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Vol. 10 No. 1 *Illustrated*

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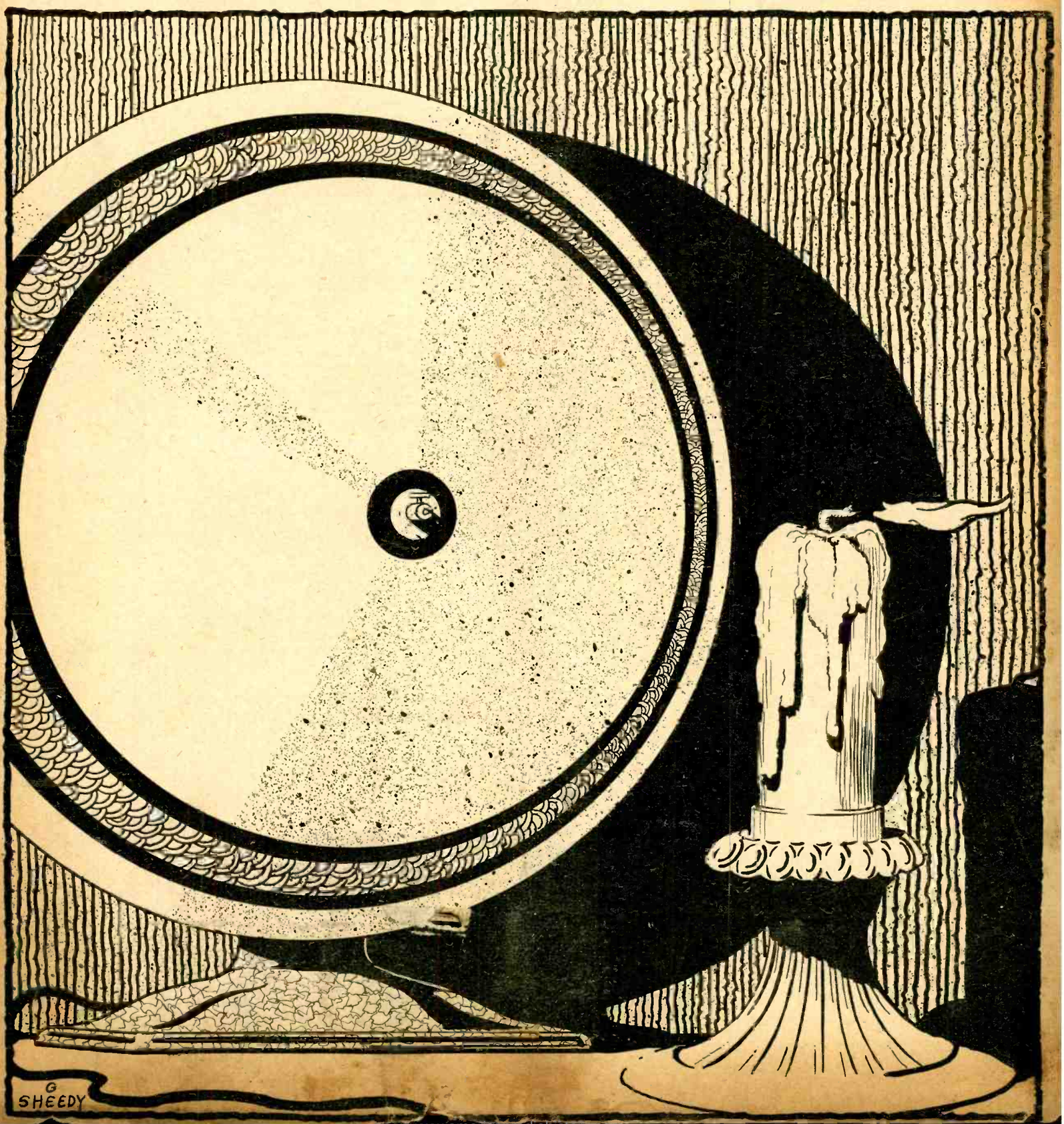
LYNCH POWER AMPLIFIER

RECEIVED NOTE BLOWS OUT CANDLE! *(See Page 8)*



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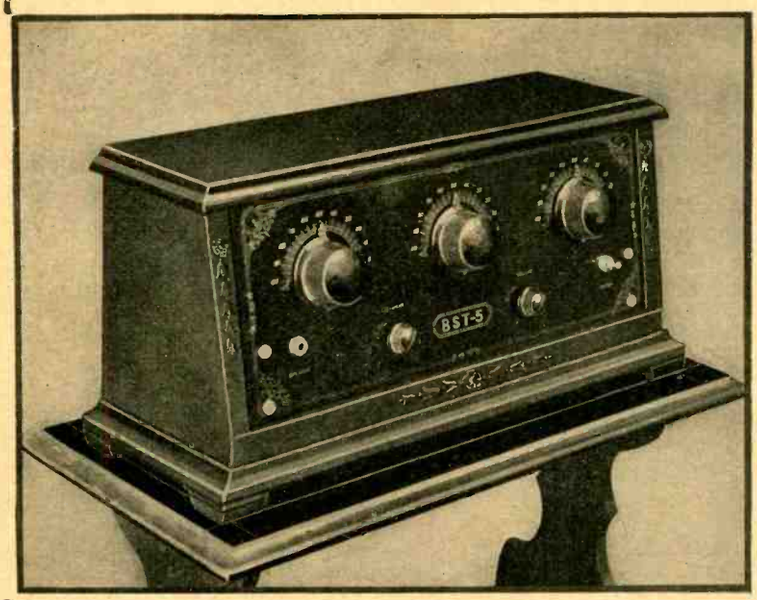
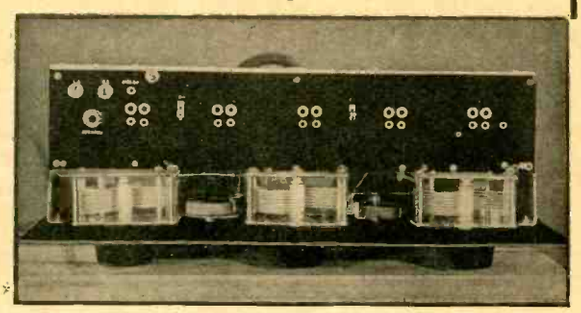
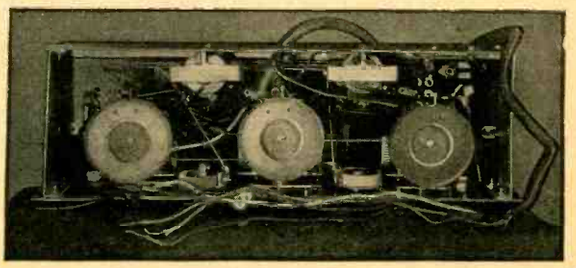


New model cabinet, Du Pont Duco finish; base 21" long by 8" wide, height 9½", top 21" by 6" Five-ply walnut veneer piano finish.



Top inside view, BST-5, showing compact aluminum shielded indestructible chassis.



Bottom inside view, BST-5, showing improved foolproof curkoid coils and rigid construction, with complete harness for simple installation.

THIS highly sensitive, powerful and selective BST-5 radio receiver has all up-to-the-minute improvements. Heavy aluminum automobile type chassis, shielded against stray currents and distortion. Flexible grip, Universal type sockets, eliminating microphonic noises. Has provision for battery eliminator and any power tube. Fahnestock clips on sub-panel for adjusting C battery, has voltages for power tube. Efficient on either long or short aerial, including indoor aerial. This BST-5 sets a new standard for true tone values and selectivity. This BST-5 gives greater volume than many six-tube sets and consumes less current.

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[Entered as second-class matter, March, 1922, at the post office at New York, N. Y., under Act of March 3, 1897]

THE LYNCH
Lamp Socket Amplifier

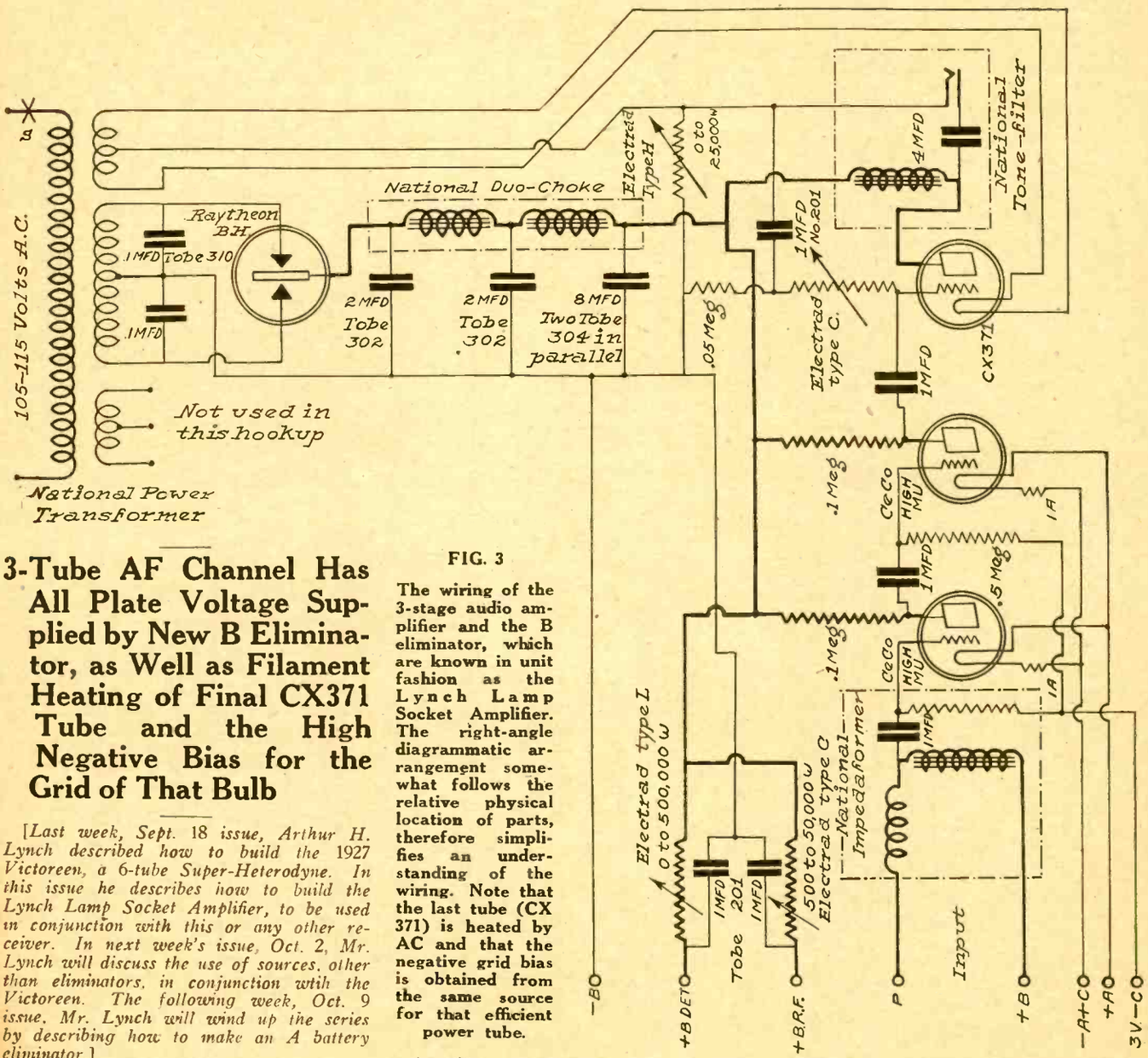


FIG. 3

The wiring of the 3-stage audio amplifier and the B eliminator, which are known in unit fashion as the Lynch Lamp Socket Amplifier. The right-angle diagrammatic arrangement somewhat follows the relative physical location of parts, therefore simplifies an understanding of the wiring. Note that the last tube (CX 371) is heated by AC and that the negative grid bias is obtained from the same source for that efficient power tube.

3-Tube AF Channel Has All Plate Voltage Supplied by New B Eliminator, as Well as Filament Heating of Final CX371 Tube and the High Negative Bias for the Grid of That Bulb

[Last week, Sept. 18 issue, Arthur H. Lynch described how to build the 1927 Victoreen, a 6-tube Super-Heterodyne. In this issue he describes how to build the Lynch Lamp Socket Amplifier, to be used in conjunction with this or any other receiver. In next week's issue, Oct. 2, Mr. Lynch will discuss the use of sources, other than eliminators, in conjunction with the Victoreen. The following week, Oct. 9 issue, Mr. Lynch will wind up the series by describing how to make an A battery eliminator.]

By Arthur H. Lynch

A SUPER-HETERODYNE capable of such performance as the new 1927 Model Victoreen previously described by the writer deserves only the best of audio amplifiers. With a good audio amplifier, having an essentially straight line frequency characteristic and a similar speaker, truly remarkable quality, along with full or natural volume, is always available.

Amplifiers of this type are not economically or conveniently operated from batteries, but should obtain their power from the lamp socket, as the tube employed in the last stage must be of the semi-power type. A loud speaker requires energy for its operation, and if the amplifier does not supply enough energy properly to operate the speaker, distortion will result. Furthermore, the last tube must be able to handle the input voltage supplied to it by the previous tubes. If it can't, then overloading, perhaps the most common cause of audio distortion, creeps in. Tube overloading is prevented, and sufficient power output is readily obtained by using a power amplifier tube with high negative grid voltage and corresponding plate voltage in the last audio stage.

The filament of this power tube may be heated with alternating current obtained from a special winding just for that purpose on the same transformer that supplies the high voltage to the B supply rectifier.

While designed primarily for use with any good receiver, such as the Browning-

Power for the Victoreen

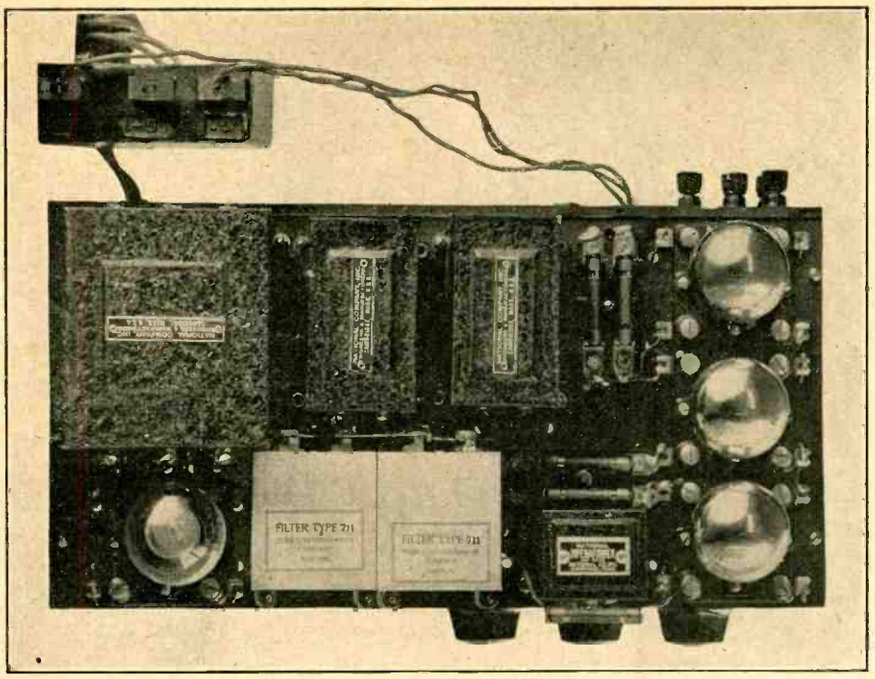


FIG. 4

The top view of the Lynch Lamp Socket Amplifier. The National Power Transformer is at left, above the Raytheon Type BH tube. The National Duo-Choke is next and after it comes the National Tone-Filter. The tubes at right, top to bottom, are first AF (CeCo Type G), second AF (CeCo Type G) and third AF, the power tube (Cunningham CX371). Three of the Royalty resistor knobs are shown. The other (final audio variable grid leak type C) is underneath the subpanel. The two visible condensers are Tobe 304, connected in parallel.

Drake, the Lynch lamp socket operated B supply and power amplifier is particularly well suited for use with the Victoreen Super-Heterodyne. Not only is this amplifier capable of handling the output of a good Super-Heterodyne, but it will also supply the necessary plate voltage for all the tubes. Thus, for a complete lamp socket operated set, it then becomes necessary to obtain only an A power unit such as the Gould Uni-Power.

The Lynch Power Amplifier consists of two stages of voltage amplification employing CeCo high mu tubes and one stage of power amplification employing the new CX371 Cunningham. The input device to the first stage is one of the National Impedaformers, which consists of a high inductance choke coil, a 1.0 mfd. grid or coupling condenser, a 0.1 meg. grid resistor, and a radio frequency choke, so designed as to prevent any radio frequency current from getting into the audio amplifier by way of the detector plate circuit. This is a rather novel arrangement, and serves well not only completely to eliminate a common source of distortion, but also results in greatly improved detector operation.

The coupling units for the next two stages are of the Lynch metallized filament resistor type with 1.0 mfd. grid condensers.

The use of metallized grid resistors is essential, if the best of quality and permanent results are to be obtained from a resistance coupled amplifier. When the impregnated paper type of resistor is employed, not only is the amplifier likely to be noisy, but the ohmic resistance of the various units will be found to change gradually with use, so that after a few months the quality becomes noticeably poor. Thus, for the best of results the resistors in a resistance coupled amplifier must be silent in operation and permanent in value.

This combination of impedance and resistance coupling results in such extremely uniform amplification that the quality, when using a high grade speaker, such as a Western Electric cone or the Best Rectavox, is well-nigh perfect.

In the plate circuit of the last tube is placed an output device. This unit, which is known as the National Tone Filter, serves several useful purposes. Perhaps the most apparent one to the layman is that indicated by its name, as it does actually eliminate that noisy background which often reminds one of the needle scratch of the phonograph. Other essential services which this little unit perform are the prevention of damage to the loud speaker by keeping the heavy plate current drawn by the CX371 tube from passing through the coils in the louder speaker, and safe-guarding the user from the danger of a shock on touching any of the exposed "live" metal terminals or parts of the jack, plug, or speaker.

The plate power for the amplifier is obtained from a special built-in current tap employing the new BH Raytheon filamentless rectifier tube. The high voltage for the rectifier tube is obtained from the lamp socket by means of a National Universal power transformer. After passing through the rectifier, the plate current is passed through a double section filter which removes the "hum" otherwise present. This filter consists of a National Duo choke and several Tobe filter condensers connected as shown in Fig. 3.

Two lower plate voltage posts are provided on the amplifier so that it may supply plate power to the detector and radio frequency tubes of any set. When used with the Victoreen Super-Heterodyne, however, only the B supply post marked RFB is used, as the detector voltages are obtained by means of resistors contained within the Super-Heterodyne.

+B Post Included

The +B detector post is included in the amplifier so that its use will not be restricted to the Victoreen Super-Heterodyne, but that it may be used with any other good receiver.

The filament of the last or power audio tube is heated by means of a low voltage winding, especially provided for that purpose on the National power transformer.

By mounting the various units on a 7x14" Bakelite panel, raised on a pair of rubber brackets, much of the wiring and many of the small parts such as resistors, Amperite, by-pass, and some filter condensers, are concealed from view, thus greatly enhancing the appearance of the complete unit. Each part is completely shielded in its own individual case, and all the metal cases are connected together and grounded by a common bus. Two small 2x14" bakelite panels one in front and the other in the rear, boxed in the under-structure, and at the same time serve as terminal boards on which are located the loud speaker jack and various binding posts, as well as the voltage controls for the receiver and grid bias control for the power tube.

The first step to be taken in the actual construction of the combined amplifier —B supply unit is to arrange the various parts on a 7x14" Bakelite panel as shown in Fig. 4 herewith. When all of the parts have been carefully located in their proper position, a scriber or other pointed instrument is used to mark the location of the various holes required for mounting them, as well as the holes through which the different leads are to pass. The parts are then removed and the holes drilled with a No. 19 drill.

The Bakelite base either may be left with the original gloss finish or given a dull satin finish with No. 00 sandpaper and oil.

The two hard rubber brackets are next fastened in place and then the various units mounted.

The two panels carry the binding posts,

LIST OF PARTS

for Lynch Lamp Socket Amplifier

Two Bakelite panels 2x14x3/16".
One Bakelite subpanel, 7x14x3/16".
Two hard rubber Garfield brackets.
Four Eby push type sockets.
Four Eby binding posts, B—, B+, B+RF, B+Amp.
One National Universal Power Transformer.
One National first stage Impedaformer, Type B.
One National Duo-Choke.
One National Tone Filter.
Two Tobe 4.0 mfd. condensers (304).
Two Tobe 2.0 mfd. condensers (302).
Five Tobe 1.0 mfd. condensers (201).
Two Tobe 0.1 mfd. condensers (310).
Two Lynch double resistor mounts.
One Lynch single resistor mount.
One 0.5 meg. Lynch metallized resistor.
One 0.5 meg. Lynch metallized resistor.
Two 0.1 meg. Lynch metallized resistors.
Six lengths flexible Acme Celatsite.
Two Electrad Royalty Variable Resistances, Type C, 500-50,000 ohms.
One Electrad Royalty Variable Resistance, Type H, 0-25,000 ohms.
One Electrad Royalty Variable Resistance, Type L, 0-500,000 ohms.
One Electrad single circuit open jack.
One Raytheon BH tube.
One Cunningham CX371 tube.
Two CeCo high mu tubes (type G).
Two 1-A Amperites.
One Cutler-Hammer toggle switch (S at cross in Fig. 3).
One Eveready 4½-volt C battery.
One jack plug for speaker.

All B, One C, Eliminated

plate voltage resistors, grid bias resistor and speaker jack. The two No. 1A Amperites, efficient and automatic filament regulators, are located under the base, as are also the grid filter resistor, the three grid condensers, the two transformer secondary balancing condensers, the three by-pass condensers, and the two 2.0 mfd. filter condensers.

After all of the parts have been mounted, the amplifier is ready to wire. The wiring should be done with No. 18 equivalent stranded tinned unvulcanized rubber covered wire or Acme Celatsite or with other wire of high voltage insulation. Start at the power transformer and wire the B supply part of the unit first, as, unless a small soldering iron is available, it may be necessary to remove the tone-filter and Duo-choke to solder the leads to their terminals. The two wires from the amplifier filament winding on the transformer to the filament terminals on the last audio amplifier tube socket should be twisted together throughout their entire length. This will prevent the low voltage AC passing through them from introducing a "hum" into the surrounding leads. When the wiring has been completed the various leads should be grouped together and bound into a single cable.

Perhaps before describing the final adjustment and operation of the amplifier it might be of interest to tell how and why the grid biasing voltage for the last audio amplifier tube is obtained.

As the plate voltage on the CX371 is in the neighborhood of 180 volts, the required grid voltage is somewhere near 40 volts. To obtain such a voltage is at first thought quite simple, as it would appear that all that is necessary is a resistor in the negative plate return lead of the last tube, which resistor has such an ohmic value as to cause a 40-volt drop across it. If such an arrangement were to be tried, however, the results would be rather discouraging as it would be found that very little amplification was being obtained from the last tube. This apparently peculiar phenomenon is due to the fact that not only would the DC component of the space current be passing through this resistor and thus produce a constant voltage drop, but also the alternating or audio frequency component, which would produce an alternating voltage. The combination of the alternating and direct voltage drops would result in a pulsating biasing voltage having such phase relations as to result in greatly reduced amplification, or a sort of negative regeneration.

If, however, the direct and alternating components of the plate current are separated and only the direct current permitted to pass through the biasing resistor, a steady grid voltage will result. By means of a simple filter comprising a .05 meg. Lynch metallized core resistor and a 1.0 mfd. Tobe filter condenser, the direct and alternating currents are readily separated and the AC kept from passing through the variable resistor across which the grid voltage is obtained. As the plate current will be different for different tubes, line voltages and set loads, it is most practical to employ a variable resistor such as the Royalty type C for obtaining the grid voltage drop. This resistor may then be adjusted for optimum results under any conditions and once so adjusted will require no further attention unless the tubes or some other part of the amplifier or super-heterodyne are changed.

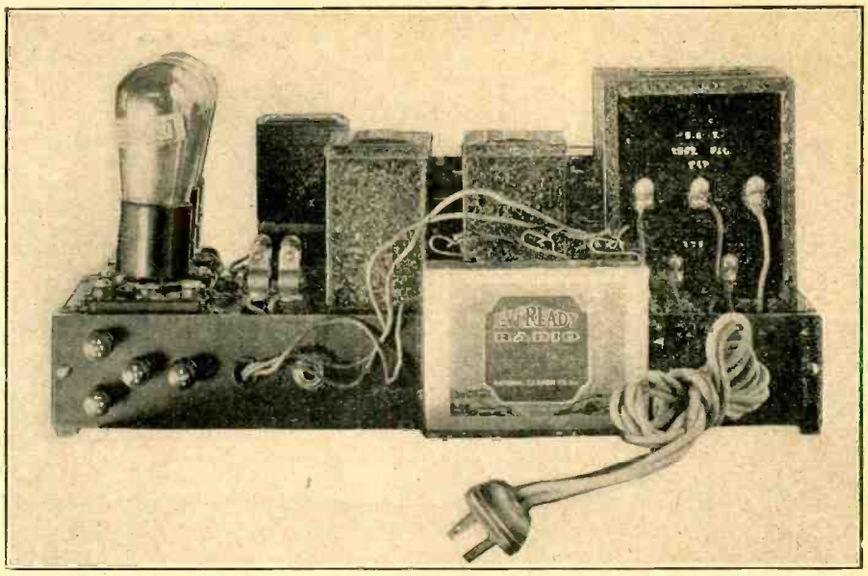


FIG. 6
Rear view of the Lynch Lamp Socket Amplifier.

Operation of Lynch Amplifier

When the amplifier has been completely wired, the Amperite, resistors, and tubes should be inserted in their proper receptacles. The plate resistors of the resistance coupled amplifier should be 0.1 meg Lynch metallized resistors. The grid resistor for the second stage should be 0.5 meg. and the one in the last stage 0.25 meg. A 0.1 meg. Lynch metallized resistor is supplied with the National Impedaformer used as an input device to the first audio stage. The grid bias filter resistor should be a .05 meg. metallized resistor, and the two Amperites, as stated, should be type 1A, the filaments of the two CeCo high mu tube filaments being connected in parallel, the connection to the A supply being completed through the Amperites.

When all the resistors are in place and the amplifier is connected to the A battery or Gould Uni-Power and the Victoreen Super-Heterodyne, for operation, then the two CeCo high mu tubes should be placed in their sockets. If all is well, they will light. The CX371 and the type BH Raytheon are next inserted in their proper sockets and the lamp socket power turned on.

The first step in adjusting the amplifier is to set the dials of the Super-Heterodyne so that it is tuned to the frequency of some local station. Then set the variable resistors on the amplifier to rather high values of resistance. The station then will be heard and various adjustments of the two resistors tried until the best results are obtained.

Potentiometer Affected

It will be found that when the Super-Heterodyne is used in conjunction with the Lynch Power Amplifier and B Supply, that the position of the grid bias potentiometer on the Super-Heterodyne itself depends more or less on the amount of voltage supplied to the receiver, which is determined by the rotation of the variable resistor which supplies this voltage from the amplifier. In this connection it will be noticed that on the amplifier there are two outlets. One is detector and the other RF or radio frequency. The radio frequency outlet will supply a higher voltage than is possible from the detector outlet. This is governed by the values of variable resistors used in these two circuits. In most of our experiments results have been found most satisfactory with the 1927 Victoreen when the detector output is used rather than the radio frequency. It will be observed by the constructor than although two output voltages are available on the Lynch Power Amplifier and B Supply only one is used when that unit is operated along with the 1927 Super-Heterodyne. The two outlets have been provided because sometimes it will be found worth while to use this power amplifier unit in connection with other re-

(*Continued on page 6*)

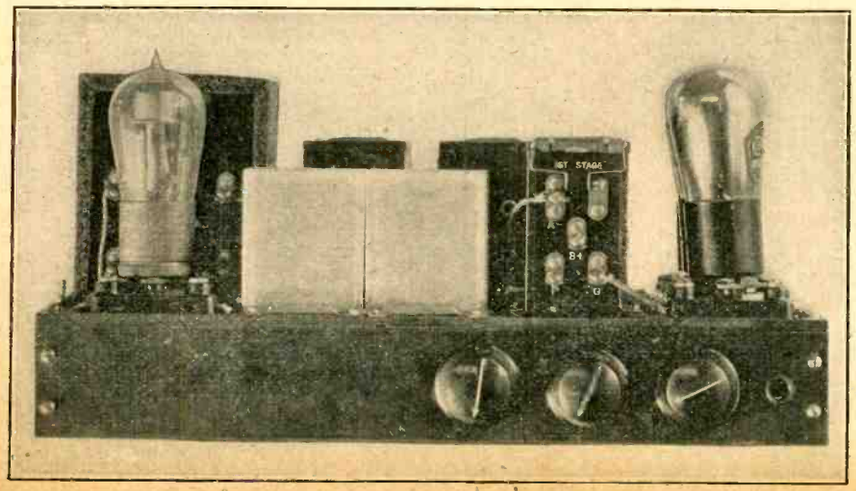


FIG. 5
Front view of the Lynch Lamp Socket Amplifier.

Wiring Up the Victoreen

Points of Novelty Discussed in Detail for the Benefit of The Novice—Resistor, Loop-Aerial Jack and Second Detector Output Wiring Stressed—Hints on Order of Procedure for Greatest Convenience

By Herman Bernard
Associate, Institute of Radio Engineers

A FEW pointers on wiring up the 1927 Victoreen, as designed by Arthur H. Lynch, may prove helpful to novices, as this is a Super-Heterodyne that even the novice can build and feel certain of fine success. Mr. Lynch's article, published last week, issue of September, 18, gave all the information of the construction of the receiver that would be required by any one who has any knowledge of radio technique, but to me has been assigned the task of taking care of the novice's needs.

A good plan is to do part of the wiring without the panel attached, as the panel and the parts mounted thereon will make access more difficult. The filament leads may be wired first, and this is good advice in regard to any receiver, It is assumed that the baseboard parts are mounted, e. g., the Victoreen antenna coupler, the Victoreen oscillator coupler, the four Victoreen intermediate transformers, the six Eby sockets, six Tobe bypass condensers, etc.

Filament Wiring

Treat the F plus post of the sixth and last tube as A plus, since the switch and pilot light wiring will be treated as part of the panel work, and then begin wiring the socket filament posts of the sockets, thus: The F plus posts of all six sockets are interconnected, but are not yet brought to the A plus binding post on the battery terminal strip. The F minus socket posts require special treatment. The A minus lead is carried from the terminal strip post to one side of R1, the 1-A amperite for the sixth tube, while the other side of this amperite goes to the F minus socket post. The A minus lead—that is, the bus from the battery itself—is connected to one side of the rheostat R4, the 20-ohm Victoreen manganin rheostat. The other side of this rheostat goes to the F minus posts of all three intermediate stage sockets (3), (4) and (5). Reference to Fig. 1, published last week, will clarify this, as well as other points that will arise in the course of this article. R2 is wired to its socket as outlined for R4.

Now five sockets are accounted for, and the sixth one (1), is wired with an Amperite in the fashion already explained in connection with the description of the last socket.

Now the single B plus lead may be run from the battery terminal strip to one side of each of the condenser-resistor combinations. As readers of the previous articles are aware, the voltage from the B source, normally 180, is dropped in each instance across a Lynch metallized resistor, which is shunted by a 1.0 mfd. Tobe bypass condenser.

The Voltage Drops

As these already are mounted on the baseboard, let us assume, you will proceed by connecting the B plus lead to one side of R7, R8, R9, R10, R11 and R12. As each resistor has its own bypass, located nearby, this lead is joined also to one side of C4, C5, C6, C7, C8 and C9. Now the other side of these combinations is wired to the plus post of the second intermediate in each instance. The open ends go as follows: C4R7, to plus post on the oscillator coil; C5R8, to plus post of the first intermediate frequency transformer; C6R9 frequency transformer; C7R10 to the plus post of the third intermediate frequency transformer; C8R11 to the plus post of the fourth intermediate frequency transformer, and C9R12 to the plus post (marked with a cross on Fig. 1 last week) of the Carter single circuit closed jack, which jack also has the cross on it. The P and B posts on Fig. 1 last week represent input posts of the audio channel, and are indicative, rather than an actual part of the wiring of the radio receiver.

The Pilot Lights

The pilot lights need some discussion. These are connected anywhere across the A battery line, but be careful to distinguish A minus from F minus. The socket post represents F minus, because it is the voltage after the drop has taken place in the filament resistor, whereas A minus represents the A battery bus itself. Hence the full 6 volts go across the pilot lights. The panel may be affixed to the baseboard at this time and the pilot light wiring done. Connect the A plus lead of the nearest tube to one point of the switch and the corresponding switch contact point to A plus on the battery terminal strip. The third point on the switch goes to A minus. Reference is made to PL1 in Fig. 1 of last week (on Bruno light switch). PL2 and PL3 are on the National illuminated type C dials and the same system (of wiring them across the A line) is used.

There remain only two points that might be confusing to the novice—the wiring of the Carter double pole double throw jack LAJ and the wiring of the Carter SCC pack DJ. For this reason the wiring of both was shown pictorially in the schematic diagram.

Wiring Tip

If you will wire the loop jack with the jack so positioned that the knob is to your left, indicator on top, then by referring to Fig. 1 you will not make a mistake. For instance, the top spring goes to one of the Carter Imp cord tip jacks CTJ, the second from top spring goes to the stator plates of the tuning condenser NE1 and to the grid condenser; the third from top to the G post of the antenna coupler (Victoreen No. 160), the fourth from top to the other tip jack, the fifth from top to the rotor plates of the tuning condenser and to one of the two posts that occupy exclusively one side of the oscillator coil (Victoreen No. 150), while the sixth and final spring is joined to the remaining open terminal of the secondary of the antenna coupler.

The detector jack is wired with plate to one of the unposts not designated on the jack itself, while the other unmarked jack post goes to the plate of the audio amplifier. The plus post on the jack is wired and goes to B plus, as explained before.

Lynch Tells About An "A" Eliminator

Says It Is a Serious Problem But That He Will Show Something Interesting in the October 9 Issue of Radio World

(*Continued from page* 5)

ceivers where two separate voltages, one for the detector and one for the radio frequency stages, are required.

The operation of radio receivers directly from the light socket has never been given the attention heretofore which it is receiving this year. The elimination of B batteries is now not only possible but it has been found to be a very practical system. The abolition of the A battery, however, has been found to be a very much more serious situation and problem than had been expected by most engineers.

May Use Trickle Charger

Several systems have been developed for this work, however, and it is the pleasure of the author to describe these in complete detail (RADIO WORLD, Oct. 9). Aside from this it is well to point out the use of various units which are on the market and which when used in combination with the storage battery or other batteries already on hand will provide actual lamp socket operation although they do not absolutely eliminate the A battery.

Among the units which may very well be considered in this class are those storage batteries which have in combination with them some form of trickle charger. If the home constructor already is supplied with an A battery this form of combination should be particularly attractive to him. Trickle chargers are made by many firms, and also sold in conjunction with suitable A batteries, e.g., The Gould Uni-Power, The Westinghouse Exide, Philadelphia Diamond Grid Co. Each of these units has some particular advantage but any of them will be found to give very satisfactory results when properly employed. To use devices of this kind it is necessary to provide your receiver with some sort of a change-over switch for connecting the trickle charger to the battery when your receiver is not in use and for throwing the trickle charger off when the receiver is in use, and at the same time setting in operation the power amplifier and B supply.

Three Fine Views of the Set

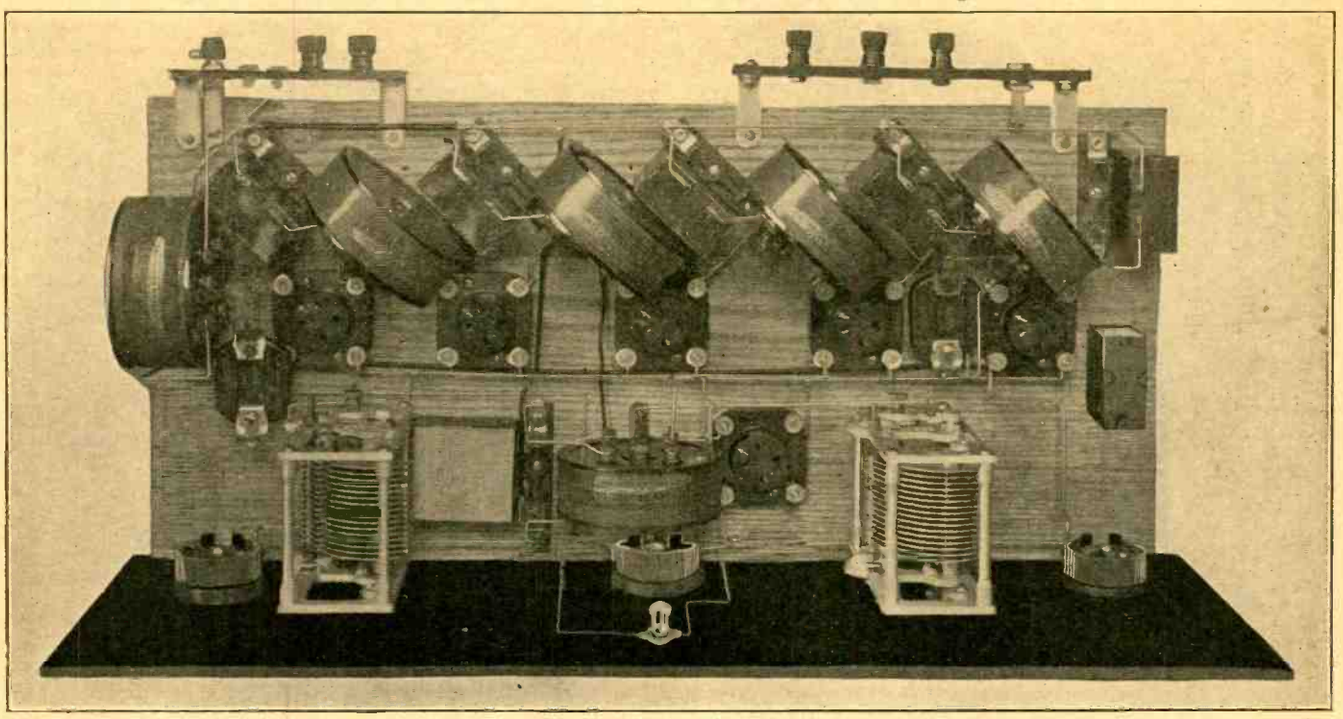


FIG. 7
Top view of the 1927 Victoreen. At left, antenna coil, lower center, the oscillator coupler.

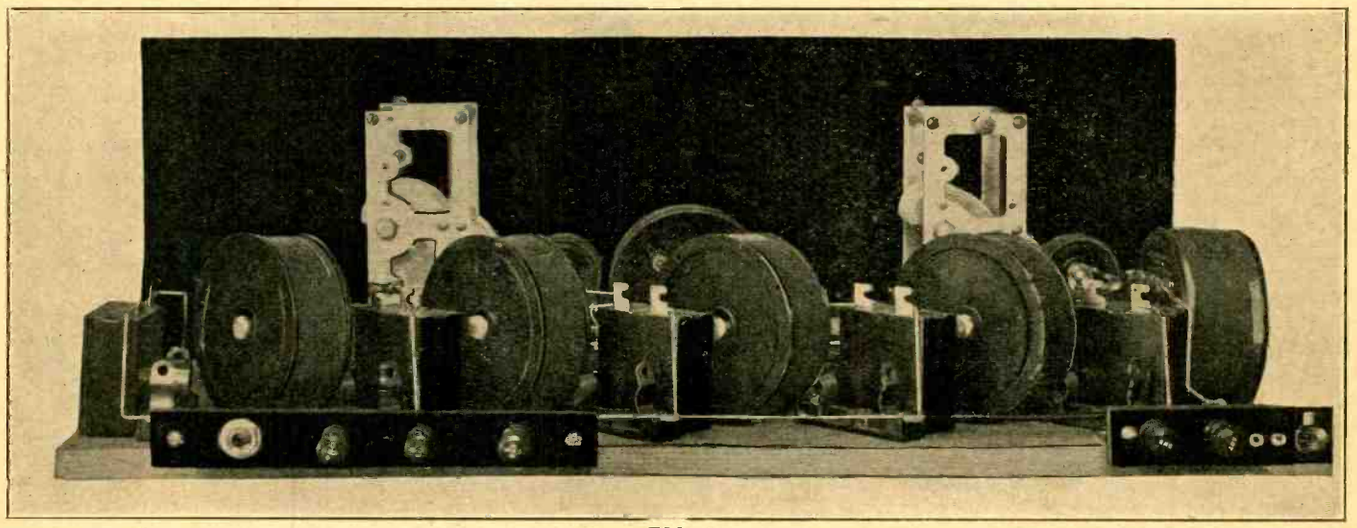


FIG. 8
Rear view of the set. Note arrangement of the two terminal strips.

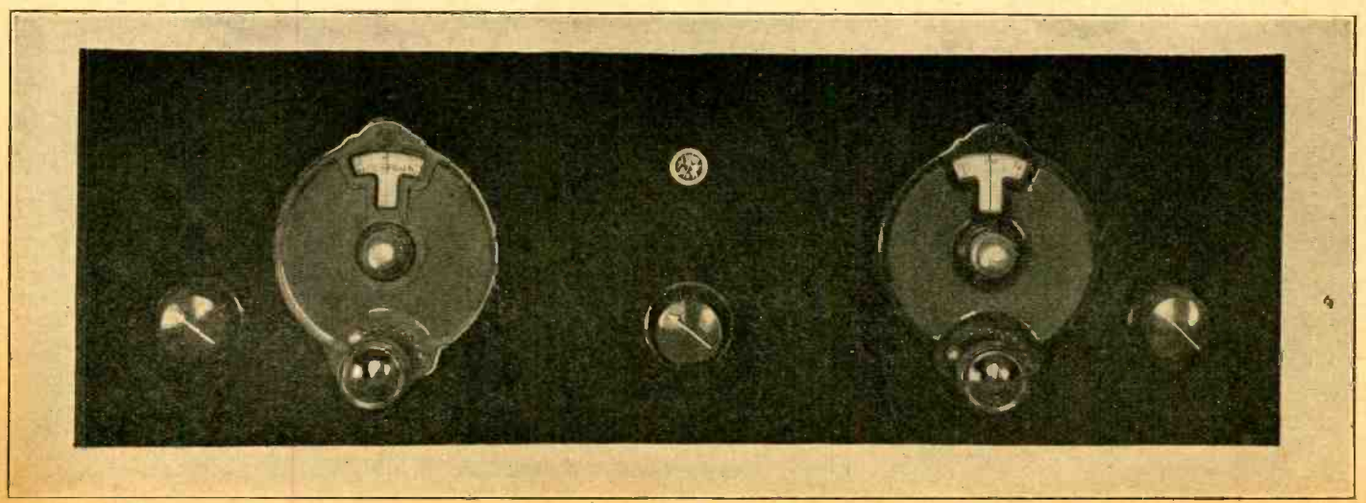


FIG. 9
Front panel view, with panel erect. Slope the panel for better aesthetic effect.

Cone Blows Out a Candle

Tenor's High Note Uttered Before the Microphone, Received by Set 12 Miles Away and Cone Sets Up Vibrations That Extinguish Light—Reasons for Phenomenon Explained

By Brunsten Brunn

EVERYBODY who has studied a weather map will know that there are areas of high and low barometric pressure over the country.

In one section the pressure is much above normal. This is an area of condensation of the air, or of compression, and there is no disturbance of the air whatsoever.

In another area a few hundred miles away, or perhaps a couple of thousand miles, there is a low barometric pressure. This is an area of rarefaction of the air, and here, too, there is no motion.

At some place between the two extremes, the barometric pressure is normal. But at this place the pressure gradiant is very steep, that is, the pressure changes rapidly from place to place. Here the air is in rapid motion, from the place of high pressure toward the place of low. But at this place the pressure gradient be extinguished immediately. When a person happens to be in one of these areas he has a difficult time lighting a cigarette in the street. This proves that an air wave of extremely low frequency may be used to extinguish a candle, or a match.

The Amplitude

The intensity of the wind in any place depends on the value of the pressure gradient at that place—it is directly proportional to it. And the pressure gradient in turn depends on two things; first, on the difference between the pressures at the high and the low, and second, on the distance between these two points. The greater the difference between the pressures at the high and the low, the greater is the gradient for any given distance apart of the two extremes in pressure. Also, the closer the two pressure extremes are, the greater is the gradient for any given difference in the pressure extremes. Half the difference between the least and the greatest pressure in a wave is the amplitude of the wave, or it is the intensity of the wave. The distance between two points of maximum pressure, or of minimum, is a wavelength, and this is inversely proportional to the frequency, or the pitch.

A sound wave of a single frequency consists of alternate regions of condensations and of rarefactions, or of high and of low pressures. Half way between the points of highest and of lowest pressure the gradient is greatest but the pressure is normal. At this point the air is in rapid motion from the point of condensation to the point of rarefaction. In other words, there is a wind there. If this wind is strong enough it will blow out a candle flame.

Can't Use Low Pitch

But for sounds of low pitch the pressure gradient is small and the wind is weak for any intensities that the ear would tolerate. Hence a candle flame cannot be extinguished by a sound wave of low pitch. If the intensity were great enough to accomplish the feat the wave would no longer be a sound wave but merely a pain in the ear. As the pitch increases, so does the gradient, and consequently the wind. For the higher pitches the wind will be strong enough to blow out the flame while the intensity is such that the ear still perceives the wave as sound, and long before it degenerates into a pain.

But the increase in pitch cannot go on indefinitely and still have the sound wave blow out the candle. There will come a pitch for which the wavelength of the sound is comparable with the width of the candle flame. The wind will no longer blow the flame away from the wick, but it will merely cause the flame to execute a violent shimmy. The motion of the air will be almost straight up and down.

Wavelength Computed

When the pitch is such that half a wavelength is equal to the width of the flame, there will be a rarefaction on one side when there is a condensation on the other. The flame will then alternately elongate and flatten out. The burning gases will remain over the wick.

The limiting pitch may be easily determined. Suppose that the width of the flame is half an inch. The wavelength which will cause the condensation to be on one side when the rarefaction is on the other is then one inch. Now, sound travels approximately 1,000 feet per second, or 12,000 inches. The velocity is equal to the frequency multiplied by the wavelength. Since the wavelength in the case taken is one inch, the pitch of the wave is 12,000 cycles per second. This is not far from the upper limit of audibility.

It is probable that the optimum pitch for blowing out a candle is such that the wavelength is from four to six inches, which would be from 3,000 to 2,000 cycles per second. The latter is about three octaves above middle C.

The Submarine Test

An experiment similar to that of blowing out a candle with a sound wave was performed during the war in connection with submarine signaling. Sound waves were set up in the water, and for reasons of secrecy super-audible vibrations were employed. A crystal or other mechanical vibrator was immersed in the water and then driven by many watts of electrical power. The fish in the immediate vicinity of the oscillator were so tremendously affected by the oscillations that they lost all sense of up and down. Many were seen floating with their bellies up, and they remained that way ever after; or they went out with the tide as old man Pegotty did.

Joviality Attends Putting Out Flame

SAN FRANCISCO.

Charles Kellogg, tenor, sang a high note before the microphone of GKO and that note was received at the University of California, Berkeley, about 12 miles away, where it extinguished the flame of a candle, a few inches from the cone speaker. There were fifty students and several professors present when the flame went out. One student, anonymous amid the darkness, asked: "Where was Moses when the light went out?"

The ability of the human voice to extinguish a flame if the voice is pitched high enough and of sufficient intensity was discovered in about 1857. A sensitive flame also can be put out with a high pitched instrument.

SAD NEWS GLADLY GIVEN

(*Underwood & Underwood*)

DR. L. W. AUSTIN in his radio research laboratory at the U. S. Bureau of Standards in Washington. He has just announced that he is convinced that static will never be completely eliminated. This, coupled with Dr. J. H. Dellinger's prediction of poor radio until 1932, due to sun spots, makes life hardly worth the living.

WITH THE AMATEURS

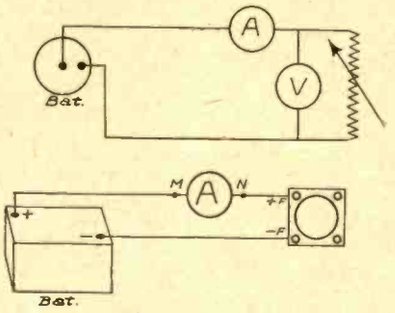
JOHANNESBURG, SOUTH AFRICA.

A silver replica of an African springbok, a variety of small antelope, and the national symbol of South Africa, has been offered by "The Rand Daily Mail," of this city, to the United States, Canadian, or Hawaiian amateur who effects the greatest number of two-way contacts on short waves with South African amateurs during September and October.

The tests are being held under the auspices of the American Radio Relay League, of Hartford, Conn., and the South African Radio Relay League, with headquarters in this city. Any amateur in either country with a transmitting station is eligible, and the only requirement of the contest is that each American, Canadian or Hawaiian station work just as many South African amateurs as possible during the two months. If an American station works the same South African amateur more than once in a given week, only one contact will be counted toward the total. The making of schedules between stations is prohibited.

Ohm's Law for the Novice

Problems in Resistance, Voltage and Amperage Easily Solved—Where Two of the Factors Are Known the Other Can Be Calculated—Application to Rheostats and Tube Filaments



FIGS. 1 AND 2

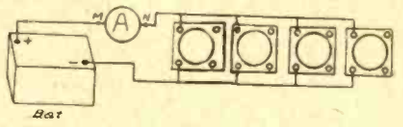


FIG. 3

Toy Trains on Track Used As Analogy, When the Pressure to Move Them is the Voltage, the Movement Itself is the Amperage and the Retarding Effect of the Tracks is the Resistance

By K. B. Humphrey

FOR a complete understanding of radio and radio circuits, though not necessarily a highly technical understanding, it is necessary to know somewhat of the fundamentals or underlying principles of the electric circuit. Without going into full details as to the various theories as to just how and why certain things take place, it is well to get an idea of the simple laws which govern the action of electricity in motion. First let us get an idea of what is meant by an electric circuit. A simple circuit consists of a battery, with a resistance connected across it, by means of copper wires. This is an electric circuit and if the wire or resistance is opened at any point the circuit is broken and no current will flow. Therefore, in order that we have an electric circuit there must be a source of electricity, such as a battery or a generator, and there must be a connection by means of some substance which will carry an electric current between the two poles of the battery or other source.

Ohm's Law

The current in amperes in an electrical circuit varies directly as the voltage impressed on the circuit and inversely as the resistance of the circuit under consideration. This relation may be expressed in a simple equation as follows;

$$I \text{ equals } \frac{E}{R}$$

where I is the current in amperes, E is the potential expressed in volts, and R is the resistance of the material carrying the current, in ohms. This same equation may be solved for resistance for

$$R \text{ equals } \frac{E}{I}$$

It may also be solved for the voltage in the circuit or any part of it, for

$$E = I \times R$$

To many an equation does not convey the meaning in a way which is readily understandable, so we will try to explain the action of the simple circuit by means of a physical illustration. Consider that we have a circular track much on the same order that the small electric trains run on which are so popular around Christmas time with the small boys (and their fathers). Consider also that the track has small cars on it all fastened together, making a complete circle. If we give one of the cars a push the whole string will move around the circle at a speed which is dependent upon how hard we push. The battery in an electric circuit remains in one place and to get the push or force all at one point we may place a forked wheel at one point. The teeth in the wheel engage with the cars on the track and when the wheel is turned the cars will move along the track.

Now, for the analogy: The current flowing is the number of cars passing a given point in a given time. The voltage is the amount of pressure we place on the wheel to make the cars go and it can eas.ly be seen that the higher the pressure the more cars will go by in a given time. The resistance of the circuit corresponds to the friction of the wheels on the track and for our purpose is considered a constant of that particular bit of track. Suppose we take the equation again:

$$I \text{ equals } \frac{E}{R}$$

If E is made greater I is increased. If the resistance is made greater (still using the same force to propel) the cars, the current would be decreased. In other words, if you put the brakes on the cars, still using the same force, the number of cars passing for a given period would be decreased. In a like manner the resistance of an electrical circuit is dependent upon the physical characteristics of the material through which the current is flowing. The resistance will depend then on the length and the cross-section of the wire carrying the current. The current may be measured by means of an instrument called an ammeter and the voltage may be measured by a voltmeter.

If we have a simple electrical circuit as shown in Fig. 1, which consists of a source of electromotive force, such as a battery, and a piece of wire which offers a resistance to the voltage impressed on it and a voltmeter and ammeter connected as shown, we may find out the resistance of the wire. Using the equation $R \text{ equals } \frac{E}{I}$, suppose the ammeter reads 2 amperes and the voltage is 6, then R is equal to 6 divided by 2, or the resistance is 3 ohms.

Now without changing the resistance suppose we make the voltage 12. How much current would flow? Solving for I in the equation $I \text{ equals } \frac{E}{R}$, we have divided by 3, or current flow Y, 4 amperes. Doubling the voltage then with the same resistance doubles the current.

It can be seen from this that with any two given quantities the third may be found without a great deal of trouble. This same law applies to every electrical circuit and is the basis upon which all electrical calculations are made.

The radio receiver has many different circuits combined to give certain results. For instance there is the filament circuit of the tubes. When a current is passed through a resistance, heat is produced. In the case of the heavy copper wire the resistance is so small that very little heat is produced even when a rather large current is flowing. In the case of the filament of the vacuum tube the wire is made small and there is considerable resistance to the current, heat is produced in quantities great enough to make the wire red hot or even white hot. The calculation of the amount of heat which will be produced so that the wire will remain at a constant temperature with a given current and voltage is rather involved.

It is enough to say that heat is produced by a current flowing in a resistance and this heat in the case of a vacuum tube is necessary to its operation. The filament circuit is indicated in Fig. 2, and consists of a storage battery, a vacuum tube, and a rheostat connected in series by means of wires. The tube is designed to run on 5 volts and we will assume that the battery gives a voltage of exactly 6. The amount of current flowing in the tube filament when it is operating normally is .25 ampere (for 01A type). The voltage at the filament is 5, however, and it is desired to cut the battery voltage down by one volt for proper operation.

What is the resistance required in the rheostat? As said before this equation may be applied to any part of the circuit and we desire to lose one volt in the rheostat. Figuring only on the part of the circuit MN then, we have the voltage across it as one and the current flowing is .25 amperes, the amount the tube is rated to take at 5 volts. The whole circuit being in series the amperage must be the same at all parts of the circuit. Then with the equation $R \text{ equals } \frac{E}{I}$ we have $\frac{1}{.25}$ or $\frac{100}{25}$ or 4 ohms. Apparently a rheostat with four ohms resistance would control the tube. This is not altogether true, as the tube actually will operate at a voltage lower than five. The normal voltage of the tube at .25 amperes is given and from this we may calculate the actual resistance of the tube by the equation $R \text{ equals } \frac{E}{I}$ or 5 divided by .25 or the resistance of a standard tube is equal to 20 ohms.

Suppose we wish to cut the voltage down to 4 on the tube. What would be the resistance in the rheostat in order to do this? The resistance remains constant in the tube at 20 ohms, but with a voltage of only 4, the current would be 4 divided by 20 or only .2 amperes instead of .25 as before. This is the amount of current flowing in the rheostat and tube. However, we want a 2 volt drop in the rheostat and solving for the resistance in the rheostat we have $R \text{ equals } \frac{E}{I}$ or $\frac{2}{.2}$

(*Concluded on page* 21)

Tube's Mu Easily Found

Simple Meter May Be Constructed in a Few Minutes — Graduated Scale Used, of Any Convenient Sort, and Resistance Wire, at Uniform Angles, Is Laid Out on a Board—Pointer Contacting With the Resistance Gives Calculation Basis

By J. E. Anderson

IT is often desirable to know the value of the amplification constants of the various tubes which are used in a receiver, but there are very few fans who have access to a suitable measuring device. But a simple "mu-meter" may be constructed in a few minutes by anyone, with which a fairly accurate value of the constant of any tube may be measured. The parts needed are a few feet of resistance wire a wooden board 1x4x24", a divided scale of some kind, and a few screws.

In Fig. 2 is shown a schematic of a "mu-meter" built by the writer. The scale in this case is a strip of cross-section paper 50 cm. long and about 2 cm. wide, cut from standard cross section paper stock. The scale is divided into millimeters, so that there are 500 divisions on the entire scale. It is very easy to estimate to half millimeters, and readings therefore may be made to one thousandth of the scale. This strip of cross-section paper is fastened to a board. The strip should be placed along one edge of the board as illustrated in Fig. 1, in such a manner that the long lines on the paper are parallel with the edge.

Construction Advice

After the paper has been fastened draw the dotted lines across the board with the aid of a square. These lines should of course be drawn through the end points of the graduated scale. This done, drive the six small wood screws G, O, 1, 2, 3, 4, into the board along these lines, not too far apart, and not quite all the way down. Next drive in the two tacks or screws A and B in the relative positions shown. These are for anchoring the resistance wire. Now take a straight resistance wire and anchor it secure at A. Then, keeping the wire straight and taut between points, wind it as indicated between A and B. Around the end points G and 4 make one complete turn. Anchor the second end at B in the same manner as at A.

The size of wire used is not important. The writer used No. 24 Nichrome, because this was available. Finer wire would perhaps be preferable, but even heavier may be used if such is handy. The distance between the two dotted lines depends on the kind of scale that is available, or on the size of board that is used. It is not necessary to use a scale divided into centimeters, nor is it necessary to use cross section paper. A yard stick or a tape measure may be used. But a decimal scale is the most convenient. This kind of scale may be had on cross section paper either in centimeters or in inches.

Should be Same Length

Each section of the resistance wire between the dotted lines represents an arbitrary unit of resistance. For his reason it is important that all the sections should be of the same length. Since the wire must necessarily zig-zag and run at an angle across the board, the angles should be small and equal. However, a slight variation is not important, since the distance between the dotted lines is large in comparison with the distance between any two points at the same end of the board, such as that between G and 1. These distances should be as small as is practicable, say about half an inch. Even if there is a slight variation in the length of the sections, any error thus introduced will be small in comparison with that introduced by the uncertainties of settings for observations.

The theory of use of the device may easily be explained with the aid of Fig. 2. A and B are the customary filament and plate batteries. They are connected as usual, and the filament current is adjusted to normal by means of the rheostat Rh. From grid to plate return is connected the resistance GH.

The Extra Battery

Across this resistance is connected a battery E of about 45 volts, and in series with this batery is a switch S by means of which the circuit may be made and broken. A head set or a sensitive milliammeter is connected between the negative terminal of the filament battery and to some point along the resistance GH. This point divides the resistance into two parts, Rg in the grid circuit and Rp in the plate circuit. Now suppose that we use the milliammeter instead of the telephone. With the switch open there will be a space current indicated in the meter. When the key is closed current will flow through the resistance GH. This will alter both the grid voltage and the plate voltage on the tube. The result will be that the meter reading will change. However, a point may be found between G and H at which there will be no change in the meter reading when the switch is opened or closed. When this point has been found the resistance GH has been divided so that $mR_g = R_p$, where m is the amplification constant of the tube. Hence the mu of the tube may be found by dividing the plate portion of the resistance by the grid portion.

Uniformity Necessary

It is not necessary to know the actual value of the two resistances provided the wire GH is of uniform cross section and resistivity. Any given length of wire may then be used as the unit of resistance, say one centimeter, one inch, or 50 centimeters.

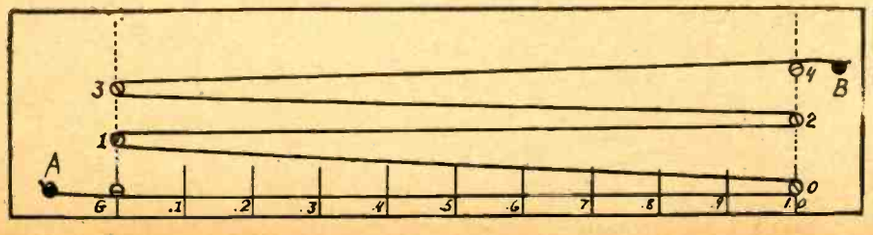


FIG. 1

Layout for calibrated scale and uniformly spaced resistance wire, used for a simple mu meter.

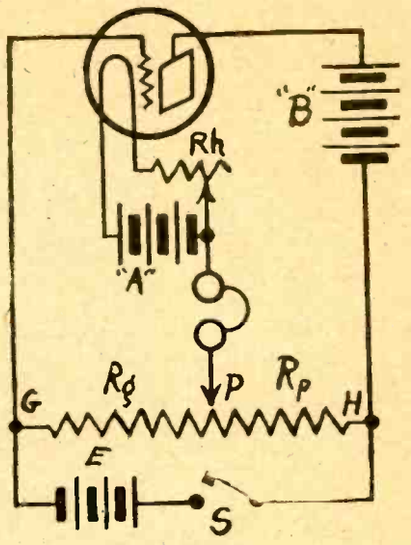


FIG. 2

The circuit diagram for the mu-meter.

In the device described, 50 centimeters have been used as the unit of resistance.

If a pair of earphones is employed instead of a meter, the switch S must be continually closed and opened while hunting for the balance point. If the circuit is not balanced there is a click in the telephone both at make and at break. As the balance point is approached the intensity of this click becomes less and less. Finally it becomes too feeble to be perceived. Mark the reading at this point. Then continue in the same direction until it can be heard again. Return until it again disappears and mark the reading. The average of these two readings is the balance point. Check this average. The silent space about the point of balance may be considerably reduced by working in aperfectl y quiet room. Approach the balance point from both directions in determining the two points at which the clicks disappear.

The exploring point P may be any sharp instrument. The writer used a safety razor blade. A more convenient instrument may be conceived, however.

The device described in the opening paragraphs of this article is merely a calibrated wire GH. Fig. 2 G corresponds with G in Fig. 1, H in Fig. 2 may be any one of the points O to 4 in Fig. 1. If the tube to be measured has a very low amplification constant, point O may be used. If it has a higher constant one of the other points may be used according to the value of the constant. It is not necessary to use any other point for H than point O, but more accurate results will be obtained the nearer the balance point is to the right hand end of section GO. Hence for large values of mu, points 3 or 4 should be used, or additional sections may be used.

The method of reading the meter and the reason for the particular way of numbering the points should be pointed out. Suppose in measuring a certain tube that H is connected to point 3 in Fig. 1, and that the balance point is found at .55 on the wire GO. Then .55 of one section of wire, or arbitrary unit of resistance, is in the grid circuit. In the plate circuit there will be 3 full units plus a portion of the first unit GO. This part is $1 - .55 = .45$. Hence the resistance in the plate circuit is 3.45 units of resistance. The amplification constant then is 6.27. The points have been so numbered that the whole number of units in the plate resistance is given directly. The fractional part of the plate resistance is the complement of the grid reading, and the latter is obtained directly from the scale reading from G.

Single Side Band Radiated

The Carrier Wave and the Other Side Band Are Suppressed in Tests by General Electric Over 2XAH, 1,400 Meters—Efficiency Improved

With Same Amount of Power in the Transmitter Twice the Signal Strength May be Obtained—Interference Decreased — Smaller Frequency Band Permits Greater Selectivity

By I. J. Kaar

Radio Engineer, General Electric Co.

BROADCAST signals whittled down to a single side band are now being put on the air by the newly developed transmitter at the South Schenectary laboratory of the General Electric Company. The usual signal consists of two side bands and a carrier. In the newly developed radio transmission system the carrier is eliminated and one side band is suppressed.

The single side band system is used on license 2XAH and operates on 1,400 meters. Programs of WGY have been broadcast on the higher wavelength and the stripped signal has been received by station WCAD of St. Lawrence University, Canton, N. Y., and rebroadcast on that station's wavelength.

The Advantages

There are three advantages fairly definitely established in the new system. First, it increases efficiency. The ordinary radio signal considered in three parts, consists of the energy at the carrier frequency, energy distributed in the frequency band extending from the carrier upward and energy in a band extending from the carrier downward. The power of the carrier frequency alone makes up somewhat more than half of the total power even when the modulation is as complete as possible. With the same amount of power in the transmitter twice the signal strength may be obtained.

The second advantage of single side band transmission is a decrease in interference. A narrower frequency band from the transmitter permits the use of more selective circuits at the receiving end. This reduces the exposure to noise thus improving the signal-to-noise ratio.

Another and third advantage is the smaller frequency band, thereby conserving the available range for other radio transmission. Audible sounds by which broadcast material is clasified, consist of frequencies or complex wave forms whose frequencies lie between about 30 and 15,000 cycles per second. Such frequecies when converted into electrical impulses could not be radiated efficiently from an antenna, so modulation is necessary. In other words, the low audio frequencies are combined with a higher frequency so the resultant may be radiated.

The Mixing Effect

When two frequencies are combined by a vacuum tube a very interesting phenomenon takes place. If a radio frequency carrier of frequency R cycles per second is modulated with a second frequency of A cycles per second, there will be four frequencies present in the resultant. These will be R, A, R plus A, and R minus A as the "lower side band." It known as the "upper side band" and R minus A as the "lower side band." It should be noted that any of these frequencies may be discriminated against or entirely eliminated by suitable means. The audio frequency seldom appears to any appreciable extent in the output, its frequency being too far removed from the tuned frequency of the output circuit. Thus, there are three frequencies present in the output of the conventional transmitter. These are R, the carrier frequency, R plus A, the upper side-band frequency and R minus A, the lower side-band frequency.

Effective to 7,000 Cycles

In a conventional receiver these same frequencies appear and from them the original audio frequency A is reproduced by the phenomenon of modulation. The "lower side-band" may be caused to combine again or "uncombine" thus giving back the original A frequency. Similarly the "upper side-band" gives back the audio frequency. These two components add to give the reproduced signal.

It is practically impossible to build a single transmitter or receiver to accommodate the band of audible frequencies between 30 and 15,000 cycles and the engineer is pleased if his transmitter handles the band from 30 to 7,000 cycles. Incidenty, this band would give excellent quality.

To illustrate the preceding explanation, suppose a carrier of 1,000 kilocycles is produced and modulated by the audio band reaching from 30 to 7,000 cycles. For every audio frequency there will be two resulting frequencies and these will divide into two bands, the "carrier plus" band and the "carrier minus" band. Specifically, the "lower side-band" will reach from 993 kilocycles to 999.97 kilocycles. The "upper side-band" will lie between 1,000.03 kilocycles and 1,007 kilocycles.

Some Questions

These questions may now be asked: Since the carrier beating with the frequencies held in either side-band will give the original audio back again at the receiver, why is it necessary to radiate both side bands? Also, why not supply the carrier itself at the receiver and avoid the waste of energy from the transmitter which lies in the carrier? The "single side-band" system is based on these principles.

Since no carrier is transmitted it is essential that one be supplied at the receiver. In the case of the example above, if the "lower side-band" is radiated, 993 to 999.97 kilocycles, and a receiver heterodyne frequency of 1,000 kilocycles is supplied, then the original 30 to 7,000 cycle band is reproduced.

A very interesting phenomenon is observed in receiving single side-band signals. If the receiver heterodyne frequency is exactly right, then true reproduction results and this is the only condition under which true reproduction may result. If the heterodyne frequency is low or high, then the reproduced signal will be low or high. It is thus possible to make a contralto out of a soprano or vice-versa at the pleasure of the operator.

The Transmitter Analyzed

The apparatus comprising the transmit-

(*Concluded on page 26*)

BEANS SURE DO GROW

(*International Newsreel*)

DR. LULU M. F. McMANIS of the McManis College of Electronic Medicine at Kirksville, Mo., in her laboratory, making tests with a new delicate vibratory instrument, which measures the vitality and forecasts the growing power of unsprouted bean seeds, a radio set tuning system being used.

Bypasses on the Diamond

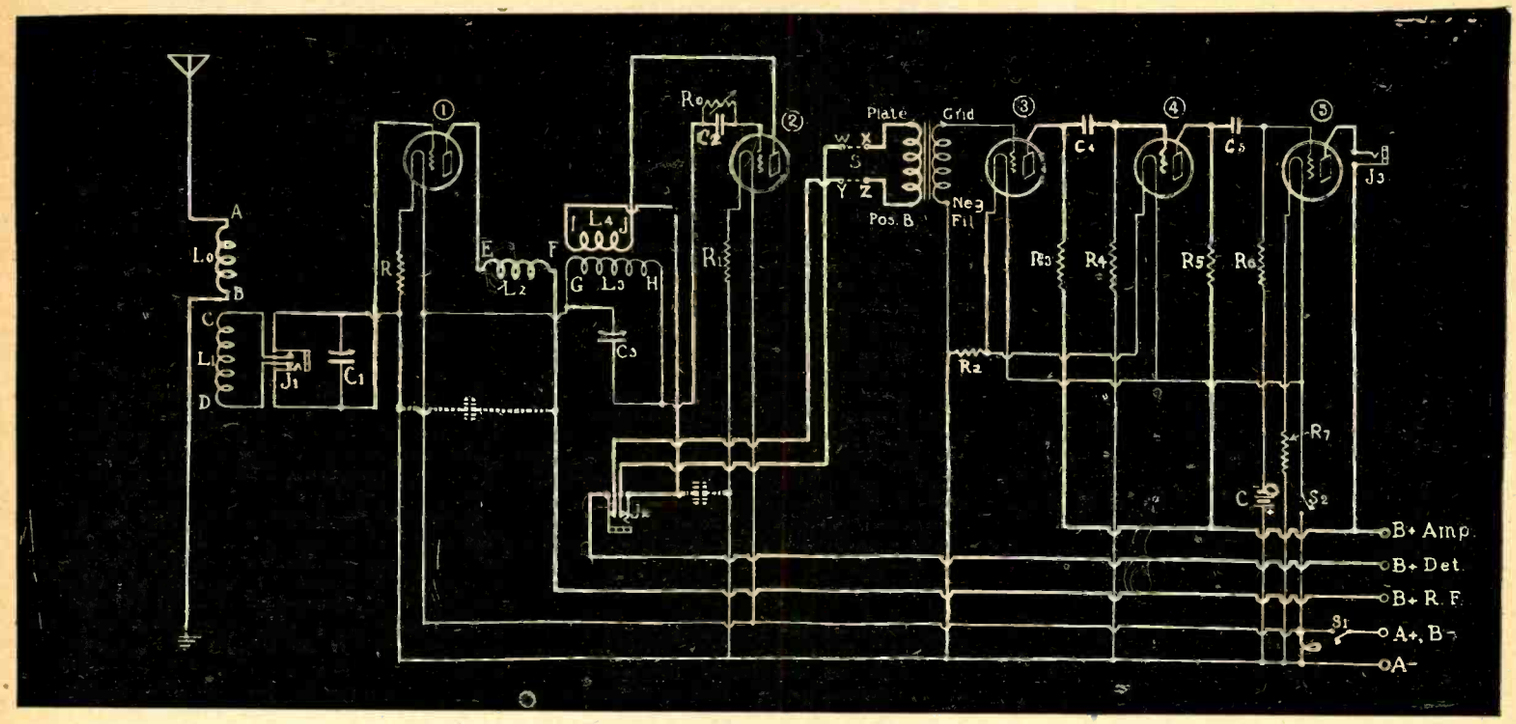


FIG. 1

Two May Be Used to Advantage on the RF Side, to Atone for High Resistance of B Battery or Eliminator — How to Use a Power Tube in the Set

By James H. Carroll

THE inclusion of two bypass condensers in the Diamond of the Air will be found helpful in atoning for shortcomings of battery or eliminator installations. These two fixed condensers are shown in dotted lines in Fig. 1, which is the schematic diagram of the wiring. Their value is not critical and one may use almost any fixed condensers he has about the house, if they are .00025 mfd. to .002 mfd. or thereabouts.

These fixed condensers are not necessary as a part of the radio receiver itself, granting that all batteries are in good condition, but if the B battery is rundown, although it is still capable of delivering enough voltage, the resistance may be so high as to impair efficiency, particularly in reducing volume and selectivity. Therefore it is a good precaution to include the bypass condensers, as they help to keep the radio current out of the batteries, both A and B, by sending them to A minus.

The second bypass condenser is additionally useful, with transformers that have a small distributed capacity in the primary. It is connected, as shown, from the B battery end of the tickler coil to A minus.

The schematic diagram shows the wiring of the New and Improved Diamond of the Air. The only change that is represented schematically is the inclusion of the wiring of the pilot light. The new kits are supplied with the Bruno light switch, and while this may be used as a plain switch, it has a socket attached for a flashlight bulb, and the window of the switch is of red glass with facets, known in radio parlance as a "ruby." So it is a good idea to incorporate a 6-volt flashlight bulb, for when the set is turned on the window of the switch will glow with a fascinating red, and this will spare you the embarrassment of forgetting to turn off the set some night when you are in a hurry to go to bed.

The variable condensers C1 and C3 in the kit this season are the Bruno straight line frequency .0005 mfd. The sockets are Pacent's. The drilled and engraved panel is newly and handsomely designed.

The blueprint and booklet on how to build the set contain the correct information for all up-to-date needs, with the solitary exception of the wiring of the flashlight bulb. This is so simple that nobody can be confused. The flashlight bulb leads, as represented by points on the switch, go respectively to A minus and to the A plus lead at some point after the A plus lead is interrupted by the switch.

A few persons have asked questions about the proper connection of the secondary of the interstage coupler (L3). All understand that one terminal goes to grid condenser, the other terminal to A plus, and of course to corresponding terminals of the tuning condenser C3. The coil is a Bruno No. 99 3-circuit tuner. The binding post on the coil that connects to the outside of the secondary, that is, the terminal farthest from the tickler coil, goes to grid. This is the lower secondary binding post when the coil is mounted with tickler on top, and is represented by H in Fig. 1 and in the blueprints. By the way, these blueprints are available to all and should be used in wiring the set, as they simplify the work.

Concerning the various condensers, it is worth watching the polarities. The Bruno condenser, because of its special design, should be connected with rotor plates to grid in each instance, and stator to A minus in one case (C1) and to A plus in the other (C3).

A power tube may be used in the final

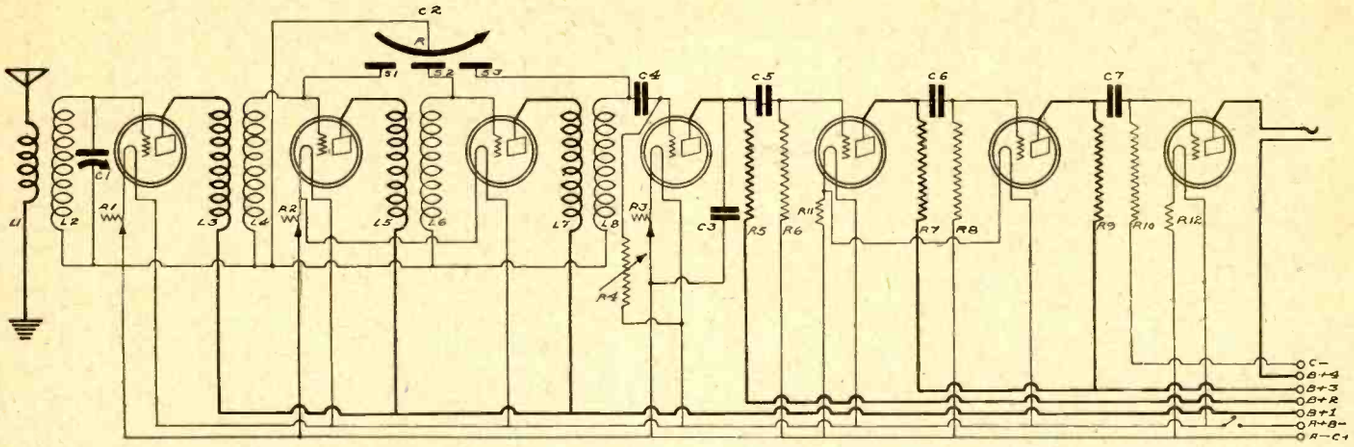
(*Concluded on page 31*)

LIST OF PARTS

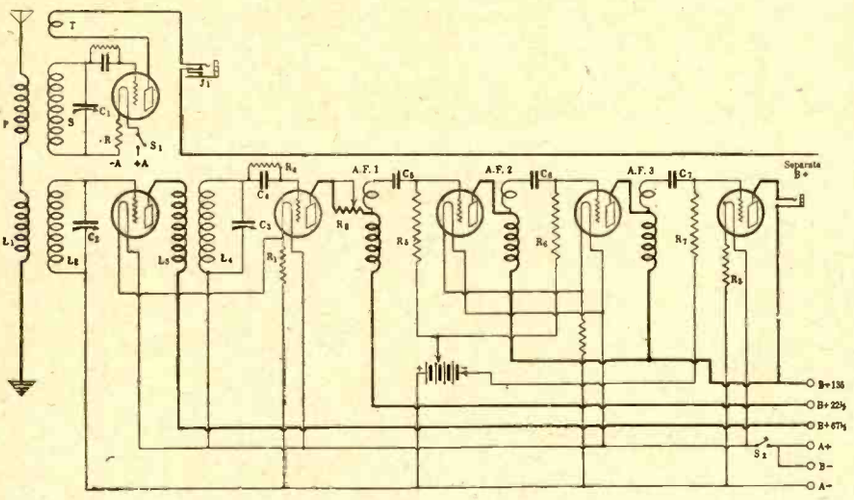
One Bruno No. 99 RF coil, (L0-L1).
One Bruno No. 99 Tuning coil (L2-L3-L4).
Two No. 101 .0005 SF Bruno condensers, (C1-C3).
One Bruno light switch (S).
Three Bruno Bakelite vernier dials.
Three No. 1A Amperites, mounted (R, R1 and R7).
One No. 112 Amperite, mounted (R2).
One 3½-1 Bruno Trutone Model D audio transformer (PBGF).
Two .1 megohm resistors (R3-R5).
One 1 megohm leak (R4).
One .5 megohm leak (R6).
One Bretwood variable grid leak (R0).
Two double circuit jacks (J1-J2).
One single circuit jack (J3).
One Century 7x24" drilled and engraved panel.
Five Pacent UX spring sockets (1, 2, 3, 4, 5).
One Century drilled socket strip.
One pair Bruno brackets.
Two .25 mfd. Aerovox by-pass condensers (C4-C5).
One 5-strand de luxe multicolored battery cable.
One push-pull battery switch (S2).
One .00025 mfd. Aerovox fixed condenser (C2).
Four Bruno binding posts (W, X, Y, Z).
Five battery cable markers.
Two flexible leads for C battery.
Four mounts, bus bar, screws, spaghetti, etc.

Motorboating or Putt-Putting Effect in This Receiver or Any Other May Be Overcome by Use of a Variable Resistor From Plate to Grid

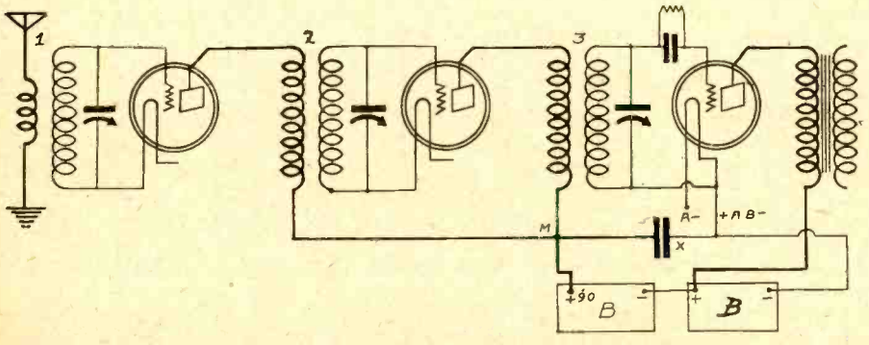
Weekly Page of Hookups



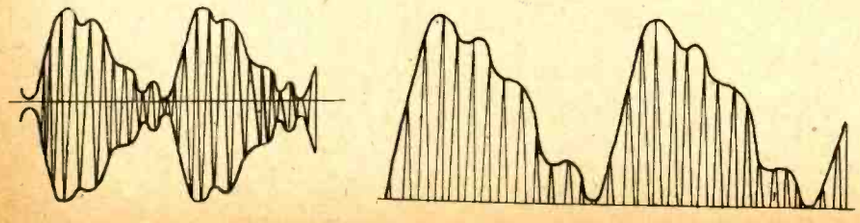
A 7-TUBE receiver, wherein three stages of tuned radio frequency amplification, a non-regenerative detector and three stages of resistance coupled audio frequency amplification are employed. A single condenser is used to tune the secondary of the first or antenna RFT, while the secondaries of the other RFT are tuned by a triple condenser. Standard RFT can be used. The grid return of the detector tube is made to plus A, through the variable grid leak.



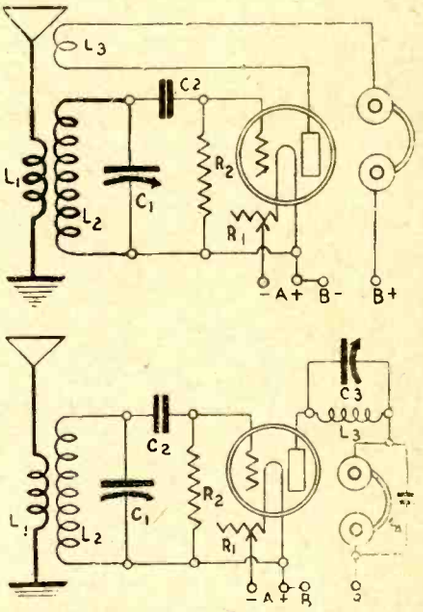
A COMBINATION 1 and 5-tube receiver. The 1-tube receiver may be used for two purposes, as a wavetrap and as an individual receiver. The detectors in both sets are regenerative.



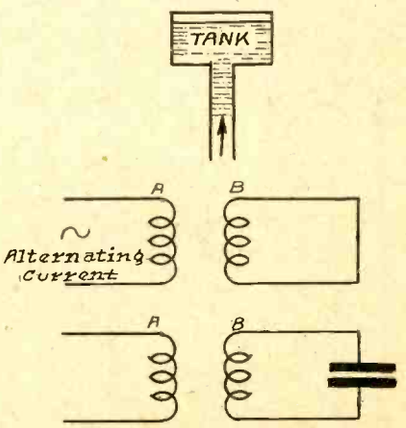
WHERE to connect the by-pass condenser in the radio frequency side of a TRF set is diagrammed above, at point X. M indicates the common B voltage terminal for the RF amplifier tubes.



HOW THE resultant modulated carrier wave appears before and after rectification.



TWO OF the most popular 1-tube circuits that exist today. In the top diagram the rotary tickler coil is used to obtain regeneration, while at the bottom a variable condenser is used with a fixed coil to obtain about the same effect.



IF DC is applied to condenser plates, the charge is held intact, until saturation point; with AC the charge alternates. Using the tank as an analogy, with DC, the water stores up; with AC, it fills and empties, etc.

Radio University

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When writing for information give your Radio University subscription number.

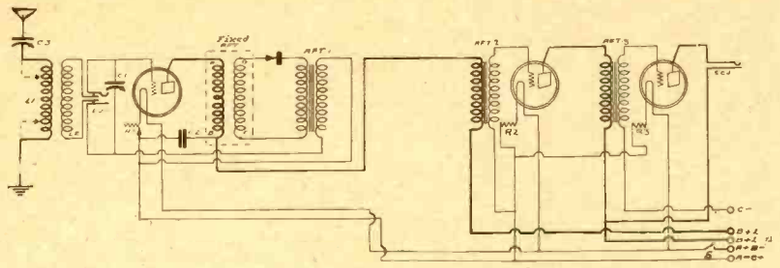


FIG. 436

The electrical diagram of the 3-tube reflex, with two stages of transformer coupled audio frequency amplification.

I HAVE a fixed radio frequency transformer, a fixed crystal and three audio frequency transformers. Two of these transformers have a ratio of 3-to-1, while one has a ratio of 6-to-1. Please give a circuit diagram of a receiver, using these parts and give all the electrical data necessary to construct the receiver.—Buddie Venks, Ossining, N. Y.

The electrical diagram of a set using the parts you mention is shown in Fig. 436. You will note that it is of the reflex type, using 3 tubes. The first tube is both a radio frequency and an audio frequency amplifier. The crystal is, of course, the detector, while the other two tubes are simple AF amplifiers. The high ratio AFT can be used in the reflex stage, with the two low ratio AFT in the AF stages. A rheostat is used to control the filament of the combination AF-RF tube. The resistance of this rheostat is dependent upon the tube you use. It is preferable to use the 01A type. For that one, a 20-ohm rheostat will fit the bill. The -99 and other dry cell type tubes may be also used. The fixed RFT is used to couple the RF-AF output to the detector input. A tuned RFT is used in the antenna circuit. The primary of this transformer consists of 20 turns, while the secondary consists of 45 turns. These turns are wound on a tubing 3″ in diameter, using No. 22 double cotton covered wire. Across this secondary, a .0005 mfd. variable condenser is shunted. The same type of a condenser is used in the antenna circuit. A loop jack, so that either the antenna or a loop may be connected in the circuit at will, is also connected in the secondary shunt circuit. It is essential that the connections in this jack be followed carefully. Be sure that the rotary plates of the condenser are connected to that portion of the jack which makes contact with the beginning of the secondary winding or that portion of the winding nearest the ground connection on the primary winding. The two internal contacts of the jack are brought to the coil, while the outer contacts are brought to the condenser terminals. Ballast resistors are used in the AF filament circuits. Using the -01A tubes, these should be Amperites, type 1-A. The high potential point of the crystal is indicated by means of the arrow in the diagram of the detector. The solid black line is the low potential point. Follow these connections with care. The grid returns of all the tubes are to A minus. The primary is tapped every 2nd turn.

* * *

I AM building the Set With a 1-Turn Primary, which was described in the July 3 issue of RADIO WORLD by Herman Bernard. (1)—What change in the wiring is necessary, if the UX112 power tube is to be inserted in the last audio stage? (2)—Is it possible to use a loop with this set? If so please describe the method of hooking up.—Dr. A. A. Marstekler, U. S. Naval Hospital, Great Lakes, Ill.

(1)—No change in the filament wiring will be necessary but the Amperite in the last tube filament should be of proper value, e.g., 112. A separate B lead may be made. That is, instead of hooking the plate return of R6 to B plus 3, and to a phone tip terminal, run it alone to a new B post. Connect the phone tip terminal to a separate B plus post. As much as 157½ volts can be applied to the plate of the 112. This voltage would cause either a high-mu or a -01A type tube in the first AF stage to distort. The C voltage at this high B voltage is 10½. If 135 volts are used on the plate of the power tube, then the B lead can be let alone, a 9 volt C bias being necessary. A ½ ampere ballast resistor must be used to control the filament temperature of the power tube. (2)—Yes, a loop may be used although the volume will decrease. About 26 turns of No. 18 bell or double cotton covered wire, wound on a 2 foot frame will do. This is connected in the grid-filament circuit of the first tube, e.g., one terminal to the stationary plates of C1 and one terminal to the rotary plates of C1.

* * *

I HAVE constructed the 4-tube receiver, shown diagrammatically in Fig. 266, Radio University columns, Feb. 20 issue of RADIO WORLD, and have had very satisfactory results with stations having wavelengths as high as 485 meters. That seems to be the limit. I am using .00025 mfd. condensers throughout. Please let me know how I can increase the wavelength range.—Edward F. Joyce, 164 East St., North Attleboro, Mass.

Add 8 turns to the secondaries. Increase the regeneration tap on the secondary winding of the second RFT, by 2 turns.

* * *

I AM going to build an experimental short wave receiver. Instead of resorting to the tapping of coils, I would like to place several fixed condensers of different values in parallel to the variable condenser in the secondary circuit and with the aid of a switch, place either of these condensers in the circuit. Is this suggestion practical?—James Coward, East Pittsburgh, Pa.

Yes. Use small sized condensers.

* * *

IN WINDING a basket weave coil, using a 3″ form, either for use as an antenna input coil or as an RF coupling coil, how many turns of No. 26 double cotton covered wire, using a .0003 mfd. variable condenser, are necessary on the primary and the secondary, respectively? The condenser is of the straight line frequency type. The primary is to be wound in between the secondary winding.—C. D. Roberts, Box 111, Osgood, Ind.

The primary consists of 12 turns. The secondary consists of 64 turns. The method of winding is shown in Fig. 434. First 26 turns of the secondary winding are wound. Then the 12 turns of the primary and 12 turns of the secondary winding are wound. The remaining 26 turns of the secondary winding are then made.

* * *

I AM interested in Fig. 422 published in the Sept. 4 issue of RADIO WORLD, Radio University columns, involving control of regeneration by a variable resistance in the plate circuit. The explanation is not clear to me, however. (1)—What is the resistance of R1? (2)—In winding my own coils, using .0005 mfd. variable condensers, how many turns of No. 24 double cotton covered wire should be made? I have this on hand and assume that it may be substituted for the No. 22 double cotton covered wire specified. (3)—Can a 2½″ diameter tubing be used? If so, how many turns of No. 24 dcc wire, should be wound on the tubing, to constitute the primary, secondary and plate windings?—Chas. Giddings, 230 Eccles Building, Ogden, Utah.

(1)—R1 may be a 100,000 variable re-

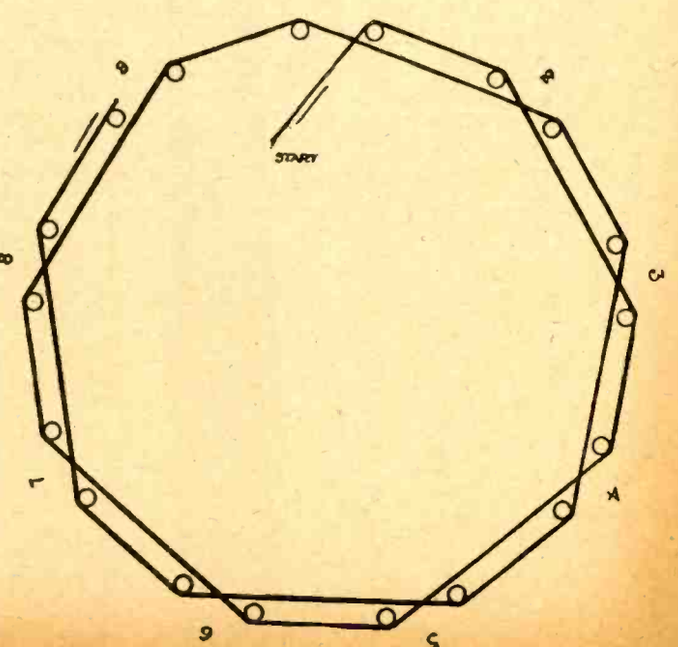


FIG. 434

The method of winding the basket weave coil is herewith illustrated. The popular under two and over two method of winding is employed. Dowel sticks, about ⅛″ or ¼″ in diameter should be used. These may be placed in a piece of wood, properly punched. The punched holes should not grip the dowel sticks too tightly, since, they will have to be taken out, through the loops in the coil. If the sticks are jammed in, when taking out, you will not only break the wire, but smash the form.

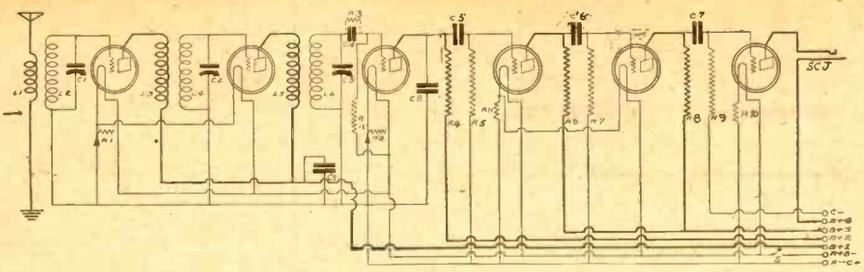


FIG. 435

The circuit diagram of the 6-tube receiver, using resistance AF coupling.

sistance, such as the Electrad Royalty Variable High Resistance, type B. (2 and 3)—Using the 2½" tubing, the primary consists of 10 turns, while the secondary consists of 50 turns. The No. 24 dcc wire may be used. The tickler consists of 38 turns, wound right next to the secondary winding, using the same wire. Between the primary and a secondary allow a ¼" space.

* * *

PLEASE STATE the approximate number of turns to place on the following size tubings, using No. 24 dcc wire, with the following type condensers. Using a .00025 mfd. condenser, on a 1½" tubing, on a 2" tubing, on a 2¼" tubing, on a 2½" tubing, on a 2¾" tubing, on a 3" tubing, on a 3" tubing, on a 3½" tubing; using a .0003 mfd. variable condenser, a .00035 mfd. variable condenser, a .00037 mfd. variable condenser, a .0005 mfd. variable condenser, in each case with the same size tubings that are used for the .00025 mfd. variable condenser. (3)—How many turns should be wound to constitute the primaries?—Harry E. Johnson, 854 East 65th St., Chicago, Ill.

In the following table you will find the proper number of turns for the variable diameters and capacities:

	Diameter of Tubing							
	1½"	2"	2¼"	2½"	2¾"	3"	3¼"	3½"
.00025 mfd..	135	125	115	102	80	65	60	55
.0003 mfd...	129	113	98	85	73	61	55	50
.00035 mfd..	125	109	95	82	70	59	53	48
.00037 mfd...	121	105	92	78	66	56	50	45
.0005 mfd...	110	95	80	62	55	44	40	35
Primary Turns....	10	10	10	10	10	10	10	10

* * *

I HAVE constructed a receiver in which transformer coupled audio frequency amplification is employed. Now in the hook-up, the F minus legs of both transformers were connected together and thence to the minus posts of a C battery. I wish to use a 112 power tube in the last stage, and keep the -O1A type tube in the first AF stage. Will I have to make a new C lead, or can I use the same lead.—Fred Jameston, Throggs Neck, N. Y.

Make a new C lead. The power tube, you are to install, requires a heavy C voltage at a higher B voltage. If this C voltage is also applied to the other tube, distortion will result. Also the complete amplification value of the tube will be lost. The minus posts of both AFT are each connected to the minus posts of individual C batteries.

* * *

I WOULD like to have the electrical data of the 4-tube receiver shown in diagrammatical form on page 9 of the July 24 issue of RADIO WORLD.—Charles Cleets, Mount Vernon, N. Y.

The single winding antenna inductance consist of 50 turns, wound on a 3" diameter tubing, using No. 22 double cotton covered wire. The tap is made at the 8th turn, from the beginning of the coil. The primary of the tuner consists of 10 turns. The secondary consists of 45 turns. Both are wound on a tubing 3" in diameter, using No. 22 double cotton covered wire. No space need be left between the two windings. The tickler consists of 36 turns, wound on a tubing 1¾" in diameter, using No. 26 single silk covered wire. In both cases, .0005 mfd. variable condensers shunts the secondaries. Ballast resistors of the ¼ ampere type are used in the the filament circuits. The bypass condenser in the detector and radio frequency plate—A minus circuit is of the .001 mfd. type. The transformers may be of the low ratio, such as the 3 to 1 type. The grid leak is of the 2 megohm type, while the grid condenser is of the .00025 mfd. fixed type. The grid leak may be variable. It is very important that the grid returns are properly made, e.g., all the amplifiers going to minus A and the detector to the plus A. S indicates the filament switch. A common B voltage is applied to the plates of the AF tubes, e.g., 90. The plate of the RF tube receives 67½ volts. Keep the high and low potential points of the coils at opposite ends. Body capacity and poor volume will result otherwise.

* * *

I HAVE built the 3-tube receiver, described in the Radio University columns of the April 24 issue of RADIO WORLD and am having some difficulties. The detector tube will not oscillate, no matter which way I turn the plate condenser. I tried increasing the plate voltage and reversing the A leads, but to no avail. The plate coil consists of 20 turns, just as stated. Would adding about 5 turns to the plate coil help? The detector tube I am using is about a year old. Is it possible that the tube may be at fault?—Henry Jackson, Haines Falls, N. Y.

Adding the turns as you suggest will help. The tube, may be aiding the trouble. Connecting a .001 mfd. fixed condenser from the plate of the detector tube to the A minus post will aid. Try changing the tubes around.

* * *

PLEASE GIVE the circuit diagram of a 6-tube receiver, employing two stages of tuned radio frequency amplification, a non-regenerative detector and three stages of resistance coupled audio frequency amplification. I wish to use TRFT, having 10 turn primaries and 60 turn secondaries, wound on tubings 3" in diameter, the secondaries being shunted by .000375 mfd. variable condensers. State the resistances of the fixed resistors and condensers.—Will Landam, Oshkosh, Wis.

Fig. 435 shows the circuit diagram of this receiver. The resistances in the plate circuits, are of the .1 megohm type. The resistor in the grid circuit of the first AF tube is of the 1 megohm type, the resistance in the grid circuit of the second AF tube is of the .5 megohm type. The resistance in the grid circuit of the last AF tube is of the .25 megohm type. The bypass condenser between the B plus and the A minus lead is of the 1 mfd. type. The bypass condenser between the plate and the A minus post in the detector tube circuit is of the .001 mfd. type. Great quality as well as volume, can be obtained from this set. The RFT, you have, can be used.

* * *

WHAT HAPPENS to an alternatisg current, when it flows in a conductor?

It has a tendency to flow in the outer portions of the conductor more so than in the center.

* * *

WHERE IS the flux in a piece of wire greatest?

The flux in the wire is greatest at the external surface or circumference. At the axis, it is zero.

* * *

DOES MORE current flow towards the center or axis of the wire, when the frequency is increased?

No, as you increase the frequency, the current towards the axis diminishes, while it increases toward the outer surface.

* * *

WHAT REQUIREMENT is necessary for procuring continuous oscillations from a 3-element tube?

The voltage placed in the grid circuit, must vary the plate current to an amplitude capable of supplying to the coupling circuit, enough power to keep this voltage in the grid circuit. That is if the mutual inductance between a plate and grid coil, be increased beyond a certain point, the pulsating current flowing through the plate coil will deliver enough power through the grid coil to keep an oscillating current through the secondary circuit. This causes the grid voltage to produce oscillatory changes in the plate circuit. This is known as feedback.

* * *

HAS A storage battery a high internal resistance?

No, it is very low. A complicated formula involving high mathematics must be employed to find the internal resistance of such cells.

BEAUTY QUEEN BROADCASTS

(Underwood & Underwood)

CROWNED victor of the Atlantic City beauty test, Norma Smallwood, 22, of Tulsa, Okla., broadcast her emotions of joy of being "Miss America 1926." At right is Norman Brokenshire, of WJZ, guest announcer for the occasion.

WBZ to Broadcast Big Elevens' Games

J. E. Murley Will Be at the Microphone, Giving Play-by-Play Narrative—Schedule of Dates

WBZ, Springfield, Mass., will broadcast nine football games, including the "Big Three" contests, beginning Oct. 2. The usual play-by-play accounts will be transmitted. J. E. Murley, former sports writer and present press representative of WBZ, who handled the games last year, will again be at the microphone.

The following is the schedule of games to be broadcast:

Oct. 2—Harvard vs. Geneva at Harvard.

Oct. 9—Harvard vs. Holy Cross at Harvard.

Oct. 16—Dartmouth vs. Yale at New Haven.

Oct. 23—Harvard vs. Dartmouth at Harvard.

Oct. 30—Yale vs. Army at New Haven.

Nov. 6—Harvard vs. Princeton at Harvard.

Nov. 13—Harvard vs. Brown at Harvard.

Nov. 20—Yale vs. Harvard at New Haven.

Nov. 27—Holy Cross vs. Boston College at Boston.

Whole Wo To Radio'

Broadcasting Rapidly Increa eign Nations Grasp Ar Its Great

WASHINGTON.

The steadily increasing popularity of radio throughout the world is strikingly revealed in a trade bulletin just made public by the Department of Commerce. While the United States is still supreme in the radio field—having three-fifths of the world's broadcasting stations and five times more receiving sets in use than any other country—foreign nations are awakening to the immense possibilities of radio as a medium of education and entertainment. Last year radio equipment exported from the United States was valued at $10,000,000, which was ten times the amount shipped by any other country and 80 per cent. more than the value of shipments in 1924.

Broadcasting stations, according to the report, are now operating in every corner of Europe; there are stations in the larger cities of South America, Australia and South Africa.

Asia Is Slower

Japan and India also have broadcasting stations, although radio development naturally has not been so great in these countries as in other parts of the world. These broadcasting stations range in power from 16,000 watts at Daventry, England—a superpower station built for foreign broadcasting—to numerous smaller stations of 1,000 watts and less scattered throughout the world.

The United States, the report points out, is the only important country where the radio fan can listen in free of charge. License fees exist in foreign countries, ranging from the nominal one franc per year in France to $18 in Salvador and $13 in Lithuania. In the British Isles the fee is 10 shillings; in Sweden about $2.70; Japan's fee is 80 cents, and the United South Africa, $1.25.

Along with license fees in many countries there exist rules and regulations of various kinds in connection with radio broadcasting and reception.

Greek Sets for Greeks Only

In Greece, for example, only a Greek can own a radio set and even he is sub-

Better Hon Aim of E

The Woman's Club of Schenectady, the first organization of its kind to provide radio programs on a regular schedule, began the series of 1926-27, Tuesday afternoon, September 21, through WGY, with a Scotch program.

Officials of the Schenectady club three years ago saw the opportunity of expanding the activities and influence of the organization by including in its membership the great many women within hearing distance of WGY. Letters from list-

·ld Rises ; Occasion

ısing in Popularity as For- ıerican Realization of Utility

ject to Government restrictions; Germany does not allow persons of Slav origin to own radio sets; the Latin-American countries have also numerous regulations which must be observed by radio operators.

Next to the United States, the report shows, the United Kingdom has gone the farthest in radio development with 35.6 sets per thousand population. Sweden ranks next with 30.3 sets per thousand population, followed by the Union of South Africa, Denmark, Austria, Germany and France. The development of radio in Sweden has been outstanding, the report reveals. Up to about the beginning of 1924 there was practically no market at all for radio equipment, largely because of the total lack of broadcasting, and the existence of severe government restrictions. On March 31 last, not far from 200,000 sets were licensed throughout the country.

Little Jazz Abroad

The type of broadcasting in the various foreign countries varies widely. Much attention is given to music and there is a general absence of jazz. The programs differ from those of this country in that much more attention is given to current news and there is a tendency in some sections to use the radio for direct advertising. In Brazil a radio society is preparing to broadcast daily for the benefit of the wealthy planters in the state of Sao Paulo all the latest coffee news, together with quotations.

In Northern and Central Europe the climate is ideal for continuous radio reception. The German in Berlin can tune in without trouble and listen to a musical program broadcast from Rome; getting Paris is no feat at all and the stations of Northern Europe may be easily heard. The Frenchman and the Englishman likewise find the whole of Europe at their beck and call. The rapid development of radio indicates that it is following the course of the automobile, the phonograph and other modern inventions which have added to the pleasure and comfort of mankind.

ıe Life roadcasts

eners have proved the popularity and helpfulness of the club series. Programs are prepared expressly for the air and the subjects of talks are all such as will be of interest to women in the home.

Mr. W. D. Bearce, chairman of the radio committee, has this season prepared an elaborate series and in nearly every case, the program consists of a talk on home economics, child welfare, or home hygiene and several musical numbers which makes an attractive program.

OH, HAIL THOU UMBRELLA

(Keystone View)

J. B. TAYLOR, consulting engineer of the General Electric Co., (in auto) entertaining a couple of friends seated on the running board, with a radio concert from a distant station, using his specially designed parasol radio receiver.

Metropolitan Won To Radio By Kent

Set Maker Gets Call on Opera Company's Full List of Stars For Winter Broadcasts, First Such Instance in History

Announcement was made by A. Atwater Kent, of Philadelphia, that starting Sunday evening, October 3, he will begin the broadcasting of a new series of weekly programs by nationally famous grand opera and concert artists. The series for the coming Winter may eclipse even the high standard set by the Atwater Kent program of last Winter.

Among those already scheduled for early appearance in the new series are Frances Alda, Lucrezia Bori, Madame Schumann-Heink, Frieda Hempel, Josef Hofmann, Edward Johnson, Albert Spalding, Maria Kurenko, Louise Homer, Reinald Werrenrath, Margaret Matzenauer, Mary Lewis, Rosa Ponselle and Charles Hackett.

Through an arrangement with the Metropolitan Grand Opera Company of a sort never before effected by any outside agency, Mr. Kent has obtained the call on the services of the artists of that great organization for radio appearances. This connection will enable him to put on the air, in the course of this new series, a number of artists not heretofore available for broadcasting because of their engagements with the Metropolitan.

The new series of Atwater Kent programs will be on the air each Sunday evening from 9:15 to 10:15 eastern standard time. It will be broadcast through a hook-up of fifteen stations, as follows: WEAF, New York; WJAR, Providence; WEEI, Boston; WSAI, Cincinnati; WRC, Washington; WCCO, Minneapolis-St. Paul; WEAR, Cleveland; WLIB, Chicago; WFI and WOO, alternating, at Philadelphia; WCAE, Pittsburgh; WGR, Buffalo; WOC, Davenport; WTAG, Worcester; KSD, St. Louis, and WWJ, Detroit. These stations practically cover the country.

Huge Chain Planned For WEAF by R. C. A.

Recently Purchased Station to Be Run by Newly Formed National Broadcasting Company—Better Programs, Bigger Sales, the Aim

The assumption of control of WEAF, recently purchased, will be assumed by the Radio Corporation of America after November 15, or two weeks earlier than expected. However, a new organization, to be known as the National Broadcasting Company, will administer the station and effect tie-up with numerous other stations for chain broadcasting.

The sale of WEAF by the American Telephone & Telegraph Company marked what was considered its withdrawal from the broadcasting field. The purchase price is reported at $1,000,000 in certified check, and there are certain exchanges of patent licenses involved.

The National Broadcasting Company therefore will be the controlling agency of WEAF under the new scheme and new proprietorship. It was formed so that the R. C. A. name would not hurt the broad plans laid out for the station, since cooperation even of competing radio companies is invited.

The president of the N. B. C. will be M. H. Aylesworth, former chairman of the Colorado Public Utilities Commission, and more recently managing director of the National Electric Light Association.

Young-Harbord Statement

The policies of the company were outlined in a statement signed jointly by Owen D. Young, chairman of the R. C. A. board, and General James G. Harbord, president of the R. C. A. They pointed out that any group of stations, willing to finance a cross-country net-work of broadcasters, would be welcomed in the field, either competitively or cooperatively.

"The purpose of the company will be to provide the best programs available for broadcasting in the United States," said the statement.

"The National Broadcasting Company will not only broadcast these programs through station WEAF, but it will make them available to other stations throughout the country so far as it may be practicable to do so, and they may desire to take them. It is hoped that arrangements can be made so that every event of national importance may be broadcast widely throughout the United States.

Not Seeking Monopoly

"The Radio Corporation of America is not in any sense seeking a monopoly of the air. That would be a liability rather than an asset. It is seeking, however, to provide machinery which will insure national distribution of programs of the highest quality.

"If others will engage in this business, the Radio Corporation of America will welcome their action. If other radio manufacturing companies, competitors of the Radio Corporation, wish to use the facilities of the National Broadcasting Company for the purpose of making known to the public their receiving sets, they may do so on the same terms as accorded to other clients. The Radio Corporation of America is making this experiment in the interest of the science and the furtherance of the industry.

To Have 12 Advisers

"In order that the National Broadcasting Company may be advised as to the best type of program, that discrimination may be avoided, that the public may be assured that the broadcasting is being done in the fairest and best way, it has created an advisory council, composed of twelve members, to be chosen as representatives of various shades of public opinion, which will from time to time give it the benefit of their judgment and suggestion. The members of the council will be announced later. M. H. Aylesworth will perform the executive and administrative duties of the company."

Mr. Aylesworth made this statement:

"There have been more than enough broadcasting stations to serve the public, and the essence of the formation of the National Broadcasting Company is to conserve and make permanent existing facilities, rather than to add anything to the growing contention for wavelengths.

"While there has been a crowding of stations, there has been no assurance of permanency, and this has not been the fault of any one. Stations have been free to come into the field and go out again.

Money Drawback

"Because the supply of service has probably exceeded the demand, there has been no particular responsibility for staying on the air or withdrawing from it. So far the experience of the various broadcasting companies has been somewhat disheartening, financially, because expenses have exceeded the income."

The statement said the National Broadcasting Company might also lease time from other stations. The board of directors will be announced within a few days. The Vice President and General Manager will be George F. McClelland, the present manager of WEAF, under the regime of the American Telephone and Telegraph Company.

To Stimulate Sales

It was pointed out that one of the main objects behind the new organization will be to stimulate the sale of radio receiving sets by broadcasting interesting programs. This was set forth as follows:

"Today the best available statistics indicate that 5,000,000 homes are radio equipped, and 21,000,000 homes remain to be supplied. Radio receivers of the best reproductive quality should be made available to all, and we hope to make them cheap enough so all may buy. The day has gone when the radio set is a plaything. It must now be an instrument of service."

NANCY ON AIR

(*International Newsreel*)

LADY ASTOR, M. P., before the microphone, broadcasting from WJZ her views on prohibition, flappers and other interesting American topics.

Weekly Woman's Forum Announced By Station WEEI

WEEI's Woman's Forum, a broadcasting feature conducted in the interests of mothers and home-makers, sponsered by the Massachusetts Department of Education cooperating with leaders in various women's organizations, is the latest addition to the Edison station programs for the winter.

This forum is to be conducted under the personal supervision of Dr. Payson Smith, Massachusetts Commissioner of Education, assisted by Mrs. A. M. Hume of the Melrose Women's Club who with Arthur F. Edes, "EFA," program director of WEEI are responsible for the new educational feature.

In discussing the plans for the Winter, Mrs. Hume declared that the need for a woman's forum has been urgent for a long time. She says that women listeners with families are so busy with household duties that they do not have time in many instances to read and become familiar with some of the problems of the day.

The new feature will probably start the latter part of the month. One-half hour of one afternoon per week will be used.

AUTO DRIVING TAUGHT

Now it is "drive your auto by radio instruction." Harry Rainess, working through station WHN, New York has started this newfangled method of learning to drive that car, whether it be flivver or big limousine. Rainess, who by the way, started life as a newsboy in the old Tenderloin of New York, has a novel way of making his instructions easily comprehended.

Radio Farm School Has 250,000 on Roll

Agriculturists Enthusiastic Over 24 Short Courses of Eight Lessons Each—Stations Are Co-operating With the Government

By Thomas Stevenson

WASHINGTON.

More than a quarter of a million farmers have already enrolled in Uncle Sam's radio farm school, which opens early in October.

Arrangements have been completed by the Department of Agriculture with more than 100 stations for the broadcasting of the farm school which will be divided into a series of 24 short courses of eight lessons each.

The radio farm school will be only one of the projects outlined for broadcasting by the Department of Agriculture for the winter. An hour for housekeepers has been arranged for the women of the farm. A dramatized version of the "Fifty Farm Flashes" broadcast last winter has also been scheduled, and other features include "autobiographies of infamous bugs and rodents," "chats with the weather man," "a farm news digest," and "interviews with the agricultural economist."

Dialogue Featured

Under the new arrangement current farm problems will be discussed between "Robbins" the county agent, and "Mr. Dibble," a representative farmer. Listeners will hear both sides of an intelligent, interesting conversation in which questions and answers will be given bearing on the most timely current farm problems. The Monday program will be devoted to live stock, Tuesday to crops, Wednesday to poultry, Thursday to fruits and vegetables and Friday to dairying.

The daily housekeepers' hours will be devoted to talks on subjects of particular interest to women in towns as well as those on farms. Seasonable, well balanced menus, tested in the Bureau of Home Economics, will make up a part of these features.

Will Have Direct Contact

According to Sam Pickard, director of radio activities of the Department of Agriculture, a brief outline of the live stock course shows the scope of work being undertaken by his Department. Beginning on October 4 and continuing for eight weeks, the discussion will pertain to live stock breeding and the feeding of farm animals. During the ensuing eight weeks lessons pertaining to animal health and sanitation and live stock barns and shelters will be taught. The courses during the eight weeks beginning January 31 will deal with live stock equipment and hides, wool and mohair. The concluding eight lessons will discuss the production, curing, selection and use of meats, and the uses of work horses and mules.

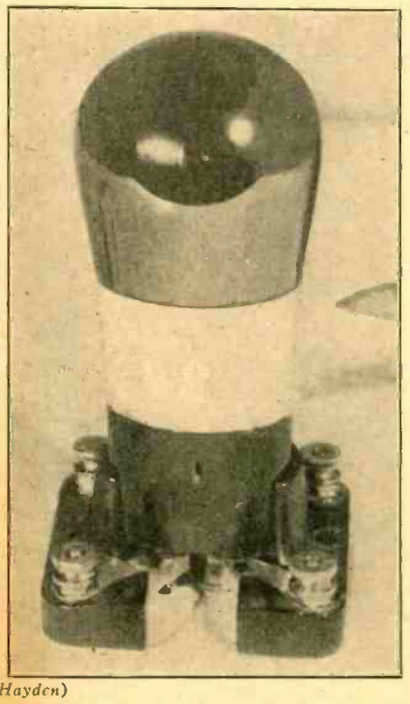
"It is the intention of the Radio Bureau to be in direct contact with the farmers," says Mr. Pickard. "Over a million cards for the radio farm courses have been placed in the hands of county agents, radio stations and others for enollment. Farmers are securing enrollment blanks either from these sources or direct from the radio service at Washington. These names will be used as a mailing list for the radio lectures and for bulletins which pertain to the subjects in which the farmers designate that they are interested.

Enthusiasm General

"Farmers in every section are enthusiastic over the radio farm school. This is their first opportunity to get in immediate touch with the sources of scientific agricultural information and to receive important announcements concerning farm problems as soon as they are solved by our investigators. Every farmer who has a radio set depends upon it for market and weather reports. But the farmer wants more than that—he wants to attend a college of agricultural experts. We will give it to him right in his own home. I am positive we will have a million students before our first year is over.

"Radio manufacturers are now conducting a campaign to double the number of sets on farms. While the Department can take no part in a commercial enterprise, we believe an increase in the number of radios will be beneficial to the farmer. Agricultural scientists believe that radio is a money-making proposition for the farmer and that the national radio farm school will become a permanent part of the agricultural life of the country."

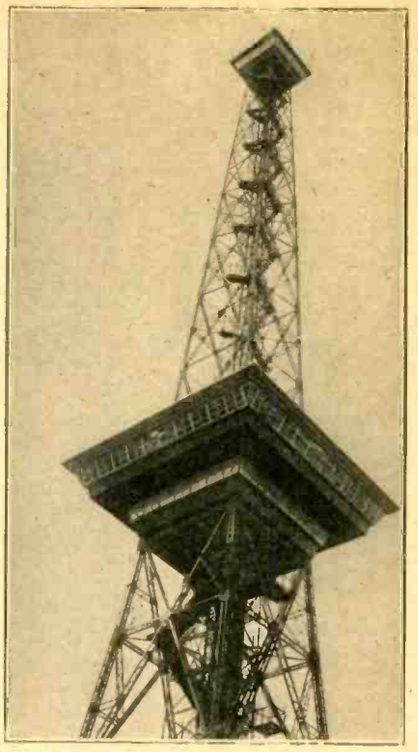
TUBE SAFEGUARD



(*Hayden*)

A PIECE of adhesive tape placed between the top of the base and the lowest portion of the glass tube, where the glass is loose in the base, will prevent the tube from moving about, when inserting it in socket. In this way it is possible to prevent the severing of the leads which enter the base.

CAFE IN TOWER



(*Keystone*)

A CAFE is the center of the Radio Tower in Charlottenburg, a suburb of Berlin, is the latest atraction in Germany.

NO CHANGE IN AIR DURING A FULL WEEK

WASHINGTON.

For the first time since the announcement by Secretary of Commerce Hoover that no further effort would be made to regulate broadcasting, a week passed without new stations being licensed or changes in existing stations being reported. Although no predictions would be made, hope was expressed by Chief Radio Supervisor W. D. Terrell that it means the number of new stations may be limited until Congress has an opportunity to pass legislation.

Sylvan Harris Joins Stewart-Warner

SYLVAN HARRIS

Sylvan Harris, nationally known authority on radio and former managing editor of "Radio News," has been appointed head of the Research Department in the Stewart - Warner Radio Engineering Laboratory. He acted in his new capacity at the Radio World's Fair.

Mr. Harris is very well known for his excellent contributions to various radio magazines throughout the country.

A THOUGHT FOR THE WEEK

BRIDGE and golf conversations on the trains and wherever friendly folk gather are now lessened in frequency and volubility by discussions on radio. All of which adds something to the gayety of nations, for radio is so big a subject that it cannot be talked into an early death.

RADIO WORLD

REG. U.S. PAT. OFF.

The First and Only National Radio Weekly

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

TELEPHONE BRYANT 0558, 0559
PUBLISHED EVERY WEDNESDAY
(Dated Saturday of same week)
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Receipt by new subscribers of the first copy of RADIO WORLD mailed to them after sending in their order is automatic acknowledgement 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.

ADVERTISING RATES

General Advertising

1 Page, 7¼"x11"	462 lines	$300.00
½ Page, 7¼"x5½"	231 lines	150.00
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1 Column, 2¼"x11"	154 lines	100.00
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Per Agate Line		.75

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WEEKLY, dated each Saturday, published Wednesday. Advertising forms close Tuesday, eleven days in advance of date of issue.

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 23, 1922, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

SEPTEMBER 25, 1926

Duncan Is Proud Of WKY Programs

H. W. DUNCAN

H. W. Duncan, part owner and announcer at WKY, one of the popular radio stations in Oklahoma City, is known as "The Cheery Old Skipper." In taking over WKY, which several years ago was operated by "The Daily Oklahoman," Duncan instituted excellency of programs and that has always been the pride of the station.

He has not been in the radio game a great while, but with his chief operator, George M. Carter, the other half of the partnership, he is stepping forth at rapid strides.

An Auspicious Chain

THE formation of the National Broadcasting Company, Inc., to run WEAF and extend the co-operative chain system of broadcasting is a wholesome move by the Radio Corporation of America, the new owner, to achieve better things in radio. While great corporations all too often are suspected in every move, it is to be hoped that the calamity mongers will not improvise any bogies to obstruct this sensible undertaking maugurated by the R. C. A.

The new corporation is brought into being in recognition of a great need in radio—the retaining of the highest type of programs where they prevail and the improvement of programs where they fall below the best standards. This is recognized by the new corporation as the very foundation rock upon which radio is being built up.

Such a small percentage of the total population of this country owns a radio set that one interested in radio, even altruistically, wonders what can be done to get the unwilling into the fold. Naturally by presenting programs of compelling excellence and eagerness is engendered in nearly every breast—and to make the benefit real and practical it is necessary to have these fine programs transmitted within easy receiving range and to provide sets that are within the reach of nearly everybody's purse. Both of these aims are kept high in mind by the new corporation, whose expressed object is to better radio as such. Of course the R. C. A. sells more sets than any other company, hence to that extent has a selfish interest, but such selfishness is sensible and commendable. A point not to be overlooked is that the National Broadcasting Company invites all reputable firms interested in radio to unite in the enterprise, by co-operating on an equitable financial basis. Stations are strongly invited to join the good-will club and do their share. Indeed, rival chains of stations, while not exactly encouraged, are at least reminded that no ill-feeling, but considerable assistance may be expected. These things sound too lofty to be true, in the estimation of many, but the skeptical have ruined more things than they have made. Indeed, the frequent monopoly cry raised against the R. C. A. and its associated companies of the past, combined with the hesitancy many competing radio concerns might feel toward co-operating with the R. C. A. as such, no doubt led to the formation of the new corporation.

Sun Spots

SCIENTISTS are worried about sun spots. These radio pests appear on the countenance of Old Sol and, it seems, last eleven years, injuring radio reception. The theory has the support of learned men and it may well be sound, nevertheless this summer was much better than the previous two summers, and distance in hot weather actually was enjoyed by many. So, although the sun spots are there all right, it may be just our good luck that they do us radioists no particular injury, but only annoy some of our scientific friends.

Persons afflicted with rheumatism have said that lately the aches have been more frequent and more enduring than previously. As an example, one man, now nearing 97, said he suffered more this summer than he did in 1876, and he attributes this to sun spots. And one must never omit the fact that it was a sun-spotty day when Spain sent her two-year advance notice of quitting the League Council. Still those same sun spots that read Spain out read Germany in, hence, as in radio, there are two sides to the sun spot question, the obverse and the reverse. The question is to determine which one is the perverse.

Enlivening Farm Facts

A HUNDRED stations are co-operating with the United States Government to broadcast courses for the benefit of farmers. While the problems of farmers necessarily do not interest city folk so much, it is interesting to learn that a great deal of the broadcasting will be in dialogue form, with the farmer's view stated by one character, and the market's view by another. These will be chatty. That will make them attractive to persons who would not care so much to tune in if only statistics and recommendations on poultry, potatoes and wheat were dryly discussed. Besides, it is well for the urbanite to know the farmer's point of view and his marketing difficulties. Radio no doubt will help to bring the two classes closer together, and some day (who can tell?) we may not even have a single farm bloc in the corridors of Congress.

The Greatest Show

NO radio show anything like the Third Annual Radio World's Fair, recently concluded in New Madison Square Garden, New York City, ever was held in this country, and no doubt in the world. Amid the beautifully decorated surroundings of the new and spacious structure almost all that radio has to offer was presented to public view, and the public clamored for the privilege of buying an admission. Messrs. Herrmann and Irwin certainly made a success of this great event, but one should not forget the valuable help of their assistants, including the show's quick-minded and enterprising publicity director, Eric H. Palmer.

Chess Is Played All Night in DX Match By Radio

MANILA, P. I.

An all-night international chess match was held recently in this city when the Filipino chess champion played a match from a local amateur radio station against a combination of Chinese champions located in Shanghai. The various moves were transmitted by amateur radio stations in each country, with Mr. Manuel Felizardo, Philippine IAU, handling the transmissions from this city. The match was won by the Chinese players.

Local enthusiasts are now arranging with Mr. Felizardo and other Manila amateurs to conduct a match with players in America through stations of the American Radio Relay League.

Boston Symphony To Be On Air Again

A series of seven concerts by the Boston Symphony Orchestra will be broadcast by WGY on Saturday evenings, during October, November and December, in co-operation with WBZ of Springfield and WJZ of New York. The first concert by this nationally known organization will be heard Saturday evening, October 9. Dates of other concerts scheduled for the air by WGY are October 16 and 23, November 20 and December 4, 11 and 25. Serge Koussevitsky will be the conductor.

THE ORACLE

ROUGHLY WHAT are the three uses of alternating current, arranged according to the frequency of altenations of current?

(1)—Electric power—20 to 120 per second.

(2)—Telephony—120 to 22,000 per second.

(3)—Radio—22,000 to 2,000,000 per second.

* * *

BRIEFLY COMPARE the two types of electrical and mechanical energy?.

Regarding mechanical energy any object which is in motion possesses kinetic energy. The position of this object in relation to its energy is known as potential energy. That is, suppose a body to be released from a high altitude. At the highest point this object has potential energy, due to its relation to the earth or surface. As the body falls, the energy is changed to kinetic. In electric circuits, electrostatic energy corresponds to potential energy. This is the position of the current at rest, or that current which is charged up in a condenser. Electromagnetic or electrokinetic energy corresponds to kinetic energy or electrical energy in motion.

* * *

FUNDAMENTALLY WHAT does the 3-element tube consist of?

It consists of an evacuated tube, which contains a heated filament which acts as a source of electrons, a plate (nickel) on the outside of the filament and a grid which consists of finely meshed nickel wire, placed between the plate and the filament and acting as a control valve of the electrons flowing from the filament to the plate.

* * *

WHAT METALS may be satisfactorily used in the construction of a variable condenser?

Copper, brass and aluminum.

* * *

WHAT IS manganin?

Manganin consists of three metals, e. g., copper. manganese and nickel and is also used for rheostats.

* * *

WHAT IS the least amount of current that it is posible for a crystal and phones to detect?

About 9 or 10 microamperes.

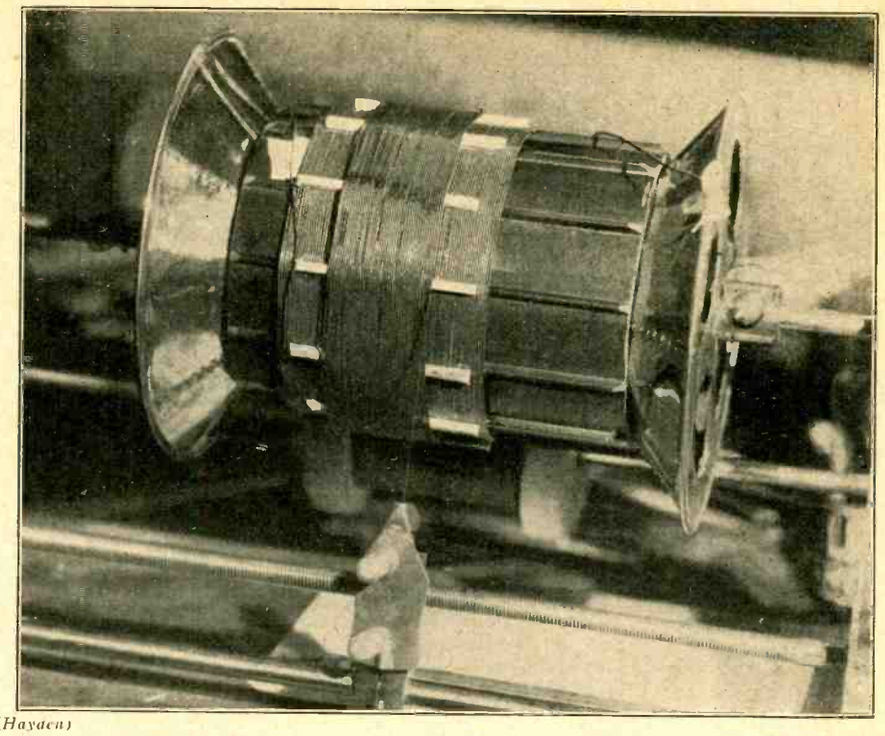
OHM'S LAW

(*Concluded from page* 9)

or $\frac{20}{2}$ or 10 ohms. In order to take care of the voltage of the storage battery, which is sometimes more than 6, the rheostats in commercial use are made with a little more resistance than the calculated value. Fig. 3 shows 4 tubes connected in the circuit in parallel. The current flowing in a case like this would be four times that flowing in one tube, i e., the sum of the current in all the tubes. To get a 1-volt drop in the rheostat where there was one ampere flowing the rheostat would be of only one ohm resistance.

There must be a source of pressure and there must be a continuous connection throughout. When a current flows through a resistance heat is produced. Power in a circuit is figured in watts and is equal to E times O. If we substitute for I in this equation we have Joule's Law, where the power consumed in the circuit is equal to the square of the current multiplied by the resistance: $P = I_2 \times R$.

Matchsticks Aid Selectivity



(*Hayden*)

After you wind a secondary on a form you may put another coil, like an oscillator plate coil or primary, directly over it, separated by matchsticks. Snip off the heads of the matches first. In the case of a primary selectivity often is improved by this device.

Reception Is Aided By Trickle Charger

Keeps Storage Battery in Full Condition, Hence at Highest Plane of Efficiency—Charging Is Done When Set Is "Off"

By Howard R. Fuller

Apco Manufacturing Co.

ALL of us are interested in better radio reception. If we were sure that we could improve the reception of our radio by using a different tube, a different battery or a different device—and if the price was within our means—we would probably buy one.

Tubes and batteries are essential and important to good radio reception and we know that we obtain greater distance, better tone and more volume when our storage battery is new or has just been recharged.

We can safely say that the storage battery is one of the most interesting mechanical devices that has ever been invented. A storage battery can easily be compared to the human body. It requires air and nourishment to live and it will die without proper care and attention. The better care we take of ourselves, the longer we live. The same is true of the storage battery. When we become hungry we eat a hearty meal. When a storage battery needs a charge it needs a full charge,—not just a small amount of current, which would be the equivalent of feeding one's self with a thimbleful after going for a great length of time without food.

There once lived an Italian nobleman, Cornaro, who in his early life abused himself and who, at the age of forty years, was given up to die by noted physicians. By a careful analysis and study of his body and the proper diet and care, he lived to be more than one hundred. While we do not expect a storage battery to give service for one hundred years, proper care and nourishment of the battery means longer life and for us the enjoyment of better radio reception from a battery that is always at full charge.

Until the conception of radio there was no demand for devices to recharge storage batteries in the home. Storage batteries when used on automobiles have their own generators for keeping them always at full charge, but when a storage battery is used for supplying six volt current for the tubes on a radio set, to do away with the inconvenience of sending the battery out to be charged, there were numerous devices and chargers offered to the radio public. Until the invention of the trickle charger, practically all devices necessitated taking the battery out of the set or installing switches and it was up to the user to remember when it was necessary to give the battery a charge. There was still an opportunity for someone to bring out a device that would operate from the lamp socket, something that when connected to the storage battery would relieve the radio owner of further thought or attention, save the battery and keep it always at full charge.

LIST OF PARTS FOR VICTOREEN

Herewith is the official list of parts for the 1927 Victoreen as designed by Arthur H. Lynch. The circuit diagram, to which the reader is referred, was published last week, issue of September 18. The list of parts for the Lynch Lamp Socket Amplifier is published in Mr. Lynch's article that features the present issue of RADIO WORLD.

Inductor Unit

One Victoreen antenna coupler, No. 160 (L1L2).

Four Victoreen No. 170 RF transformers (Intermediate Amplifier).

One Victoreen No. 150 coupling unit for oscillator (L3L4L5).

Non-Inductor Unit

Two National equicycle 270 degree variable condensers, .0005 mfd. (NE1, NEZ).

Two National velvet vernier illuminated dials, type C, with pilot lamps (PL2, PL3).

One Bruno A battery light switch (S), less pilot lamp (PL1).

Two Lynch metallized resistors, 10 meg. each, for grid leaks (R5, R6).

Two Sangamo .00025 mfd. grid condensers with clips (C1, C2).

One Sangamo .006 mfd. fixed condenser (C3).

One .012 meg. Lynch metallized resistor (R7).

Five .05 meg. Lynch metallized resistors (R8, R9, R10, R11, R12)*.

Six Lynch single mountings.

Seven Tobe 1.0 mfd. bypass condensers type No. 201 (C4, C5, C6, C7, C8, C9, C10).

One 30-ohm Victoreen manganin rheostat (R2).

One 20-ohm Victoreen manganin rheostat (R4).

One Victoreen 400-ohm potentiometer (R3).

Two 1-A Amperites (R, R1).

Six Eby push-type sockets (1, 2, 3, 4, 5, 6).

One Carter No. 6 jack switch, DPDT (LAJ).

One Carter single closed circuit "short" Jack, No. 2A (DJ).

Two Carter IMP cord tip jacks (CTJ).

One 8x22" or 7x21" drilled and decorated Lignole or Bakelite panel, by Century or Insulating Co. of America.

One baseboard, 9x20".

One pair of Bruno adjustable brackets.

Twelve lengths of Acme Celasite busbar.

Three Eby marked binding posts (A+, B—, A—, B+).

Two terminal strips, 1x6½" and 1x4".

Accessories

One Corbett Victoreen walnut cabinet, 8x22" with 25° slope.

Two CeCo type H special detector tubes (1 and 6); three CeCo high mu tubes, type G (3, 4 and 5); one CeCo type A tube (2).

One Mathieson-Sandberg loop.

One Electrad aerial kit, including aerial wire, insulators, etc.

Sources of A and B current.

Lugs, nuts, solder, screws, etc.

**R8 and R12 should be Lynch .05 meg. heavy duty resistor if special detector tubes are used in sockets 1 and 6.*

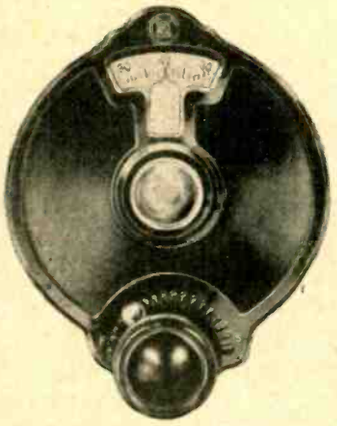
***Baseboards obtainable also from the cabinet maker.*

NATIONAL

VELVET VERNIER ILLUMINATED DIALS, TYPE C
"EQUICYCLE" CONDENSERS

play their essential part in the perfection of the new Victoreen set, described in this issue of Radio World.

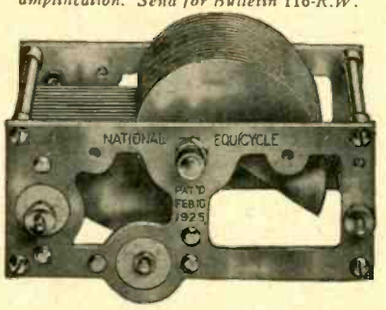
Ask your dealer to show you the NATIONALLY known NATIONAL Browning-Drake Coil and R. F. Transformers, now spacewound for sharper tuning—the NATIONAL Impedaformers for quality impedance coupled audio amplification. Send for Bulletin 116-R.W.



THE NATIONAL ILLUMINATED VELVET VERNIER DIAL, TYPE C

has its scale brightly lighted by a tiny concealed 6-volt lamp. Tuning is easy with this dial, for you can see the figures, and if the dial light is put on the filament switch it acts as a telltale for the tube. Easily and quickly installed by anyone with drill and screwdriver only. And this new dial retains every feature which has made the NATIONAL VELVET VERNIER Type A and B Dials so universally used.

Price, $3.00



THE NATIONAL "EQUICYCLE" CONDENSERS (SLF)

turn through 270 degrees instead of the usual 180, thus spreading out crowded stations still more. Their precision of action, freedom from wear, lightness, rigidity and exceedingly low minimum capacity recommend them to radio users who want only the finest components in their sets. Furnished with or without NATIONAL VELVET VERNIER DIALS.

Prices: With Type C Illuminated Dials:—

.00025 Mfd.	$7.50
.00035 Mfd.	$7.75
.0005 Mfd.	$8.00

NATIONAL COMPANY, INC., makes the NATIONAL Tuning Units comprising NATIONAL VELVET-VERNIER DIALS, genuine NATIONAL Browning-Drake Spacewound coils and R. F. Transformers, and the NATIONAL Variable Condensers in a large number of different combinations suitable for the construction of practically any type of modern Radio receiving set. These are described in Bulletin 115-R.W., gladly sent you on request.

NATIONAL COMPANY, Inc.
W. A. READY, President 110 Brookline Street, CAMBRIDGE, MASS.

Increased Quality and Volume

with such systems as LYNCH Power Amplifier and B Supply and with VICTOREEN and BROWNING-DRAKE Circuits.

Two New, Ce-Co Tube Developments

TYPE "G"
HIGH MU

For Impedance or Resistance Coupled Receivers

Fil. V	5.0
Fil. Amp	0.25
Plate Volts	90-180

Gives Clearer Reproduction With Increased Volume.

Price $2.50

TYPE "H"
SPECIAL DETECTOR

Fil. V	5.0
Fil. Amp	0.25
Plate Volts	67-90

RATING

Improved Reception Especially on DX or Distant Stations.

Price $2.50

Write for data sheet covering complete line of CeCo Tubes

C. E. MFG. CO., INC., Providence, R. I.

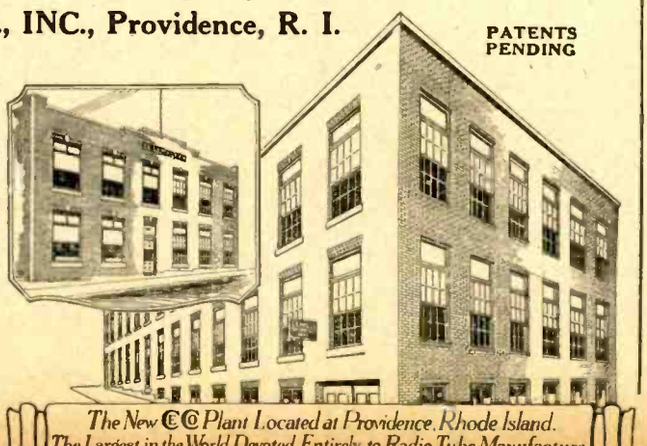
PATENTS PENDING

MEMBER RMA

CeCo

TUBES FOR EVERY RADIO NEED

"Best by Test" in the laboratory.
"Best by Performance" in the home.



The New CeCo Plant Located at Providence, Rhode Island. The Largest in the World Devoted Entirely to Radio Tube Manufacture

RADIO CABINETS

MODEL "C" CHEST

7x24 Panel, 10" Deep....$19.00
7x26 Panel, 10' Deep....$21.00

SPECIAL VICTOREEN CABINET
8x22 Panel, 25 slope, Walnut .$15.00

Write for folders showing complete 1926-27 line

Corbett Cabinet Mfg. Company
ST. MARYS, PENNA.

THE RECTAVOX

REPRODUCER

INTRODUCES

A New Principle of Acoustics

The Rectavox, the new Gothic Mantel type Reproducer, introduces a principle of sound reproduction taken from the finest violins. The resonant wood cabinet vibrates with the music, and throws off the tones in their true quality—full, clear and mellow.

There are no hollow, scratchy qualities, nor muffled tones often heard in other types of speakers.

$25.00 Complete

With 20-Foot Cord

The Rectavox is a beautiful instrument designed like a fine mantel clock. The woodwork is genuine pin-stripe African mahogany. The grill is finished in two-tone bronze. A remarkable offer is this for the music lover.

Place the Rectavox where the best acoustical properties of the room may be realized. A special 20-foot cord is provided for the purpose.

Best Manufacturing Co.
1200 Grove Street
Irvington, Newark, N. J.

SALES DEPT.
B. Hartzell Sales Co.
50 Church St., New York City

ONE SIDE BAND

(*Concluded from page* 11)

ter may be considered in two sections, the single side band equipment and the power amplifier chain. The single side band apparatus is installed in a metal screened room. This precaution is taken to prevent the powerful fields of the amplifiers from disturbing the delicate balance of the modulators where the power level is in the neighborhood of one watt. In metal cabinets are two balanced modulators and the first stage of the power amplifier chain. This stage and the following stages raise the power level from about one watt to about fifty thousand watts. Quartz crystals are used for obtaining the desired carrier frequencies.

The filters are located overhead in the shielded room. Outside of the wire screened room is the power amplifier chain, three stages being provided to increase the power level to that desired.

Two quarter kilowatt tubes comprise the first of the three stages of amplification outside the shielded room and they drive the center stage which uses two 20 kilowatt water cooled tubes. This middle stage supplies driving voltage for ten water-cooled tubes which make up the main power amplifier.

Plate voltage for the power amplifiers is supplied by two 100 kw kenetron rectifiers at 10,000 volts. Filaments are lighted by direct current furnished by a 1,000 ampere 22-volt motor generator. The filament current for the last two stages is over 600 amperes. Meters on the instrument boards indicate at all times the conditions of the numerous circuits.

An idea of the size of this installation may be gained from the fact that 33 vacuum tubes are used in its operation.

British Are Eager to Exchange Programs

Technical Difficulties Render Expectations of Scheduled Trans-Atlantic Stunts Unlikely Yet, Says B. B. C. Official

By David Sarnoff

Vice President and General Manager, Radio Corporation of America

One of the purposes of my recent trip to Europe was to discuss with the broadcasting interests abroad the possibility of expediting the exchange of programs between the United States and the principal centers of Europe.

I am pleased to report a sympathetic attitude on the part of those with whom I consulted, and in particular with the British and the Germans.

I am hopeful that the exchange of international programs, which must be still regarded as in their experimental stage, will be increased during the remaining months of the present year.

Message From England

In this connection, I have brought with me the following message to the American listeners from J. C. W. Reith, Managing Director of the British Broadcasting Company:

"I am glad of another opportunity of sending through you the greetings of the British Broadcasting Service to the broadcasters of the United States of America, for we are engaged in a common enterprise of absorbing fascination and we are charged with the same great responsibility to civilization.

"Since your last visit to Europe, the progress of broadcasting has been steady and workmanlike rather than spectacular and revolutionary. On our side of the Atlantic we are glad to be able to report considerably improved transmission, better reception, and, above all, a much higher average standard of programme.

"We believe that wireless broadcasting has now established itself as part of the normal equipment of civilization. It is natural, therefore, that what challenges attention and endeavor today is the content of the programmes rather than the mere wonder of communication through the ether.

Much to Be Learned

"There is continued speculation on the prospects of trans-Atlantic broadcasting. It is neither lack of enthusiasm nor of imagination that impels us to be cautious in prophesying the date of regular exchange of programmes across the Atlantic. We yield to no one in our desire to see this objective attained, but we realize that a good deal technically still remains to be done. Occasional satisfactory or even amazing results should not be construed into demonstrations of normal possibilities. We shall continue to conduct experiments in co-operation with the broadcasters of America in the hope that ultimately the problem of spanning the Atlantic with music and speech will be solved.

"We are following with the greatest interest and sympathy the efforts being made in the United States to tidy up the ether. While recognizing the peculiar conditions that prevail in the United States, we feel sure that the ultimate solution of your difficulties will lead you to some measure of central supervision.

International Possibilities

"We note the efforts you are making to establish the educational and ethical sides of broadcasting. The tradition which we have been privileged to found here imposes upon us the double duty of providing wholesome entertainment for all the people and of making a continuous and cumulative contribution to good citizenship.

"The international possibilities of broadcasting are as yet undeveloped, but we share your optimism in this regard. We believe that if it is administered in the public service, and if technical improvement in the future is as rapid as in the past, it should become perhaps the most potent factor for world peace and international co-operation."

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A DISCUSSION ON SELECTIVITY, by J. E. Anderson, appeared in RADIO WORLD, dated June 19. Sent on receipt of 15c, or start subscription with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

"LIBERTY AFLAME" and other verses, by Roland Burke Hennessy. Handsomely bound in cloth; sent postpaid for $1.00. Columbia Print, 145 West 45th Street, New York City.

A BUILT-IN SPEAKER SET, by Herbert E. Hayden, **POWERTONE IN OPERATION,** by Capt. P. V. O'Rourke, **THE NOVICE'S NOOK,** by James B. Scully, appeared in RADIO WORLD dated May 22. Sent on recipt of 15c, or start sub. with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

THE BROWNING-DRAKE CIRCUIT

Full particulars of this circuit appeared in RADIO WORLD, dated Aug. 14, 21 and 28. Any copies sent for 15c each, or the entire three copies for 45c, or start your subscription with any of these numbers. RADIO WORLD, 145 W. 45th St., N. Y. C.

THE BROWNING-DRAKE CIRCUIT—Text and illustrations covering this famous circuit starting with our issue of Aug. 14. The 3 numbers sent on receipt of 45c. RADIO WORLD, 145 W. 45th St., N. Y. C.

GETTING MAXIMUM RESULTS with Super Heterodynes by Herman Bernard appeared in RADIO WORLD dated May 15th. 15c per copy, or start your subscription with that issue. RADIO WORLD, 145 West 45th St. N. Y. City.

HOW TO USE AERIALS IN GROUND AND WATER, by Lewis Winner, appeared in RADIO WORLD, dated May 29. Sent on receipt of 15c, or start subscription with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

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We have put aside a supply of copies of RADIO WORLD published during the past summer. Let us know what dates you need to complete your files and these copies will be sent you for 15c each or any seven for $1. RADIO WORLD, 145 W. 45th St., N. Y. C.

VICTOREEN CIRCUIT

The series of Victoreen articles started in RADIO WORLD dated Sept. 11. Back issues sent on receipt of 15c a copy. RADIO WORLD, 145 W. 45th St., N. Y. C.

THE VACATION NUMBER OF RADIO WORLD DATED JUNE 12 contained many great features. The light 5-tube Portable, by Herman Bernard. The Freshman Masterpiece, by Albert W. Franklin. The Importance of C Batteries, by John F. Rider, etc. Sent on receipt of 15c, or start sub. with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

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GETTING DX by Capt. P. V. O'Rourke, appeared in RADIO WORLD dated April 3. 15c per copy or start sub. with that issue. RADIO WORLD, 145 West 45th St., N. Y. C.

Quality of Mercy Not Strained By Radio

Stations Broadcast Personal Messages Affecting Life and Death and Missing Persons, on Plea by Police —WGY's Service Notable

By W. T. Meenam

WGY, because of the exceptional range of its signals, has been of service many times in locating lost persons, and in notifying travelers, out of communication with friends, that they were wanted at home and in few instances in apprehending criminals.

The Schenectady station does not encourage the personal message and its management permits the use of the powerful facilities only when the request for broadcasting is sponsored by the police authorities of the city from which the message comes and after all other agencies have failed. This rule is rigidly adhered to as the only means of protecting the listener from a great many "lost persons" announcements and of preventing imposters, criminals, publicity seekers and practical jokers from imposing on station management and listeners.

Necessity Arises

The man who likes to hear the bellhop page his name in the lobby of the hotel also gets a thrill from the announcement of his name on the air.

However, there are many occasions when the necessity for broadcasting a personal message is great and when the radio station is in a position to give a service that could not be duplicated by any other form of communication.

The automobile tourist is frequently out of touch with home. Even though an itinerary is carefully planned before leaving home, accidents, weather, detours and many other causes upset plans so that difficulty is often experienced in getting in touch with the travelers.

Learns of Death

WGY has had many requests to broadcast descriptions of lost persons but the majority of "personal" requests during the Summer had to do with the announcement of deaths with the request that relatives touring by car be notified to return home.

August 17 a wired request was received to broadcast a call for Ralph Obergfell and family of Chicago, notifying him that his father had died. The request stated that all other means of locating the tourists had failed. The message contained the information that the people wanted were traveling in a certain type of coach and the license number was given. C. J. Lown, a flour and feed merchant at Rhineback, N. Y., listens to WGY every noon to get the weather forecast which he types and displays in his window for the information of farmers.

Mr. Lown heard the request to notify Mr. Obergfell of the death of his father. An hour after the message was broadcast the Rhinebeck man happened to notice an Illinois plate on the type of car mentioned in the message. He "took a chance," as he afterward wrote WGY, and hailed the driver of the car. It was Mr. Obergfell and the Chicago man was able to return home in time to attend the funeral of his father.

During the late Winter of 1926, WGY was asked to broadcast news of the death of a relative of a Buffalo man and wife who were on an island in the St. Lawrence. The island was cut off from the usual forms of communication and it was feared that the ice was about ready to break up making the trip by messenger hazardous. It was known that residents on the island had radio receiving sets. The message carried information of the funeral with the warning that the crossing was dangerous and should not be attempted unless a change in weather improved conditions. The message was received and the Buffalo couple made the journey over the ice in time to attend the funeral.

A few years ago the broadcast message of WGY resulted in the recovery of Verner Alexanderson, son of E. F. W. Alexanderson, who was kidnapped and held in a camp on the St. Lawrence.

Good Back Numbers of RADIO WORLD

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

1926:

Jan. 2—The 2-C Set for Simplicity, by Capt. P. V. O'Rourke.

Jan. 9—The 4-Tube DX Symphony Set, by A. Irving Witz. A Skillfully Made 1-Dial Set, by Herman Bernard.

Jan. 16—Anderson's 5-Tube Quality Receiver. The Raytheon B Eliminator, by Lewis Winner.

Jan. 30—An Individual AF Amplifier, by H. E. Hayden. Trapping Out Super-Power in New Jersey, by Capt. P. V. O'Rourke.

Feb. 27—The 4-Tube DX Dandy, by Herbert E. Hayden. Umbrella Aerial for DX, by Hugo Gernsback.

Mar. 6—The 1-Tube Set, by Capt. O'Rourke. The Chemistry of Batteries, by A. R. Reid.

Mar. 13—The Non-Regenerative Browning-Drake Set (Part 1), by M. B. Sleeper. The Tectron Eliminator, by Lewis Winner.

Mar. 20—The Super-Heterodyne, by J. E. Anderson. A 2-Tube Speaker Set, by Percy Warren. The Browning-Drake Set (Part 2), by M. B. Sleeper.

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

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

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

May 1—New Multiple Tube, by Herman Bernard. The Aero All-Wave Set, by Capt. O'Rourke. Kilocycle-Meter Chart. An Analysis of Detection, by J. E. Anderson (Part 1).

May 8—A Study of Detection, by J. E. Anderson (Part 2). To Wind a Loop on a Cardboard Frame. How to Reflex Resistance AF, by Theo. Kerr.

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

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

May 29—Aerials in Ground and Water, by Lewis Winner. Economized Filaments, by J. E. Anderson. How to Get DX, by John F. Rider.

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

June 12—The Light 5-Tube Portable, by Herman Bernard (Part 1). The Rogers-Schudt Receiver, by Wm. A. Schudt, Jr. (Part 1). The Freshman Masterpiece, by A. W. Franklin.

June 19—Selectivity's Amazing Toll, by J. E. Anderson. The Light 5-Tube Portable Set, by Herman Bernard (Part 2). The 4-Tube Rogers-Schudt, by Wm. A. Schudt, Jr. (Part 2).

June 26—The Victoreen Portable, by Herman Bernard (Part 1). The Manufacture of a Tube, by F. C. Kelley. The Light 5-Tube Portable, by Herman Bernard (Part 3). The Rogers-Schudt Circuit (Part 3 concluded), by Wm. A. Schudt.

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

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

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

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

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

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

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

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

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

Any copy, 15c. Any 7 copies, $1.00. All these 29 copies for $4.00, or start subscription with any issue. RADIO WORLD, 145 West 45th Street, New York City.

INTERESTING FACTS

WHAT IS the best type of antenna to use for broadcast reception? Give a brief description.

A single wire about 100 feet in a straight line, using No. 14, either stranded or hard drawn makes an ideal antenna. A thin coat of enamel over the hard drawn wire will tend to prevent corrosion caused by exposure. When using the stranded wire, it is quite important that each strand be enameled, so as to prevent added RF resistance between the turns, due to friction, weather conditions, etc. If it is not posible to install an antenna 100 feet in a straight line, the next best bet is a V or L shaped antenna. This 100 feet length holds true when the leadin is no more than 50 feet long. If the leadin is about 65 or 70 feet, then a 75 or 85 feet antenna will give satisfactory results. The bare antenna wire should not be run down the side of the building, unless it is going to be at least 2 feet away from the wall. If this distance is kept, then this system will give great results.

* * *

HOW DOES a crystal detector function?

It acts as a unilateral conductor. A greater resistance is present when the current flows in one direction, than in the opposite direction. Therefore when an alternating emf. is impressed on the crystal, the flow of current in one direction is much greater than in the other direction. We then have rectification.

Usually the resistance of the crystal detector with current flowing in proper direction is about 8,000 ohms. In the opposite direction, the resistance is about 80,000 ohms.

NEW CORPORATIONS

Pilot Radio Sales Co., N. Y. C., $5,000; H. Schiff, L. Fradkin. (Atty., H. Shapiro, 261 Broadway, N. Y. C.)

Henry Burr, N. Y. C., broadcasting, 200 common, no par; H. H. McClaskey, L. C. Mountcastle, W. T. Kirkeby. (Atty., Kohl & Mathews, 36 West 44th St., N. Y. C.)

Rider Radio Corp., Long Island City, N. Y., 15 shares, $100 each, 300 common, no par; J. F. Rider, E. W. Little, E. J. A. Brook. (Atty., Oeland & Kuhn, 115 Broadway, N. Y. C.)

Radio Mechanics, N. Y. C., publication, 100 common, no par, M. B. Sleeper, R. Atwood, B. S. Davis. (Atty., H. H. Keepe, 342 Madison Ave., N. Y. C.)

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E. C. Haslett, 624 Merton Ave., Akron, O.

E. J. Buller, 2123 South Tacoma Ave., Tacoma, Wash.

Lunds Radio Service, 312 Stocking St., Mobile, Ala. (Dealers).

G. A. Frame, P. O. Box 606, Winnipeg, Man., Canada.

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GRID BIAS ON LAST TUBE IS OF BIG VALUE

Adjustment, if Not Properly Made, Often Causes Oscillation That Baffles Fan—112 Power Tube Suggested For Diamond's Final Socket

(*Concluded from page 12*)

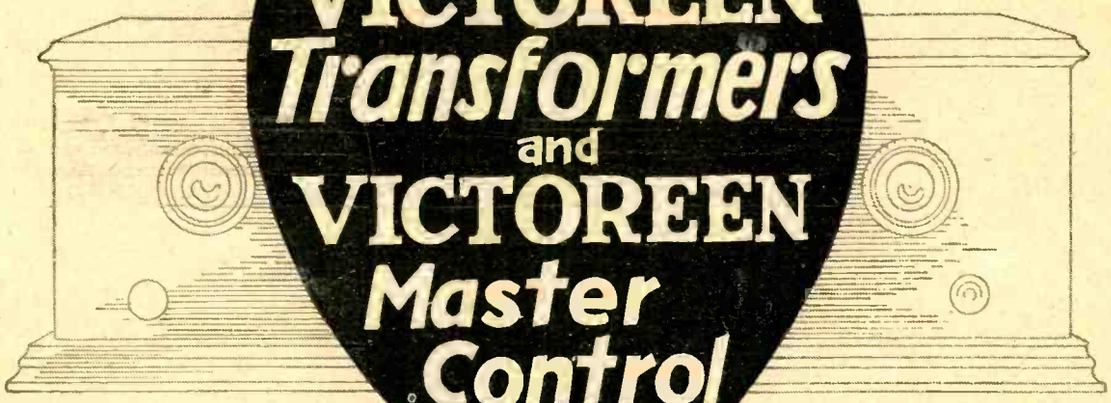
audio stage, but if this is done the Amperite R7 should be one suitable for the tube. The type of power tube recommended is the CX312 or UX112 or the CeCo power tube, which has the same characteristics and which too draws .5 filament current at 5 volts. The Amperite for these is the 112 (R7 in Fig. 1) and it replaces the 1A Amperite at this point. If 3-volt tubes are used in the set the power tube should be of the 120 type or CeCo 3-volt power tube. The Amperite in this case would be the 120.

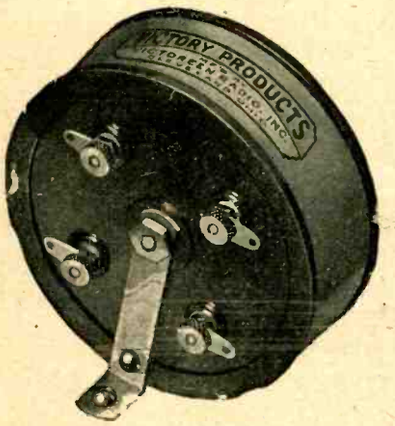
The negative grid bias should be determined by experiment. Most likely with 135 volts on the final plate the correct bias will be found somewhere between 4½ and 7½ volts, with a tendency toward the lower order of bias, except that the 120 tube takes a very much higher bias, up to 22½ volts.

If a B eliminator is used, and the putt-putting sound is heard, the so-called motorboating effect, then try a variable grid leak, connected between the plate of the first audio tube (3) and the grid of the second audio tube (4), leaving all the rest of the wiring intact. Turn the leak to various settings until the one is found that gets rid of this nuisance. Also try altering the bias on the final audio tube, as this, if wrong, will induce audio oscillations that permeate the whole receiver.

The Heart of the Circuit

VICTOREEN Transformers and VICTOREEN Master Control Unit





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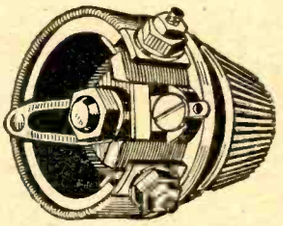

Victoreen R. F. Transformers

are made with air core construction. They are not merely "matched" but are actually tuned to a guaranteed precision of 1/3 of 1%.

Victoreen Super sets are free from oscillations, howls or squeals—no matching of tubes is necessary.

The B battery consumption is exceptionally low—8 to 10 milliamps with potentiometer at negative side—less than some 3 tube sets.

For range, clarity, volume, selectivity and ease of operation, a Victoreen Super cannot be excelled.

The Heart of the Circuit

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1 Victoreen No. 150 Coupling Unit, each	5.50
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1 400-ohm Victoreen Potentiometer	1.50
2 6-ohm Victoreen Rheostats, each	1.20
2 30-ohm Victoreen Rheostats, each	1.20
1 type V. S. Master Control Unit	19.50

Get a complete list of necessary parts from your dealer or write us direct. Your dealer will be able to supply all parts. The free Victoreen folder and hook-up answers all questions about the Victoreen circuit.

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The only Rheostat with zero temperature coefficient—no matter how warm the unit becomes the resistant remains absolutely constant.

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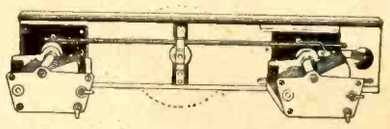

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