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America's First and Only National Radio Weekly

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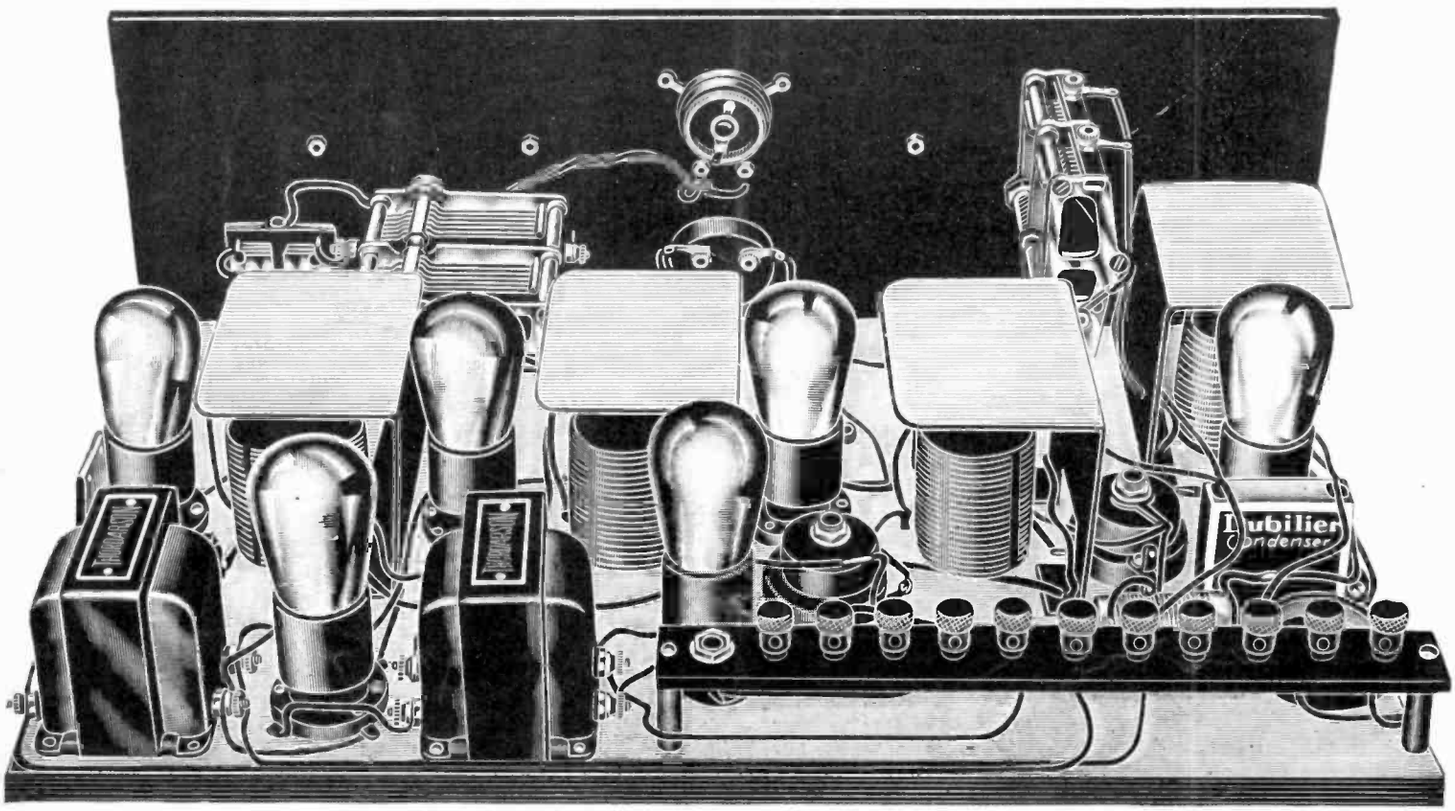
1928 Victoreen Universal

The Set Aboard "Old Glory"

The One-Dial Witz

THE PURATONE AC RECEIVER

SEE PAGE 3



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SIXTH YEAR

RADIO WORLD

REG. U.S. PAT. OFF.

Vol. XI
No. 25
Whole No. 285
September 10, 1927
15c per Copy. $6.00 per Year

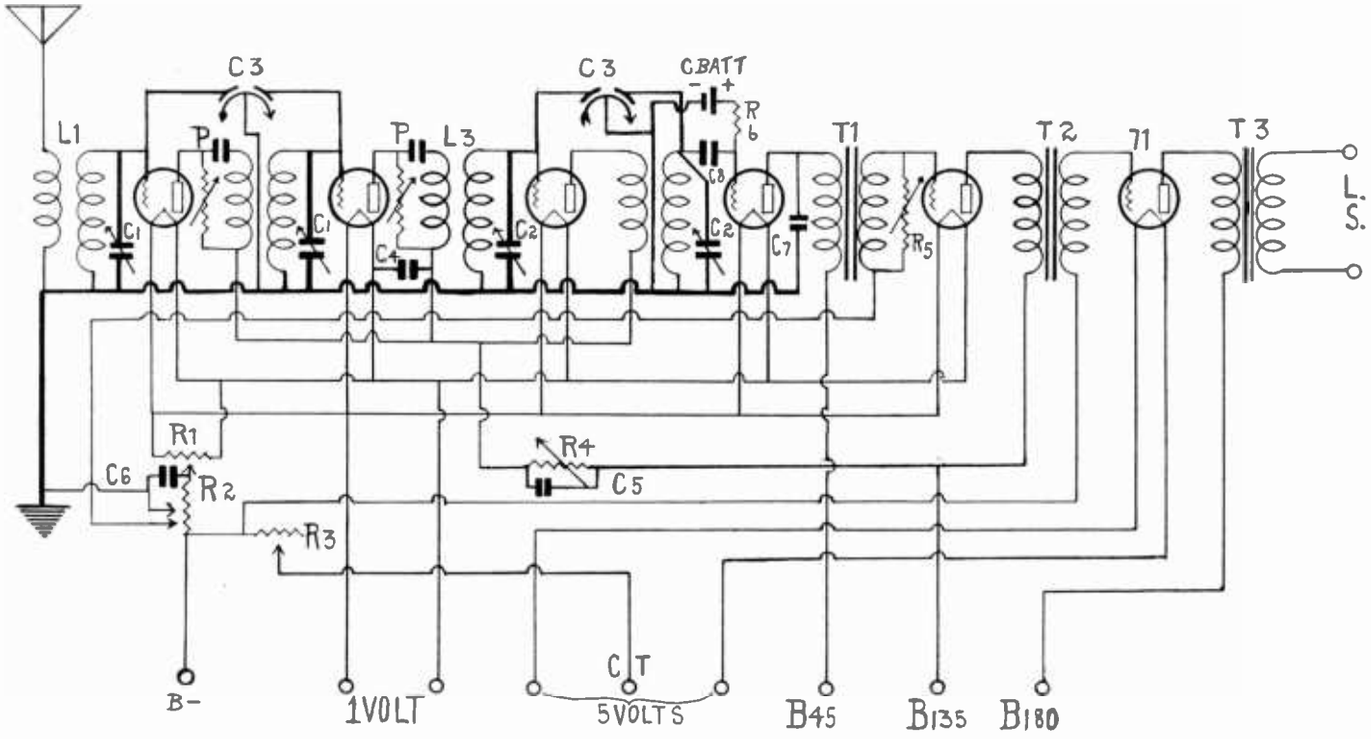
A Weekly Paper Published by Hennessy Radio Publications Corporation from Publication Office, 145 W. 45th Street, New York, N. Y.

Phones: BRYant 0558 and 0559

[Entered as second-class matter, March, 1922, at the post office at New York, N. Y., under Act of March, 1897]

The Puratone AC Set

By Robert Frank Goodwin and Stuart S. Bruno



THE PURATONE, A TRANSFORMER COUPLED CIRCUIT in which all the filaments are heated with alternating current. The first five tubes require one volt across the filaments and the last tube requires five volts. The grid bias is obtained through resistance. L2 and L4 are the second and third RFT.

THE Puratone receiver about to be described, incorporates the latest development of AC tubes. Use of these tubes enabled the writers to design and construct a receiver that works direct from the house current (if AC). The receiver is easily constructed and is inexpensive to build in comparison to other elaborate schemes. Also we will say that the receiver compares quite well with one using regular -01A type tubes with batteries for supply.

The AC 100 tubes are used both in the amplifier and detector stages. If the proper returns are made and the receiver correctly wired, you will notice that there is hardly a trace of hum. The supply unit delivers the necessary current for the filaments of the AC 100, the filament for the power tube and B and C voltages. You will notice that the bias for the RF stages and power tube is furnished by the two variable resistances while the bias for the first audio amplifier is furnished by the eliminator.

Uses Three RF Stages

As the filaments of the tubes are operated by alternating current, and since this is changing its polarity from negative to positive at the rate of 120 times per second, we cannot consider either end of the filament as negative, and since the grid returns of all the amplifier stages must be connected to the negative end of the filament, an average point must be determined. This is accomplished by connecting a 20-ohm potentiometer across the filament voltage terminals and bringing the returns to a midpoint. This we may consider as negative.

The set consists of three stages of radio frequency amplification, tuned detector and two stages of transformer coupled audio amplification.

The first and second stages are tuned with a double tandem condenser. So are the third and detector stages. It is practically impossible to tune four stages of radio frequency amplification with two tandem condensers, and not use some sort of compensation to make up for an unbalanced condition that will exist due to tube, capacity, capacity between wires and parts.

Here we used a two stator, one rotor compensating condenser for each tandem condenser.

It will be noticed that a small shield is used over each coil to help prevent interstage coupling. The idea was conceived by one of the writers some years ago in experimenting with shielding for multi-tube receivers. The method proved to be very useful. The success of this method of shielding greatly depends on the type of coil used. It is necessary to use one that has a small external field.

Phasatrols are used in the first and second stages, in conjunction with a variable resistance in series with all the plate returns of the RF tubes. The Phasatrols are set once and for all while the variable resistance controls the required amount of regeneration for each individual wavelength setting. Using this scheme, we can obtain almost a maximum efficiency from each tube, due to the fact that the regeneration can always be obtained, whereas without regeneration it would be quite difficult to receive distant signals with volume.

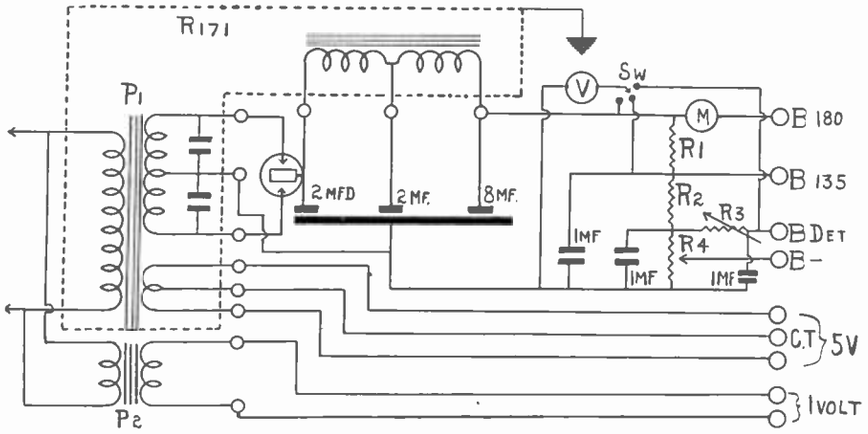
The audio amplifier used is a two-stage transformer coupled type.

A power tube in the second stage is absolutely necessary, due to the great amplification of the signal. A tube such as the —71, capable of handling much power without distorting, must be used. The voltage applied to the plate of this tube should be approximately 180 volts, with an approximate grid potential of minus 40 volts.

Tonatrol Controls Volume

For control of volume a very suitable device is used which is connected directly across the secondary terminals of the first stage audio transformer. It is called a Tonatrol. It is possible to increase the volume from a whisper to a maximum undistorted output, without affecting the quality of reproduction.

There are two main tuning control dials on the front panel and in addition to these there are two compensating condensers, one mounted on each side of the control dials.



CIRCUIT DIAGRAM of the power supply unit for the six-tube AC heated receiver. The low voltage for the one volt tubes is obtained from a separate step-down transformer P2, the primary of which is connected in parallel with the primary of the power transformer P1.

There is also a control for regeneration and one for volume.

The front panel is 7 x 21 inches and the baseboard measures 12 x 20 inches. Since the layout and parts can be clearly seen in the photographs, we will not go into great detail here. The variable resistance (R1) which is used to give a negative return to the tubes is a 20-ohm potentiometer especially designed for the purpose. The two power resistance sshown as R2 and R3 are the Electrad Truvolts. The value of these may be varied by loosening the clamps supporting the unit and making contact with the wire, sliding the clamp back and forth until the proper value is obtained. The bypass condenser shown across the power resistance R2 is most important and must not be left out, otherwise a hum will be noticed.

The wiring is all done with flexible wire. The AC filament leads should be twisted whenever possible and must not run parallel with any grid or plate leads. All AC filament leads coming from the eliminator should be twisted.

Twist These Leads

The leads coming from the Tonatrol and going to the secondary winding of the first stage audio transformer should be twisted together. You must be careful and not bring these leads too near any of the grid leads in the RF portion of the receiver. They should not run parallel to any of the AC leads.

After the mechanical operations on the receiver are completed, connect the different voltage leads from the eliminator to their terminals on the receiver. Now connect the current supply unit to the house lines. Before inserting the tubes, with the 0-200 voltmeter, check the different B voltages and make sure that the power tube is receiving 180 volts, the amplifier about 100 volts and the detector about 40 volts. To do this a Read-Rite meter was used which proved to be accurate and inexpensive.

Insert the tubes in their proper sockets. Again check the B voltages. Then adjust the grid resistance (R 3) until the C voltage to the power tube is about 35 to 40 volts. Turn the arm on the 20-ohm potentiometer to a point where any hum noticed in the speaker is down to a minimum point.

In preparing to balance the receiver, first turn the two Phasatrols entirely to the right and also the variable resistance (R 4) about three-fourths of the way to the right. Then tune in a strong low wave signal. When doing this violent oscillation may be present. It is then necessary to adjust the two Phasatrols to the left, also varying the resistance (R4) also being sure that all circuits are in resonance. This is done by manipulating the two compensator condensers. This operation is not completed until oscillation is solely controlled by the variable resistance. This scheme of balancing should be repeated at several wavelengths until oscillation is solely controlled by the regeneration control (R 4), of course always being sure that the compensating condensers are properly adjusted, thus assuring resonance of all circuits.

Interesting Pointers

If a hum is noticed in the speaker it can generally be traced to the potentiometer being incorrectly set, wrong C bias, or improper plate potentials. Also try shifting tubes from one socket to another excepting the power tube.

It may be noticed that the voltage applied to the detector tube is rather critical. This may be due to tube or existing circuit conditions. For this reason we use a variable resistance so as to obtain the proper voltage for this portion of the circuit.

We also advise trying different tubes in the detector socket, always adjusting the plate voltage. This way, we can pick the best tube for detection. The other tubes must be shifted around until they are in the best position for the maximum of satisfactory results.

Glancing at the diagram you may notice that a 4½-volt battery with its positive end going to the grid leak resistance, is used in the detector portion of the circuit. This is a favorable method of detection when the AC tube is used. Since there is no drain on this battery it will last as long as it would on the shelf. This is about four to six months.

The power supply portion is made up of a separate unit which the aid of two brackets and two 7 x 12-inch panels, one as a front panel to mount the controls and meters and the other for the base to support the transformers, condensers and resistances. As for the layout of these parts, this is clearly shown in the photographs and we doubt it is necessary to go into details describing the position of each part. The transformer and two chokes including the buffer condensers are concealed in one container, thus making the unit quite compact. The condensers are also in one container. It will be noticed that the filament heating transformer is a separate unit.

Carry Up to 25 Watts

The resistances used are all capable of carrying 25 watts. The switch on the front panel is so arranged to make possible the reading of the two different voltages applying to the receiver. As for the milliammeter which is used in the plate circuit of the power tubes, this is used to determine the amount of current drawn by the tube. It should not be over 15 mils. The wiring of this unit is completely shown in Fig. 2.

The two leads coming from the AC filament winding for the AC-100 tubes should be twisted together carefully and brought direct to the posts and also the three leads coming from the filament winding of the power transformer to the filament posts for the power tube should also be braided together. The leads coming from the binding posts (1 volt transformer leads) should be of heavy wire, say about No. 14. This should be carefully twisted together and the leads made short and direct as possible.

LIST OF PARTS
for Receiver

T1, T2—Two Thordarson audio frequency transformers, type R-200.
T3—One Thordarson output transformer, type R-76.
C1, C2—Two De Jur .00035 mfd. double condensers.
C3—Two Daven compensator condensers.
C4 C5—Two Dubilier 160-volt, ½ mfd. by-pass condensers.
C6—One Dubilier 160-volt, 1 mfd. by-pass condenser.
C7—One Dubilier .0005 mfd. by-pass condensers.
C8—One Dubilier .00025 mfd. grid condenser.
L1, 2, 3, 4—Four Benjamin Lekeless radio frequency transformers.
R1—One De Jur 20-ohm potentiometer.
R2—One Centralab 2000-ohm four-point potentiometer.
R3—One Electrad 2500-ohm resistance, type B.
R4—One Centralab heavy duty variable 200,000-ohm resistance.
R5—One Electrad Tonatrol.
R6—One Electrad ¾ megohm grid leak.
P—Two Electrad Phasatrols.
Seven De Jur Buffalo non-microphonic sockets.
Twelve X-L push type binding posts.
One Carter midget jack.
Two Kurz Kasch vernier dials.
Five Armor AC 100 tubes.
One Armor CF 571 tube.
Two rolls Corwico Braidite wire.
One 12 x 20 baseboard.
One Micarta Fabricators 7 x 21-inch Bakelite panel.

LIST OF PARTS
for Power Supply Unit

P1—One Thordarson power compact R-71.
P2—One Thordarson transformer for 1 volt AC tubes.
R1, R2—Two Electrad 1,500-ohm, type B, fixed resistors.
R3—One Electrad Truvolt 50,000-ohm variable resistor, No. 500.
R4—One Electrad Truvolt 2,000-ohm variable resistor, No. 20.
Sw—One Carter 3-point switch.
V—One Readrite 0-200 voltmeter.
M—One Readrite 0-100 milliammeter.
One Aerovox condenser block, type B-H 420.
Two Benjamin No. 8629 brackets.
Nine X-L binding posts.
One Q. R. S. 85 milliampere rectifier tube

Champ Set Builder To Defend His Title

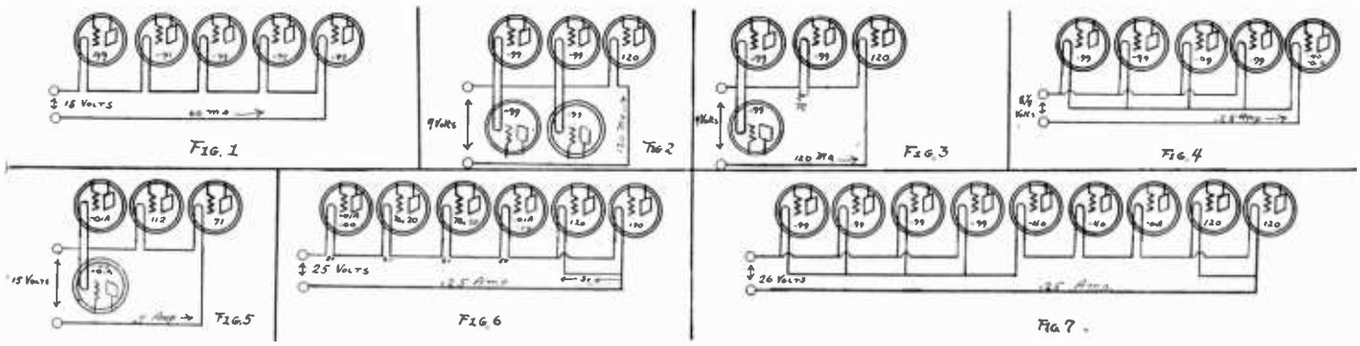
Jack Hartley of Brooklyn, who won the amateur world's championship in constructing radio receivers in the international competitions held last year at the Radio World's Fair and the Chicago Radio Show, and also captured the national championship in the same expositions in 1925, will defend his title at the Fourth Radio World's Fair, in Madison Square Garden, New York City, beginning September 19. Hartley is a student in Technical High School, Brooklyn, and has built many multi-tube Super-Heterodyne receivers in elaborate cabinets.

There will be many amateur contests at this year's show, and the grand prize will be a silver trophy emblematic of the championship.

Series Filaments Follow the Trend

By J. E. Anderson

Contributing Editor; Consulting Engineer; Associate Institute of Radio Engineers



RECEIVERS in which the filaments are connected in series are gaining in popularity. The reason for this is the desire to eliminate all batteries from the receivers.

Since nearly all sources of electrical power contain a ripple in the current it is necessary to employ filter systems to remove this before the current can be used in a radio receiver. The difficulty of filtering heavy currents has led to the series connected filaments so as to keep the current drain of a chain of tubes down to the drain of any one tube. The voltage available is high enough to take care of any practical number of tubes connected in series.

The maximum current required in such a series is that required for the heaviest current-consuming tube in the series, and this need not be so great that it cannot be filtered.

Suppose we wish to use —99 type tubes throughout. Each of these requires a filament voltage of 3 volts and a current of 60 milliamperes. A five-tube receiver then will require a voltage of 15 volts and a current of 60 miliamperes when the filaments of the five tubes are connected in series. A current of 60 milliamperes is not at all difficult to filter. Fig. 1 illustrates the connections of the filaments in such a circuit. If the source of the direct voltage is 15 or more this connection can be used.

Needs Semi-Power Tube

But a five-tube receiver in which all the tubes are 99s is not practical in these days of high power and flawless quality reproduction. At least one semi-power tube should be employed in the circuit. Fig. 2 illustrates the connections of the filaments in this case. The 120 power tube requires a filament voltage of 3 volts and a current of about 120 milliamperes. The most economical way of connecting the five filaments is the series-parallel. The 99 type tubes are connected in pairs in series with the 120 tube. Each of the 99s then gets 60 milliamperes while the power tube gets 120 milliamperes.

The required filament voltage in Fig. 2 is 9 volts and the current is 120 milliamperes. It is much more difficult to filter 120 ma than to filter 60 ma, but still it is practical.

Suppose it is not required to use more than four tubes in the receiver, one of which must be a type 120. Fig. 3 shows how it can be done. One of the tubes in Fig. 2 has simply been replaced with a 50-ohm rheostat, or a 75-ohm rheostat set at 50 ohms. There is no difference in the current that flows in Fig. 2 and in Fig. 3 because the rheostat R admits just the same current as the 99 tube did. The filtering problem is also the same.

Now suppose we want to connect a five-tube receiver, one of which is a —01A and the rest —99s. We connect the filaments of the four —99s in parallel and then we connect the —01A in series with this parallel combination as is shown in Fig. 4. If the terminal voltage is so adjusted that the current in the —01A is the normal .25 amperes, the current in each of the —99s will be 62.5 ma, which is 2.5 ma more than normal. This difference is negligible. The total voltage required is slightly more than 8 volts.

Bigger Filtering Problem

The filtering problem in Fig. 4 is much greater than those in the preceding cases. The filter coils must be wound with much heavier wire, and the cores of the chokes must be much larger. Filters and rectifiers capable of handling the .25 ampere current have been developed and can be obtained in all up-to-date radio stores.

Fig. 5 shows a circuit in which two .5 ampere tubes and two .25 ampere tubes are used. The two .25 ampere filaments are connected in parallel and then connected in series with the two .5 ampere filaments. The total current required for the four tubes is .5 ampere, and the required voltage is 15 volts.

A circuit like Fig. 5 would be practical from the viewpoints of volume and quality, but not so from the viewpoint of filtering. The choke coils required would have to be enormous. Perhaps some day suitable filter coils will be available for a circuit like this. At the present time it is best to avoid such connections and heat the power tubes with alternating current.

In Fig. 6 we have a combination of filaments which may be considered practical. A high amplification can be obtained; the filtering problem is not insuperable; and the volume is satisfactory. The last two tubes are 120s and their filaments are connected in parallel. These tubes can be operated either in parallel or in push-pull as far as the signal is concerned. In either case a high output is possible.

Rest Go In Series

The filaments of the remaining tubes are connected in series with each other and with the two parallel filaments. The total current is .25 ampere, which gives 125 ma to each of the parallel filaments. This is about the right value. The filament terminal voltage depends on the type of tubes used in the series-connected portion. With the tubes indicated the total voltage is 25 volts.

While certain filaments have been designated as Mu20, —01A and —40 it does not mean that these tubes must be used in the order given, or at all. They are merely given to show that the filaments of these tubes may be connected in series. The voltage drop across each has been given. The two 120s should be the power tubes of course.

In Fig. 7 is shown a practical filament connection for a nine tube super-heterodyne receiver. At first there are four —99 filaments connected in parallel, then three .25 ampere filaments are connected in series, and finally two 120 filaments are connected in parallel.

The first of the —99s can be an oscillator tube, the second can be a modulator tube, and the next two can be intermediate frequency amplifier tubes. The fifth filament is that of a —40 high mu tube and that can be for the second detector. Resistance coupling following is assumed. The sixth filament is also that of a —40 tube. Again resistance coupling is assumed to follow the tube.

Another Problem

Now suppose that the two 120s are working in push-pull relation. There must be a transformer between the grids of these tubes and the plate of the preceding. Hence the seventh tube should be of the —01A type rather than a high mu tube.

In Fig. 7 then we have the possible filament structure of a nine tube super-heterodyne requiring a filament current of about .25 ampere and a voltage of 26 volts The filtering problem in this circuit would be no greater than if a single .25 ampere tube were used in the circuit. The power required could all be obtained from a BA Raytheon rectifier delivering slightly more than 250 milliamperes. The output voltage would have to be 26 for the filaments, 22½ or more for the grids of the power tubes, and 135 volts or more for the plates. A voltage at the filter output of about 200 volts would be enough.

Around the filament structure shown in Fig. 7 it is not only possible to build a super-heterodyne of low current consumption but also of high sensitivity, satisfactory selectivity and excellent quality. It would be inexpensive to operate and would need but little attention.

WNYC BACK ON 526

Washington.

WNYC, the Municipal broadcasting station of New York City, received notice from the Federal Radio Commission to resume operation on 560 kilocycles (526 meters), instead of 570 (529 meters). This change was made to effect an adjustment between WOAC, the Connecticut Agricultural College station, and WTIC, the Travelers Insurance Company station, both of which will share time on 560 kc.

The 1928 Victoreen Universal

By Capt. Peter V. O'Rourke

Contributing Editor

[The first instalment of this article on how to build the eight-tube 1928 Victoreen Universal was published last week, issue of September 3. The theory of the circuit and the operation of the new Victoreen audio were fully discussed. Herewith is Part II, presenting ideas that Victoreen fans will seize upon eagerly.]

PART II

THE Victoreen Super-Heterodyne has been assembled in many different ways, and it seems that most of them give excellent results. Any fully experienced fan who builds the receiver can therefore exercise his own judgment in the placement of parts, provided that his judgment does not deviate from practice dictated by scientific principles.

As an aid to simplicity of assembly and of wiring the "company front" arrangement of the parts is to be recommended. In this method all the Victoreen intermediate transformers and the Victoreen audio transformers are placed in a row at the rear of the baseboard. The eight Eby sockets are then placed in a row in front of the transformers, each tube being as near the transformers with which it is connected as is practicable. With this placement it is possible to make all the grid leads to the IF and AF transformers very short—less than an inch in some cases—and the plate leads not very much longer.

In front of the Eby sockets all the controls in the set are drawn up in a line. Most of the controls are, of course, mounted on the panel, but they are nevertheless in a line. On the panel are mounted the two tuning condensers with the single Mar-Co vernier dial, the Victoreen oscillation control potentiometer, the Yaxley filament switch, the two-ohm master rheostat, the 6-ohm intermediate rheostat, the Jewell meter and the Yaxley antenna-loop switch. The rheostats for the audio tubes and the second detector are placed on a sub-panel on the baseboard near the right end of the set, instead of on the Lignole front panel. They are purposely left inside to discourage their use as volume controls.

Condenser Placement

The various fixed condensers used in the circuit are drawn up in the same line as the Eby sockets. Thus the first grid condenser is at the left of the first detector, or first tube in the circuit. The second grid condenser is placed similarly with respect to the second detector. The by-pass condenser in the plate circuit of the detector is placed between the detector socket and that of the first audio tube. The large by-pass condenser associated with the oscillator is seen standing between the second and the third tubes.

That simplicity of wiring is gained by this arrangement as well as shortness of leads is evident. The wiring is even simpler in the circuit than the indicated wiring is in the circuit diagram. Bus wires for plus B, plus A, minus A, minus C are run straight and taps are run from them to the various points where the respective voltages are required. All contact points to the bus bars are in the open so that they are easily accessible with a soldering iron. For permanent connections of low resistance all joints should be well soldered, and this work is greatly simplified by the use of a good, non-corrosive solder, such as the Kester rosin-core solder.

Even the Eby binding posts have been drawn up in a row to complete the general scheme of the layout. The loop and the antenna-ground posts are on a separate strip at the extreme left end of the set, next to the Victoreen RF transformer.

Strip Is Raised

The binding posts for A, B and C and the Yaxley pup output jacks are lined up on another strip and the right end of the set just back of the audio transformer. Note that this strip has been raised some distance above the baseboard by means of brass rods. This has been done to make the wiring underneath accessible and to make the posts themselves accessible for making connections inside the set. The advantage of this can readily be appreciated by those who have tried to change the connections after the set has been put into the cabinet.

In any circuit it is desirable to make the physical succession of parts the same as the electrical to prevent any reflexing of leads and of parts. This requirement must often be sacrificed in the interest of symmetry of the set. Neither has been sacrificed in the Victoreen super-heterodyne, and all this has been accomplished by the system of unified control employed. The panel has been laid out symmetrically and still both the tuning condensers are at the extreme left end of the cabinet very close to the coils with which they are connected.

Rack Serves as Connection

Connection is made with the centrally located Mar-Co dial and the two tuning condensers by means of a rack. The details of construction of this tuning unit can be seen on Fig. 3. This ingenious device for placing the control in the center and the condensers at the left where they are desired greatly helps to shorten high frequency and high potential leads and also to make the set efficient.

ANN MACK, soprano, heard recently in an Atwater-Kent hour.

In any circuit of high sensitivity like the Victoreen trouble may be experienced occasionally. This does not call for a condemnation of the receiver. Some of the troubles are inherent in the Super-Heterodyne system, some are due to faulty operation. With a little experience the owner of a circuit like this can avoid both the troubles which are inherent in the system and those which are due to faulty operation.

If two stations come in at the same time accompanied by an annoying squeal the trouble is inherent in the system. It is due to the beating of the local oscillator with two different stations so spaced in the frequency spectrum that the frequencies produced can pass through the intermediate filter. The operator has several possible remedies at hand. He can turn to the second point on the oscillator dial which gives the desired station.

Operator Can Choose

There may be interference there also if the receiver is located in an especially bad place. In that event the interference will be more severe on one setting than on the other. Choose the better one. If the interference is not severe on this one it is sometimes possible to get rid of the squeal by detuning the oscillator a little without decreasing the desired station materially.

The best remedy in the case of this type of interference is to tune the radio frequency stage very sharply. This can be aided with a little regeneration. With loop pick-up this type of trouble is less annoying than with antenna pick-up. If it does occur it can often be thrown out by a slight turn of the loop.

If the radio frequency tube or first detector oscillates, nothing can be received amid the great variety of squeals which will result. There is nothing to do but to stop the undesired oscillations. The Victoreen described here will not oscillate in the first detector and therefore this trouble will not occur.

A possible source of trouble is oscillation in the intermediate frequency amplifier. When oscillation occurs here it is manifest by whistling at about a million places on the oscillator dial. Squeals even seem to overlap at times. Nothing can be received clearly through this racket. There are two controls especially provided against this trouble and there is no need of having it spoil the signals.

Squealless Circumstance

Sometimes the signals come through without any audible squeal but they seem distorted or mushy. This is caused either by oscillation or by other overloading. The oscillation may occur at a frequency which cannot be heard and which does not beat with any other frequency to produce audible notes.

The controls which stop oscillation of an audible frequency will also control the inaudible. If this trouble is due to overloading the only thing to do is to cut down the volume or to increase the power of the tubes used. This trouble should not occur if proper grid, plate and filament voltages are used. To stop this trouble the volume should never be cut down by reducing the filament current in any audio tube. The mushiness will simply be increased if an attempt is made to decrease it in this manner.

[Part III will be published next week.]

Radio Aboard "Old Glory"

By Bert E. Smith

THE installation of the radio set in the Fokker monoplane, "Old Glory," made famous by Lloyd Bertaud and James D. W. Hill is one of the finest equipments which has been used on Trans-Atlantic Airplanes.

The outfit, which was installed by The Allen D. Cardwell Manufacturing Corporation of Brooklyn, well-known among radio fans as introducers of "low loss" radio construction, consists of four major units: the transmitter proper, the generator which supplies power for the transmitter, the receiver and the control box.

A special compartment has been built into the fuselage of the plane, just aft of the chart room, in which all of the radio equipment except the generator will be placed, where the navigator can simply turn on his chair from the chart table and be directly facing the radio set. The receiver is mounted on exerciser cord so that the vibration of the plane will not be communicated to the receiver. The transmitter is mounted facing the operator just underneath the receiver. On a special partition convenient to his right hand, is the antenna reel and the control box on top of which the key is placed.

R. C. A. Renders Assistance

The transmitter utilizes two 50 watt transmitting tubes, which have been loaned by the Radio Corp. of America for the flight, a push-pull circuit which allows the use of unrectified alternating current for power, each tube working on one polarity of the alternating current cycle and rectifying its own current at the same time it transforms it to radio frequency. This type of construction eliminates the necessity for expensive and intricate rectifying apparatus, which in addition to the extra complications introduced, would add a great deal to the weight of the unit.

Two transformers are a part of the transmitter. one of which reduces the 110-volt, 900 cycle alternating current supplied by the generator to 11 volts for the filament of the transmitting tubes, and the other of which steps the generator current up to about a thousand volts where it is used for the plate supply. The oscillator inductor is wound with Litzendraht wire, in order that the greatest possible efficiency may be obtained, and is provided with a single rotating section, the adjustment of which will vary the emitted wave of the transmitter from six hundred to eight hundred meters.

Wavemeters on Panel

Two small wave meters are mounted on the panel, each equipped with a flashlight bulb. One of these is permanently adjusted in the factory to six hundred and ten meters, and the other to eight hundred, and in flight all that is necessary to change from one wave length to the other will be for the operator to rotate the dial until the flash light lamp marked with the desired wavelength lights to its brightest point and then proceed with his message. He will be enabled to read his own transmission by watching the blinking of the light, which will only be illuminated when the key is pressed and the transmitter is sending out a signal.

The two meters on the transmitter are built with carefully matched magnets, and are then placed in the transmitter in such a position that the influence of the magnets on external instruments is balanced out. This is to prevent them from throwing the compasses out of adjustment.

The frame of the transmitter is made out of aluminum, and is so constructed that the maximum strength is obtained with only a few ounces of metal, and the panel and other Bakelite portions are drilled away at points where nothing is attached, in order that the greatest possible saving of weight may be accomplished.

Generator at the Side

The generator is mounted at the side of the fuselage where it is directly in the slip stream of the propeller, and is streamlined so that it offers practically no resistance to the passage of air. A rather interesting feature is the Des Laurier head in which the propeller vane is mounted. This contains a unique mechanism which so adjusts the pitch of the propeller vane that, regardless of the speed of the ship, of the changing load which is imposed on the generator when the control switch is moved or the key is pressed, the generator will continue to rotate at the same rate, and will prevent the well known phenomena of a falling tone in the signals. This automatic adjustment of the generator protects the transmitter from any possibility of an accident burn-out due to too rapid generation of current.

The generator is connected with the transmitter by a cable provided with such insulation that it will continue to operate even though continually immersed in salt water.

The receiver is a four-tube job with a circuit almost identical to that of the Roberts receiver, embodying one stage of very efficent radio frequency amplification, a regenerative detector, and two stages of low frequency amplification. It utilizes four standard 201 A tubes of the types familiar to every radio fan, and will cover a wavelength range of five hundred and fifty to thirteen hundred meters.

Total Shielding

The receiver is completely shielded, the B batteries being contained inside the aluminum case and the leads to the storage A battery are enclosed in Belden Braid which is grounded. This will nullify the effect of the plan's own ignition system on the receiver and simplify the problem of operation, from the standpoint of interference, considerably.

The control box contains a rotary switch with 10 poles and four positions, and accomplishes a variety of operations when the knob is rotated from "transmit" to "automatic" to 'off" or to "receive." When it is on "transmit" the receiver is entirely grounded, the filaments are turned off, the generator is connected to the transmitter, and the antenna is connected with the transmitter.

When it is on "automatic" the same connections are made, except that the key is discontinued and an automatic device. which is described in a later paragraph, is connected in its place. In the "off" position everything is grounded and the generator is idling. In the "receive" position the receiving tubes are lighted and the antenna is connected to the receiver, while the transmitter is still entirely disconnected.

Parts Flame Proof

The automatic device just referred to is a tiny wind driven fan, which is geared to a comutator with the segments so connected that the transmitter continually send out WRHP, the call letters of the plane.

The antenna reel contains approximately 600 feet of special antenna wire to the end of which are attached small brass and lead fish which keep the antenna extended to its full length. Approximately two hundred feet of antenna will be used, and the additional wire on the reel will make it possible, if one length is broken off by the plane coming too close to the waves, or other obstructions when over the land, to attach another fish to the broken end of the wire, reel it out and go back on the air again. It will be recollected that on the recent San Francisco-Hawaii flight the plane approached so close to the surface of the water that the antenna dragged, and was broken off, and thereafter the aviators were unable to secure communication. If they had been equipped with sufficient antenna wire this trouble would have been averted, and enough additional wire is carried in the "Old Glory" equipment to allow operation to continue even though the antenna be lost twice.

All parts of the whole outfit at which any sparking may occur are so arranged that they are absolutely flame-proof, and no possible ignition of gasoline fumes can occur from electric sparks caused by the radio in case of an accident.

The current consumption of the transmitter is approximately 85 milliamperes and during tests the radiation meter indicated that about three amperes of radio frequency current were being dissipated by the antenna. The reliable range of the transmitter as guaranteed by the Cardwell Corporation, is 150 miles, but with a very similar outfit the Byrd Expedition messages were received from a distance of over 11,500 miles.

Useful Range

The useful range of the transmitter is greatly increased by the fact that 900 cycle alternating current is used for the plate supply in place of the usual direct current as the tone of the transmitter signal, instead of being a whistle of varying pitch. is a steady sound about like the musical note A two octaves up from middle C played on the violin. This tone will be readily recognized when heard.

Unfortunately, however, this freedom from interference which applies to the transmitter does not apply to the receiver, for while transmission is subject to much less difficulties from the airplane reception is subject to many more. The throbbing of the big Jupiter motor practically deafens the pilots. Crackles and crashes caused by the plane's own ignition system keep the air apparently full of "static" all the time.

(Photographs on Page 13)

Interference By Ships Stirs Federal Experts

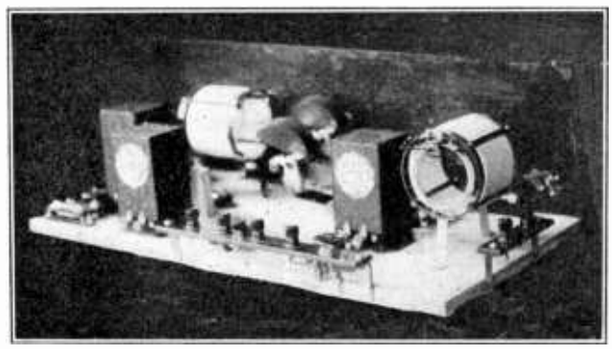
Washington.

The American delegation to the International Radio-telegraphic Convention, which is to be held in Washington in October, will take steps with a view to coming to an agreement that will cut out interference to broadcast listeners caused by commercial land and ship stations.

Spark sets, which cause most of the interference, are still used by a great many of these stations. Since, however, this type of equipment is also employed by foreign ships, the Federal Radio Commission have to date been powerless to completely eliminate the interference without international agreement.

Coil Placements Are Vital

By A. Irving Witz



AN adjustable primary facilitates balancing of the two simultaneously tuned circuits in the One Dial Witz.

[*Here is the thira and last instalment of the constructional details of the One Dial Witz. Next week the author will describe an original way of simplifying single control sets in respect to the grid return, where a common-rotor condenser is used.*]

PART III

BEFORE the new radio regulations went into effect one required three accurately tuned circuits in a non-regenerator receiver to tune out the interference. Now this is no longer strictly necessary because the broadcasters are readjusted and are compelled to stay on their frequencies or to stay off the air. Furthermore, the powers used by the stations have been judiciously chosen so as to cause a minimum of interference. The result is that now two tuned circuits will give adequate selectivity. The reduction in selectivity has considerably improved the quality obtainable.

In the One Dial Witz two tuned circuits are used and they are synchronized with a double Continental die cast condenser. While extreme accuracy in synchronization is not necessary for selectivity, it is desirable for gaining volume Very close synchronization can be maintained in the two tuned circuits with the condenser used in this receiver because both sections of the double condenser have been made in the same mould and they are therefore identical. It is only necessary to adjust once for distributed capacity, to adjust the circuit over the whole range.

Antenna Capacity Effect

One thing that militates against permanency of adjustment of a receiver using common control is the effect of the capacity of the antenna on the secondaries, But this is easily remedied by making the coupling between the antenna and the first tuning coil adjustable. If the coupling is loose the antenna constants have very little effect on the tuned circuit. The apparent inductance in the coil can be changed by moving the primary coil, as the apparent inductance is changed the capacity required to tune the coil to a given frequency is changed. Hence if there is a slight divergence between the two tuned circuits they can be brought together by adjustment coupling. The adjustment is not molested after the proper setting is obtained.

As will be observed from the photograph, the two radio frequency coils are placed at right angles and they are also placed far apart. Both of these details are important from the view of minimizing the stray coupling between the coils. The great distance between the coils makes the capacity coupling negligible and the right angled placement makes the inductive coupling zero. Since the strays coupling between the coils is extremely small there is little or no self-regeneration in the radio amplifier. This makes for stability in operation, freedom from oscillation, as well as good quality.

Questions of Coupling

Some fans prefer to have the utmost in quality even if they have to sacrifice a little in selectivity to get. These fans use small inductance coils wound with fine wire with fixed coupling between primary and secondary. A One Dial Witz circuit in which small coils are used will prove practical, too. The only difference in this is the size of the tuning coils. There is much more space left when the small coils are used. This fact makes the effective distance between the two tuning coils much greater, which in turn reduces both the electrostatic and the electromagnetic coupling. Which of the two types of coil to choose would depend on the interference in any particular locality, and on the demand for quality at all costs.

The method of placing the Ford Mica Co. double impedance couplers in the One Dial Witz was shown August 27. In each case the coil is placed so as to shorten the leads as much as practicable and also to keep the iron shields of the impedances a few inches away from the tuning coils. One of the features of the circuit is the ample room which has been allowed for the parts. These wide open spaces is not the result of using a very large box, because only a moderate one is used, but of the economical use of space which the parts used admit.

[*Get the August 27 and September 3 issues, containing Parts I and II of the article on how to build the One-Dial Witz.*]

Five Set Makers Form Big Merger

The United States Electric Corporation has been formed as a merger of the Apex Electric Manufacturing Co. and the Sentinel Manufacturing Co., both of Chicago; the Indiana Electric Manufacturing Company of Marion, Indiana; Slagle Radio Co. of Fort Wayne, Ind.; and the Workrite Manufacturing Co. of Cleveland, O.

The merger is accomplished by incorporation under the laws of Delaware, with 30,000 shares no par value common stock. The participation in the new company is based on a rigid appraisal and audit of each of the five individual companies, no allowances of any kind being made for good will, promotion or any intangible assets. It has further been accomplished without any public offering of stock. The aggregate assets of the corporation will be in excess of $1,000,000.

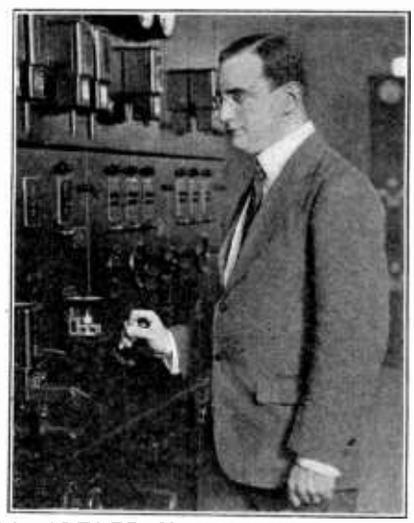
The new corporation is licensed under all radio receiving set patents of the Radio Corporation of America (except Super-Heterodyne patents), as well as the patents of the American Telephone & Telegraph, Westinghouse Electric & Manufacturing Company, General Electric Company, Hazeltine Corporation, Latour Corporation and Technidyne Corporation.

The merger contemplates the immediate establishment of a central engineering laboratory, into which will be put the combined engineering personnel of the individual companies. This central laboratory, along with the main offices of the corporation, will be located at Chicago, Ill.

The officers are: Allen G. Messick, president; Carl B. Boyd, first vice president; P. K. Romey, secretary; John Beatty, treasurer.

Directors: A. E. Case, V. H. Meyer, L. S. Slagle, these three being operating vice presidents.

NOTED ENGINEER



DR. ALFRED N. GOLDSMITH, chairman of the National Broadcasting Company's board of consulting engineers, throwing the switch which put the company's new 50 kw transmitter at Belmore, Long Island, N. Y., on the air for its first tests. The station will replace WEAF'S 5 kw transmitter in N. Y. City.

Up, Up, Goes the Volume

Hence Bigger Power Tubes are Inevitable

By Webster Donegan

The volume that is required of a set seems to be determined more by the power-handling capacity of the last tube than by all other requirements. At one time a loudspeaker was connected to the output of a —99 tube and it seemed to all concerned that very great volume was obtained from it. Everything that came out of the speaker could be heard plainly, though not always without distortion. The demand then was not for more volume but for greater freedom from distortion. The cry went around that the distortion in the little tube was excessive and this could be remedied by the use of a 120 tube and higher plate voltages.

An 120 tube was put in and the circuit adjusted to fit the new requirements. Oh, what an improvement in the quality! Not a word was said about the volume. But that improvement in quality was very largely imaginary, while the increase in volume was real. With the new tube the volume was boosted until the per cent. distortion in the signal was the same as it had been in the small tube. After the first ten minutes with the larger tube the listeners did not realize that the volume had been more than doubled, but they just knew that the quality had been greatly improved.

Considerable Improvement

There was a parallel case with respect to the —01A tube and the 112. At a certain stage in the development it was realized that the quality obtainable from the -01A was not good enough. The volume was all that could be desired. Could not the set be heard half a mile way, loud and clear? While the set was loud and clear there was too much second harmonic in the output! That could only be remedied by putting a larger tube in the set and boosting the voltages. In due time that was done. A 112 tube was put in and the plate voltage was raised from 90 to 157 volts.

Everybody agreed that the second harmonic was now entirely absent, and there was a considerable improvement in the quality. But as to an increase in the volume, that was not apparent. After a few minutes of operation with the new tube no one could tell that there had been the slightest change in the intensity. But there had been. The volume was now approximately twice as great as it was before, and the percent harmonic was expressible in the same figures as previously. The volume had simply been boosted to the limit of the new tube. They just thought the quality had been improved, and they could not tell that the volume had been increased.

Loud Enough, But—

Again the cry arose in the land that there was too much harmonic in the output of the 112 and the 120 tubes. The volume was loud enough but the quality was not as good as could be desired. From this cry came the use of the —71 and the —10 tubes with frightfully high voltages on the plates—even up to 180 and 500 volts. When these were installed there was a general exclamation of approval of the excellent quality and the remarkable absence of second harmonic. Not one of the thousands of fans who installed —71 and —10 tubes with high voltages ever again heard a second harmonic peep. The increase in the volume was hardly noticed although it had been tripled and quadrupled in the circuit ahead of the power tube, which in most cases had been pushed to the limit so that the increase in volume had been great but the improvement in quality small.

Why is not the increase in volume noticed even though the increase may be a thousand percent and more? The human ear has no memory for intensity. The limits of perfect audibility are enormously far apart as regards intensity. We do not say that a sound is weak until we have difficulty hearing it. We do not say that it is loud until it becomes painful to listen to. The ear accommodates to a given intensity and calls it audible and lets it go at that.

The ear is much keener on detecting distortion after it has once heard the distortion. Therefore when the power capacity of a set is increased by enlarging the tube and raising the voltages, the volume is turned up until there is noticeable distortion on some of the notes. The ultimate volume usually is determined by resonance peaks. These will be chopped off first by the limitations of the tube. The volume is set just below the point where this chopping off occurs. The volume at that point may be so great as to shake the entire house, so that it penetrates every nook of the building; and yet it does not seem very loud next to the speaker. It is not loud enough to cause a pain in the ear.

The next step will be the use of 50-watt tubes with 1,000 to 2,000 volts on the plates. We will have to use them to get away from overloading. Now the question arises, will these tubes give undistorted output until the ear refuses to accept the increased volume, that is, until the output will be a pain in the ear rather than a sound? We shall see in the near future.

Voltage Divider Gets O.K. as Volume Control

By Gerald Pierce Wander

There is a difference of opinion as to which is the better volume control, a variable resistance across the secondary of a transformer or a high resistance potentiometer across the winding. Some say that it makes no difference which method is used.

When a high resistance potentiometer is used the load resistance on the transformer is the same for all volume adjustments. Consequently the impedance of the primary of the transformer does not vary with volume adjustments. It varies only with frequency. This is desirable.

When a variable resistance is used across the secondary the load on the transformer depends on the volume adjustment. When the maximum volume is desired the transformer is virtually working on open secondary.

When the resistance is reduced to lower the volume, the current in the secondary is high. The transformer virtually works into a short circuit. When the secondary is short-circuited the impedance of the primary is low, that is, a large current flows for a given primary voltage.

When the impedance of the primary is low the load on the preceding tube is also low, and when that is the case there is a great deal of harmonic distortion introduced.

Wrong Two Ways

Therefore, when the rheostat method is used distortion is introduced by inadequate loading of the detector on low volumes, and distortion of the same kind is introduced by overloading the amplifier tubes on high volume. Hence when the variable resistance method of volume control is used you cannot minimize distortion by reducing the volume. You invite distortion at every turn.

In resistance and impedance coupled circuits the variable resistance method is ruled out for another important reason. Suppose we consider a resistance coupled circuit in which moderately large stopping condensers are used.

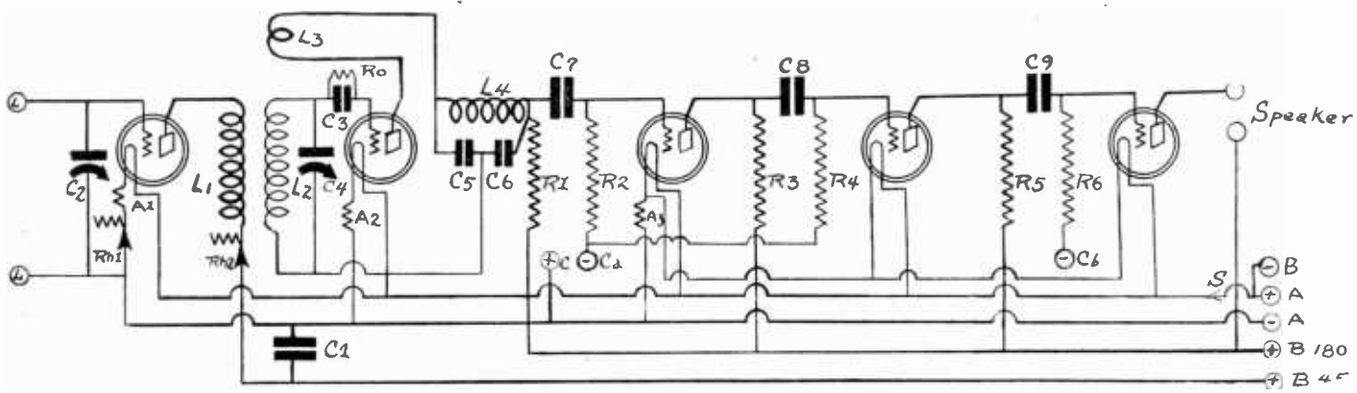
In the load circuit of the tube preceding we have the parallel combination of the plate resistor and the condenser-leak.

Part of the AC component of the plate current passes through the condenser and leak. The input voltage to the second tube is the voltage drop in the grid leak resistance. The smaller this resistance is, the lower will be the voltage impressed on the tube and consequently the lower will be the amplification.

Desirable Method

That of course is the desirable part of the volume control—reduction in the amplification. But that is not the only effect. There is also a voltage drop in the condenser which reduces the amplification. The smaller the condenser, the lower the frequency, and the lower the value of the grid leak resistance, the lower will be the amplification. The amplification depends not only on the resistance in the leak but also on the frequency. When the resistance is low the lower audio frequencies are cut off—they are not amplified. That is, when an attempt is made to reduce the volume by reducing the value of the resistance in the grid circuit, the volume of the lower frequencies depresses more than that of the higher. In other words, this method of volume control introduces distortion. It nullifies the very thing that the resistance coupled amplifier is supposed to accomplish.

Therefore the variable resistance method of volume control not only introduces harmonic distortion on the lower volumes but it cuts down the volume of the low notes more than on the high.



THE circuit diagram of the high quality receiver described by Tim Turkey. Even amplification from the lowest audible to the highest essential frequency is a feature of this receiver. Additional directions for building and operating the receiver are given in the present issue. Freedom from motorboating was emphasized in designing the set.

Preservation of Quality in a Well-Designed Set

By Tim Turkey

The fan who has built a resistance coupled amplifier using high mu and power tubes, large leakless stopping condensers, high grid and plate resistors, high plate voltage and correct grid bias and yet not experienced motorboating in any of its varieties has experienced the quality which the protagonists of the resistance coupling have become enthusiastic over. They have also experienced the type of reception which is possible with the receiver described by me in the Aug. 27 issue of RADIO WORLD.

Herewith are additional data on the operation of the receiver and on the correction trouble which might develop in some cases.

For reception of signals from very strong local stations the current in the first tube can be cut off entirely and still the volume at times is too great. The coupling is mainly through the inter-electrode capacities of the tube.

The second volume control is the variable high resistance Rh2 in the plate circuit of the first tube. If cutting off the filament current in the first tube does not reduce the volume enough, the resistance Rh2 can be used. This is especially valuable in stopping radio frequency oscillations. Note that the by-pass condenser C1 is connected below Rh2. Thus the radio frequency current is forced through the resistance Rh2. This method of connection is much more effective than connecting the by-pass condenser above the resistance, as is usually done. Thus the oscillations are not controlled so much by reducing the plate voltage on the tube as by actual damping.

Tickler Effects Volume

The third volume control is the tickler. This is mainly for building up the volume on weak stations rather than for cutting down the volume on strong stations. However, if there is a strong station close to the receiver it is at times necessary to set the tickler at maximum in reverse and still employ both the other controls.

The filament current in the first tube has already been disposed of. That in the detector is controlled by a No. 1A Amperite. The filament currents in the last three tubes may be controlled by a common ballast resistor A3, which should be designed to drop one volt when one ampere flows through it (1 ampere Amperite). However, when the Mu 20 and Mu 6 tubes are employed A3 should be short-circuited, or the ballast should be replaced with a metal slug.

A Carter midget switch S is placed in the negative lead to the filament battery.

There are seven Eby binding posts indicated on the circuit diagram. There is one more in the set, which is used in the event that an antenna is desired. There are also three small binding posts required for the grid battery. The battery binding posts have been made different to aid in distinguishing one from the other.

Condenser Stops Oscillation

It is highly probable that this circuit will oscillate at a high frequency if the plates are served either by a dry cell battery or by a B eliminator. But this squeal can be stopped with a condenser across the battery or eliminator. About 4 microfarads should be connected across the battery. If an eliminator is used there is already a condenser and none other is necessary.

Should the receiver develop a flutter at a low frequency, say of the order of one cycle per second or slower, the trouble can be remedied in one of several ways. First, it can be stopped by either increasing or decreasing the grid leak resistances. It is best to try larger values first. Second, it can be stopped by increasing the stopping condensers. This method cannot very well be applied when the condensers are built in. It can also be stopped by decreasing the inductance and the resistance of the eliminator chokes.

Question of Phases

The cause of the trouble is regeneration in the audio amplifier by feedback through the impedance of the eliminator.

While the circuit is stable at low audible frequencies, the phase changes introduced by the stopping condensers upsets the stability at very low frequencies. Hence the possible flutter. The flutter should not develop if the circuit is fed with dry cell or other batteries, but will often occur when an eliminator is used.

The possibility of a flutter in the output should not deter anyone who desires to hear low notes from building a receiver like this. The trouble can always be stopped without sacrificing the low notes.

And the means is very simple in most cases.

Broadcasting Elevated By Sponsored Programs

This development from the broadcasting of phonograph records to world famous opera and concert stars is said to have done more in recent years for the widespread popularity of radio than any other factor. Speaking of the Atwater Kent Concerts M. H. Aylesworth, president of the National Broadcasting Company, said:

"To a great extent these features and a few others of the same caliber have been responsible for raising the entire level of broadcast entertainment. They have led the listening public to expect great things from radio, and gradually other manufacturers and the broadcasting stations themselves have responded to this demand by improving the tone of their programs."

This costly series, when inaugurated by Mr. Kent, was considered a novel experiment of doubtful expediency. Artists who had previously demurred at the thought of radio broadcasting were not sure of the effect upon their own reputations, prestige and concert careers.

Mr. Kent, however, was convinced that the public wanted music of this type when he scheduled thirty consecutive Sunday evening concerts. The experiment starting with only eight stations was a great success. It resulted in a greater series last year through an arrangement which Mr. Kent made with the Metropolitan Opera Company which, for the first time, made outstanding artists of this internationally famous organization available to the radio public. And in response to the popular demand the number of stations broadcasting the series gradually increased until a network of nineteen stations was required.

New Station to Send On 54-Meter Wave

A new station which will be international in scope will be ready for regular operation soon, it was announced by John P. Coulon, newly appointed general manager of station WCGU, the Sea Gate Station.

Authority has been granted to use the call 2LBH and a license has also been granted by the Federal Radio Commission, for a short wave transmitter which will operate on 5,550 Kilocycles or 54 meters.

Mystery Clears Up Before the Distortion

By Creatore Bellini

One recent evening there was a peculiar and unpleasant buzzing noise in my loudspeaker. At times it was crashing like static. At other times it sounded like the buzzing of an imprisoned fly. Again it sounded like the bumble of a bee. It was exasperating always.

It sounded like overloading of tubes. Yet there was no overloading, because the receiver had been stopped down so that the output was not one-fifth of the maximum obtainable without noticeable distortion under ordinary circumstances.

The first thing that came under suspicion was the loudspeaker. It was subjected to a thorough scrutiny. Not a flaw could be found, at least not one which could be held responsible for the distorted output.

Well, it might be the batteries which are at fault. Perhaps the A battery is exhausted. That measured 6.1 volts and the net voltage across the tube filament terminals was a shade over 5 volts. The trouble was not there. Can it be the plate battery? This was composed of a 45 volt dry cell battery and the 110 volts of the DC lighting line in addition to the 6 volts of the A battery. The dry battery measured 44 volts on full load and the DC line measured 117 volts. There was nothing wrong with the plate voltage, neither at the source nor at the plates.

Tubes Measure Up

But finding that out did not abate the distortion. Perhaps the grid battery has quit? Part of it had been in use for over a year. It was about time that that should fail. This part measured 4.1 volts instead of 4.5 volts. The other portion measured 18, as it should. Hence the grid batteries were not to blame for the distortion.

Could it be that one or more of the tubes had played out All the tubes in the set were relatively new and there was no good reason why any of them should be weak. Neither were they bad. The emission was as good as the day they were put in the set, and the receiver had given good results from the beginning. What had gone wrong? The case was becoming nerve-racking.

Had the coupling and grid leak resistors failed? They are metalized and had never been abused. The circumstantial evidence did not point to them. Nevertheless they were tested and found all right.

The circuit was not motorboating nor oscillating at radio frequency. These points were carefully tested. Hence the distortion was not due to oscillation in the set.

Speaker Suspected

Neither was the set near oscillation at either frequency. Hence there were no amplification peaks caused by regeneration through the impedance of the filter. The set was being operated so far below its upper limit that even comparatively high amplification peaks woull not have been high enough to cause blasting.

At this juncture suspicion was again directed at the loudspeaker. So strongly did I now suspect it that I was on the verge of poking an anger-driven fist through it. But a second examination of the speaker failed to reveal any serious defects.

Ah, I had forgotten the stopping condensers in the amplifier! When they leak reception is about what I was experiencing at the time. Could the condensers have broken down? That was a disquieting thought, because if they had, the set would have had to be rebuilt for the most part. A preliminary examination of the point was favorable to the condensers, yet it did not remove all suspicion. I resolved to test them more thoroughly at the first opportunity.

Meanwhile I replaced the speaker with another and at the same time I tuned in another station. The second speaker was a 540AW cone and the new station was WEAF, my old stand-by. Then I forgot all about distortion for the evening. I recalled when the program was over than there had not been appreciable distortion.

Still a Problem

The next day I had this problem to solve: Why was the reception bad the first part of the evening and all right the latter part? Why did it take a couple of hours for the set to settle down and work right? Was the speaker at fault after all, and did the distortion cease because the new speaker was hooked to the set? I was disposed to give the first speaker a clean bill because I had made it myself from the ground up, and very painstakingly at that. Therefore I was resolved to find out why the distortion had disappeared during the evening.

I put this problem up to a radio fan friend the next day. Said I:

"I had a very peculiar experience with my set last night. During the first two hours of reception the signals were very badly distorted. Then they cleared up and the latter part of the evening they were clear and undistorted."

"What station were you tuned in on when the signals were distorted," inquired my friend.

"WJZ," said I.

"Same Here"

"Well, I had the same experience with reception from WJZ," my friend encouraged me. "And I have noticed the same thing for several evenings past," he added. Continuing: "I called up several of my friends who have different makes of sets and they all reported having the same reception from WJZ, so the trouble cannot be blamed on the set."

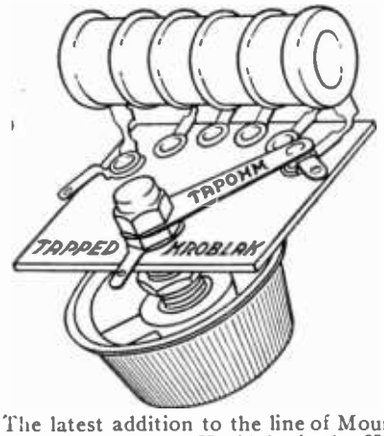
And then it occurred to me that I, too, had had the same experience with that station for several nights. I had paid no particular attention to the distortion because I had preferred the programs from WEAF on those occasions and had lingered on WJZ just long enough to learn the nature of the programs. So the transmitting station must be blamed. The time of my experience was Aug. 9, between 8 and 10 p. m. eastern daylight saving time.

Somewhere between the microphone and the transmitting antenna of WJZ was an overloaded tube. It might have been in the speech amplifier or in the modulator. Wherever the distortion entered the signal of WJZ it entered in large amounts. It made the quality unbearable, and it was the reminiscent of the early days of broadcasting.

Powertone's Unit Uses Direct Drive

When the Powertone Electric Co. decided to go into the manufacture of cone speakers and cone speaker kits, they determined to make the finest possible unit. Powertone engineers were therefore instructed to devote all their energies to this task. The result is the Powertone unit shown, which has been developed in their laboratories after considerable research and experiment. It is a unit of the horseshoe magnet, direct drive type. Every individual part in the unit itself, the coils, the magnets, the pole pieces and the armature, has been especially designed for service and tone quality. This unit is furnished with a strong guarantee of satisfaction with every Powertone speaker kit sold. So far, there are three kits ready for the fan, namely the 18-inch, the 24-inch and the giant cone, 36-inch.

Tapped Resistor



The latest addition to the line of Mountford resistances and Kroblaks is the Kroblak variable resistor of approximately 30,000 ohms, tapped in five equal sections. This unit makes an excellent output control device for B eliminators. The total capacity is 10 watts and the overall size is 2x2x2¼ inches. This unit is made by C. E. Mountford, Sullivan Street, New York City.

Abox to the Fore With Eliminators

The Abox Company, 215 North Michigan Avenue, Chicago, announces that its new complete A battery eliminator is now ready for distribution. It consists of a combination of a rectifier (charger) and the well-known Abox filter, built in one compact unit. It works direct from the light socket, converting the 110 volt alternating current into uniform direct 6 volt smooth flow for any type receiver. It can be installed almost instantly, requires no changes in the circuit and will supply full filament supply for up to eight six-volt tubes. The Abox A unit and the Abox filter are handled in the East by the M. J. Powers Co., 109 Lafayette Street. This organization is headed by Mike Powers. Full information on these appliances may be had either from him or from the Abox Company.

4-FT. 9, SHE TEACHES 6-FT. BOYS

RENA JANE FREW, of Beaver, Pa., who is working on a new circuit which she will show at the Radio World's Fair in Madison Square Garden in September. She has just been graduated from Geneva College, and won fame as the operator of 8ME, the station of the Beaver High School. Although only four feet nine inches tall, she taught 6-foot boys in the high school how to build sets.

MAIL PLANE TESTS OF BEACON SUCCESS

A radio beacon has been erected at Hadley Field, N. J., by the General Electric Company, and the ground and air tests are well under way, according to Maj. E. Jones, the Chief of the Information Division of the Aeronautics Branch, Department of Commerce.

A radio receiving set designed by the General Electric Company was installed on a Douglass Air Mail plane and a number of test flights have been made. These tests indicate that satisfactory reception of the radio beacon can be obtained up to 50 miles with the ignition system of the motor unshielded.

The Post Office Department has cooperated in these tests by furnishing a plane with pilot and arrangements have been made with the Navy Department to conduct further tests on the beacon, using a small dirigible flying out of Lakehurst, Major Jones said.

SWITCH RHEOSTAT

The newest addition to the line of the De Jur Products Co., 199 Lafayette Street, New York City, is a combination switch and air-cooled metal rheostat, one hole mount. It is sturdy and efficient and the metal frame will not bend or warp. Shaft alignment is permanent and contact perfect. It is furnished in any ohmage from 2 to 50. Prices and full information on this and other De Jur products will be furnished to those interested upon application to the above concern.

Water Hose Coils on New WEAF'S Tubes

In the 50-kw 610 kc amplifier at new WEAF, which follows the intermediate stage ten UV-207 tubes are employed, but only eight will be used at any given time, the remaining two acting as "spares." This unit, about 20 feet long, is built in open fashion. The most conspicuous feature is the ten water hose coils wound on insulating cores into which the anodes of the tubes themselves fit. These coils insure a water stream sufficiently long to insulate the plates, with their 10,000-15,000 volt potential from ground.

Below each coil there is a pressure-actuated relay which prevents voltage from being applied to the plates of the tubes when water is not flowing at a safe rate. With 27 water cooled tubes in use, in the absence of such automatic protection, an operator's mistake might cost the station upward of $10,000 in a few seconds.

The super-structure of the 50-kw amplifier carries meters, individual choke coils, indicating relays, switches, and other paraphernalia required in the operation of large vacuum tubes.

At one side of the transmitter room the rectifier, which supplies plate power for all the three element tubes, is located. This is a relatively small frame, mounting six water-cooled rectifiers of the UV-206 type, but it is capable of delivering 12 amperes direct current at 15,000 volts, corresponding to a power of 180-kw.

Fans Now Are Busy Building Best Sets

Radio fans are now busy building the best radio receivers available to them. They are still in the preliminary stages of the fascinating work, but they are taking a lively interest in allt hings pertaining to radio. They are devouring everything the magazines and newspapers print on the subject with the view of finding the most suitable and most up-to-date circuit.

Almost any time of the day they can be seen swarming around radio stores like bees around a beehive, for new parts.

TINNED WIRE

"Corwico" Braidite is a hook-up wire made from either solid or stranded tinned copper wire covered first with a cotton wrap and then with a cotton braid. The product is then impregnated with a damp proof compound making it impervious to moisture and adding to its insulating qualities. To make a soldered connection it is unnecessary to strip back the insulation. The braid is simply pushed back while the soldering is done and then replaced thus forming the neatest possible connection. For this reason this product has been adopted by most of the leading set manufacturers. Braidite is made in five colors, red, green, yellow, brown, and black and is manufactured by the Cornish Wire Company, 30 Church Street, New York City.

Watson Will Ask for Permanent Board

Washington.

Senator Watson (Rep., Indiana) announced that he plans to introduce a bill calling for the establishment of a permanent commission which would have supervision over radio communications and would also be charged with the regulation of the interstate use of the telephone and the telegraph.

"We have an Interstate Commerce Commission to regulate transportation facilities," he said, "why shouldn't we have a similar commission to deal with the problem of communications?"

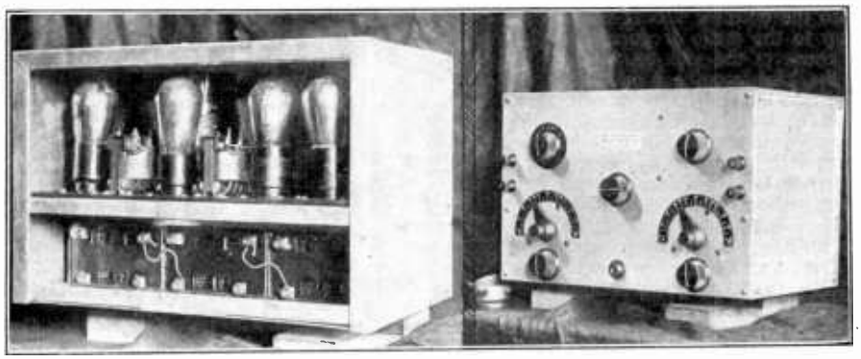
Announcer's English Good; Anzac Surprised

Cincinnati.

A letter to WLW following a special program broadcast by the station to Australia follows:

"Your 52-meter transmission came through very well here. I just tuned WLW in as our National Anthem concluded and heard your first opening announcement. The speaker had a decided American accent but the person who announced the items spoke very good English and there was no noticeable accent.

TWO VIEWS OF BERTAUD'S SET



(Wide World)

BACK AND FRONT views of the receiver designed by the Allen D. Cardwell Mfg. Corp., selected by Lloyd Bertaud and J. D. Hill in the scheduled New York to Rome flight.

REPLIES GIVEN

I HAVE a one-dial commercial set which gives me good service. However, I notice that when I connect the ground to the set, the volume both on local and distant stations goes down appreciably. What is the cause of this and how can it be remedied?—J. P. MACKEN, Pittsburgh, Pa.

The effect is due to detuning of the first tuned circuit in the set by the antenna-ground capacity. A smaller antenna would minimize the effect, as would a condenser of about .0005 mfd. in series with the antenna. A better remedy, though not so convenient, is to connect a vernier condenser across the first section of the triple tuning condenser and adjust the inductance of that tuned circuit. The vernier can then be used to compensate for any capacity introduced in the tuned circuit by the antenna-ground.

* * *

WILL YOU kindly publish a circuit diagram of a three-tube receiver using a regenerative loop and two stages of transformer coupled audio frequency amplification?

—MELVIN JONES, Little Rock, Ark.

See Fig. 1.

IRWIN ON THE JOB

(Harold Stein)

G. CLAYTON IRWIN, JR., general manager of the Radio World's Fair, which is to be held in the Madison Square Garden, New York City, Sept. 19-24.

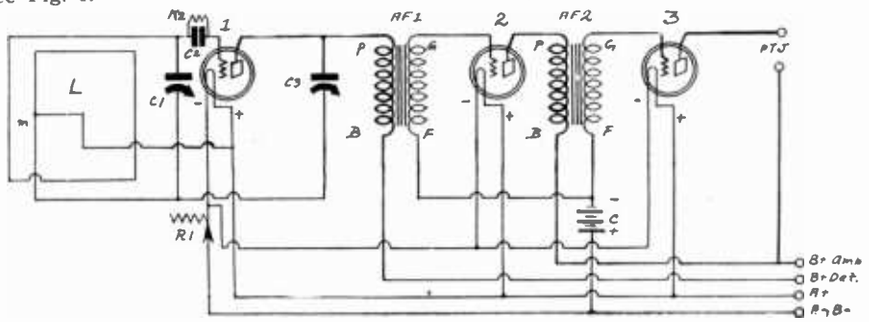
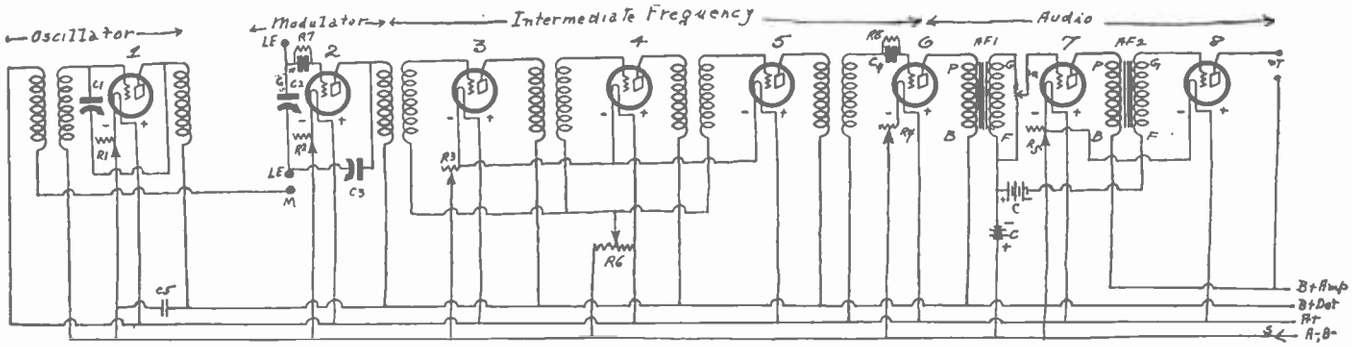


FIG. 1

The circuit diagram of a simple three-tube receiver.



IF a Super-Heterodyne is to be regenerated in the modulator, here's how it's done.

Grid Favored for Pick-up

Phonograph Device Must Be Properly Placed or Quality Is Reduced

By J. E. Anderson

Contributing Editor; Consulting Engineer; Associate, Institute of Radio Engineers.

PHONOGRAPH pick-ups which have recently been placed on the market are almost invariably provided with a plug for insertion into the detector socket when connecting it up to the audio frequency amplifier. This connects the pick-up winding in series with the load impedance on the detector tube, and usually also in series with that portion of the B battery which supplies the detector tube. This connection may be the best in the average transformer coupled receiver, but it may not be suitable at all for circuits having other types of coupling.

When the set is transformer coupled and the pick-up winding is connected in series with the first transformer primary, the matching of impedances is good, because the impedance of the primary is of the same order of magnitude as the impedance of the pick-up winding. The impedance of the primary is probably much greater but that is not a serious matter. Fig. 1 illustrates the usual type of connection. When the pick-up plug is inserted in the detector socket one connection is made at point (0) and another at point (2).

Uses the B Battery

Observe that the B battery is in the circuit formed and that this battery sends a steady current through the transformer primary and the pick-up winding. If this current is large there is danger of magnetic saturation in the transformer or the pick-up, or both. This would result in distortion of the phonograph music. If the resistance in the two windings involved is high and if the voltage of the battery is not great, the danger of magnetic saturation is not great.

When the usual connection is made the voltage induced in the pick-up is stepped up by two transformers and it is also amplified by two tubes. A high output can be expected. It seems preferable to connect the pick-up terminals to the grid side of the tube and then convert the detector tube to an amplifier. There would then be no direct current flowing in the pick-up and no useless drain on the B battery. Suppose the pick-up is connected between (0) and (1). The detector automatically becomes an amplifier with zero grid bias. The induced voltage is then amplified by three tubes and stepped up by two transformers. A much greater output than with the previous connection can be expected. In fact if the pick-up is of average efficiency the volume will be too great for ordinary output tubes and it is necessary to employ a volume control and an output tube of the order of the 210 or 310.

Volume Considerations

When connecting the pick-up to the grid side there is no necessity of opening the grid circuit on the tuner side because the grid condenser and grid leak are very high impedances to audio frequencies. If, however, the grid return is connected to the positive end of filament it might be well to remove the grid leak.

The disadvantage of the grid connection is that the plug and the tube cannot be used simultaneously in the same socket. If it is desired to use the plug another socket can be provided and this can be wired so that when the plug is inserted the proper connection is made to the grid of the tube even though the plug has been wired to make the (0, 2) connection. The connection is shown in Fig. 2.

If the pick-up is unusually efficient sufficient volume can be obtained by connecting it to the grid of the first audio amplifier, or between (0) and (3)), as in Fig. 1. The circuit can also be arranged for plug-in connection as in Fig. 2. The low potential connection can then be made to minus C so as to take ad-

(*Concluded on page* 17)

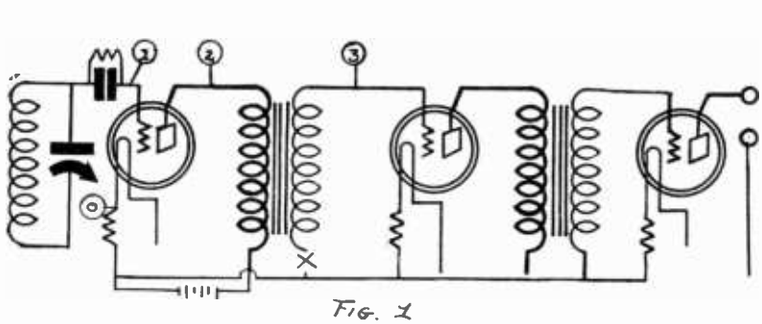


FIG. 1

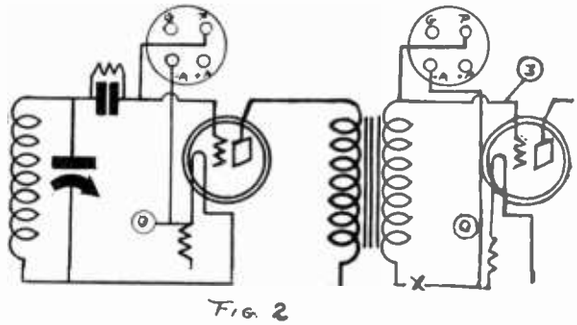


FIG. 2

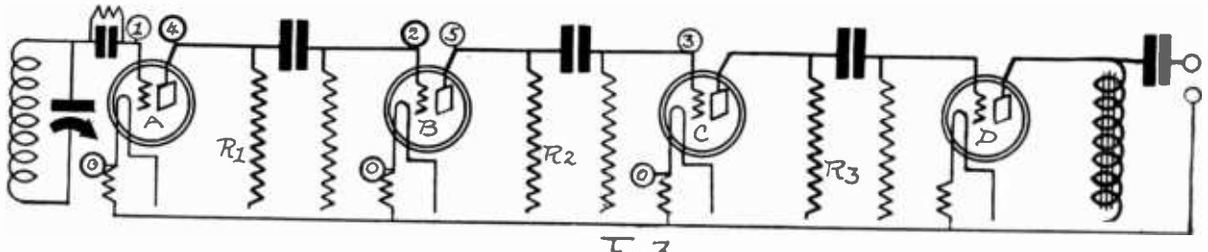


FIG 3

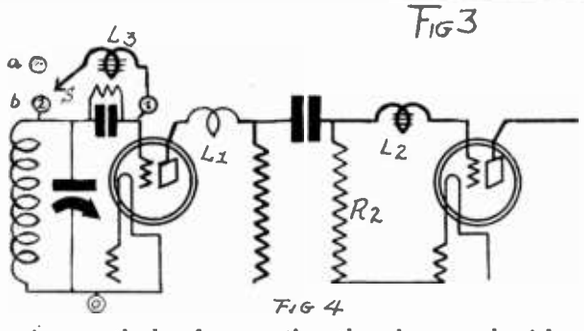


FIG 4

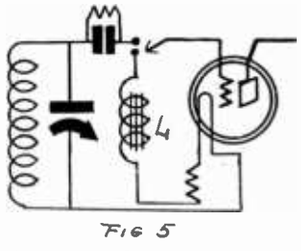


FIG 5

FIG. 1 illustrates various methods of connecting the phonograph pick-up in a transformer coupled amplifier. The grid connections (0, 1) and (0, 3) are the preferred methods but not the usual. Fig. 2 shows how by the use of auxiliary sockets the preferred grid connections can be made with the plugs furnished with the commercial pick-ups. Fig. 3 illustrates the various methods of connecting the pick-up to a resistance, or an impedance, coupled amplifier. Only the grid connections (0, 1), (0, 2) and (0, 3) should be used. These can easily be made with the standard plug by the use of an auxiliary socket. In Fig. 4 the pick-up coil should never be connected in positions L1 or L2. It may be connected in position of L3, especially when the switch S is used to connect pick-up across grid leak when it is to be used. Fig. 5 shows a convenient way of connecting the phonograph pick-up so that the detector tube can be converted into an amplifier tube. When the switch is up the tube is a detector; when it is down the tube is connected to the pick-up coil L and is an amplifier.

Power and AF for Pickup

By Spencer Hood

A VERY convenient unit to build is a combination B eliminator and a power amplifier for a phonograph pick-up. The tubes in the amplifier may be heated entirely with alternating current and the plate power for the tubes may be obtained from the eliminator. Also, the eliminator may be used for the radio frequency receiver by simply providing the ordinary terminal posts for the various voltages that will be required. Herewith is a description of such a combination.

The phonograph pick-up leads are connected across the terminals (1) and (2). Between these posts is connected a .5 meg. potentiometer R1 by means of which the volume of the phonograph music is controlled.

The filaments of all the tubes in the amplifier are heated with alternating current. The first tube is a special AC tube requiring 1 1-2 volts and 1.05 amperes. The second two are of the -71 type and they require a total of one ampere at 5 volts. The filament current for the first tube is obtained from a low voltage winding on the power transformer PT and the current for the two push-pull tubes is obtained from another winding of 5 volts.

Hum Elimination

Two audio frequency transformers are used in the amplifier. The first, A1, is a push-pull input transformer and the second, A2, is a push-pull output transformer. Good grade instruments of this type are now available.

Since there is a possibility of a 60 cycle hum in an amplifier of two AC heated stages, it is necessary to employ a balancing potentiometer, P, across the filament of the first tube. This may have a resistance of 200 ohms or less. The grid is returned to the slider on this potentiometer and the slider in turn is set experimentally where the hum is minimum or where it disappears completely. In the second stage it is not necessary to use a balancing potentiometer, but it is necessary to return the grids to the mid-point of the transformer winding. There is no difficulty in eliminating hum from the last stage, particularly when that stage is a balanced push-pull amplifier.

A grid bias is necessary in each stage. For the first tube this is obtained from the voltage drop in the variable resistance, R2, placed in the lead to the mid-point on the potentiometer, P. The value of this resistance depends on the applied plate voltage and on the plate current in the tube. Suppose that the applied plate voltage is 135 volts. The grid bias should be 9 volts. The plate current is 6 milliamperes. The value of R2 should therefore be 1,500 ohms to give the 9 volt bias. A slightly higher grid bias can be used for that plate voltage if desired. Hence the variable resistor used should have a maximum resistance of 2,000 ohms.

Resistor Drop Bias

The grid bias for the push-pull tubes is obtained from the variable resistance, R3, placed in the common grid return lead of the two tubes. The grid bias for the -71 tubes should be 40 1-2 for an applied plate voltage of 180. The current through the resistance R3 will be the sum of the plate currents of the two power tubes, or it will be 40 milliamperes. Therefore when the value of resistance R3 is 1,000 ohms the voltage drop in it will be 40 volts. The resistance then should be a little more than 1,000 ohms A variable resistor of 2,000 ohms maximum value will also serve in this position.

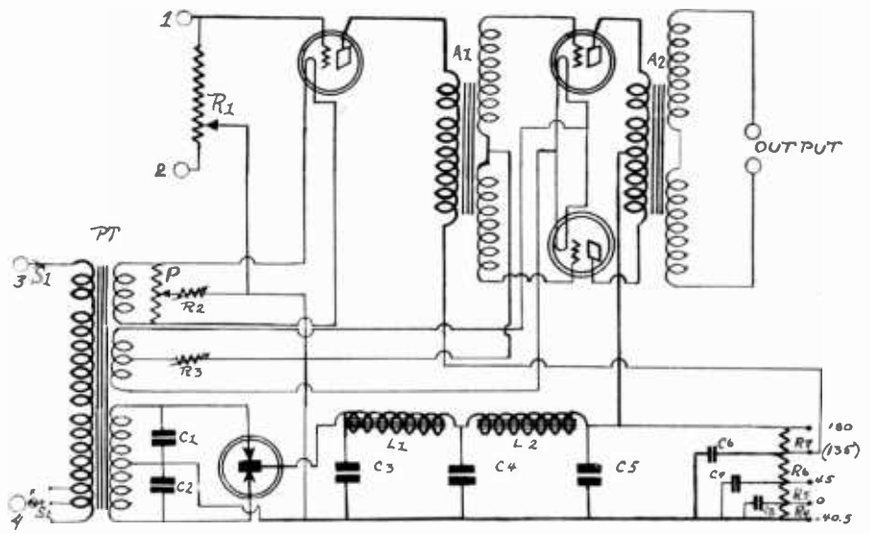
The plate voltages for the two stages are obtained from a rectifier-filter combination employing a BH Raytheon tube. The power for this rectifier is obtained from a high voltage winding on the power transformer PT.

The buffer condensers C1 and C2 should have a capacity of .1 mfd. They should be able to stand continuously at least 1,000 volts AC. Condenser C3 should have a capacity of 4 mfd. and it should have a rating of at least 400 volts. C4 should have a value of from 4 to 8 mfd. and C5 should have a value of at least 8 mfd. A voltage rating of 400 will be enough for these and the condensers across the different resistance in the output voltage divider. Each of the condensers C6, C7, and C8, should be at least 2 microfarads.

The plate return of the two push-pull tubes is connected to the highest potential point on the output of the filter. Hence the entire voltage of the rectifier is divided between the grid bias and the plate voltage for these tubes. When the total voltage is 220.5 volts 180 volts can be given to the plates and 40.5 volts to the grids by suitably adjusting the resistance in R3. Not more than 135 volts will be necessary on the plate of the first tube. This added to the required 9 volt bias will take 144 volts from the output of the filter.

The plate return from the first tube should be connected to a point which is 76.5 volts lower than the positive terminal of the filter. This point can best be found by a high resistance voltmeter. The point is marked (135) on the potentiometer. This does not mean that the voltage at that point is 135 volts above the point marked zero, but that the effective voltage on the plate of the first tube is 135 volts when R2 has been adjusted so that the grid bias is 9 volts. The voltage at that point is actually 103.3 volts above the zero point. This voltage can well be used in plate of 90 in ordinary receivers.

Each of the two choke coils L1 and L2 should have an inductance of 30 henrys and each should have a resistance not in excess of 250 ohms.



HOW to connect a two stage push-pull power amplifier for amplification of phonograph pick-up and a B battery eliminator. No batteries are used in the device.

LIST OF PARTS

PT—One power transformer with one 1½ volt winding, one 5 volt winding and one 350 volt winding.
A1—One push-pull input transformer.
A2—One push-pull output transformer.
L1, L2—Two 30 henry choke coils.
C1, C2—Two .1 mfd. buffer condensers, 1,000 volt test.
C3—One 4 mfd. condenser.
C4, C5—Two 8 mfd. condensers.
C6, C7, C8—Three 2 mfd. condensers.
R1—One .5 megohm potentiometer.
R2, R3—Two 2,000 ohm variable resistors.
P—One 200 ohm potentiometer.
S1—One line switch, 250 volts test.
S2—One switch for tapping the primary windings.
F—One 5 ampere fuse.
One Edison screw socket.
One Raytheon BH rectifier tube.
Four standard tube sockets.
Nine binding posts.
A suitable metal box, preferably of sheet iron.

Binding posts are provided on the output potentiometer in case it is desired to use the eliminator for the various tubes in the radio receiver. One post gives the grid bias for the power tube, another for the minus filament connection, or zero, another for 45 volts for the detector and R. F. amplifiers, one for 180 volts and one for the intermediate voltage of about 100 volts. A standard voltage divider strip can be employed for the resistances marked R4 to R7.

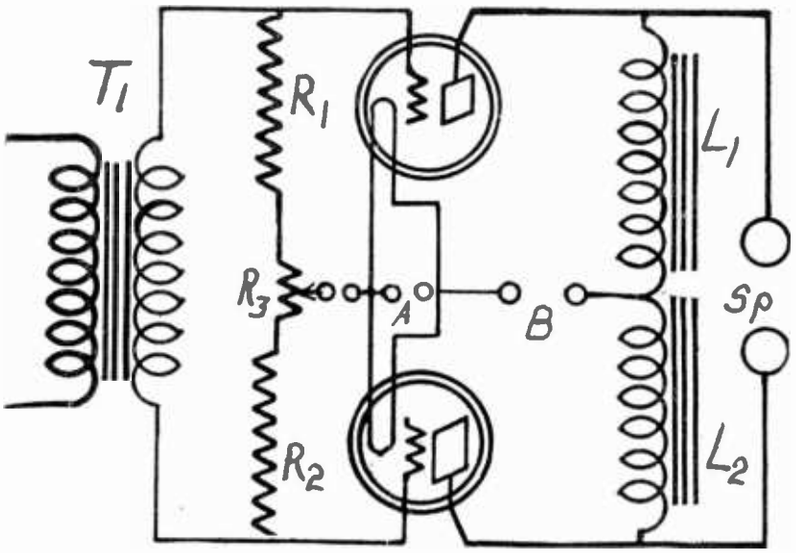
In the primary of the supply transformer PT is a switch S1 for turning on the power. This should be designed for voltages up to 250 and a current of one ampere or more. A switch S2 is also placed in the primary, for voltage adjustments. A five ampere fuse F is also placed in the line to protect the installation. The terminals marked (3) and (4) should be connected to an Edison socket for convenience of connection.

The combined phonograph amplifier and B eliminator should be assembled in a metal case of suitable proportions, which can then be placed in the old phonograph console.

It is obvious that the two stage amplifier can also be used for the radio set if desired. It is designed for high power output and it may be superior to the audio amplifier already in the set. The changes required in the wiring would be simple.

While the power transformer PT calls for three secondary windings, two of low voltage and one of high, difficulty may be experienced in finding such a transformer, as it will not be on the market for a while. It is not necessary to go to this expense, as considerable latitude is allowed in choice of tubes and voltage. For example, the first tube is a —26 type requiring a voltage of 1½ and a current of 1.05 amperes. This tube may well he an ordinary —01a type or a 112. Either of these tubes requires the same filament voltage as the two power tubes.

Absence of Condenser Startles Orthodox Fan



THE condenserless output, described recently in Radio World, and which started one orthodox fan on a path of doubt and challenge.

By Gen. T. C. H. Brenon

On page 10 of the August 6 number of Radio World, there appeared a push-pull amplifier in which the loudspeaker was connected between the plates of the two tubes without any stopping condenser. A couple of audio frequency choke coils were used to take care of the direct plate current. Objections have been raised to this circuit on the ground that the condensers are omitted. It is claimed that there is danger of short-circuit and damage to the rectifier in case either of the loudspeaker terminals should come in contact with ground and also because dangerous shock would be experienced if the operator should touch one of the loudspeaker binding terminals.

That criticism is much ado about nothing. Suppose that one of the loudspeaker terminals should be grounded while the other is connected to its proper place. A circuit would be established comprising the source of plate voltage, the loudspeaker and one of the choke coils. The loudspeaker might have a resistance of 1,200 ohms or more, the choke will have a resistance of at lease 1,000 ohms and the filter and the rectifier of at least 1,000 ohms more. There will then be a total of 3,200 ohms in series with the voltage. Suppose this is 180 volts. The current will be 56 milliamperes. This will not be high enough to burn out the filter nor to damage the rectifier, although the loudspeaker windings might be damaged.

Small Chance of Shock

But there is no more reason for connecting one of the terminals of the speaker to ground, intentionally or accidentally, than for connecting the positive terminal of the rectifier to ground, or to the negative terminal. Should a rectifier be condemned just because it is possible to short-circuit it? Of course not, and neither should an amplifier circuit.

The objection on the ground of a possible dangerous shock is equally puerile. It is possible to get a dangerous shock by grasping two terminals of the house line at the same time, or by grasping the output terminals of a rectifier and filter. But that possibility is not enough to condemn these devices. Should an amplifier be condemned for similar reasons?

But there is really very little chance of a shock. It is necessary to grasp both a high potential point and a grounded point at the same time. Even when such a blunder is committed there will not be a dangerous shock because there is too much resistance in series with the voltage and the "shockee" to admit much current.

Habit Is the Reason

The main reason for the criticism is habit. Fans have become accustomed to a condenser in series with the loudspeaker to keep the direct current out of it. When that is missing the first feeling is that something is wrong. Reasons must be given why the innovation is not as good as the old familiar circuit. The necessity for these objections wear away as the new circuit becomes familiar.

If one condenser is used in the double circuit two of them must be used to maintain balance. And the two must be equal. These condensers do protect the careless experimenter against shocks, little tickling shocks, and they also protect the loudspeaker against the low notes. If the low notes are not desired, by all means connect the condensers in the circuit.

It may be pointed out to those who are afraid of a shock that they can also get a shock in an ordinary receiver in which the loudspeaker is connected in the plate circuit without the benefit of a filter. And they can get the shock by grabbing the high and the low terminals at the same time. There are millions of sets like that in use in the country, and no series shocks or short circuits have occurred.

Is there any reason why the danger should be increased by removing superfluous condensers?

One condition for the successful operation of the condenserless push-pull circuit is that the impedance of the tubes below, but that is also true if the condensers are used. This is because the impedances of the two tubes are in series. The impedance of the loud speaker connected across the output should be large.

Meter Reads Tube Curves

If the resistance per volt of a sensitive voltmeter is known, the meter can be used for taking characteristic curves of tubes. Suppose that measurements on the voltmeter have established that the voltmeter has a resistance of 100 ohms per volt. When this meter is placed in the plate circuit of a tube of high resistance a certain reading will be indicated.

That reading will be the voltage drop in the meter caused by the flow of plate current. If the meter has a total resistance of 10,000 ohms, that is, a maximum reading of 100 volts, the current required to give a full scale reading is 10 milliamperes. If the reading is 50 volts the current in the plate circuit is 5 milliamperes. If the reading in volts is 5 volts, the current is .5 milliampere. With the meter assumed, it is possible to measure the plate current if it comes within the range of zero to ten milliamperes.

Can Be Told in Curve

Now it is not likely that any meter will have exactly 100 ohms per volt. But that does not prevent the use of the meter for measuring the plate current as long as the resistance in the meter is known. Suppose that the total resistance of the meter is R ohms. If this meter when connected in series with a high resistance plate circuit reads V volts, then by Ohm's law we know that the plate current is V/R amperes.

If we vary the grid voltage in a definite manner and measure the plate current by the V/R rule we can take a complete grid voltage, plate current curve. First we adjust the grid voltage to some desired value with the aid of the voltmeter, used as such. Say we start with —10 volts. We measure the plate current by connecting the voltmeter in series and note the voltage reading. V/R gives the current.

Switch Is Advisable

Next the grid bias is changed by a small amount and the plate current is again taken. This is continued until the entire curve has been taken. A simple switching arrangement whereby the meter can quickly be thrown from across the grid bias battery into the plate circuit can be worked out. It is, of course, not necessary to divide the voltmeter reading by the resistance every time a reading is taken. This can be deferred until all the observations have been made.

U. S. Exports Rise After 1926 Slump

Approximately $30,000,000 worth of wireless apparatus is estimated to have entered into international trade in 1926, according to H. E. Way of the Commerce Department's Electrical Equipment Division. The United States was the largest exporter, American shipments making up 29.4 per cent of the total; Germany came next with 25.6 per cent, followed by Great Britain with 20.5 per cent and France with 13.7 per cent. Exports from Germany showed a slight decrease during 1926 as compared with the previous year.

United States exports of radio apparatus decreased 12 per cent in 1926 as compared with 1925, amounting to $8,794,453. Export figures for the first half of this year, however, were valued at $3,705,861, an increase of $450,000 over the same period of 1926, indicating that the trade is reviving.

The Origin of Innocent Squeals

By J. Edwin Ralphael

THE object of the reallocation of stations in the frequency spectrum was to eliminate interference among them. Stations operating in any one locality were placed so far apart that no receiver of reasonable selectivity would be received at the same time. Again due attention was given to the possibility of heterodyning between stations operating on adjacent channels. Stations were required to keep within 500 cycles of their allotted frequency.

It would seem that rigid enforcement of such a program would completely eliminate all interference, both program interference and heterodyning whistles. But that is not the case, and it would seem that the Commission has overlooked one possibility of interference which not only may occur but which actually is ruining reception of certain stations in some localities.

An actuality will serve to illustrate the possibility. WEAF is a powerful station operating on a frequency of 610 kc. This station stays well within the 500 cycle limit. Its antenna is located on the shore of the Hudson River on lower Manhattan.

The 1,000-Cycle Note

WAAT is operating just across the river in Jersey City on a frequency of 1,220 kilocycles. This frequency is just twice that of the frequency of WEAF, and hence it is equal to the second harmonic of WEAF. When these two stations are operated simultaneously and when an attempt is made to tune in WAAT a very strong heterodyne whistle is heard, which completely ruins the signal from WAAT.

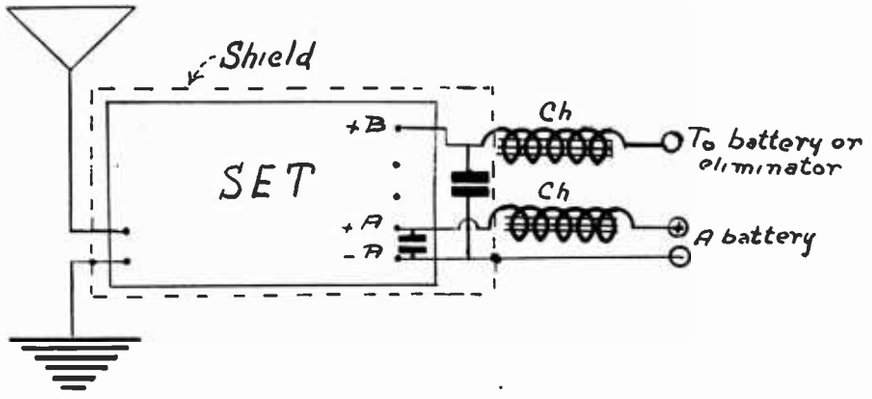
The frequency of the whistle resulting from the interference between WEAF and WAAT is very nearly 1,000 cycles and it is very steady. This indicates that not only is WEAF operating close to its assigned frequency but also that WAAT has not strayed off very much. Suppose that WEAF is off its frequency of 610 kc by 250 cycles in one direction. The second harmonic is then off 500 cycles from 1,220. Now if the frequency of WAAT is off 500 cycles in the opposite direction, the 1,000 cycle beat note is accounted for.

If both of the stations are off their frequency in the same direction, and they differ by 1,000 cycles, at least one of the stations is too far off its frequency.

The heterodyning in this case can arise in two ways at least. WEAF can send out some energy on its second harmonic. When any receiver is tuned to WAAT it is also tuned to the second harmonic of WEAF. Very little of the second harmonic of WEAF is required to cause a strong squeal on top of the signal from WAAT. Yet such interference as this can only occur with serious intensity in the immediate vicinity of WEAF, because extremely little of the second harmonic of this station is transmitted.

Home-Generated Harmonic

The second way in which the interference can occur is more severe and more frequent. In this case the harmonic is generated in the receiver which is tuned to WAAT. The fundamental of WEAF gets into the receiver and one of the radio tubes doubles the frequency. The doubled frequency is picked out and amplified together with the signal from WAAT, since the two have the same frequency. Again only a very small amount of the second harmonic of WEAF is required to cause ruinous interference with WAAT.



HOW the receiver should be shielded and how choke coils and by-pass condensers should be placed when unshielded batteries or eliminators are used, or when the leads to power source are long.

The continuous squeal heard when listening to WAAT within the area of influence of both WEAF and WAAT is therefore due to heterodyning between the fundamental of WAAT and the second harmonic of WEAF generated in the receiver itself or transmitted from the station.

I tried the reverse procedure, that is, to see whether WAAT could interefere with WEAF when this station was properly tuned in. There was no perceptible squeal. One reason for this lack of interference is that the receiver was within a few blocks of WEAF while WAAT was at least ten times as far away. However, another observer receiving in the Flatbush section of Brooklyn observed a feeble squeal of 1,000 cycle frequency when he was listening to WEAF while WAAT was operating.

Some Solutions

It is obvious why the 1,220 cycles frequency of WAAT could not interfere very much with the reception of WEAF on 610 kc. When the set is tuned to 610 both the fundamental of WAAT and the harmonic of WEAF are rejected. What little of these two that reaches the detector could only cause a very feeble sound when detected, in comparison with the detected fundamental of the desired station. In the immediate vicinity of WAAT the situation might be different, as it might be in any location where the fundamental of WAAT is strong compared with the signal from WEAF.

What is the solution of this interference problem? One solution is to assign another frequency to WAAT, making sure that its new frequency is not a harmonic of another station in the same locality. But this solution might lead to a great deal of trouble throughout the country, for undoubtedly there are more cases like that of WEAF and WAAT.

Another solution lies at the receiver, where most of the trouble is really introduced. That is to shield the receiver so thoroughly that no signal except the one to which the circuit is tuned can enter the radio frequency amplifier. But that is not a simple solution either, since it might mean the rebuilding of thousands of receivers. But it is the best solution in the long run, and it will not only eliminate interference from harmonics but it will also help to eliminate strays and static.

Precautions in Shielding

In regards to the question of shielding thereceiver, it is not sufficient to put the tuner in a metal box and ground the case. If the set is connected in any way with the house lighting circuit a radio frequency choke coil must be placed in series with the line that runs to the set and then a large by-pass condenser must be connected across the line. The choke coil should be placed very close to the case shielding the receiver but outside of it, unless the coil itself is shielded, when it may be placed within the shielded case. The condenser should be placed inside the shielded case.

Similar precautions must be taken with regard to battery leads. It will not do to leave a few feet of battery leads outside the shield. These leads will pick up enough of the signal from a strong local station to cause interference. The batteries could be placed in a separate shielded case and shielded leads run from them to the receiver. If the batteries are left unshielded it will be necessary to use radio frequency choke coils and by-pass condensers as in the case of the connection to the power circuit.

When the set has been thoroughly shielded from all outside disturbances, with the sole exception of the antenna and ground leads, everything that enters the set must pass through the first tuner. This rejects every thing except the frequency to which it is tuned. There is then little chance that any strong signal of half the frequency will come in to be doubled. If, however, the harmonic exists in the ether, it will come in just as the desired signal does.

SIXTH YEAR

RADIO WORLD

The First and Only National Radio Weekly

Member, Radio Publishers Association

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

TELEPHONES: BRYANT 0558, 0559
PUBLISHED EVERY WEDNESDAY
(Dated Saturday of same week)
FROM PUBLICATION OFFICE
HENNESSY RADIO PUBLICATIONS CORPORATION
145 WEST 45th STREET, NEW YORK, N. Y.
(Just East of Broadway)
ROLAND BURKE HENNESSY, President
M. B HENNESSY, Vice-President
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European Representatives: The International News Co.
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Paris, France: Brentano's, 8 Avenue de l'Opera

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SUBSCRIPTION RATES

Fifteen cents a copy. $6.00 a year. $3.00 for six months. $1.50 for three months. Add $1.00 a year extra for foreign postage. Canada, 50 cents.
Receipt by new subscribers of the first copy of RADIO WORLD mailed to them after sending in their order is automatic acknowledgment of their subscription order. Changes of address should be received at this office two weeks before date of publication. Always give old address; also state whether subscription is new or a renewal.

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1 Page, 7⅛"x11"	462 lines	$300.00
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¼ Page, 4½" D. C.	115 lines	75.00
1 Column, 2¼"x11"	154 lines	100.00
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52 consecutive issues	20%
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CLASSIFIED ADVERTISEMENTS

Ten cents per word. Minimum 10 words. Cash with order. Business Opportunities ten cents per word, $1.00 minimum.

Entered as second-class matter March 28, 1922, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

WBAL Conductor Gets Word from Boyhood Pal

Baltimore, Md.

Through the medium of WBAL, Baltimore's super power station, two old friends, who had completely lost track of each other, have been happily reunited.

When a small boy, John Lederer, now conductor of the WBAL Dance Orchestra, had a special pal with whom he went through school and enjoyed more than one boyish prank. The years, however, brought their changes and the two boyhood friends later found themselves many miles apart, following their chosen careers in different cities. Soon they had lost complete trace of each other.

A short while ago, Mr. Lederer received a letter from a Northern city. It was, he found, from his old friend, who, it seems, had heard him over the air and was writing to renew their friendship, adding he intended to come to Baltimore within a few weeks to see him and personally recall some of the "good old times" they had had together.

NEXT WEEK A TREAT

The Show Number of Radio World next week, issue of Sept. 17, will have extra features, extra pages, extra circulation, but no extra prices for copies or advertisements. Send 15c now for a copy to Radio World, 145 W. 45th St., N. Y. City.

Leakage Is Big Factor In Resistance Audio

By Harry Barry

A resistance coupled amplifier is no better than its leakages. There are two kinds of leakages in an amplifier, and they work in opposite directions. One is the leakage through the insulation between the grids and the plates, and this includes the insulation of the stopping condensers. The other is the leakage through the grid leaks. The leakage through the insulation makes the grids positive and the leakage through the grid leaks makes the grids negative.

For proper operation of an resistance coupled amplifier it is necessary to maintain the grids negative with respect to the filaments. It is for this purpose that the grid bias is put into the circuit. One end of the leak is connected to the grids and the other to the negative of the bias battery, or its equivalent. If the grid bias or leaks are omitted the operation of the circuit is very erratic.

If the insulation between the grids and the plates is not very good the positive leakage will offset the leakage through the grid leaks, so that the grids are maintained positive in spite of the negative leakage through the leaks.

When the Grids Block

When this condition exists the circuit will not amplify. The grids choke up or block.

Oddly enough, the result of the positive charge on the grids is to reduce plate current to zero, indicating that the grids are strongly negative. This negative swing is secondary and is the result of the high plate current when the grids are positive.

One complaint against resistance coupled amplifier is that the output grows "nasal," distorted, mushy. Sometimes it is said that the tuning is "thick." If this condition cannot be ascribed to overloading of the grids, the trouble most likely lies in the leakages. There may be too much positive leakage through the insulation or there may not be enough leakage through the leaks.

An example will help to show what may be the cause of this condition. I worked with a resistance coupled amplifier which for some time gave excellent results. Finally it began to distort the signals. The first indication of it was a tardiness in getting started after the power had been turned on. This grew worse and worse until finally it required several minutes after turning the switch before the signals would come through intelligibly.

Symptoms of Disease

There was also severe "thickness" of tuning, which was just another evidence of the tardiness referred to above. While the signals became intelligible after a while they never cleared up enough to merit the designation "good quality." They were nasal and distorted, and on loud volume they were decidedly mushy.

This failure of the resistance coupled amplifier occurred during a prolonged period of high humidity.

A milliammeter placed in the plate circuit of the last tube gave an indication of what was happening. As the switch was first turned on the meter showed a current of over 30 milliamperes for an instant and then it went back to zero. There it stayed for a while, and no signals came through. Gradually the reading increased up to 10 milliamperes, and with the climb of the current the signals gained in intensity and clearness.

When a new grid leak was put in the last tube the current jumped up to 15 milliamperes. The old leak was labeled .5 megohm and the new was a .1 megohm leak. There was a great improvement in the quality with the lower leak.

Ample Tests Made

The next step was to test all the grid leaks and plate coupling resistors in the circuit. All measured up satisfactorily except the .5 megohm leak that had been in the grid circuit of the last tube. This was open. All the good resistors were put back and the defective leak was replaced with a good .5 megohm leak. All was well with the signals.

During the wet weather the moisture had increased the leakage through the insulation. Large currents had evidently flowed through the leak and these had gradually broken down the resistance element.

Part of the leakage which gave rise to this trouble is avoidable. If dust is permitted to gather on the sockets, stopping condensers, and other essential insulators this will form a continuous film which may be conductive at all times. But in wet weather the dust layer absorbs moisture and becomes a fairly good conductor.

First Columbia Program To Be Given Sept. 18

The first program of the Columbia Broadcasting System, which is controlled and operated by the Columbia Phonograph Company, will be sent out on Sunday afternoon, September 18. There are sixteen stations in this chain, WOR, being the key station.

The Columbia chain programs will be thereafter broadcast from 3 to 5 P. M., each Sunday afternoon, from 9 to 11 P. M. each Sunday evening, and from 9 to 11 P. M. on Monday, Wednesday and Friday nights. Three new indoor and two new outdoor studios have been added to WOR for the chain broadcasts.

NEW WAVE FOR WLTH

WLTH, located in the new Leverich Towers Hotel in Brooklyn Heights, Brooklyn, N. Y., has been granted permission to change its wavelength from 1370 to 1170 kilocycles or 256.3 meters. This station succeeds WFRL.

Station Is Upheld In Right to Any Site

A station cannot be denied the right to move its transmitter wherever it desires, regardless of the objections raised by the community, according to a decision handed down by Admiral Bullard, chairman of the Federal Radio Commission, in the case of WIIC of Bridgeport.

Nevertheless, if the residents of Easton, Connecticut, the proposed home of WIIC, continue to object, it is expected that other plans for the station will be made.

Blind Boy a Hit

LeLand Mack Logan, blind vocal and violin virtuoso, who recently was graduated from the Colorado State School for the Blind, gave a short vocal recital from KOA, Denver. The broadcast met with instantaneous success, letters and telegrams from all over the country being received praising the quality and power of his voice.

Greatest Progress Ever, Freshman's View of Future

Licensing of Set Manufacturers by R. C. A., Arrival of AC Tubes and New Equaphase Circuit Cited As Outstanding Events

"The Summer of 1927 will undoubtedly be recorded in the annals of history of radio as a period of more than ordinary importance," said Chas. Freshman, president of Chas. Freshman Co., Inc., New York, manufacturers of the Freshman Masterpiece and Freshman Equaphase radio receivers, in a recent interview.

"During this Summer period there were three developments of major importance which mean a great deal to the radio industry and the users and prospective users of radio receivers.

"First of these was the licensing of radio manufacturers by the Radio Corporation of America and associated companies, which permitted those manufacturers to use the important patents held by the R. C. A. group.

Means Stability

"To the general public the true significance and importance of this move may not be readily apparent. Briefly, it is stabilizing the entire radio industry by eliminating small irresponsible manufacturers and placing the business in the hands of the more substantial companies which have the financial and personal resources to inspire and merit the confidence of the public. The Chas. Freshman Co., Inc., manufacturer's all radio receivers bearing its name under license of the R. C. A. and its associated companies, the General Electric Company, Westinghouse Electric and Manufacturing Company and the American Telephone & Telegraph Company.

"The second important development was the perfection of the AC tube, which makes it possible to build a radio set which operates directly from any 60 cycle 110 volt alternating current light socket.

"Over two years ago, Freshman engineers began experimenting with AC tubes which were then in the early stages of development. Our engineers built a set using AC tubes, but while it functioned comparatively well it did not come up to Freshman standards, so it was never put on the market.

"They continued their experiments until a few months ago, their efforts were rewarded by the perfection of a real AC set worthy of the name of Freshman.

The Equaphase Principle

"The third step was the perfection of a new circuit embodying an entirely new method of stabilization—the Freshman Equaphase circuit, which eliminates howls and squeals in the set. Briefly.. by this new principle the energy which causes oscillation is controlled before it reaches the point where it can cause oscillation.

"The new Equaphase Reciever, which is also an electric set operating directly from the light socket, was introduced in New York the middle of August and was received by the trade and the consumer with far greater enthusiasm than we had dared to hope for. It has been necessary to augment our manufacturing facilities in order to keep pace with the demand for this new set.

"That this new Equaphase circuit is of great importance to the radio public is evidenced by the fact that the radio editors of such metropolitan newspapers as the

CHARLES FRESHMAN

New York Herald-Tribune, New York Telegram, New York World, New York Times and New York Sun, as well as newspapers throughout the country have devoted many columns to minute descriptions and diagrams of the new Equaphase circuit because of its news value.

Unprecedented Progress

"Summing up the entire situation I can see every reason to believe that during the next few months the entire radio industry is going to make unprecedented progress.

"Hundreds of thousands of people who have heretofore put off owning a radio because they were waiting for radical new developments, will now buy sets manufactured under these new conditions, and additional thousands will discard their old battery operate sets for the new development in AC operate receivers, and the new Equaphase sets."

R. F. I. and Spartan Firms Consolidate

The Radio Foundation, Inc., of New York, manufacturers of R. F. I. speakers, and the Spartan Electric Corporation, of New Jersey, for many years manufacturers of Spartan speakers, have merged their interests and henceforth will market their products under the name of R. F. I. Speakers.

The new company, which will operate under the name of Radio Foundation, Inc., has established executive and sales offices at 116 West 14th Street, New York City. All manufacturing will be done in the former plant of the Spartan Electric Corporation, 164 Pennington Street, Newark, N. J. The officers of the new corporation are Eugene A. Widdman, Sanford Samuel and Ernest Alschuler.

AMPLIFICATION

A power tube like the —71 amplifies less than a tube like the —340 or the 201-A.

Grid is Favored For Connecting Up Phonograph Coil

(*Concluded from page* 14)

vantage of the bias. This connection is shown in Fig. 2. Note that when the second tube is used it is necessary to open up the secondary winding of the transformer to prevent this from acting as a shunt to rob the output of the low notes.

Case of Resistance Audio

While most pick-up plugs have been wired for use with transformer coupled receivers, many fans have resistance coupled receivers which they want to use in connection with their phonograph work. When the ordinary pick-up plug is inserted in the detector socket, connection (0, 4) Fig. 3 is obtained. The pick-up then is called on to work into the plate coupling resistor R1. Less output can be expected if the plug is inserted in the subsequent sockets, as at (0, 5). In resistance coupled amplifiers it is most desirable to make the grid connection. For example, connection can be made to (0, 1). This will give very great volume, since the voltage induced in the pick-up is amplified by four tubes, some of which may be high mu tubes. When this connection is used a volume control is absolutely necessary.

Connection (0. 1) is relatively free from motorboating because there are four plate circuits active.

Sufficient volume can usually be obtained by making connection (0, 2). Nevertheless it is a sacrifice of volume, compared with (0, 4). In fact if the two next tubes are high mu tubes the volume will be all-sufficient. This connection is subject to motorboating, since there are three plate circuits active. The tendency is usually reduced if the detector is left in.

Permanent Connection

Now if the efficiency of the pick-up unit is more than the average and if a mu 30 tube is used in the second audio stage, enough volume will be obtained if connection (0, 3) is made. Volume control will then be unnecessary. This connection is free from motorboating.

Neither of the three grid circuit connections can be made with the ordinary plug-in arrangement. Special leads must be run from the pick-up to the various points. The alternative is to instal auxiliary sockets as suggested in connection with Fig. 2.

In some cases it is desirable to leave the pick-up connection permanently in one place. That leads to the question how that can be done without affecting the reception of radio signal or of sacrificing some of the quality of the phonograph music. Suppose we put the pick-up L1 in series with the plate lead as in Fig. 4. L1 would then act as a radio frequency choke coil. But its inductance would be too high to transmit the higher audio frequencies, even though it is in series with a high resistance. But it is even worse when it comes to the phonograph pick-up. L1 is in series with the internal plate resistance as well as with the external plate resistance. If the detector tube is not lighted the pick-up circuit is open and no appreciable volume would result. When the tube is lighted the case is not much better on account of the very high resistance in series with the induced voltage.

Suppose we connect the pick-up in series with the grid lead as at L2 in Fig. 4. The volume is only a small fraction of what it should be. If L2 is put in parallel with the grid leak R2 the low notes from the radio receiver will be lost.

One more connection is suggested in Fig. 4. Suppose L3 is the pick-up coil and that it be connected across the grid leak of the detector. That would be all right as far as the pick-up with negative grid return.

Radio University

A FREE Question and Answer Department conducted by RADIO WORLD for its yearly subscribers only, by its staff of Experts. Address Radio University, RADIO WORLD, 145 West 45th ST., New York City.

When writing for information give your Radio University subscription number

HOW MUCH resistance should be put in series with a 110-volt direct current line to yield .25 ampere for six —01A tubes connected in series?

(2)—Is it practical to connect the tubes in series and heat the filaments directly the line?

(3)—Will there be danger of hum and oscillation?

(4)—Is it necessary to put a choke coil in series with the line to remove the hum? If so, what should the inductance and resistance of the choke be?—JOHN OHMER, Chicago, Ill.

(1)—If no choke coil is used in series with the line the resistance should be 320 ohms. The resistor used must dissipate 20 watts. A 40 watt, 110 volt electric lamp has a resistance of about 300 ohms. This then may be part of the resistance.

(2)—Yes, if a filter is used.

(3)—There will probably be some hum unless the current is well filtered. There may be oscillation if the receiver is not well by-passed.

(4)—Some inductance should be used in series with the line, say about one henry, but it is better to use by-pass condensers to cut down the hum. When an inductance is used the resistance in series should not be 320 ohms. It should be less by the amount of resistance in the choke coil. Suppose this is 50 ohms. The required external resistance will then be 280 ohms. A 50 watt, 110 volt electric lamp has a resistance of about 240 ohms, which may be a part of the total resistance. The condenser used across the line should be as large as practical— 10 mfd. or higher. In fact best results are obtained if an electrolytic condenser of very large capacity is used.

* * *

I WANT to arrange a switch so that I can quickly connect two loudspeakers in series or in parallel. Will you kindly show a diagram how this can be done—EVERETT HARRIS, Memphis, Tenn.

See Fig. 564.

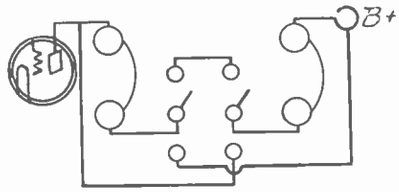

FIG. 564
A series-parallel switch tests speakers.

* * *

IS IT possible to get both the heating current and the plate voltage for a five-tube set from a 110 volt direct current line?

(2)—If so what is the best method of connecting the tubes?

(3)—What is the maximum plate voltage that can be obtained?—CHARLES STRAND, Tallahasse, Florida.

(1)—Yes, it is possible provided that not much power is required for the loud speaker.

(2)—It is best to connect the five filaments in series and thus limit the current drawn from the line to that required by one tube.

(3)—The maximum plate voltage obtainable is not definite and it is not the same for any two of the tubes in the series. The voltage available for the tube next the negative end of the line is the dif-

A SET IN A NUTSHELL

(Wide World)
A COMPLETE RECEIVER, built in a cocoanut shell, was demonstrated by Lucille Lester. She will exhibit this unique set at the National Radio Exposition to be held in Los Angeles.

ference between the line voltage and the drop in the filter, if one is used. Suppose the resistance in the choke coil is 50 ohms, the drop in it will be about six volts. Hence only 104 volts remain for the first tube. The next tube in the series gets 99 volts, and the next 94 volts, and so on. If the lowest tube in the series be made the output tube there will be enough voltage for all the tubes if only moderate loud speaker volume is desired.

* * *

WHAT IS the significance of R. M. S. in reference to alternating currents and voltages. This abbreviation is used very often in radio but I have never seen an explanation of it.—MACKENZIE ANDERSON, Halifax, Nova Scotia.

R. M. S. is the abbreviation for "root mean square," and, as the term indicates, it is the square root of the average square. Suppose we have a varying current which changes according to the following law: At first it is zero, at the end of one second it is .5 ampere, at the end of two seconds it is .707 ampere, at the end of three seconds it is .863, at the end of four seconds it is 1 ampere. At the end of five, six, seven and eight it is respectively .863, .707, .5 and zero amperes. The squares of these numbers are zero, .25, .50, .75, 1.00, .75, .50, and .25 squared amperes. The sum is 4.00. Since there are eight of these squares the average square is .5 squared amperes. The square root of this is .707 amperes, which is the R. M. S. value of the current during the eight seconds. This is also the effective value of the current as it would appear in heating a resistance. In short, the R. M. S. value of a current is the effective value of the varying current.

Show Dates

The third annual Pacific Northwest Radio Exposition will be held in the Public Auditorium, Portland, Oregon, from September 14 to 18 inclusive.

* * *

The Fourth Annual Radio World's Fair will be held in New Madison Square Garden, New York City, September 19 to 24.

* * *

The first combined Aviation and Radio exposition will be presented at the Rhode Island Auditorium, Providence, R. I., from October 24 to 29. The auditorium covers an area of an entire square block.

BLUEPRINTS OF INEXPENSIVE DX RECEIVERS

THE FIVE-TUBE DIAMOND OF THE AIR, a very selective circuit of thrilling tone quality, that brings in distant stations to the great delight of the fans, is easily built, in fact can be constructed in a couple of hours. The authorized blueprints that make this speed and efficiency possible are just off the press and will be shipped at once, together with a booklet of full textual exposition of construction, including winding of coils, how to connect coil terminals, what values of condensers and resistors to use, etc. If you want a tone quality set that will give you great enjoyment, be sure to build this five-tube Diamond of the Air. The receiver consists of a stage of tuned radio frequency amplification, a specially sensitized detector, first stage of transformer audio and next two stages of resistance audio. It is easily adapted to playing, phonograph records on your speaker. Get acquainted with this NEW delight.

THE FOUR-TUBE DIAMOND represents the most that is obtainable from four tubes. A stage of tuned radio frequency amplification, a specially sensitized detector, and two stages of transformer coupled audio. Follow the diagrams as shown in the blueprint and you can't go wrong. You will be amazed at the results. Build the set from parts that you have. Full instructions cover utilization of such apparatus. Thousands are eager to build an economical set and this one is the most economical in cost of construction and upkeep, where one considers the surpassing results. Works splendidly from batteries, with either type 99 or type 01A tubes, and can be used with A and B eliminators, power packs, etc., with great success.

Look Over Both of These

blueprints and read the text in both cases before choosing the receiver you are to build.

SEND NO MONEY!

Just fill out the coupon below, and note what you get FREE!

Guaranty Radio Goods Co.
145 West 45th Street, New York City

Please send me one newly-printed official blueprint of the 5-tube Diamond of the Air, one newly printed official blueprint of the 4-tube Diamond, and the textual data giving full directions for constructing these sets. I agree to pay the postman 75 cents on delivery. Also, you are to send me, without extra cost, one Auto Strop Safety Razor, one blade and one automatic razor strop.

Name .....

Address .....

City .....State.....

CANADA SEEKS NEW WAVES

Washington.

Attempts will be made by the Canadian delegation to the Radio-telegraphic convention to get new assignments for additional waves. There are now only six Canadian exclusive waves, twelve others being shared with stations in the United States.

Do you want to complete your files for Radio World?—Any copy that you missed during the past Summer will be supplied @ 15c. the copy, or any 7 copies for $1.00, or you can start your subscription with any issue. Circulation Dept. Radio World, 145 W. 45 St., New York City.

Literature Wanted

THE names and addresses of readers of RADIO WORLD who desire literature on parts and sets from radio manufacturers, jobbers, dealers and mail order houses are puhlished 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 .....

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State .....

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R. B. Murphy, 247 Charlotte St., St. Augustine, Fla.
J. B. Williams, 312 Berkley Ave., Virginia Heights, Roanoke, W. Va.
G. A. Hillsman, 757 North Ave., Wilkinsburg, Pa.
A. MacArthur, 454 Quebec St., London, Ont.
D. D. Bartholomew, 221 South 3rd Ave., Bozeman, Mont.

Universal Announces New Socket Supplies

The Universal Battery Company, 3410-34 South La Salle St., Chicago, Ill., are producing an A eliminator, a B and C eliminator and an ABC eliminator. The A unit contains a moisture-proof battery in pressed glass and a Westinghouse Rectox dry disk rectifier. The operation of the charger is automatic. The Raytheon tube is used in the B and C units. As high as 180 volts at 40 mils for B and 45 volts for C can be obtained. Photo shows the A supply.

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WGL Goes Off Air During Removal

WGL, owned and operated by the International Broadcasting Corporation, has completed its new transmitting station located at Secaucus, N. J., and began the removal of the transmitting apparatus. The station closed for two weeks, to resume transmitting on or about September 12, from Secaucus and broadcasting from its new studios in the heart of the theatrical district of New York City.

The cost of this removal is approximately $25,000.

MOVIE STARS AT KNX

Los Angeles.

On each of the Grauman's Chinese Theater nights over KNX, a star of the screen world appears in person. The most recent was Mary Astor. Cecil B. de Mille, director of the "King of King,' started off these programs by appearing himself before the microphone.

HANDY RF BIAS

An Eveready No. 706 dry cell, which is used paired in the fountain pen type flashlight, may be mounted singly in a standard grid leak holder, with clips reversed, making a neat 1½-volt C bias arrangement for the RF portion of the set. The flashlight arrangement is broken into its component cells.

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

COMPLETE AND LATEST LIST OF STATIONS appeared in Radio World, dated Aug. 6. Sent on receipt of 15c., or start your subscription with that number. RADIO WORLD, 145 West 45th St., New York City

Do you want to complete your files for Radio World?—Any copy that you missed during the past Summer will be supplied @ 15c. the copy, or any 7 copies for $1.00, or you can start your subscription with any issue. Circulation Dept. Radio World, 145 W. 45 St., New York City.

TELEVISION

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Here is the first and only book in print that gives you the complete story of television from earliest experiments to the present day machines.

The book is the most complete publication of its kind. It gives you *the history, the facts* and the full instructions on how to build, in your own home, an up-to-date model Television apparatus.

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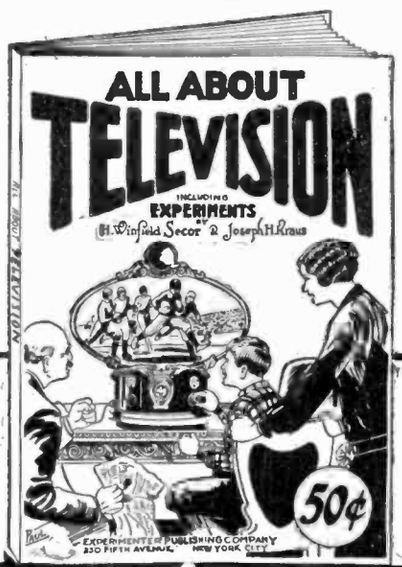

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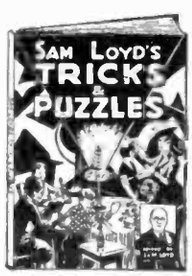

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