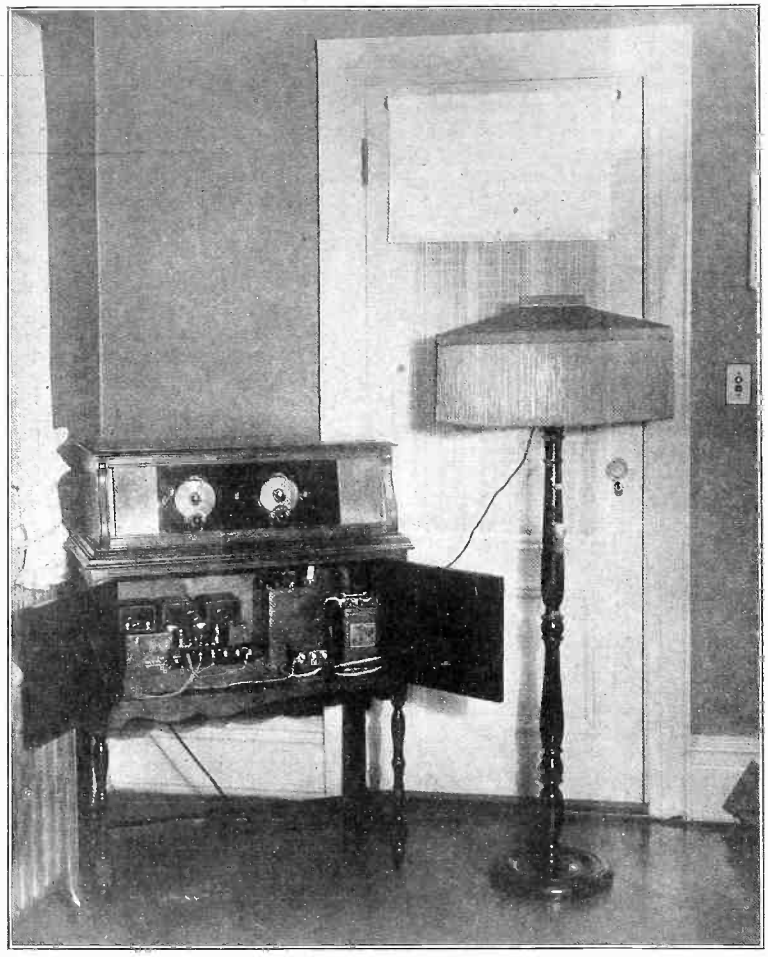
With the rapid improvement of both receivers and transmitters, which have increased the mileage range to such an extent that it is as simple to get in touch with all portions of the world by code as it is to call up your friend, via the telephone, the topic of what language should be universally employed comes into the limelight.

Esperanto has been and is still being tried. However this so-called universal language presents difficulties in that few people already speak it and it may be difficult to learn. English, however, which so many people can talk, and which many more are learning, is becoming the tongue, which broadcasters say, will be universal. During the last half century English speech has become so widely distributed, that it is with much difficulty that one can enter a community and be unable to find a person who cannot speak English.

Up to the present, however, the growth and spread of languages have been comparatively slow due to the difficulties presented by transportation and communication. Even the telephone has not helped very much. However, the radio, has cut through all the obstacles, and now signals can be sent through with ease, with little expense and over great distances. The English language has benefitted by these improvements, and it seems it will in a very short while extend to every portion of the universe.

A Radio Receiver De Luxe

A Real Quality Design By Noted Engineers



THE TWO-TUBE DE LUXE RECEIVER is shown in a table model cabinet. This is the set to be described next week. The amplifier is inside the table, at left, and this will be discussed the ensuing week. Adaptation of the outfit to lamp socket operation will be the subject of subsequent articles.

By Herman Bernard

Associate, Institute of Radio Engineers

THERE was a time not so very long ago when tone quality meant nothing. The more a set squawked, squealed, hissed and yapped the more highly it was prized, so long as it was "plenty loud." In fact it was termed "powerful" and thought to be capable of dragging in the elusive signals from a small broadcaster across the continent. Miles and volume, not tone quality, were then the criterion of radio reception.

But the intelligence of the broadcast listener has improved with the age and scientific developments of the industry. Mr. Radio Listener is now beginning to realize that it's how **good** not how **far** that really counts. In other words, the novelty stage has passed and the radio industry is now established as an important public utility. The broadcast stations of today are disseminating programs of irreproachable artistic and electrical perfection. There remains only the necessity for the education of the public so that full advantage of the present-day engineering knowledge concerning well-nigh perfect reception may be realized.

The essentials for such reception are but few and easily met. First, a set having such an RF amplifier must be used that distortion due to "cutting" of side bands is not introduced. Some multi-stage RF amplifiers tune so sharply that the side bands of the broadcast station carrier wave are cut off and so never reach the detector. Without side bands the high notes are lost and the set sounds deep toned and unnatural.

Then the detector tube must not be overloaded. A single stage of RF amplification seldom will overload a detector unless the reception is from a powerful local station. The prevention of detector overloading is one of the several good reasons for using an RF amplifier gain control as a general volume control for the set as a whole.

With good quality detector output, it is necessary only to use a real good audio amplifier to build up the volume to such a value as to give satisfactory loudspeaker operation. To complete the chain, of course, it is imperative that only the best of cone speakers be employed. There is little reason in supplying a high quality input to a poor speaker. Good quality cannot result.

In subsequent issues of RADIO WORLD Arthur H. Lynch one of the country's pioneer and best known radio engineers, will describe the construction and operation of a lamp socket operated set designed with reliability, service, ease of operation and construction, and last but most important, the best of tone quality in mind.

Mr. Lynch is an outstanding engineer in the radio field and has spent many months in developing the B-D, resistance-coupled amplifiers, resistance-coupled power amplifiers, etc. Seldom is it possible for two such engineers to get together so as to develop a product that is right both from a radio, electrical, mechanical, and assembly point of view. This new National-Lynch Amplifier marks a real step forward in the progress of the radio industry along the line.

The author has spent a great deal of time on the development of this lamp socket operated receiver and has collaborated with and received the valuable assistance of the best known engineers in their individual fields. For instance, the RF amplifier employs the B-D circuit developed by Fred Drake and G. H. Browning and tuning units developed by the engineers of the National Company in a special improved Lynch arrangement—separating of the RF and AF circuits.

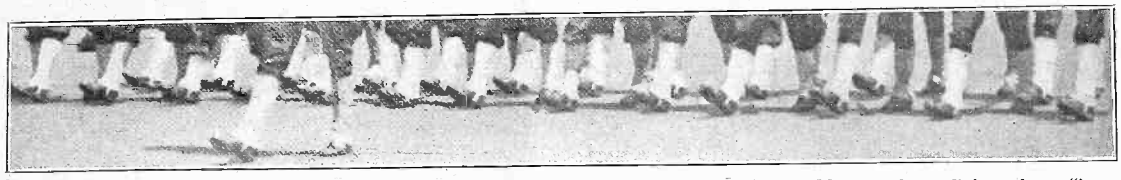
The circuit used in the lamp socket power amplifier was also designed by Mr. Lynch. The units were made for it by the National Company. The entire mechanical layout and assembly are the work of James Millen, who, although a recent graduate of Stevens Institute of Technology, already has come to be recognized as a radio engineer of great merit. Mr. Millen has contributed many articles to radio and other scientific magazines and was on the staff of "Radio Broadcast" when Mr. Lynch was its editor.

Resistance-coupled amplification has long been known as a positive road to quality when high grade resistors and coupling condensers were used in its construction. Until recently, however, it has been difficult for the home constructor to obtain satisfactory resistors. The impregnated paper variety formerly so much used were far from satisfactory. In fact, not only were they noisy in operation, but they also rapidly changed in resistance value with age, so that after a few months use distortion and even failure to operate at all frequently resulted. With the new metallized filament resistors, however, both of these objections are entirely overcome, as the units are both silent and permanent.

One of the most common causes of distortion in the average amplifier, other than that due to frequency characteristics, is tube overloading. For the best of results it is essential that the proper power tube be used in the last stage. It takes real energy to operate a cone speaker properly and a 201A, and even an UX112 for that matter, is not capable of supplying this power. For the home radio set the UX171 is the ideal tube as it can supply plenty of energy to operate a speaker with as much volume as will ever be required, unless, of course, the purpose of the set is to keep all the neighbors awake at night. The UX171 tube does not require the dangerously high plate voltage and the expensive filter condensers needed for the UX210 tubes.

With an amplifier built into the set, many leads, several being of rather high potential, must be run between the set and the power unit. To eliminate such unnecessary leads, the amplifier and power supply are combined into one unit which, as it requires no adjustments after once being put into operation, may be placed out of the way in the battery compartment of a console or table. Such arrangement not only simplifies construction, but also makes it easy to use the

Result of Engineers' Choice Is Exquisite Lamp Socket Operated Console



IF a radioist had as many dials on his set as the members of a regiment have feet, he would want those dials to keep "in step," station for station, just as do the marchers. The De Luxe receiver has only two dials. How these are made to tune in step will be told next week.

amplifier with different sets and with existing sets of the factory-made type. If he so desires, a fan may have several sets, say one, such as the Victoreen Super-Heterodyne, for distance, and another, such as the BD for ordinary use, without the necessity of duplicating an expensive audio-amplifier and power supply.

Perhaps a few words about the development of high quality lamp socket amplifiers in general may be of interest. In the spring of 1925, as a result of the laboratory work in connection with the development of the electric phonograph or panatrope and the R. C. A. 104 speaker. Messrs. Rice and Kellogg delivered a paper before the American Institute of Electrical Engineers on high quality lamp socket operated audio-amplifiers. Realizing the value to the public of the theoretical data presented in this paper, the engineers of the American Transformer Company, particularly George C. Crom, Jr., developed a line of practical parts so that the advanced home constructor could enjoy a "real" radio program. At the instigation of Mr. Lynch, then editor of "Radio Broadcast," Mr. Millen took the parts developed by the American Transformer Company and in collaboration with Messrs. Crom and Lynch, developed a high quality broadcast receiver. In the November issue of "Radio Broadcast," Mr. Millen described this set, making available to the radio public for the first time a truly fine receiver. This set used an UX210 tube as a power amplifier. Realizing the disadvantages of the 210 and the possibilities of the new 171 in conjunction with the Raytheon BH rectifier, Mr. Lynch originated the idea of making a safe and economical amplifier in one unit so that it might be connected to any existing set.

Further realizing that the parts available on the market at that time were not suitable for the construction of amplifiers which could duplicate the results obtainable with the laboratory models that he had developed in conjunction with Mr. Millen, Mr. Lynch looked around to find a reliable radio manufacturer that had the facilities for manufacturing the necessary chokes, transformers and condenser blocks so that any one purchasing a kit of the parts would have no difficulty in constructing an amplifier which would perform with the same high degree of excellence as the laboratory models.

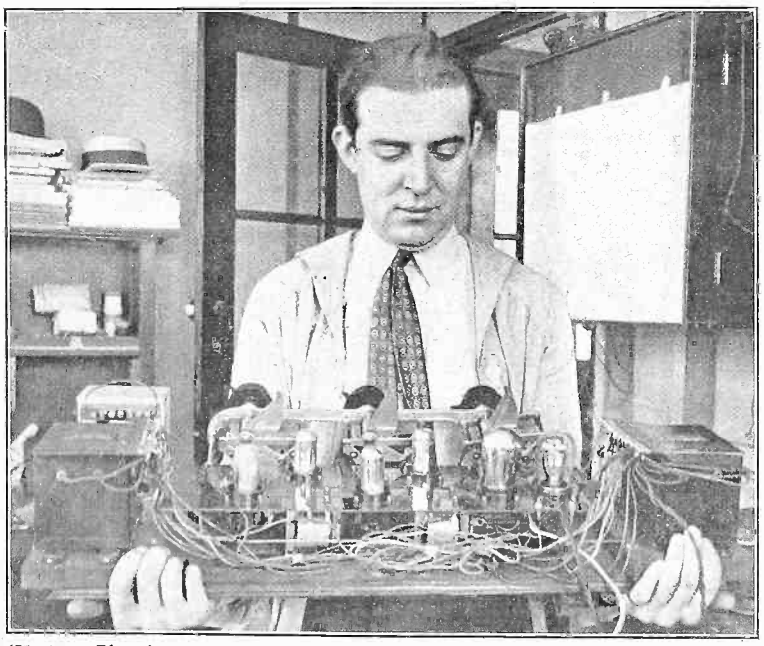
The National Company was selected because of their long experience in the manufacture of power transformers, scientific equipment and high grade radio products.

An entire floor of the new National factory, which takes in a whole block, is now devoted to the manufacture of all the necessary parts according to the exact ideas and specification of Messrs. Lynch and Millen, for the construction of one of the finest amplifiers that it has so far been my privilege to examine and listen to.

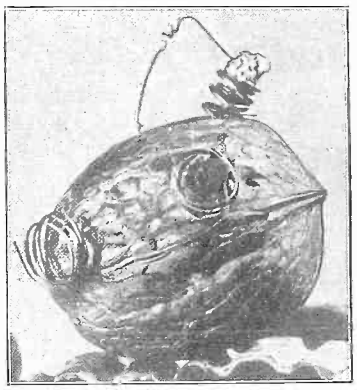
By taking the best in radio frequency amplification and combining it with the best in audio-frequency amplification Mr. Lynch has produced a truly remarkable combination. Not only is lamp socket powerization obtained with this receiver, but also automatic power control by means of an automatic line supply relay.

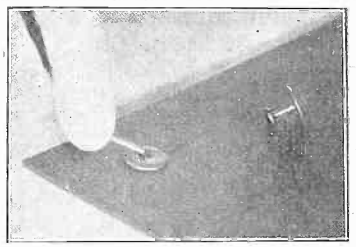
The set proper is also most easily operated, as the only tuning controls are two illuminated National variable ratio vernier dials and a volume control. The adjustable ratio feature on the dials permits either a fine or coarse vernier adjustment, within the limits of six to one to twenty to one, at the will of the operator. Provision is made for directly recording the call letters of the different stations on the dials.

Next week the first of the three articles by Mr. Lynch will appear in RADIO WORLD on the construction of the two tube Browning-Drake receiver. In the second article Mr. Lynch will describe the construction of his new high quality power amplifier and in subsequent articles he will tell how to combine the various units into the complete Lynch Browning-Drake lamp socket operated receiver and how to adapt it to commercial devices that concern powerizing the installation.



(Herbert Photo)





(Hayden)

THE GENERAL TREND is toward making receiver installations larger. Note batteryless 5-tube set at left. The rectifying tube is at right. The other photos show a "nut" crystal set and a front collar button used as a tip jack.

Radio University

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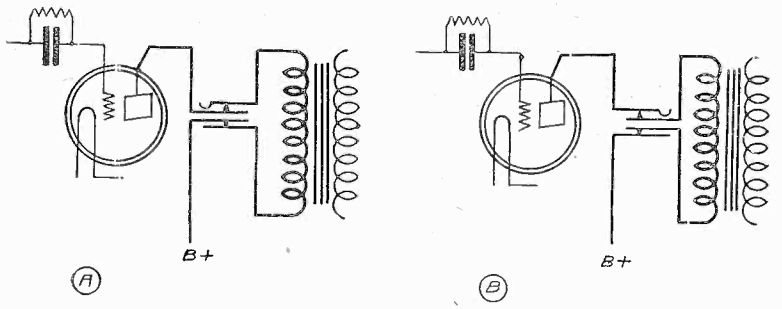


FIG. 484

The circuit diagrams illustrating the correct and incorrect methods of connecting up a double circuit jack to a detector output, A being the wrong away and B the right way.

I HOOKED up a double circuit jack at the output of my detector tube as per diagram and cannot get signals, when the plug is inserted, although I can hear them through the output of the last tube. What could be the trouble?—Dave Greenberg, Bx., N. Y. City.

Your method of connection is wrong. The correct way of connecting up the jack at this point is shown in Fig. 484B. In the same figure, A, the wrong way, which you have followed, is shown. You will note in A, that the plate and B plus terminals of the transformer are connected to the outer terminals of the jack, instead of to the inner terminals, as per B. Therefore when you place the plug in the jack, the two outer prongs are separated, there is no contact to the output terminals, as per B, the contact being made to the transformer. In B, when the plug is inserted, contact is made to the plate of the tube and the B plus post, the transformer being shunted completely out of the circuit.

* * *

I CONTEMPLATE building the 1-tube receiver (bottom diagram), used in illustrating the short wave article in the Nov. 27 issue of Radio World, page 5, for broadcast waves. (1)—Can a 10 turn primary and a 70 turn secondary coil wound on a 2¾" diameter tubing, using No. 22 double cotton covered wire, be used as L1 and L2 respectively? (2)—What capacity condenser should shunt the secondary winding? (3)—How many turns should the plate coil consist of and what capacity condenser should be used?—Harry Morton, Atlantic City, N. J.

(1)—Yes. (2)—Use a .00035 mfd. variable condenser. (3)—This coil consists of 35 turns wound on a 3" diameter tubing, with No. 22 double cotton covered wire. It should be shunted by a .00035 mfd. variable condenser.

* * *

I HAVE built a 1-tube receiver, using a 3-circuit tuner, hooked up in the standard fashion. In series with the antenna I connected a 33 turn coil, wound on a 3" diameter tubing, and shunted by a .001 mfd. variable condenser. This, I used as a tuned antenna system. I used a 20 ohm. rheostat for controlling the filament circuit of the detector tube. I would like to know if it is possible to add two stages of transformer coupled audio frequency amplification to this set. I have two 3 to 1 type AFT. (2)—Are the P and B output posts connected to the P and B posts of the AFT respectively. I have the circuit diagram of a standard two stage amplifier. C battery provision for each AF tube and automatic filament controls for each tube is made. Is this O. K.?—Wesley Lyter, N. Y.

(1)—Yes. (2)—Yes. Check it up against the audio frequency amplification unit addition, in the Selective 1-tube set described in the Dec. 18 issue of Radio World.

* * *

I HAVE built the crystal set, described in the May 15 issue of Radio World, Radio University columns, and have obtained good results. Now I would like to add transformer coupled audio frequency amplification. To what terminals are the P and B posts of the first audio transformer connected to? (2)—How many stages should be added for best results? (3)—I have several all stage ratio transformers. Can they be used? (4)—Should I use an output transformer? I have a cone speaker. I desire to use a power stage in the last audio stage.—Leonard Pacifico, Portland, Me.

(1)—The P post is connected to the rotor plates of the variable condenser. The B post is connected to the potentiometer arm. (2)—Two. (3)—Yes. (4)—Yes.

* * *

IS IT possible to use fixed Vitrohm resistors in the output of the B eliminator described in the June 26 issue of the Radio World, so that I may obtain many fixed voltage values? (2)—From each B plus to B minus lead, should a 1 mfd. fixed condenser be shunted? (3)—I have a 2 mfd., a 4 mfd., and an 8 mfd. fixed condenser. Can they be used? How should they be installed?—Willard Mork, Houston, Tex.

(1)—Yes. Be sure to insert the correct values as per data on the carton. (2)—Yes, this is absolutely necessary. (3)—Yes. Place the 2 mfd. first, the 4 mfd. next, and the 8 mfd. last.

* * *

I HAVE constructed a 4-tube reflex, designed exactly as per diagram on the bottom of page 8, in the Dec. 4 issue of Radio World, under the Big Five article. Although the set operates satisfactorily, there is a tendency for it to howl. Can this be prevented by inserting radio frequency chokes in series with the grid returns of the two RF tubes? I have two such coils containing 150 turns, wound on a 1" diameter, using No. 30 enameled wire.—Robert Harris, Bar Harbor, Me.

Yes, this is a good stunt. Also try reducing the number of turns on the primaries in the plate circuits of the RF and detector circuits. Try reducing the plate voltage on these tubes, also.

* * *

PLEASE SHOW how to connect up a separate B battery in the detector plate circuit, so that there is no feedback through the batteries. At present, I am using a 6-volt storage battery to light the filaments of 5 tubes, with three 45 volt batteries supplying a single plate voltage.—John Carston, Atlantic City, N. J.

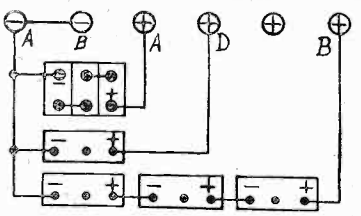


FIG. 483

The diagram illustrating how to use a separate B battery for plate voltage.

Fig. 483 shows the circuit diagram illustrating this stunt. The individual battery connection to the set is indicated at point D.

* * *

I READ with interest the description of the radio frequency unit using variometers and shown diagrammatically under Fig. 482, in the Radio University columns of the Dec. 18 issue of Radio World. I am going to build this receiver with two stages of transformer coupled audio frequency amplification. Could I place the parts in a 7x18" cabinet with a panel to fit, using the panel outline shown in Radio University columns of the Nov. 13 issue?—Gregory Halstead, Altoona, Pa.

Yes. However, there are several precautions which you will have to take. A small copper or other good conductive material must be placed between each variometer for shielding. This shield should be grounded. The resistance in the plate circuit controlling B voltage should be placed on the inside of the receiver on a subpanel. Automatic filament controls should be used in the amplifier filament circuits.

* * *

IN REFERENCE to the 4-tube receiver shown under Fig. 479, Radio University columns, Dec. 4, issue of Radio World. (1)—Can a separate 10 turn primary and 44 turn secondary RFT, wound on a 3" diameter tubing using No. 22 double cotton covered wire, be used to couple the RF tube to the detector tube? The 33 turn coil wound on a 3" diameter form is to be used as a plate coil, for regenerative control of the RF tube. That is, this plate winding is to be connected in series with the primary winding of the RFT. (2)—Can the double circuit jack, at the first amplifier audio amplifier output, be left out, direct connections being made to the transformer and tube respectively?—Godfrey Luce, White Plains, N. Y.

(1)—Yes. (2)—Yes.

* * *

CAN 20-ohm rheostats be used to control the filaments of the radio frequency amplifier and detector tubes in the 4-tube set, shown in the July 24 issue of Radio World on page 9? (2)—I am going to use a 50 turn coil tapped at the 8th turn for L1L2, and a 3-circuit tuner with a 10 turn primary, 42 turn secondary and 35 turn tickler. The primary and secondary windings are each wound on a 3" diameter tubing with No. 24 double cotton covered wire, with no spacing. The tickler is wound with No. 26 single silk covered wire, on a 1¾" diameter tubing. Can these be used? (3)—I am going to use —01A tubes throughout. Are they O.K?—Laurence Anderson, Los Angeles, Cal.

(1)—Yes. (2)—Yes. (3)—Yes.

* * *

I AM going to build the Tectron B eliminator, described in the April 3 issue of Radio World. (1)—Will I get better

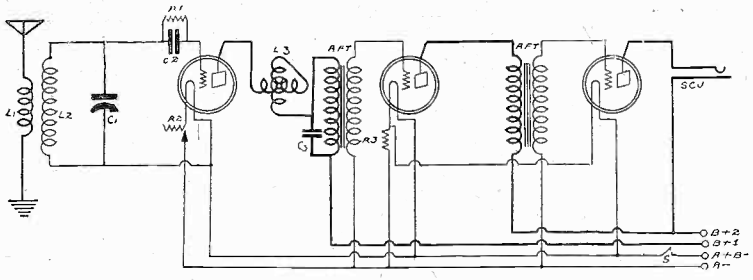


FIG. 485

The circuit diagram of the 3-tube regenerative receiver requested by Maxwell Phillips.

results if I place a .5 mfd. fixed condenser across the B plus Amp. 90 post and the B minus post? (2)—Can R1 be a variable resistance, such as the Clarostat?—Joseph Murps, Louisville, Ky.

(1)—No. (2)—Yes.

* * *

CAN A tube be successfully substituted for the crystal in the 4-tube Toroid set, shown in the Radio University columns of the Feb. 27 issue of Radio World? (2)—Can ballast resistors supplant the rheostat in the AF filament circuit?—James Hartford, Bridgeport, Conn.

(1)—Yes. The grid is connected to the stationary plate post of the third variable condenser and to G post on third coil. The rotary plate post of this condenser is brought to the A plus post and to the F post on third coil. The plate post is brought to the P post on the audio frequency transformer. The F minus post is brought to the resistance terminal of a 20-ohm rheostat. The arm of this rheostat is brought to the A minus post. The F plus post is brought to a terminal of the filament switch. (2)—Yes.

* * *

I AM going to build the one stage transformer and two stage resistance coupled audio frequency amplifier, shown on page 19 of the July 24 issue of Radio World. Please state the values. Also give any improvements to be made.—William Thompson, Boundbrook, N. J.

The transformer is a 3 to 1 type. The coupling condensers in the resistance stages are of the .25 mfd. type. The last output condenser is a 4 mfd. one. The plate resistors are of the .1 megohm type. The first grid resistor is of the 1 megohm type, while the second one is of the .5 megohm type. Don't use a resistor for preventing DC from entering the speaker, as shown. Instead use a choke coil. The connections are the same as for the resistor. Connect the filaments of the first two AF tubes to a single rheostat, 10 ohm type. Connect a rheostat or ballast in the filament circuit of the last tube. Return the plate leads of the first and second tubes to a separate B post connecting the plate of the last tube to a separate B post. Also connect a filament switch in series with the A plus, B minus lead. C battery connections to the first and second tubes and to the last tubes, should be made through the grid resistors and secondary winding of the AFT.

* * *

IN THE November 6 issue of Radio World, Radio University columns, there appeared a circuit diagram of a 6-tube set, using double impedance coupling, which interested me. (1)—Could I use separate ballast resistors to control the filaments of the two AF tubes at one time and the filament of the last AF tube? That is, a 112 Amperite on the first two AF filaments and another 112 Amperite on the filament of the last AF tube. The -01A tubes will be used the first two stages, while a 171 will be used in the last AF stage. (2)—What type rheostat could I use in the filament circuit of the detector tube? (3)—Using the -01A tube as a detector, is the grid leak connected across the grid condenser? (4)—Using a B eliminator, would it be a good idea to run the detector plate to the plus post of the 6 volt A battery, to prevent feedback?'—Henry Williamson, Butte, Mont.

(1)—Yes. (2)—20 ohm type. (3)—Yes. (4)—Yes. A separate B battery can also be used.

* * *

I HAVE a tuned radio frequency transformer, containing a 15 turn primary and a 50 turn secondary wound on a 3" diameter tubing; a variometer with a 58 turn rotary section, wound on a 2½" diameter tubing and a 74 turn stationary section wound on a 3" diameter, and a .0005 mfd. variable condenser. The radio frequency windings consist of No. 24 double cotton covered wire, while the variometer windings consist of No. 26 double cotton covered wire. Can I have the circuit diagram of a 3-tube receiver using these parts. I wish to use transformers in the audio stages. Please state the type. —Maxwell Phillips, Hollywood, Cal.

The windings on the radio frequency transformer will have to be changed. That is, the number of turns on the secondary winding will have to be reduced to 44 turns. It is also advisable to reduce the number of turns on the primary winding to 10. The circuit diagram of a receiver using these parts is shown in Fig. 485. It employs a regenerative detector and two stages of transformer coupled audio frequency amplification. Both these transformers should be of the low ratio or all stage type. The tuned radio frequency transformer is used in the antenna and grid circuits, while the variometer is used to control the oscillatory action of the tube, it being in the plate circuit. Across the secondary winding of the tuned RFT, the .0005 mfd. variable condenser is shunted. A 20 ohm rheostat is used to control the filament temperature of the detector tube, which is of the —01A type. A .00025 mfd. fixed condenser is used in combination with a 2 megohm leak in the grid circuit. C3 is a .001 mfd. fixed condenser used for bypassing. A ballast resistor is used to control the filament temperature of both AF tubes, which are also of the —01A type, SCJ is a single circuit jack, S is a filament switch. A single B voltage is used for the detector plate and a single B voltage is used for the amplifier plates. If you use the 15 turn primary, you are liable to experience trouble with uncontrollable oscillations on the low waves and also broad tuning.

* * *

HOW MANY Canadian broadcasting stations are there at present? (2)—How many of these stations are owned by the Canadian National Railways? (3)—How many Cuban broadcasting stations are there? (4)—Has WRW, of Tarrytown, N. Y., discontinued operation?—Samuel Lessens, Port Jervis, Conn.

(1)—There are 53 stations (2)—Ten are owned by them. (3)—Ten stations. (4)—Yes.

* * *

CAN RESISTANCE coupled AF amplification be used instead of the transformer coupled audio frequency amplification, in the 9-tube Super-Pliodyne, described in the Aug 14 issue of Radio World, Radio University columns? (2)—Can ½ ampere ballast resistors be used to control the filaments of the RF tubes, one for two tubes at a time? (3)—Can a power tube be used in the last stage of resistance coupled AF amplification?—Warren Howard, Pittsburgh, Pa.

(1)—Yes. Higher plate voltage will have to be applied. The exact voltage will be dependent upon the tubes. (2)—Yes. (3)—Yes. Apply the proper B and C voltages.

* * *

IF I reduce the number of turns on the primary windings of the radio frequency transformers, in my 5-tube tuned RF set, will the tendency of the tubes to oscillate decrease? (2)—Do run down B batteries have a tendency to cause the tubes to oscillate? (3)—If I space the primary winding further away from the secondary winding, will the tubes decrease their oscillatory action on the lower waves? (4)—If I place the coils further away from each other, will it aid keeping the oscillatory condition of the tube down. At present they are angles, but about 2" from each other. (5)—Will shielding between the radio frequency coils aid in decreasing the oscillatory action of the tubes?—Morgan Fitzgerald, East Pittsburgh, Pa.

(1)—Yes. (2)—Yes. (3)—Yes. Suggest you see the Dec. 18 issue, in the explanation of the operation of the Equamatic coil in the special one and three tube. (4)—Yes, at least 4". (5)—Yes. the shields should be grounded.

Atlanta's Schools Teach With Radio

ATLANTA, GA.

In the Atlanta educational system, the "three Rs" no more exist. There are now four and the fourth is Radio.

Daily classroom instruction by radio is being given in each of the 70 public schools.

On the basis of more than two months' experience with radio as an adjunct to teacher instruction, Willis Sutton, superintendent of schools, is not only convinced that radio will be retained as a permanent instrumentality of education in Atlanta, but that its adoption by school systems generally is inevitable. Both as a factor in education and as an aid in school administration, he declares the value of radio has been proven unmistakeably by the Atlanta experiment.

But a value even beyond these, Superintendent Sutton believes, is established by radio in the schools. It widens the educational horizon and fires the imagination of the students as no other agency of instruction ever has done. The stimulated interest and broadened scope of work has thus made possible, promise to give our schools new efficiency and to place the American educational system on a level never before approached. National educators, particularly the experts of the United States bureau of education, in Washington, and leaders in the National Educational association, are watching the Atlanta experiment with great interest.

Must Adopt Modern Devices

"Any school system that does not recognize and adopt the latest and most modern devices," says Superintendent Sutton, "is out of date. And any school system that does not look at least 13 years ahead cannot serve its students with the greatest degree of usefulness.

"The public schools demand and take 13 years of a child's life. At the end of that time he is supposed to be ready to enter into the usual activities of life. If equipment and appliances and modern devices as now used are not included in the teaching material, then the child will enter life handicapped.

"So marvelous a discovery as radio must be shaped into a medium for broader education. It must be utilized both as a means of stimulating the interest of the pupil and for providing more effective teaching. The amount of knowledge that may be communicated by radio, the time saved for school administrators in disseminating this information, the intensity of the child's attention, and the certainty that the same message is delivered to all—all these give to radio distinct educational value."

Experts Make the Installation

In developing the necessary radio plant for the Atlanta school hookup, Dr. N. R. Eubanks, president of the board of education, and Superintendent Sutton obtained the co-operation of radio experts. The result is a uniform high-grade installation that insures maximum reception under all conditions. Each of the 70 schools in the city—white and colored alike—is equipped with a modern five-tube receiving set and loudspeaker. A microphone in the office of the superintendent of schools carries the broadcasts to station WSB, where they are put on the air.

One daily 30-minute radio period suffices to give each grade one radio lesson each week. On Mondays there is a program for the kindergarten and the first grades. Tuesdays, the junior and senior high schools have the radio hour. On Wednesdays the program is shaped for the third and fourth grades, on Thursdays for the high schools again, and on Fridays the fifth and sixth grades are the lucky ones.

"Thus every child in Atlanta," Superintendent Sutton points out, "has the opportunity to listen to at least one radio lesson each week.

Faculty Meetings Use Radio

"In addition the radio is used for weekly faculty meetings of the entire force. Another decided advantage is the fact that the superintendent and supervisors can speak instantly to the entire teaching force, without the difficulty and expense of assembling at some central point. There is a unifying power in this method of procedure that is giving solidarity to the entire system.

"The Parent-Teacher Association also is addressed over the radio. Messages concerning the health of the children, advice as to how the children should be taught to study and information concerning the public schools in general constitute a part of the material for these talks.

"At 6 p. m. each day a program for both parents and children is put on. Prominent educators, entertainers and musicians are employed."

FORMER EMPRESS

(Wide World)

THE FORMER EMPRESS ZITA of Austria, with her son
home in Lequeito, Spai

AID TO BEAUTY

(Hayden)

A CONE SPEAKER can be made more decorative with the aid of designs and other illustrations cut out of magazines. These designs may be pasted on the paper of the cone. The lower photo shows how a cut out parrot is being prepared for pasting.

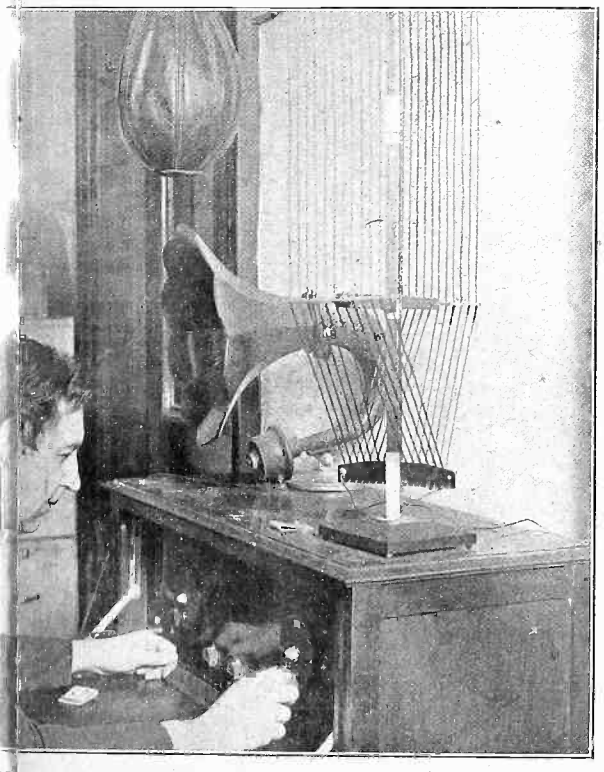
HE

(Herbert Phot
IT SEEMS TO
play, "Adele Dis
readers of the
Broun loses a D

ND FAMILY ENJOY SET

and his brothers and sisters, spending a quiet evening at their tening to a radio concert.

WOOD BROUN KEEN FOR DX



that Heywood Broun, who gained all deserved renown for his s," gets just as big a kick out of tuning in distant stations as . "World" get out of his masterful daily column. When Mr. tation, due to fading, he wreaks his vengeance on the punching bag, or lights a cigarette.

McCormack-Ponselle New Year Program

Radio programs for the New Year have a most pretentious beginning with the presentation of four operatic and concert artists of world-wide reputation in a two-hour program to be given by the Victor Talking Machine Company on the evening of New Year's Day. The artists are: John McCormack, tenor; Rosa Ponselle, soprano; Mischa Elman, violinist, and Alfred Cortot, pianist. With them will be heard the Victor Salon Orchestra, under the direction of Nathaniel Shilkret.

The program begins at 9 p. m. Eastern Standard Time and will be broadcast simultaneously through practically all of the National Broadcasting Company's "Red Network," with WEAF as the "key" station, in addition to its newly formed "Blue Network" emanating from WJZ.

Red and Blue Together

The "Blue Network" is broadcasting its first simultaneous program this evening under the new arrangement which enables the distribution of WJZ features to WBZ, Springfield and Boston, KDKA, Pittsburgh, and KYW, Chicago, during certain hours throughout the week. The stations of the "Red Network" participating will be: WEAF, New York; WEEI, Boston; WJAR, Providence; WTAG, Worcester; WFI, Philadelphia; WCAE, Pittsburgh; WTIC, Hartford; WGR, Buffalo; WRC, Washington (D. C.); WGN, Chicago; KSD, St. Louis; WOC, Davenport; WCCO, Minneapolis-St. Paul; WCSH, Portland (Me.); WDAF, Kansas City (Mo.); WTAM, Cleveland; WWJ, Detroit, and WHAD, Milwaukee. It is quite possible that others will be added to the latter list before the evening the program is presented.

Of the four artists on the program, three of them are being heard over the air for the first time. John McCormack has been heard on each of the two previous Victor New Year programs. The 1927 New Year program marks the radio debut of Rosa Ponselle, Elman and Cortot.

Remainder of Series

Elman is being heard in concert this season with the Elman String Quartette and the January 1 broadcast is not only his first appearance before the microphone, but is also his first solo concert of the season. He sails for Europe a few days after his appearance during the coming Victor presentation.

Cortot will also sail for Europe shortly after the Victor concert. He is now on a concert tour which is announced as his last American tour for two years.

Following the New Year's night program, the remaining concerts in the Victor series will be heard on alternate Friday evenings from 9:00 to 10:00 o'clock, Eastern Standard Time, through the National Broadcasting Company's "Blue Network."

WGY to Be Christmas Gift Testing Station

WGY will be the Christmas broadcast testing station.

The Schenectady transmitter will go on the air at 6:30 Christmas morning, enabling recipients of radio sets from Santa Claus to test the outfits for distance and quality. Most of the country will be in darkness at that hour and the range of station should be very nearly that of night.

So far as the technical operators of WGY are concerned Christmas is just another day for service to radio listeners. The day's schedule calls for operation morning and evening.

The day's broadcasting will start at 6:30 a. m. with the Candle Service of the First Lutheran Church of Albany, N. Y. This is the oldest Lutheran Church in America and the Candle Service has been a Christmas feature for many years. A large vested choir will lead the congregation in singing of familiar Christmas carols and the sermon will be by the pastor, the Rev. Charles E. Frontz.

At 11 a. m. the service of St. Peter's Episcopal Church of Albany will be put on the air. The Rev. Charles C. Harriman will give the Christmas message and the choir, under the direction of Dr. Frank Sill Rogers, will offer a special program of music.

From 6 o'clock until midnight WGY will be continuously on the air beginning with dance music by the Original Bay State Aces. A program of dinner music will be furnished by the Hotel Onondaga Orchestra, following which Shea's Buffalo Theatre will send down a half hour variety program.

A feature of the evening will be another program in the exceptional series presented by the Boston Symphony Orchestra. WBZ and WJZ will also broadcast this program.

A THOUGHT FOR THE WEEK

Perhaps the 1926 Santa Claus will display a new get-up on Christmas Eve. Earphones, spaghetti wiring for whiskers, a cone speaker for a hat and a tube for the jolly red nose—who can tell? Santa Claus is so real, even to grown-ups, that any change in standard equipment will be met with mixed feelings by an astonished world.

RADIO WORLD
REG. U.S. PAT. OFF.
The First and Only National Radio Weekly

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

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KJR USING 20 KW

KJR, Seattle, Wash., has increased its power to 20,000 watts, becoming one of the four super-power stations in the United States.

CLOSING OF MANY STATIONS URGED

Air Committee of American Bar Association Sees Shutdown of Hundreds as Only Solution to Congested Ether—Reimbursement Recommended

The recommendation that several hundred stations be closed and put out of business, the Federal Government to reimburse these stations and to devise some tax plan for the remaining ones to defray the actual expense, was made in a report of the Air Law Committee of the American Bar Association. Chester W. Cuthell, chairman, gave out the report in New York City, and said that the principles set forth in the report were approved by fellow members, including George C. Bigert of Chicago, formerly dean of the Cornell Law School; W. Jefferson Davis of San Diego, Cal.; John C. Cooper Jr., of Jacksonville, Fla., and Robert T. Swaine of New York.

The relief plan offered by the committee is intended as a safeguard to the listening public, so that inter-station interference and peanut whistles, so prevalent now, will be avoided. The report sets forth that there are 615 broadcasting stations existing in the United States, 70 under construction and 110 others contemplated, all on wavelengths between 200 and 600 meters, while there are only 89 channels which can be used by all these stations at the same time without interference with one another.

Congressional action is necessary, the report states, so that the recommendations can be carried out.

Suspension of New Licenses

In a discussion of opinions and court decisions which have held that the present radio regulatory law gives the Secretary of Commerce no discretion in issuing licenses, the report advises that the issuance of any new licenses be suspended until new legislation is enacted to prevent the increase of broadcasting stations. The report cites the decision of Chancellor Francis S. Wilson of Chicago in an action brought by The Chicago Tribune (WGN) against the Oak Leaves Broadcasting Station (WGES) as important. In this decision, the Court held that the "priority of time created a priority of right," in the possession of a wavelength and that WGN was entitled to the possession of the wavelength it had held for several years before WGES undertook to operate on it.

"It seems obvious to our committee that there are already too many broadcasting stations and that it is already impossible to avoid interference if all the stations are to be permitted to operate at the same time," the report adds.

Expected to Get Worse

"The probabilities are, according to the Department of Commerce that the situation—bad as it is—will get steadily worse by reason of the fact that the broadcasters are steadily increasing their power. Five hundred watts was formerly considered ample, but now the stations are using many thousands of watts and the tendency is constantly upward.

"We understand also that there are problems other than this one of interference between broadcasters, such as the possibility that pictures and even motion pictures will be transmitted by radio within the next few years; that power transmission by radio is also being experimented with, and that some provision will have to be made so as to permit radio communication for the guidance of airplanes."

The report discusses the two bills introduced in Congress, that in the Senate by Dill and that in the House by White. It expresses a preference for placing the administration of any new radio regulatory law in the hands of the Secretary of Commerce, as proposed by the White bill, instead of in the hands of a newly created commission, as proposed by Senator Dill.

Opposes Separate Commission

"The opinion of our committee, which we believe is shared by a very large percentage of the bar, is that the creation of more and more commissions, which are merely appointed by the President and which thereafter do not report to the President, is not the form of organization that tends to the greatest efficiency," the report continues. "There is a constant tendency on the part of commissions to enlarge their own powers. They rarely work harmoniously because their members are chosen from different parties. They are slower to act and slower to deal with new problems than an individual Cabinet officer.

"Senator Dill stated to your committee that he believes that this commission would be merely the beginning of a communications commission. If that be so, then it would be our thought to add another member to the President's Cabinet and make him Secretary of Communications. It seems to us that the framers of the Constitution did not contemplate attrition of the Executive's power by the creation of a series of commissions, reporting to the legislative rather than to the Executive branch of the Government."

In discussing proposed anti-monopoly provisions of radio legislation, the report says:

"The committee believes that it is not the best legislative policy to incorporate in a radio regulatory measure provisions that either parallel or duplicate the Sherman and Clayton laws with respect to monopoly or limitation of competition.

"Those laws have been on the books for a good many years. They have been litigated perhaps more fully than any other group of statutes, and they seem to us adequate to deal with any tendency toward monopoly. In the Senate bill, however, we think that the provision for revocation of a license, if the licensee or any subsidiary is found guilty of a restraint of trade (even though such a restraint of trade might have been in some business other than radio), is in effect an additional penalty for the enforcement of the Sherman and Clayton laws. It there-

(*Concluded on page* 19)

The Leading Points Of Lawyers' Report

The outstanding recommendations of the Air Law Committee of the American Bar Association for clearing the chaos out of the air follow:

That the Secretary of Commerce be given authority by Congress to close down several hundred stations.

That the Federal Government reimburse the stations thus closed.

That the remaining stations be made to bear the expense by a tax on their profits.

That any new legislation vest full authority in the Secretary of Commerce, instead of in the hands of any new executive commission.

That, if need be, another cabinet portfolio be created, that of Secretary of Communications, rather than creation of an executive board.

(*Concluded from page* 18)

fore, in our judgment, has no place in a radio regulatory act.

"The provision in the Senate bill, we think, is improper in that it confers upon the commission a purely judicial function. The language, 'the commission is hereby directed to refuse a station license to any corporation or any subsidiary thereof which has been found guilty by any Federal court of unlawful monopolies or attempting unlawfully to monopolize,' is more drastic than is necessary.

"Close Several Hundred"

"It seems to be the consensus of opinion that to bring about a situation where interference will not be possible several hundred stations now existing will have to be closed if the remaining stations are to operate on full time and if power is to be increased so as to bring about the best conditions for reception. To close stations in which large sums of money have already been invested is obviously a drastic provision. We do not believe that the courts would hold constitutional legislation which permitted such closing, either directly or indirectly by way of declining to issue new licenses, unless just compensation were paid.

"We have therefore urged on Senator Dill and Congressman White that they incorporate provisions permitting either the commission or the Secretary of Commerce to close stations entirely and to pay compensation. We appreciate the legislative situation—that such provisions cannot be put in the present bills without unanimous consent. Nevertheless, we think it would be wiser to bring in new bills in order to cover this vital point. The companies securing the new licenses when thus limited will benefit very largely by the closing of many of the old station. They will make much larger profits than they are now making.

Profits Tax Proposed

Therefore they are the companies whose profits should be taxed in order to provide the funds to pay the compensation to the stations which have been closed.

"In summary permit us to state that we believe that either of the bills would be an improvement over the existing situation, but only in respect to future licenses. On the other hand we think neither bill deals, except by indirection, with the present condition, which the Secretary of Commerce says is chaotic.

"The committee believes that if its suggestions are followed there will be a greater justification for more complete regulation of the broadcasters and that the situation from the point of view of the listeners will be greatly improved."

ROGERS OFFICIATES

(Fotograms)

AT THE laying of the cornerstone of the Ziegfeld Theatre, Fifty-fourth Street and Sixth Avenue, New York City, Will Rogers acted as master of ceremonies. At right is Patricia Ziegfeld, daughter of Florenz Ziegfeld and Billie Burke.

Stations Waive Right to Wave Under New Act

WASHINGTON

President Coolidge is expected to sign the emergency measure passed by the House and Senate last session providing that all stations applying for licenses or renewals must sign a waiver to any vested right in a wavelength as against the United States Government. The resolution, which also limits broadcast licenses to ninety day periods, will be put into force immediately by the Department of Commerce upon enactment.

According to officials of the Department of Commerce, the emergency measure will in no way affect present policies other than requiring signature of a waiver.

Congress Is Expected To Pass Relief Bill

WASHINGTON.

Meetings of the Conference Committee of the House and Senate on the White and Dill radio bills were delayed due to the ill health of Senator James E. Watson, (Indiana), chairman of the Senate conferees. Senator Watson was ill since his arrival in Washington. Meantime Congress continued to mark time so far as radio is concerned.

Reactions in the House and Senate on the President's message are interpreted as favoring the White bill which provides for Department of Commerce regulation of radio, and the general opinion is that a regulatory measure of some kind will be enacted early in the session.

50,000 WATTS FOR NICE

WASHINGTON

A 5 kilowatt broadcasting station is to be constructed at Nice, France, according to a report to the Department of Commerce.

16 New Stations Join Merry Throng

WASHINGTON.

Sixteen new stations have been licensed by the Department of Commerce, four of which are of 500 watts power. Seven stations reported having changed their wavelengths, and one station discontinued operation.

NEW STATIONS

WKBU—Harry K. Armstrong, New Castle, Pa., 238 m., 1260 kc., 50 watts.

WFKD—Foulkrod Radio Engrg. Co., Phila., Pa., 249.9 m., 1,200 kc., 10 watts.

KFQX—A. M. Hubbard, Seattle, Wash., 210 m., 1,428 kc., 15 watts.

KVOS—L. L. Jackson, Seattle, Wash., 333.1 m., 900 kc., 500 watts.

WLBH—J. J. Lombardi, Farmingdale, N. Y., 230 m., 1,304 kc., 30 watts.

WMVM—E. J. Malone, Jr., Newark, N. J., 475.9 m., 630 kc., 500 watts.

KGCU—Mandan Radio Ass'n. Mandan, N. D., 285 m., 1,052 kc., 100 watts.

WABF—Markle Broadcast Corp., Pringleboro, Pa., 410.7 m., 730 kc., 500 watts.

WPEP—Maurice Mayer, Waukegan, Ill., 212.6 m., 1410 kc., 500 watts.

KGDP—Boy Scouts, Pueblo, Colo., 260.7 m., 1150 kc., 10 watts.

KGEA—Puget Sound Broadcast Co., Seattle, Wash., 345 m., 869 kc., 15 watts.

WRRS—Racine Radio Co., Racine, Wis., 360 m., 832.8 kc., 10 watts.

WPAB—Radio Corp. of Va., Norfolk, Va., 319 m., 940 kc., 100 watts.

KGDR—Radio Engineers, San Antonio, Texas, 240 m., 1249 kc., 15 watts.

WWVA—J. C. Stroebel, Wheeling, W. Va., 348.6 m., 860 kc., 100 watts.

WLBI—A. Yarc, East Wenona, Ill., 296.9 m., 1010 kc., 250 watts.

The following stations changed their wavelengths: WKBO, Newark, N. J., from 309.1 m., 970 kc., to 303.9 m., 980 kc.; WCOA, Pensacola, Fla., from 222.1 m., 1350 kc., to 252 m., 1190 kc.; WSAR, Fall River, Mass., from 254.1 m., 1180 kc., to 322 m., 931.1 kc.; WKBM, New York, from 215.7 m., 1390 kc., to 285.5 m., 1050 kc.; KFVD, Los Angeles, from 205.4 m., 1460 kc., to 208 m., 1441 kc.; WOAN, Lawrenceburg, Tenn., from 282.8 m., 1060 kc., to 356.4 m., 841.2 kc., and KGCL, Seattle, Wash., from 230.6 m., 1300 kc., to 238 m., 1260 kc.

The calls of the following stations have been changed: WABC, Ashville, N. C., changed to WWNC; KGCM, San Antonio, changed to KTAP, and WJAF, Ferndale, Mich., changed to WTHO.

KGBW, a 250 watter at Joplin Mo., is reported as having discontinued operation.

Her Visit to WEAF Leads to the Altar

BROOKLINE, Mass.

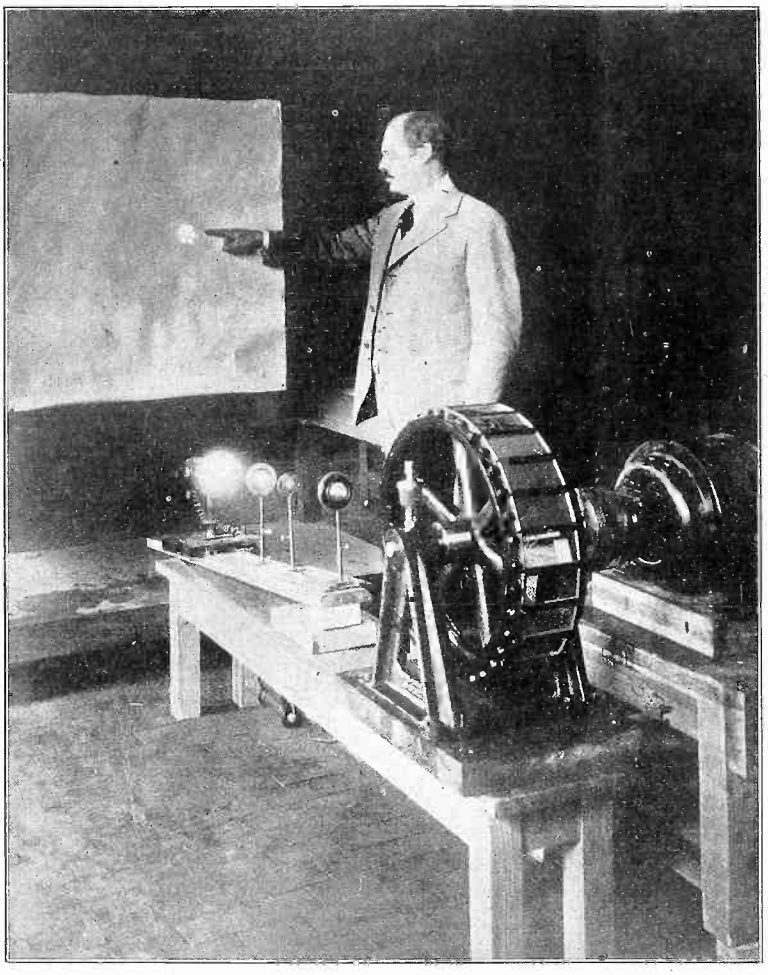
Little did Violet E. S. Stewart realize that the writing of words of appreciation to WEAF, would result in a romance. However, recently, Mr. and Mrs. Charles E. Stewart announced the marriage of their daughter, Violet, to Harold M. Schaffer, the assistant program director of the station.

When a letter of thanks from Miss Stewart for complying with requests to play certain numbers was received at the station several members of the orchestras and their wives sent her an invitation to visit the station for inspection and see how the broadcasting is actually carried on. She accepted and it was during this visit that she met Mr. Schaffer.

GRID WIRING CRITICAL

If a detector tube squeals when you put your hand near it, inspect the grid wiring.

EYES TO WATCH SCENES BY RADIO



(Fotograms)

DR. E. F. W. ALEXANDERSON, chief consulting engineer of the General Electric Company, testing out one of his experimental television projectors. This is the first public announcement that the noted genius is experimenting with television.

Scientists Encouraged by Advance in Televison Experiments—Alexanderson Is Revealed as Inventor of One Machine

By Conrad Nugent

Expert on Television

Many scientists say that television is coming, but few will undertake to state the approximate time when it will arrive, because at the present time no sure way of accomplishment has been revealed. Yet they state that it is coming because such encouraging advance has been made.

Many experimenters have attacked the problem. A few have had a certain amount of success. Noteworthy among those who have made progress are John Baird of Scotland; C. F. Jenkins in Washington, D. C., and E. F. W. Alexanderson. Baird employs a large number of lights, Jenkins a revolving disc containing a large number of prisms, and Alexanderson employs a revolving cylinder containing a large number of mirrors.

The problem of television may be stated briefly in terms of transmission of pictures by wire or radio. Pictures may now be sent successfully but it takes from 10 to 20 minutes to send a complete picture 5x7" in size. Say that it takes ten minutes to send an average picture. A motion picture must contain at least 16 separate pictures every second to give the illusion of continuous motion. In television the same number of pictures must be sent per second. But how much time is there in which to send each picture? A motion picture is on the screen one-fifth of the time and off four-fifths. That means that each picture is only on the screen one-fifth of one-sixteenth of a second, or in one-eightieth of a second. In television each picture must be sent in the same short time. Since it takes 10 minutes now to transmit a complete picture it is obvious that the solution of the television problem lies in increasing the speed of transmission of ordinary pictures in the ratio of 1/80, to 600, or they must be transmitted 48,000 times faster than they are now. There may be a simpler way out of the difficulty, but it is not now on the scientific horizon.

The question may now be raised why the picture could not be reduced in size and thus increase the speed of transmission somewhat. The answer is that lack of definition of the picture. If the size is decreased, it must be enlarged after reception, and the enlarged picture would lack detail. It would be like a pen and ink drawing with very heavy lines.

In the photo herewith is shown Dr. Alexanderson and his machine. The large bright spot in the background is an arc light. Then there are three lenses in a row, and finally is the large wheel containing the mirrors. Note the seven bright spots on the screen to which Dr. Alexanderson is pointing. When the wheel containing the mirrors rotates at a high rate of speed, the seven spots cover the entire screen in rapid succession. If the intensity of the spots varies from black to white in accordance with the gradations of a picture a person viewing the screen will see the picture reproduced on the screen provided that the picture is traced out rapidly enough. If a complete picture is traced out once in every sixteenth of a second a moving picture may be seen.

Some striking demonstrations of the various methods, in their present state of incompletion, have been given before learned spectators, who patted the demonstrators on the back and said that some day men will focus their eyes on a receiver and see by radio what is being enacted at the studio.

Expectation of Television Good, Says Alexanderson

ST. LOUIS.

A television projector which he believes will result in a realization of the dream of a direct vision of moving objects by means of radio, was explained by Dr. E. F. W. Alexanderson, consulting engineer of the General Electric Co. and the Radio Corporation of America, in the course of an address before the members of St. Louis section of the American Institute of Electrical Engineers.

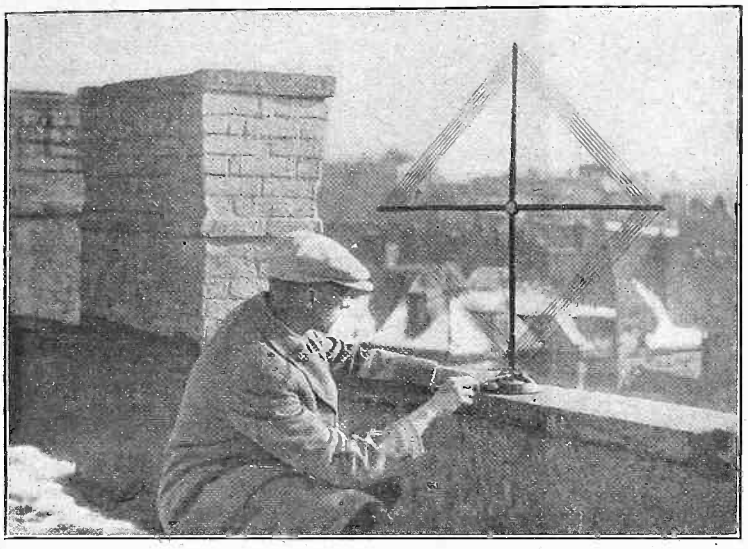
Many internationally known scientists and experimenters have declared that television is impossible, but Dr. Alexanderson, who has devoted a great deal of time to telephotography and television, declared that "our work has already proved that the expectation of television is not unreasonable and it may be accomplished with means that are in our possession at the present day. How long it will take us to attain practical television I do not venture to say."

Radio transmission of a single photograph has been accomplished by Alexanderson in two minutes in the research laboratories of the General Electric Company. Television will require the transmission reception and reproduction of a single picture in one-sixteenth of a second. One of the fundamental difficulties in the way of a speed of sixteen pictures per second is the development of a projector which will enable anyone to see on a screen the movement of objects miles away.

Dr. Alexanderson explained the television projector which he now has in operation in his laboratory and by means of which he is hopeful of getting the 300,000 brush strokes per second that are necessary for producing motion pictures.

"It is easy enough to design a television system with something like 40,000 picture units per second," stated Dr. Alexanderson, "but the images so obtained are so crude that they would have no practical value.

WAVE REFLECTED BY IMPEDIMENTS



Loop Is Used to Determine from What Direction the Energy Comes, as Contrasted with the Geographical or Compassed Direction

By Hood Astrakan

Theoretically the radio wave front is a perfect sphere; actually it has a shape widely divergent from that. The wave front is distorted by all obstacles in its path. What happens to the radio wave may be compared with the conditions met by a water wave. Suppose a stone is thrown into a still body of water. A series of circular waves starts from the point and advances in the shape of ever-increasing circles. The wave front is circular in this case. But if there is an obstacle in the water the circular front of the wave will be distorted. There will be a small wave starting back again, that is, it will be reflected. Behind the obstacle there will be a certain area of still water, or there will be a "shadow." If the wave strikes a very large obstacle like a shore line, most of the wave will be reflected and part of them will be absorbed. Similar phenomena take place in radio, only they are much more complex because there are many more obstacles.

Antennas, used for receiving, walls, chimneys, rivers, storm areas, shore lines, are all obstacles to a radio wave. Some of them affect the wave front just a little, others a great deal. An antenna is a sink hole into which radio energy disappears, that is, the antenna is an absorber. Structures such as walls and chimneys are obstacles which absorb, bend and reflect the wave. Near them the apparent direction of the origin of the wave is not the true direction. If they reflect the greater part of the wave, the apparent direction of origin may be exactly reverse from the true origin. If these objects bend the wave the apparent direction is changed to a smaller degree. An analogy may be cited from optics. A straight rod inserted partly into water will appear bent. If one should sight along the immersed portion one would not look in the direction in which the other end of the rod actually is.

Storm areas are obstacles because there is a difference in the velocity of the radio wave, which is due to the difference in the barometric pressure. A river or other water course is an obstacle for a similar reason.

The direction of the wave front at any point may be determined very easily by an ordinary loop and a receiver, and thus the distorting effect of various objects may be found. The loop is set in the direction in which the signal from a certain station comes in loudest. The plane of the loop then points in the apparent direction of the broadcast station. This is compared with the actual direction in which the station lies as determined from a map or with a compass.

In the photograph the man with the loop is engaged in determining the distorting effect on the wave front of the chimney to his left. Where more accurate work is desired the operator himself should remove himself from the field of influence of the chimney or he will introduce additional distortion. Careful operators turn the loop by means of long strings and a couple of levers attached to the loop.

90-Day License Confirmed By Law

Joint Resolution (S. J. R. 125) signed by President Coolidge, which provides a limitation of time from which radio broadcasting licenses are effective, merely confirms the present practice of the Department of Commerce, said Secretary Hoover.

The Department, Secretary Hoover said, had always held broadcasting licenses to 90 days, and this practice of five years standing has not been involved in recent judicial decisions.

Efficiency Ruined By Stray Leakage In Direct Coupling

By SPENCER BURROUGHS

One of the most frequent causes of failure of direct coupled amplifiers is the coupling condenser which is used to isolate the grid from the plate of the preceding tube. The trouble is that it does not isolate. At times it is leaky, and when it is it is useless for isolation purposes. It is then impossible to maintan the grid of the tube negative no matter what reasonable value of grid leak is employed. This trouble is often attributed to blocking of the grid when it is in reality due to a reverse condition, that is, to a too much positive grid.

As a proof of this a tube was calibrated under actual working conditions in a resistance coupled amplifier, that is, a grid voltage plate current curve was taken from zero plate current to saturation. Such a curve may be used to determine the actual grid potential by measuring the plate current. When no potential was applied to the plate of the preceding tube the calibrated tube behaved normally when the grid bias was varied, even when fairly high grid leak resistance was used. But when the voltage was applied to the plate of the first tube the plate current in the second tube would not respond to changes in the applied grid voltage. The plate current indicated a highly positive grid even when the applied grid voltage was so much negative that it should have reduced the plate current to zero. Removing the plate voltage from the preceding tube immediately restored the second tube to normal. The rate of leakage through the condenser was much greater than the leakage through the grid leak, even when the leak resistance was reduced to very low values.

Some condensers are better in this respect than others, even condensers of the same make and capacity.

This trouble may arise also from leakage through the insulation other than that of the condenser. For instance, certain sockets are leaky, particularly on the surface. Again, the sub-panel or baseboard may be at fault. One frequent cause of the trouble is the mounting unit for the coupling resistor and the grid leak. Some materials are very leaky and are wholly unsuitable for this purpose.

Dr. Taylor Recalls Aid to Explorers

WASHINGTON.

Dr. A. Hoyt Taylor, Chief of the Naval Research Laboratory, at Bellevue, is fond of telling of unusual experiences is connection with his work.

One night two years ago the operator on late duty at NKF, the Laboratory station, heard a weak call by a station signing itself GNB. The operator knew of no such station and in curiosity he tuned in and asked who it was. It was the Roosevelt Expedition in Brazil 6,000 miles away. The expedition was being attacked by brigands and wanted help immediately. The operator called the Brazilian Legation on the telephone and a cable was dispatched to that government.

The Laboratory kept in constant communication with the Expedition throughout that night and the next day. The expedition had a gasoline engine and when running it sounded like a machine gun. This kept the brigands off for a short time but the engine ran out of gas. The brigands then closed in and robbed the party of its transportation facilities.

THE RADIO TRADE

PROSECUTOR PUT ON GREBE'S CASE

Defendant's Alleged Model of Neutralization Invention Vanishes in Action Brought by Hazeltine—Court Orders Inquiry by District Attorney

Federal Judge Moscowitz in Brooklyn recently ordered that the minutes of some of the testimony in the suit for $100,000,000, brought by the Hazeltine Corporation against the A. H. Grebe Company for infringement of certain radio patents, be turned over to the District Attorney for investigation.

The Hazeltine Company charged that the process of plate neutralization, or neutrodyne, patented by Professor Louis A. Hazeltine December 5, 1922, had been improperly used by the Grebe Company. Mr. Grebe admitted that the sets his company manufactured employed a similar process of neutralization, but said it was for the use of tuned and untuned circuits, while the Hazeltine patents covered untuned circuits alone.

Their process, Mr. Brebe said, had been patented November 2, 1926. The patent had been issued to Carl O. Weber, of 412 East Fifty-first Street, and was owned by the Electric Service Engineering Company, whose laboratories are at 105 West Forty-seventh Street.

The Hazeltine Company denied this difference between the use of circuits and obtained a subpoena for a model built by Weber, which the Grebe Company said proved their right to the patent.

This model was never produced in court. Mr. Weber testified it had been stolen. He said he had got the model to bring it to court, when he noticed that it seemed to have been tampered with and would not work. He passed most of a night, he said, in repairing it and left the laboratories of the Electric Service Company.

On his return in the morning, he said, he found the model had been stolen.

Isaac Gottlieb, of Cedarhurst, L. I., secretary-treasurer of the Electric Service Company corroborated him.

Judge Moscowitz reserved decision on the question of admitting this testimony as evidence and turned it over to the District Attorney, should the latter find ground to use it as the basis of a criminal action.

The final decision in the suit will determine whether the Hazeltine Company has a monopoly of the manufacture of plate neutralization sets. At the present there are more than 500 independent companies manufacturing such sets.

The outcome is eagerly awaited.

ALBANY INTERFERENCE CURED

ALBANY, N. Y.

Albany's radio interference noises, first called to the attention of power and traction officials in a story which recently appeared in this city's papers, were fast traced down and the cause removed, under the direction of radio engineers.

C. C. Harris, radio engineer in the employ of the Radio Corporation of America, sent to Albany to lend his aid and the benefit of his training and experience in running down radio interfereces, reported much progress. He was receivig full cooperation of the Municipal Gas Company and the United Traction Company in his work. Mr. Harris was assigned to Albany at the request of Sidney J. Lane of the Havens Electric Company.

Other investigating parties were making progress in bringing about the elimination of the annoyances.

Hazeltine Begins Third Kent Suit

NEWARK, N. J.

An action alleging infringement of the Hazeltine neutrodyne patent has been filed against E. B. Latham & Co., a distributor of radio receiving apparatus in New York City by the Hazeltine Corporation and Independent Radio Manufacturers, Inc., in the United States Southern District court of New York.

The action just filed is the third of a series alleging infringement of the Hazeltine patents through the manufacture and sale of the same radio receivers. One action was filed recently in the courts of Pennsylvania against Atwater Kent Manufacturing company, and a second in the Eastern district Federal court of Brooklyn against E. A. Wildermuth, another distributor of the Atwater Kent Manufacturing company.

$2,000,000 FOR HIGH FREAKS

One Michigan concern alone spent $2,000,000 last year on research in the field of short waves.

Home Builder Knows, Says Veteran Dealer

SAN FRANCISCO.

Parts of home-built radio sets are in large demand, according to Conrad Richter, manager of a radio store at 1284 Market Street. Experimenters, both old and young, are making sets of their own with the same fervor and enthusiasm that attended the first two years of broadcasting.

The home-set builder of the present day, says Richter, demands parts of high-class manufacture, whereas the earlier experimenters were satisfied with almost anything. "He knows a great deal about radio today and you can't fool him with parts of inferior construction."

Richter started in the radio business nearly twenty years ago, long before broadcasting was ever dreamed of.

NEW SHOP IN IOWA

MONTICELLO, Ia.

A new radio shop has been opened here by Messrs. Harms and Zimmerman. In addition to selling radios they will repair outfits.

Dealer Tries Stunt To Bring a Crowd To Set on Wheels

HUTCHINSON, Kans.

A. R. Cogswell, a radio dealer at Kirwin, Phillips county, has adopted an interesting method of attracting the attention of prospective radio buyers.

He tells how he did it in this letter:

"I put a five tube set in the rear seat of my car and hook up dry B and C batteries. Then I hook the set to the car battery for A current. A piece of wire about ten feet long is hooked to the A post and a battery clip to the outer end. A loud speaker is set on the trunk on the rear of the car and attached to the set.

"I drive up in the street where there were a few people and get out of the car with a screwdriver, take hold of the wire connected to the A post of the set and stick the screwdriver in the ground and clip the wire to it. Before starting, the set is tuned to KFKX and as I get out of the car I connect the positive A. As quick as I touch the wire to the screwdriver the speaker begins giving the dope right out. I do not get any very great distance during the day time but at night I get nearly anything.

"The action is that of a big condenser, as the negative post of the car battery is grounded to the frame and the entire car becomes one side of the condenser with the ground forming the other. It happens that I have disc wheels on my car and the same thing tried in a coach with wooden wheels was even more successful."

Swindlers Decamp With Sets On Trial

LAWRENCEVILLE, Ill.

Merchants throughout the State are being warned of a new type of swindle, a radio swindle, that has been worked successfully in Rockford. The warning was issued by the Illinois Chamber of Commerce. The two swindlers went to Rockford recently and rented apartments in different parts of the city. Then each of them ordered a radio, on trial, from each of the twenty-two radio dealers in Rockford. They got away with about $3,000 worth of radios.

Another radio graft has also been found in Rockford. One man there kept himself in radios for forty-four weeks by "trying out" various radios for two weeks each at the expense of each of the twenty-two dealers there. From now on the Rockford radio dealers are to report every radio sale and each machine put out on trial to the local chamber of commerce for a checkup.

FIRE IN HURON SHOP

HURON, S. D.

The Brand Brothers Tire & Radio Shop was damaged by fire with a loss of $3,000.

NEW CORPORATIONS

Hygrade Radio Products, Newark, N. J., 500 shares, no par; Gale Harrison, Bloomfield, N. J.; Vernon W. Bennett, Alice M. Bennett, Newark, N. J. (Atty., Michael Breitkopf, Newark, N. J.)

Transcontinental Coil, Inc., Newark, N. J., coils for radios, 500 shares, no par; Gale Harrison, Bloomfield, N. J.; Vernon W. Bennett, Alice M. Bennett, Newark, N. J. (Atty., Michael Breitkopf, Newark, N. J.)

Bernice Radio Electric Shop, 9816 Dexter Boulevard, Detroit, Mich., wholesale and retail radio and electrical supplies, $10,000. (Incorporated under the laws of Michigan.)

Altitude Radio Manufacturing & Supply Co., Denver, Col., $15,000. E. A. Morassey, C. H. Alexander, R. F. Whitmore. (Incorporated under the laws of Colorado.)

Field Studies Held A Boon to Business

LINCOLN, Neb.

The comforts of the modern midwest homes have made radio problems in this section that differ widely from the interference encountered in the east, according to J. B. Ferguson, president of J. B. Ferguson, Inc., of New York City. Mr. Ferguson was the guest for a few days of Donald Chaplin of the Chaplin Electric Co. Mr. Ferguson made a trip over the midwest territory to investigate radio problems in this part of the country.

"You have considerable man-made static in this section caused by arc lights, electric refrigeration and other modern appliances in the homes," said he.

Mr. Ferguson feels that radio manufacturers must make separate study of radio problems in the mid-west.

"I feel that the trip should be made twice a year by the head of every radio manufacturer, because the problems here are so different from those of the east," stated Mr Ferguson.

"You have far more possibilities out here. Reception is made difficult in the east because there are so many stations operating in the big cities and because so much steel is used in the big buildings. I have gathered some very important data on conditions which have made it possible for me to develop in this territory a decided improvement. It is something which makes possible the simplifying of operation of high powered radio receivers, making the receiver of today as simple and easy to operate as the original crystal receiver of years ago."

Mr. Ferguson has been engaged in radio engineering work since 1907.

Pioneer Organizes Drumright Company

KANSAS CITY, Mo.

The Drumright Radio Company has been organized in this city by Jack Porter, one of the pioneers in the radio industry, and associates for the purpose of selling radio outfits and accessories. Mr. Porter was one of the original radio men who became interested in the industry when its possibilities became known eight or nine years ago and has since continued his interests in radio. He began experimental work in radio when the first broadcasting station was put on the air and has been instrumental in developing the industry in Oklahoma to a considerable degree.

The Drumright Radio Company is at 136 East Broadway.

KRAFT VISITS ST. LOUIS

ST. LOUIS, Mo.

Vincent Kraft, president of the Northwest Radio Company of Seattle, now erecting a super-broadcasting station here, was a visitor in St. Louis recently. He mentioned as his only worry the location of a suitable downtown studio. The new plant will cost nearly $100,000.

Basement Sideline Becomes Big Factor

ST. LOUIS, Mo.

The Star Square Auto Supply Company, which recently established its eighth store in St. Louis at the corner of Cherokee Street and Iowa avenue, ha utilized the whole basement of the establishment to accommodate the radio trade, which now constitutes a major portion o the company's winter business. Willian Lisak, formerly of the sales force at th Locust Street store, is manager of the Cherokee Street store, and Edward Weisendanger, who was in charge of the service department at the Grand and Shanandoah avenue store, is now managing t radio department.

"Radio has become an important factor in the everyday life of every one now, and our sales departments all over the city are busy," J. A. Stiffelman, general manager of the chain of stores, said.

Bensons Combine Their Two Stores

ST. LOUIS, Mo.

The Benson Radio Company, which formerly operated a wholesale establishment at 1003 Pine Street and a retail store at 920 Pine Street, has combined the stores and now is located at 808 Pine. The Benson company, of which L. A. Benson is president and C. W. Benson, secretary and treasurer, was organized four years ago.

L. A. Benson and William Woods, both radio operators with commercial licenses, opened the first radio house in St. Louis, at the southwest corner of Thirteenth and Olive streets in 1919 under the firm name of Benwood Radio Company. This firm later was combined with the Linze Electric Company.

GREAT GROWTH IN SOUTH

ATLANTA, Ga.

The demand for radio this season according to M. O. Hutchinson, of th Fulton Electric Company, prominent local distributors, is far greater than normally expected. Of course, with the rapid improvement and developments, certain numbers outsell other styles, but the growth and development of the industry is very gratifying, especially in the South.

OPERATOR OPENS STORE

NEW ORLEANS, La.

Guy S. Craig has quit radio work at sea to open a radio service station at 3702 Loyola Street, this city, where he has installed a shop for the repair and equipment of radio sets.

Literature Wanted

THE names of readers of RADIO WORLD who desire literature from radio jobbers and dealers are published in RADIO WORLD on request of the reader. The blank below may be used, or a post card or letter will do instead.

RADIO WORLD,
145 West 45th St., N. Y. City.
I desire to receive radio literature

Name .....

Address .....

City or town.....

State .....

C. Baird, 3922 Crawford St., Verdun, Montreal, Quebec, Canada.

A. S Metal, 1358 Lyman Place, N. Y. City, N. Y.

Frank Zowada, 82 Alden St., Wel Wallington, Passaic, N. J.

W. F. Holtz, 1726 Mandeville St., New Orleans, La.

F. S. McComb, 79 Mamaroneck Ave., White Plains, N. Y.

Donald F. Jones, 3660 S. W. 24 Terrace, Miami, Fla.

O. T. Hodson, Jr., 50 Dartmouth St., Portland, Me.

HOLD AN OPENING

BINGHAMPTON, N. Y.

B. W. Livingston & Sons, wholesalers and retailers of radio receiving sets and a variety of radio and other electrical accessories, recently held a formal opening of both their wholesale and retail stores at 289-291 Main Street, Johnson City.

VICTOREEN HAS HIGH SELECTIVITY

(Part 1 of the article on "How to Build the Victoreen Universal," was published in the Dec. 11 issue. Hints on construction were given in last week's issue, dated Dec. 18.)

By Ralph Hurd

One of the difficulties met with in many Super-Heterodynes is what might be called secondary interference. By this is meant crosstalk between two broadcasting stations which are so far removed in frequency that they should not ordinarily cause any trouble. Yet they do in some Super-Heterodynes which have not been properly designed. The interference is caused by the beating of the intermediate frequency with another beat current produced in the detector by the two interfering stations. For instance, suppose that the intermediate frequency of the super is 50,000 cycles, and suppose further that there are three broadcast stations operating on 600,700 and 800 kc. Now if it is desired to receive the 700 kc station, the loop is tuned to this frequency and the oscillator is either tuned to 750 or 650 kc. So far so good. But suppose one should desire the 600 kc station. That would require a setting of the oscillator for 650 or 550 kc. But one of these 650 is the same setting as the lower setting of the oscillator for the 600 kc station. It is obvious therefore that both the desired 700 kc station and the 600 kc station would be received when the oscillator is set at 650 kc. The relative strengths of the two signals would be largely a matter of loop tuning. Since the loop is tuned to a 700 kc station the interfering station is reduced. But it is very difficult to tune out the interference unless special precautions have been taken in designing the receiver, particularly the squeals which are very annoying even if they are not strong enough to spoil completely the reception.

Well there is another possibility. The oscillator may be set at 750 kc to get the 700 kc station. But then the 800 kc station also may be received when the oscillator is set at this point. Hence that station will interfere just as badly as the 600 kc station. In an ordinary Super-Heterodyne, then, it would not be possible to receive the 700 kc station without interference unless one of the other stations is off the air.

The case looks bad for the Super-Heterodyne, that is, for the hap-hazardly thrown together Super. But Supers—have so many attractive features that much time and effort have been spent to remedy this one minor defect. It has been attacked in two different ways with success. One is to increase the selectivity of the loop or pick-up circuit to such a point that the interfering station may be rendered innocuous as far as producing squeals is concerned. The other is to choose the intermediate frequency so that secondary interference cannot take place, or at least is rendered negligible. Both of these methods have been thoroughly considered in designing the Victoreen Super-Heterodyne.

The main method is that of designing the intermediate frequency transformers or the filter system, which here are of the best grade.

STATION IS SOUGHT BY ASHEVILLE AS PART OF BIG CHAIN

ASHEVILLE, N. C.

An attempt to make some definite plans to obtain a $25,000 municipal radio broadcasting station for Asheville was made at a special meeting of the radio committee of the Asheville Chamber of Commerce.

The meeting was called by F. A. Barber, chairman of the radio committee. If the committee is successful in its attempts to establish a station here, Mr. Barber says, reception of outside programs will be materially facilitated in addition to Asheville's own programs furnishing additional publicity for Asheville and Western North Carolina.

Supporting the broadcasting station plan the Battery Park Investment Company has offered to build a radio studio on top of the Flatiron building and give it to the city rent-free for two years. A check for $1,000 as a contribution toward the station has also been offered.

According to Mr. Barber the city is practically assured of being placed on the National Broadcasting Co. program if it gets a standard type broadcasting station. He has the assurance of H. A. Aylesworth, general manager of the company that Asheville will receive favorable consideration.

This would mean that Asheville would be connected by a direct telephone wire with the New York studios and other large stations of the company which would allow it to relay programs. This would enable fans here to get as good results with cheap sets as they now get with the most expensive apparatus made.

DIAMOND NAMEPLATES OUT

Our supply of nameplates for the Diamond of the Air has been exhausted. We can, however, continue to send a booklet and blue print for the 5-tube Diamond of the Air on receipt of 50c, and a booklet and blue print for the 4-tube Diamond of the Air on receipt of $1.00. Radio World, 145 W. 45th St., N. Y. C.

BIG DRIVE IS ON FOR MORE POWER

WASHINGTON.

Eighty-two new broadcasting stations are under construction in the United States, according to reports received by the Department of Commerce from Radio Supervisors throughout the country. This is an increase of twelve over the last reports by Supervisors on November 1.

The reports indicate that present congestion of stations has not in any way discouraged would-be broadcasters. The last reports showed 110 stations being planned. The more recent reports show an increase to 130.

One of the outstanding features of the report is the general increase in power. Fifty-six stations are preparing to increase their power, while 100 stations increased power since July 1. There have been 88 new stations licensed since July 1, the reports show, of which thirty-nine use more than 500 watts power.

Only five stations changed their wave lengths between November 1 and 15, the reports show.

The reports by districts follow:

First, Boston, District: Eight new stastations, five with increased power, twelve have changed wavelengths, seven are under construction and seven new stations are planned.

Second, New York, District: Fifteen new stations, seven with increased power, nine have changed wavelengths, two are under construction, fourteen are preparing to increase power, and twenty-three new stations are planned.

Third, Baltimore, District: Two have increased power, two have changed wavelengths, and five are preparing to increase power.

Fourth, Atlanta, District: Seven have increased power, five are under construction, and five are preparing to increase power.

Fifth, New Orleans, District: Ten new stations, six have increased power, five have changed wavelengths, ten are under construction, eleven are preparing to increase power, and thirteen new stations are planned.

Sixth, San Francisco, District: Three new stations, six with increased power, fifteen have changed wavelengths, seven are under construction, and eleven new stations are planned.

Seventh, Seattle, District: Nine new stations, nine with increased power, eight have changed wavelengths, ten are under construction, three are preparing to increase power, and thirteen new stations are planned.

Eighth, Detroit, District: Thirteen new stations, seventeen have increased power, three have changed wavelengths, seven are under construction, one is preparing to increase power, and forty new stations are planned.

Ninth, Chicago, District: Thirty new stations, forty-one have increased power, twenty-five have changed wavelengths, thirty-four are under construction, seventeen are preparing to increase power and twenty-three new stations are planned.

Thoriated Filaments

Is it as harmful to operate a tungsten filament (thoriated) below the rated voltage as it is above the rated voltage? Is any material gain in amplification effected with a tube, if the filament brilliancy is maintained above the rated value? The answers to these questions cannot but be of interest to the entire radio fraternity, since they constitute factors encountered in everyday reception. A series of experiments conducted in the Amperite laboratory, has cast a great deal of light upon these problems, and observations of the modus operandi of great research organizations, with respect to the filament circuit design of their receivers, have substantiated the findings in the laboratory. It is generally conceded that the grid is the most important element in the three element thermionic vacuum tube. But to the average fan, the grid is not the paramount item. His personal experiences have forced upon him the conclusion that the filament, the source of electrons in the most important factor in the tube operation. He is fully aware that the grid manifests a tremendous influence upon the utility of the tube. But he also realizes that when the filament becomes inactive for some reason or other the function of the other two elements, the grid and plate is of no avail. When the tube filament is dead, the tube is dead.

The fact that the overload safety factor is approximately 6 per cent. should therefore be of great interest. Increasing the voltage above 5.3 in the case of 01A type tubes for instance materially reduces the operating life of the filament by greatly accelerating the electronic emissions from the filament. Needlessly increasing the rate of electronic emission, rapidly dissipates the supply of thorium in the filament. When this supply of thorium is exhausted, the filament is dead. It was furthermore found in the Amperite experiments, that the increased rate of electronic emission from the filament brought about no material gain in amplification with the tube, with a definite applied plate voltage. Therefore operating the tube filament above the rated voltage is a total loss from every angle. The necessity for recharging of the "A" battery is hastened, the operating life of the tube is reduced and the time for tube replacement hurried.

LYNCH'S ANONYMITY PENETRATED

A DRUMMER of no mean ability is Arthur H. Lynch, shown doing a remote control job at his home on Long Island. He usually performs anonymously before the microphone.

SETS SO PROFUSE, WAVES BROADEN

The More Receivers Tuned to a Station, Particularly Near It, the Greater the Radiation Resistance, Expert Contends

By Knollys Satterwhite

A broadcasting station projects into space a certain number of watts. Anybody within range may tune in on the wave and get a portion of the energy. As the number of receivers increases, the amount of energy for each one is decreased. Those receivers which are nearest to the transmitter have the first chance at it and they can take much more than those far away. The greater the number of stations within a certain radius of the transmitter the less of the transmitted wattage is left for those receivers outside that radius. It is not surprising therefore that at present, when there may be hundreds of thousands of receivers tuned in on a certain station, that that station does not carry as far as it did a few years ago when there were only a few receivers tuned in on it. Even with the increase of power of the station fivefold or more it is now harder to receive that station at some distance away from it than it used to be with the lower power.

Using the same reasoning, the more unpopular or less well known stations should carry to greater distances because not so much of the energy transmitted by them is picked up by receivers. This is undoubtedly a fact. This may also account to a certain extent for the fact that DX is easier in the late hours of the evening when many of the local receivers have signed off for the night and while the broadcast station is still stirring up the ether.

If everybody at present uses a large outdoor antenna and a simple crystal set as of old, much more of the transmitted energy would be absorbed by the recivers, and distant reception of the station would be much more difficult. Perhaps it is only because of the greater sensitivity of present receivers that receivers at remote points will get anything at all. The modern receiver picks up a very small portion of power as compared with the old time crystal set and the single tube single circuit receivers. A Super-Heterodyne picks up the least of all. Next come the various regenerative radio frequency sets. They cannot be accused of hogging the transmitted power. They take just a tiny bit and make the best of it.

It has been said that the selectivity of a broadcasting station is dependent on the number of receivers tuned in on it. That is, as the number of stations tuned in on the wave of the station increases, the selectivity of the tuned circuit controlling the frequency is reduced because each receiver introduces just a little bit of resistance into the transmitter. It was reported that the selectivity of the transmitter of station WEAF was measurably lower during evening broadcasting hours than during transmission periods when the general public did not know of it, as during test periods.

If there is a large number of receiving stations tuned in on a transmitter within a very short distance, say one wavelength or less, then the receivers should react on the transmitter just as one coil reacts on another. But when the receivers are located farther away, the connection between transmitter and receivers is totally different, and there seems to be no reason why the receiver should react on the transmitter.

Receivers very close to the station are within the practical induction field of the transmitter, but stations farther away are within the radiated field only. The energy in the induction field returns to the station without loss, unless there are secondary tuned circuits very close by. The radiated field is thrown out by the station for good. It does not return even if there is no receiver to pick it up. If it is not picked up by receiving antennas it is absorbed by various obstacles in its path, or else it goes on and on forever. The radiated field is the load on the transmitter, and is a type of friction; the induction field is a reaction only and is an alternating magnetic field of the same kind that exist around any coil carrying alternating current.

TESTING THE Hi-Q

[The construction of the Hammarlund-Roberts High-Q Receiver was described in the three preceding issues.]

Connect the plus terminal of the A battery to the binding post marked A Bat. plus. Then touch the wire from the minus side of the A battery to the metal part of the A Bat. binding post (the tubes are not yet in the set). If a spark occurs it indicates an error in the filament wiring, entire filament circuit should be checked until the mistake is found and corrected.

If no spark occurs make the connection to the A Bat. binding post and turn the combination volume control-filament switch in a counter-lockwise direction as far as it will go. The switch is now off. All five tubes should be placed in their sockets **but not one should light.**

With the volume control full on and with all the tubes in their sockets, remove the wire from the A Bat. binding post and connect it to the plus terminal of a voltmeter. Connect one end of another wire to the minus terminal of the voltmeter and touch the other end of this wire to each of the two C Bat. posts and the 45 V, 67 V, 90 V, and 135 V posts. In no case should there be any movement of the voltmeter needle. If any movement should occur the circuit on which it occurs should be traced and the error corrected.

After completing the above tests replace the plus A wire on the A Bat. plus binding post and turn the volume control to the "off" position.

You are now ready to connect the "B" and "C" batteries. First connect the "C" batteries and then the "B" batteries.

Final Adjustment and Operation

After completing the connections to all batteries the antenna should be attached to the middle post of the antenna switch and the ground wire should be connected directly to the minus terminal of the "A" battery. Now plug in the loud speaker and the receiver is ready to operate.

Turn the volume control in a clockwise direction as far as it will go and slowly turn the two tuning dials simultaneously, keeping both at approximately the same settings. As soon as a station is heard, turn back the volume control until the signal becomes barely audible. Then adjust each tuning dial separately for loudest signal and set the volume control so that the output from the loud speaker is **quite soft.** Now adjust the Midget condenser (on the left side of the detector stage shield) to the point where the signal is loudest. Then carefully retune the second tuning dial for loudest signal and then make a final adjustment of the midget. Once set, this midget compensating condenser should need no further attention.

We are now ready to adjust the equalizing condensers. First tune in a loud signal at about 30 on the dials. Then disconnect the wire running to the "minus" post of the first socket, leaving the tube in the socket however. Now, with a wooden stick sharpened like a screw driver, turn the screw in the center of the first equalizer until the signal is at a minimum or disappears entirely. Now replace the wire on the post of the first socket. This completes the balancing of the first R. F. stage and the same procedure should now be following with the second R. F. stage.

The antenna "short" "long" switch enables the receiver to be adapted to different types of antennae and should be experimented with until the operator becomes familiar with the best position of the switch for the different wavelengths.

In general, the two tuning dials will read more nearly alike with this switch in the "long" position and this position will also afford the greatest selectivity. When throwing this switch from one position to another it will be necessary to slightly readjust the first tuning dial.

Batteries and Tubes

For the operation of the receiver the batteries and amperites required depend on the type of tube used. It may be noted that the new detector tube UX200A or CX300A may be used in any of the combinations of storage battery tubes which are listed herein. It is recommended that this type of tube be used if great sensitivity is desirable or if reception over extreme distances is an object of special importance. No change in either battery voltages or amperites is required.

Although either dry cell or storage battery tubes will prove entirely satisfactory, it should be noted that in general, storage battery tubes are more satisfactory than the dry cell type and should therefore be used where possible.

The new power tubes which have recently become so popular well deserve their popularity. For maximum operating efficiency they call for somewhat higher plate voltages and consume a little more A and B current than the 201A type of tube, but this is more than repaid in the form of greater volume and greater freedom from distortion caused by overloading. Therefore, it is recommended that type 112 or 171 tubes be used in the last audio stage of storage battery tube combinations, and the 120 type in dry cell tube combinations.

A tube combination which is highly recommended for the average installation, is shown below. It may be used without making any changes in the receiver and can be depended on for stability, volume and tone quality.

UX201A or CX301A in sockets Nos. 1, 2, 3 and 4.
UX112 or CX312 in socket No. 5.
6 volt storage A Battery.
Three 45 volt B batteries.
Two 4½ volt C batteries.

To secure in full the advantages of the 171 type of tube, four 45 volt B batteries should be used, and a 40 volt C battery should be connected to the C Bat. (2nd audio) binding post. With these voltages the plate current drawn under normal conditions is 18 or 20 milliamperes, which is too much to safely pass through the windings of the average loud speaker.

This difficulty can be easily overcome by connecting a choke coil (such as used in B eliminator filters), directly across the terminals of the loud speaker jack. As the resistance of the average loud speaker windings is considerably higher than the direct current resistance of such a choke, most of the 18 or 20 milliamperes of plate current will pass through the choke coil and so prevent the burning out of the speaker windings. At the same time the alternating current impedance of the choke coil is so high that practically all of the voice currents will go through the loud speaker and no loss of volume will be noticed.

If the method suggested herewith is used the choke coil may be placed in the rear portion of the left side of the cabinet, two wires run from the terminals of the choke through the space between the front and rear shields, and then soldered to the terminals of the jack.

CAPITAL INCREASES

Brandt Radio Power Co., Indianapolis, Ind., increased its capital from 1,000 shares of no par value to 1,000 shares no par value and $30,000 preferred stock.

THE THREE TUBE SELECTIVE SET

[*The theory and operation of both the one and three tube receivers using the Equamatic coil were described in last week's issue, December 18. The following gives the constructional data.*]

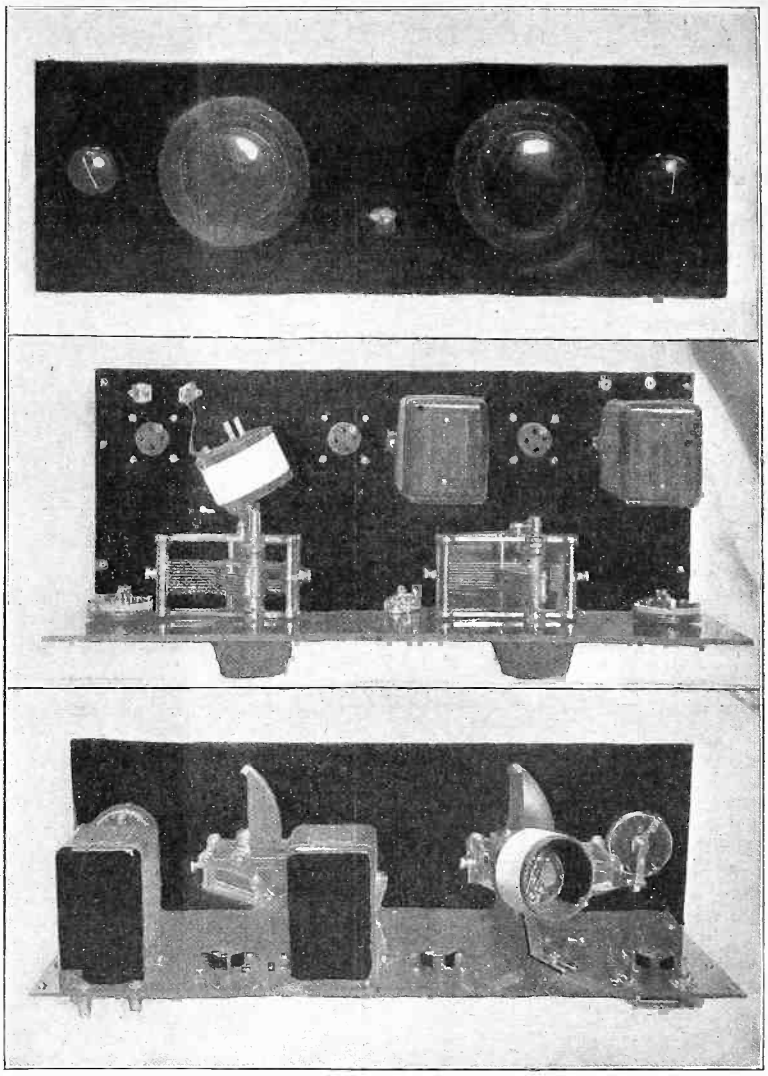
By Edgar Speare

The photos on this page illustrate very clearly how to lay out the parts for the 3-tube set. The center point of the shaft of each variable condenser is 5¼" from each side and 3½" from the top and bottom, using a 7x21" panel. The condenser to the right controls the antenna coupling coil, while the one to the left controls the regeneration. The 20-ohm Yaxley rheostat, which is used to control the filament of the detector tube, is placed in the left hand center, while the 20-ohm Yaxley rheostat used for the filament control of the first AF tube is placed in the opposite center. The filament switch is in the center of the panel.

As to the layout of the subpanel, which is held up by Karas subpanel brackets, placed underneath this panel. The socket for the detector tube is placed near the coil terminals, e.g., 2½" from the left hand edge and 3" from the back. The two audio sockets are 3" from the back and 5" from each other. The first audio socket is 6½" from the detector socket. They are all in the same line, measuring from the back, though. The two audio transformers are placed near the audio sockets, toward the back, the respective terminals being placed opposite the posts on the sockets, so that short leads can be made. Either a phone jack or a pair of phone tip jacks can be used at the output. In the model shown, the tip jacks were used. There will be no difference in the results, though. The grid condenser is placed underneath the subpanel close to the detector socket, while the grid leak is placed across this condenser. The plate coil, as stated, last week, is placed underneath the subpanel, with its axis vertical or in the same line as the larger coil on top of the subpanel, which is also vertical. Either a cable or binding posts can be used for battery connection.

The above data are for the 3-tube model. Now as for the 1-tube model, a 7x14" panel can be used. The shafts of both condensers should be 3" from each side and 3½" from the top and bottom. The rheostat can be placed between the condensers. Nothing else appears on the panel. The detector can be placed in the center of the subpanel, being sure to place the G and F terminals, so that they are close to these terminal connections on the secondary winding of the coil. The grid leak and condenser are placed underneath the subpanel. Only two subpanel brackets are used to hold the subpanel up. Phone tip jacks or a single circuit jack is used in the output. Since there are only three battery connections, binding posts are used. No filament switch is used or necessary.

A few tips on how to get the best results from the set. Use the variable condensers having the capacity specified only. Use the -01A type tubes in the detector and first AF sockets. A power tube can be used in the last stage. Take care to use the proper ballast resistor in this filament circuit of the last tube.



The panel, top and rear views of the selective 3-tube speaker receiver. The AF transformers are Silver-Marshall No. 220. Karas condensers, coil and dial are used.

RADIO SHOP OPENED IN ORLANDO, FLA.

ORLANDO, Fla.

"The Radio Shop," 141 Court street, Orlando, recently opened. They are exclusive retailers of the Bosch radio.

A full line of accessories and parts is available, also parts for the home builder. In addition, they have a fully equipped laboratory and repair shop on hand, and a service department.

Chas. E. Haywood has resided in Orlando for 17 years and has had several years' experience in radio.

Microphone Exacting But True Friend, Says Rosaline Greene

"The microphone makes certain unique demands on one's voice," declares Rosaline Greene, possessor of "the perfect radio voice" and winner of a cup emblematic of that distinction at the Radio World's Fair.

"Resonance is perhaps the first requirement," asserts the former leading lady of the WGY players. "This calls for placing the voice where it receives the utmost re-enforcement. My unusual lung capacity, with an unladylike chest expansion of four inches, I am told, aids me here. The next, I think, is richness due to overtones in the voice. This I possess, at the sacrifice of song for as a child, I had a lovely singing voice, while now it seems all the music has entered my speaking voice and left me unable to sing at all."

Miss Greene, radio fans will recall, played several hundred parts in the dramas staged each week in the studio of WGY at Schenectady, when she won the honor of being the first, and later, the most prominent leading lady of the air.

"I've had to adopt various kinds of voices for the many diversified roles I've played in the radio dramas," Miss Greene stated, in an interview with Eric H. Palmer.

"These characters included the low modulated voice of the cultured woman, the whiskey voice of a suffering Madame X, the joyous treble of an enthusiastic schoolgirl, and even the nasal coarseness of another type of woman. No costume nor makeup could help me make these characters live for my audience—only the flexibility of voice with its almost astounding propensity for creating a living character.

"'Agatha's Aunt' was a severe test for the voice. In it I had to portray an educated young girl disguising herself before a suitor as her own great aunt, and again as an uncouth servant girl. I could not rely on any makeup, wrinkles or white hair, abetted by a cane and faltering steps. Only by my thin quavering voice, could I suggest age, as by my slouchy nasal speech, could I suggest Hepzibah—and in a flash, shift back to an amused fullness of tone.

"I wonder if you realize how all important the voice becomes when one is doing radio work. Cheering at a football game one afternoon robbed me of all speech for six days. A big play was scheduled for that Friday night which had had columns of advance publicity—my whole radio world was anticipating the well-known role of Ophelia, and I couldn't speak above a whisper! My gallant mike, however, came to the rescue. It seems to possess a certain magic which always restored my voice, for at play time, the tones actually came out, clearer and sweeter than ever, it seemed.

"Sometimes, unforeseen things occur at the studio which make unusual demands on one's voice. One of the women of the company may be unable to speak her lines. In a flash, I've had to disguise mine, make it sound just like hers, say the lines and then go on again with my own part—while the radio audience remains blissfully unaware of any holdup. Many a time I've blessed this flexibility of voice for saving a play.

"My fan mail? That is among my most cherished possessions. From old and young, from educated and uplettered, come unsolicited the most touching tributes to my voice and acting. Invalids write of the soul quieting peace I bring them; isolated farmers of the sunshine I carry into their lives, young folks of the romance. I wish I could show you the expressions of love received from people who know me through my voice—even a marriage proposal. And there was one crippled man who used to travel miles every week to bring me a gift at the studio—he has never seen me.

"The most touching tribute I have ever received is the Ace's wings which a wounded aviator cut from his uniform to send me as the thing he prized most highly on earth to show his appreciation. I feel that I have never been more greatly honored."

Congressional Aid Asked by Pittsburgh

PITTSBURGH.

On presentation by W. Y. English, the city council recently adopted a resolution calling on the congressional delegation of Allegheny county to urge prompt passage by Congress of a bill to regulate radio broadcasting. The resolution also is to be called to the attention of the United States senators from this state, with a letter from the president of council stating that it is the belief that the resolution expresses the sentiment of many thousands in Western Pennsylvania.

When the resolution was offered some councilmen said that the matter was not one for councilmanic consideration. However, when it was explained that the question was one affecting many, and that there had been published requests that individuals write their congressman to the same effect, the resolution was adopted unanimously.

THREE FROM MAMARONECK IN BUSINESS AT PORT CHESTER

PORT CHESTER, N. Y.

Fully equipped with an expansive supply of radios and parts three local young men opened "The Radio Shop" at 110 Westchester Avenue, recently.

Charles Lilling, Leo Margoluis, and Mortimer Levy, who have conducted a successful radio business in Mamaroneck for the past months, are the proprietors of this new establishment here. Atwater-Kent, Garod, Bosch, Crosley, Ferguson, Fada and many other popular-make radios will be sold at this shop.

SINGER AT WMSG

(White)

HELEN GLEASON, of the San Carlos Opera Company, sang before the microphone of WMSG, New Madison Square Garden, New York City.

CONSTRUCTION IN SET IS FLEXED

(*Concluded from page* 4)

circuit, though these are not shown in the circuit diagram. One is from B_1 to minus side of the filament battery, and the other is from B_2 to the same point on the battery. Both of these should be large, preferably more than 1 mfd. If large condensers are not used they might as well be omitted altogether.

The set is primarily designed for 1A type of tubes in all sockets except the last, which should house a power tube. However, if it is desired to increase the sensitivity of the set on weak signals Ce Co high mu tubes may be used in the first radio frequency stage and in the first two audio stages.

Voltage Advice

The applied plate voltage at B_1 should be 45 volts or slightly more. The voltage at B_2 should be 135 volts or more, preferably more. It will be observed that the plate return from the detector tube is connected to the 45 volt line through the 100,000 ohm resistance R_6. Since the voltage drop in this resistance is considerable the effective voltage on the plate is quite small. Voltage is increased by decreasing the coupling resistance to about 50,000 ohms or by connecting the plate return of the detector to the higher voltage line. It may also be increased by using a high mu tube for detector.

A small grid bias is provided for the radio frequency tubes by the voltage drop in the rheostat Rh_1. The grid bias for the audio tubes is provided by a small battery, and three separate binding posts are used for this purpose. The grid returns from the first two first audio tubes are connected to one of these, and the grid return from the last to a second. The third is used for the positive and this, of course, connected to the negative filament line. Since the first two audio tubes have both the same grid and plate voltages, these tubes should always be of the same type.

The first step in the building of the receiver should be winding and mounting the coils (Fig. 2). Then the panel layout should be attended to. A suitable arrangement for the panel with Bruno dials is shown in Fig. 3. The panel is reinforced by the brass angle strips, which are fastened by the four screws shown in the corners of Fig. 3. The next step should be mounting the parts on the panel and wiring these as far as possible at this time. The parts that go on the panel are the three tuned circuits, the three vernier dials, the filament switch, the filament rheostat, and the variable resistance Rh_2.

Now comes the sub-panel layout. (Figs. 4 and 5). It should be pointed out that the circuit is not laid out as is the custom. It is mechanically flexed. That is, the radio frequency imput is on the right end of the set, as is also the audio frequency output. Thus the extreme right hand condenser and coil form the antenna input tuner. The middle is the tuned impedance, and the coil and condenser at the left hand end form the detector input tuner. The two front tubes are the radio frequency tubes. The detector tube is the first in the back row and the power output tube is the last in the same row. This arrangement makes for the shortest possible leads throughout the set.

Sub-panel Data

The sub-panel is set back 1.5" from the panel, or just sufficient to clear the condenser rotors as they are opened up wide. The sub-panel is also raised up so that there will be plenty of room for the sub-panel wiring and the various fixed condensers. The method of mounting the sub-panel to the front panel is shown in Fig. 5.

Strips of soft rubber are placed between the mounting brackets and the sub-panel in order to minimize tube noises arising from jars. These are quite effective although they are very thin.

As much of the wiring as possible on the sub-panel should be done before putting it on the mounting brackets. If this is done, only a few wires need be put in place after the mounting. This simplifies the work and it also protects the panel from injury while working.

RESULTS

Results Editor:

Please give my best regards to Herman Bernard for his wonderful contribution, the 4 tube model Diamond of the Air, to the radio public. I have built the set and rejoice over the fact. Many distant stations were received on the loud speaker with great volume.

WILLIAM STIEMAN,
16 Passaic St.,
Trenton, N. J.

* * *

Results Editor:

I have built the 4 and 5 tube Diamond of the Air receivers, and have had exceptionally good results from them. I have received about 114 distant stations.

RAYMOND THOMPSON,
Kingfisher, Okla.

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Results Editor:

About six months ago I constructed the 4 tube model Diamond of the Air. The results have been beyond my expectation. Throughout the summer, stations up to 1,000 miles away, came in with good speaker volume.

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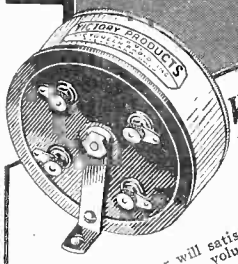
A Super Set Without an Equal!
Build it with VICTOREEN Parts



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I received my B. S. T. radio set two weeks ago and I am very well pleased with it.

I had the set working in fifteen minutes and at the end of two hours and a half I had twenty-nine stations logged. The set brings in new stations almost every night.

The cabinet is very well constructed and the people that have seen it say that it is a very beautiful set.

G. C. PARRISH, Dallas, Oregon.

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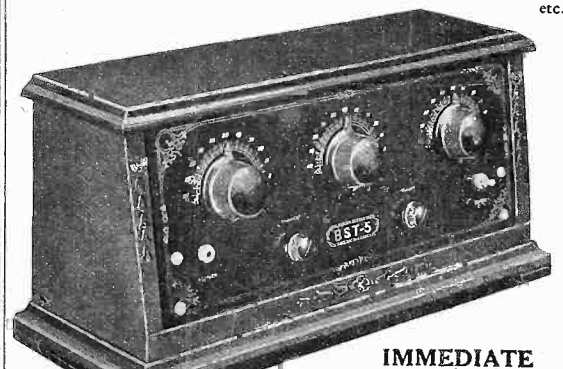

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