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RADIO WORLD

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America's First and Only National Radio Weekly
Vol. 10 No. 18 252 *Illustrated*

HOW TRANS-OCEAN 'PHONE WORKS

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LYNCH'S POWER SUPPLY UNITS

WHAT VALUE RESISTORS TO CHOOSE

HOW DO YOU "MICROPHONE?"

WHY LOOP IS REGAINING FAVOR

MASTER MINDS DISCUSS TELEVISION

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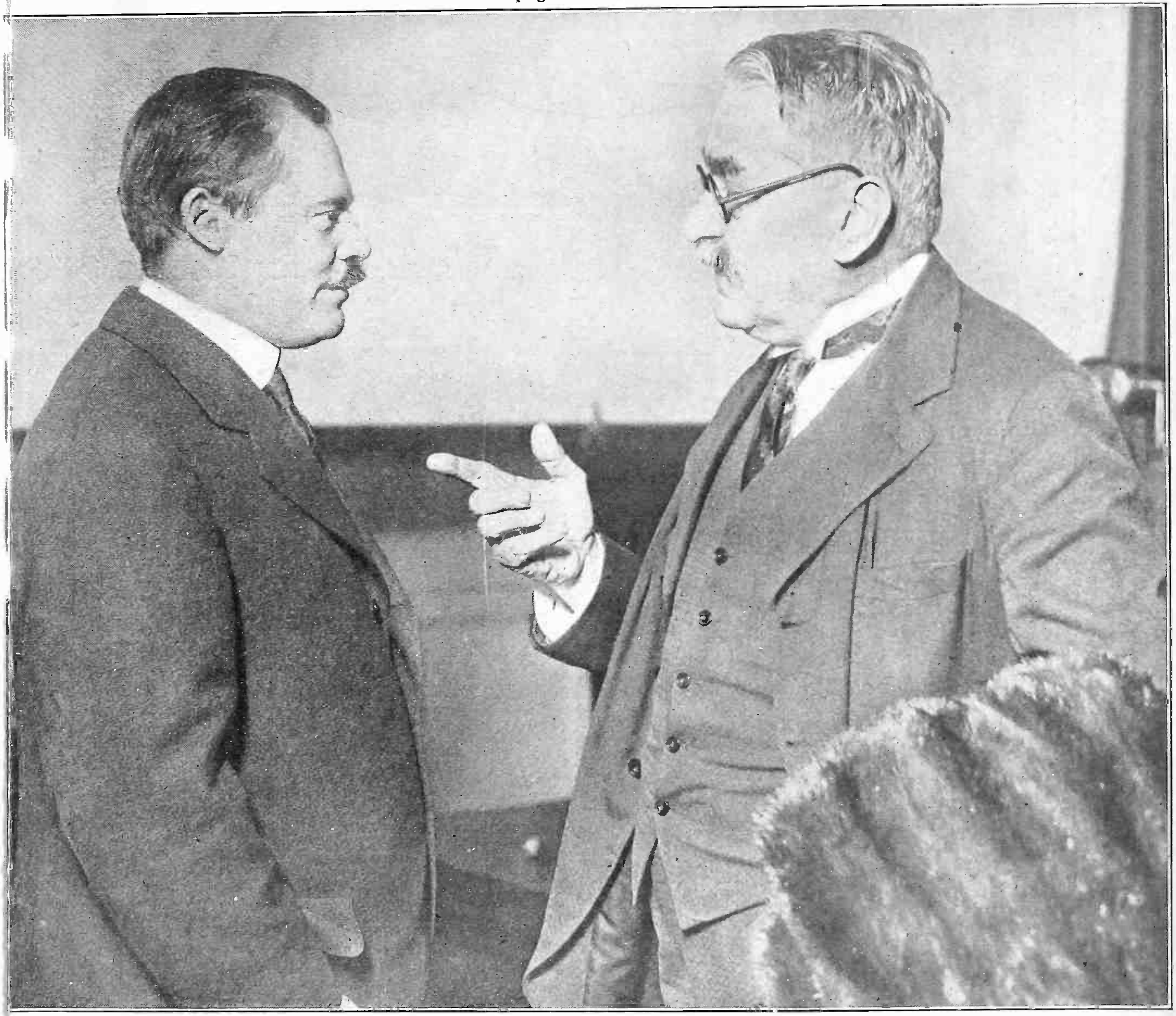

(Wide World)

TWO MASTER MINDS held an informal discussion of television at the recent convention of the Institute of Radio Engineers, in New York City. Dr. E. F. W. Alexanderson (left) is listening intently to the opinions of Prof. Michael Pupin, of Columbia University. As Dr. Pupin's coat was a valuable fur, he wouldn't risk checking it.

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How N. Y.-London 'Phone Works
Explained In Detail by Modulation Engineer

Receiver Can Be Built Which Will Bring in the Talk From London as Well as From New York—Very Accurate Tuning Required, Due to Special Method of Tranmission That Omits Carrier and One Side Band

System Assures No Privacy, But Reception of the Remote Voice is Difficult for Experimenter—Radio Waves Make 3,700-Mile Trip in .018 Second, 22 and 5,000 Meters Being the Two Used, Choice in U. S. Depending On Which Works Better

By Lewis Rand

NEW YORK at last has been connected telephonically with London. The course of the conversation between the speakers is interesting. A New York subscriber calls up a number in London, and a connection is established with the party desired. The New Yorker talks into the microphone. The sound waves are translated into equivalent electric currents. These currents travel by wire to the transmitting station at Rocky Point, L. I., where the electric currents of voice frequency are mixed with an electric current of radio frequency. The result is that the audibility disappears, only a modulated radio wave remaining. This current is then impressed on the transmitting antenna of the radio station and converted into radiant energy, or electromagnetic waves. The electric waves are picked up by the receiving antenna at Wroughton, England, and are converted into electric currents. These currents are amplified millions of times and then transmitted by wire to London and the telephone set of the person addressed. The answer of that individual goes through a similar transformation but travels a different course. It goes from London to Rugby transmitting station and then it is picked up by the receiver at Houlton, Maine. Thence it goes by wire across New England to New York, and finally reaches the person for whom it is intended. The actual length of time that it takes the signal to go from one person to the other is extremely short, .018 of a second. It depends on the actual distance that the signal travels, and this is considerably greater than the air line distance between the two persons.

Single Side Band Used

One thing which contributed to the practical success of New York-to-London telephony is the use of single side band transmission and carrier suppression. When a single side band is used there is less trouble from fading and atmospheric disturbances and very much less power is required with which to reach a certain distance. The same applies to carrier suppression. The chief difficulty with the carrier suppression is that before the single side band can be understood at the receiving end a current of the same frequency as the original carrier must be supplied. This does not mean that the frequency of the supplied current should be approximately the same, but exactly

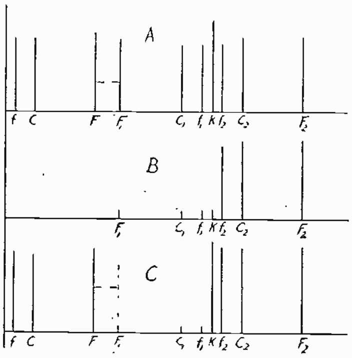


FIG. 1

DIAGRAMS that help one to visualize the suppression of the carrier and one side band. The word "carrier" is retained, although no "carrying" is done under these conditions.

the same. If it is not the same within a few cycles per second at all times the recreated signal will be distorted to a point where it cannot be understood.

There may be some who do not understand what is meant by single side band transmission and carrier suppression. Let us attempt to explain.

First let us talk about the carrier. At the transmitting station there is an oscillator which generates an alternating current of a very high frequency, depending on the wavelength on which the station is operating. When this alternating current is sent into the transmitting antenna, part of the energy is radiated into space, just as heat is radiated from a hot stove. In space this radio energy is called the carrier wave, because before any one had seriously considered side band suppression the effect of the audible frequencies on the frequency generated in the oscillator was called the "envelope," and the generated frequency, naturally, the "carrier."

The alternating current has a certain amplitude or swing when it is undisturbed, and this amplitude remains constant. That is, the current is continuous A. C. Every crest of every wave has the same height. The current is unmodulated.

What Modulation Is

If the amplitude of the current is varied in some definite manner current is said to be modulated. The modulation may be done by alternately stopping or starting the alternating current. This is done in dot and dash telegraphy. The amplitude of the current may also be varied periodically from some minimum to a maximum value, and this variation may be done according to any law desired. For example, it may be done according to the amplitude of a current of some other frequency. This current may be of audio frequency, and may well have been produced by speaking into a microphone. The modulation of the carrier current by the voice current is done in a circuit similar to that of an ordinary detector. The two currents are mixed, scrambled, modulated. When a modulated current is sent into an antenna the wave which is radiated is also modulated, that is, its amplitude varies in the same manner is the modulated current.

There are two ways of looking at a modulated wave. It may be regarded as a wave of high frequency with its amplitude varied according to the amplitude of the slower current, or it may be regarded as the result of the combination of two waves of high but slightly different frequencies. For example, if a wave of a frequency of 1,000,000 cycles is modulated with a current of one thousand cycles, the resulting wave may be regarded as a wave of one million cycles whose amplitude waxes and wanes at the rate of one thousand cycles per second. It may also be regarded as composed of two waves of frequencies of 1,001,000 cycles and 999,000 cycles. These frequencies are actually present in the modulated wave, and they are known as the side frequencies of the 1,000 cycle signal frequency. The carrier is one million, the signal frequency is 1,000, and the two side frequencies are the sum and the difference between these two. Hence the carrier "envelope" has two aspects, one on the positive, the other on the negative half of the wave.

Honest-to-Goodness

The side frequency waves are not fictions, but they are real waves which leave the antenna when it is transmitting, and ordinarily they leave together with the carrier.

When a receiver is tuned in on a station it is tuned to the carrier wave, but the two side frequencies also come in, provided that the tuner is not so sharp as to cut them out, and this is not likely in any ordinary receiving set. When the signal arrives to the detector in the receiver the two side frequencies and the carrier are demodulated, unscrambled, detected, and there results one frequency which is the difference between the carrier frequency and either side frequency. That is, the output of the detector is of the same frequency as the frequency with which the original carrier was modulated.

So far nothing has been said of the meaning of side bands. The side bands can only be defined in terms of the side frequencies. Audible frequencies range from about 16 cycles per second up to about 5,000 cycles per second, for radio

The Carrier Is Eliminated
By Filter Circuits, As Is One Side Band

(*Concluded from page 3*)
telephony the signal frequency may take any value within this band, or any combination of frequencies within the band. Hence in the modulated wave the side frequencies may have any value of the carrier frequency plus and minus 5,000 cycles. In the case of the 1,000,000 cycle carrier the side frequencies may lie anywhere in the bands (999,984—985,000) cycles and (1,000,016—1,015,000) cycles.

Reference to Fig. 1

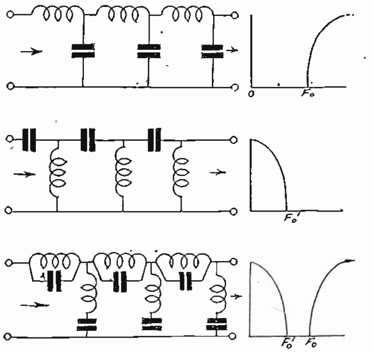
These are the side bands and are simply the locations with reference to a given carrier where a given signal frequency may be represented. When the signal contains a single frequency one cannot speak of side bands but of side frequencies; when the signal contains, or may contain, many frequencies, then it is necessary to speak of side bands. Every frequency in the signal is represented by two side frequencies, and these side frequencies differ from the carrier by the amount of the signal frequency.

The graphical representation in Fig. 1. A may help to visualize signal frequencies, side bands and carrier. C in Fig. 1A represents a signal frequency, say one of 1,000 cycles. K represents a radio frequency or carrier, which may have a value of 1,000,000 cycles. When C and K are mixed in a modulator there result the two side frequencies C_1 and C_2. The entire band of audio frequencies is represented by the distance fF, the lower and upper limits of the audible scale. This band of frequencies is represented higher up in the frequency scale by the two side bands f_1F_1 and f_2F_2, with reference to the carrier frequency K. The frequency bands fF, f_1F_1 and f_2F_2 have all the same absolute width.

It was stated at the beginning of this article that the New York-to-London telephony was carried on with a single side band and suppressed carrier. What this means may be understood by studying Fig. 1B. Here F, C and f, are no longer present because they are all audio frequencies and they are not sent into the ether. Only very short lines are shown at $F_1C_1f_1K$, because all these frequencies have been suppressed. They are shown in rudimentary form to indicate where they should be in the frequency scale. In some cases they are not quite suppressed because of imperfections in the filtering system used. In B the carrier and the lower side band have been suppressed. The upper side band is transmitted and therefore $f_2C_2F_2$ are shown as long as in A. A spoken signal may lie anywhere within this band, not as audio frequency but as radio.

Effect of Single Band

In receiving single side band transmission it is necessary to supply a current of the same frequency as the original carrier, that is as K, before the transmitted side band can be interpreted. Hence in C the line representing K is drawn full length. When the locally generated K current and the received side band f_2F_2 are put on a detector the output contains the audible frequency band fF, which is an exact reproduction of the transmitted frequency band fF in A. That is, it is the same provided that the re-supplied frequency K is the same as the suppressed carrier. From this it appears that it is not strictly logical to speak of the carrier when no carrier goes along with the side band that is transmitted. One might speak of the auxiliary frequency, or of the modulated frequency, or of the central frequency, or of the key frequency. But carrier is established, so let's stay put.



Top—Three sections of a low-pass filter which will pass all frequencies up to a certain frequency Fo and which will suppress all higher frequencies in the manner shown at the right (Fig. 2).

Middle—Three sections of a high-pass filter which will pass all high frequencies down to a certain frequency Fol and which will stop all lower frequencies in the manner shown by the curve at right (Fig. 3).

Bottom—Three sections of a band pass filter which will pass all frequencies between two values Fol and Fo and which will stop all others according to the curves at the right (Fig. 4).

The necessity of keeping the re-supplied frequency exactly the same as the original carrier is of prime importance. Suppose that they should differ by as much as 1,000 cycles. The received signal of 1,000 cycles would then be either zero or two thousand cycles. Other frequencies in the signal would be shifted by the same absolute amount. The resulting distortion is evident. A person speaking in a basso profundo voice would sound like lyric soprano, or higher, and a soprano would sound like a locust. Or the distortion might go in the opposite direction. Even if the deviation of the original and the re-supplied frequency is as great as 50 cycles the distortion of the lower audible notes would be considerable.

Re-supply Must Be Accurate

A prime requisite, then, for the success of single side band carrier suppression is that the original and the re-supplied carrier frequencies be the same and that they remain the same. Ordinary oscillators cannot be held constant enough. They vary by more than one tenth of one per cent. The solution to the constancy problem lies in the use of piezo electric crystals for controlling the oscillations. Quartz plates are used for this purpose because this mineral is piezo electric and at the same time has unvarying mechanical properties. By means of this an electric oscillator can be held to about one cycle in one hundred thousand. If two identical pieces of quartz are used, one at the transmitter and one at the receiver, the two oscillators can be held to the same frequency, and consequently frequency distortion can be avoided.

The methods whereby one of the side bands and the carrier are suppressed have not been published as yet, but it is done by a system of filters. Electrical networks or filters may be constructed to accomplish almost any type of suppression or transmission. A simple series tuned circuit transmit one frequency. A simple parallel tuned circuit, as a wave trap, suppresses one. Each of these two devices is simply made of an inductance coil and a tuning condenser. If more condensers and more inductance coils are connected in certain combinations certain frequency bands may be transmitted or suppressed.

The Low Pass Filter

A combination of series inductance coils and shunt condensers such as that which is shown in Fig. 2 is known as a low pass filter, because it will pass all frequencies up to a certain value known as the cut off frequency. Above this frequency the current will be suppressed in varying degrees depending on the frequency and the number of sections of the filter. In Fig. 2 the filter has three sections. The curve to the right of the low pass filter shows the attenuation of it. Up to a frequency F_0 there is very little attenuation but above it there is very great attenuation.

The combination of coils and condensers shown in Fig. 3 is known as a high pass filter because it attenuates all frequencies up to the cut off frequency F_0 and lets all higher frequencies through without much loss. Its attenuation curve is shown to the right of the filter network.

In Fig. 4 is a network which is a combination of the two preceding. It is known as a band pass filter. It passes all frequencies between the two cut off points F_0' and F_0, and suppresses all others provided the constants of the coils and condensers have been properly chosen.

It is apparent from the above networks how one side band may be suppressed and one transmitted. One way is to use a band pass filter and to choose its values so that it passes nothing but the side band it is desired to transmit. There are other ways of accomplishing this. There are certain balancing arrangements which may be used which will balance out one side and let the other through and which will also balance out the carrier. In balancing out one side band use is made of the fact that the two side bands are in opposite phase.

Two Waves, No Privacy

The construction of filters for the suppression or transmission of certain frequencies is not the simplest matter, and should not be undertaken by the amateur unless he has a thorough understanding of electrical phenomena, and unless he has the measuring equipment to make sure that the values of the actual apparatus is exactly that called for by the design. It is difficult enough at low frequencies, but it is particularly difficult at radio frequencies.

Three interesting points in connection with the trans-Atlantic 'phone is that privacy is not strictly assured, two wavelengths, one very high and one very low, are used, and very much greater power is received, due to the special method of transmission.

THE STOPPING CONDENSER

The stopping condenser in resistance and impedance coupled audio frequency amplifiers should be not smaller than one-tenth of a microfarad. It must also be absolutely free from any leakage from the plate preceding. The condenser in series with the loud speaker in the output of a CX-371 power tube should be as large as the pocketbook will permit. It should never be smaller than four microfarads.

How Well Do You "Microphone?"

Your Voice May Be Tested By Using Button

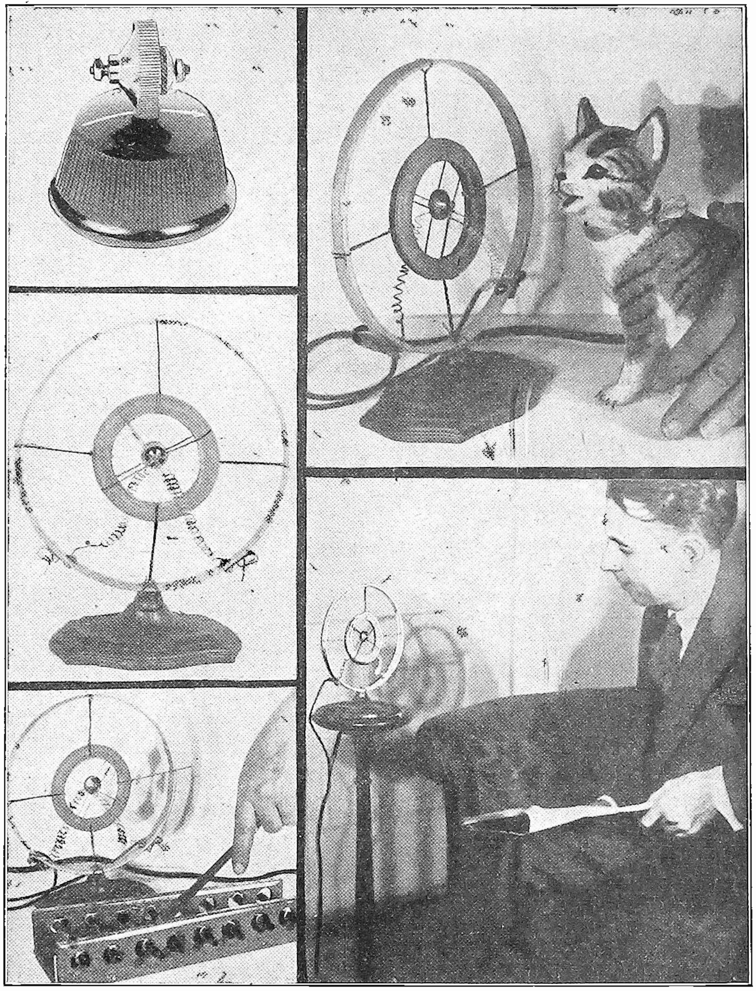
By Herbert E. Hayden

Photographs by the Author

ONE interesting use of a little microphone is to determine how you and your friends "microphone." How will your voice sound when it is reproduced? Will it sound as well as the voice of your favorite announcer at the broadcasting station? Will you be able to recognize the voices of your friends? The way to find out is to get a microphone, talk into it and have the loud speaker in your receiver reproduce the voice.

If the sound is to be natural and free from noises it is essential that the pick-up microphone be so mounted that it does not receive any vibrations except those desired. One way of insuring against picking up extraneous vibrations is to provide the mike with a vibration filter. How this may be done very simply is shown in the photographs herewith. An embroidery hoop about ten inches in diameter is used, with a rubber ring from four to five inches in diameter. The rubber ring may be taken from the wheel of a discarded go-cart.

First mount the microphone button in the center of the rubber ring by means of rubber elastic bands of just sufficient strength to hold it in place. Then mount the rubber ring in a similar manner in the center of the embroidery hoop. This triple rubber mounting will kill all mechanical vibrations of audible frequency and consequently it will prevent all undesired noises from getting into the mike.



FIGS. 2 TO 6—Views of the voice tester. Upper left, the microphone button is placed on top of a 1¼ inch rheostat knob. Left center, the method of mounting the microphone button in the vibration filter mounting. Lower left, the music from a baby's xylophone may be tested and reproduced by the loud speaker. Upper right, even kitty may be induced to perform before this mike. Lower right, an amateur testing his voice before the mike and overcoming microphone fright.

Coil the Leads

The lead from the microphone should be light and flexible and should also be coiled up to some extent, otherwise the leads would partly nullify the efficacy of the vibration filter. The leads may be connected to Fahnestock clips attached to the hoop.

Some experimenters would, no doubt, prefer to buy a microphone ready made instead of making one. There are several on the market and one instrument of very small dimensions is known as the Skinderviken microphone button.

Some of the most interesting experiments in radio and allied work may be performed with the aid of the simple microphone button. There are innumerable ways in which this may be used for converting sound energy into electric energy, that is, for modulating a direct or alternating current by means of sound waves.

The term microphone in general indicates an instrument capable of picking up sounds and converting the energy into electric current, but ordinarily the term suggests a carbon granule instrument of this type because this type is the most sensitive and the most commonly used. There is one in every telephone instrument and one in nearly every radio transmitter. This type of microphone is also used in detectophones for eavesdropping and in certain types of stethoscopes for listening to minute noises in the heart and lungs.

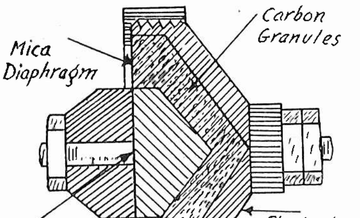


FIG. 1

A carbon microphone button may be made by enclosing carbon granules in a chamber between two electrodes as shown. The Conrad transmitter button is the commercially made product.

How It Operates

A carbon microphone depends for its operation on the fact that pressure changes the resistance of carbon, a fact well known to users of carbon compression type rheostats. The reason that carbon granules are used in the more sensitive types of microphones instead of carbon is that the granulation increases the resistance change with a given pressure, that is, it increases the sensitivity of the instrument. The larger the granules are, the more sensitive is the microphone.

The method of making use of the resistance variation property of carbon granules is to enclose the carbon in a small compartment of metal. On top of the granules is placed a diaphragm, either of metal or some other substance. If of metal, the diaphragm is insulated from the chamber holding the granules but not from the carbon. If the diaphragm is of a non-conducting material a piece of metal is fastened to the diaphragm and this metal is in contact with the carbon.

Battery Voltage

A low voltage battery (say 6 to 12 volts) is connected in series with the carbon microphone and some external device, which may be a transformer primary or an ammeter. When sound waves impinge on the diaphragm they vibrate against the carbon granules and vary the pressure. This in turn varies the resistance of the circuit, and the current is thus varied. If an ammeter is used as an indicator a steady current flows as long as the dia-

(*Concluded on page 30*)

Socket Power for Receivers

Analyzed In the Light of Latest Appliances

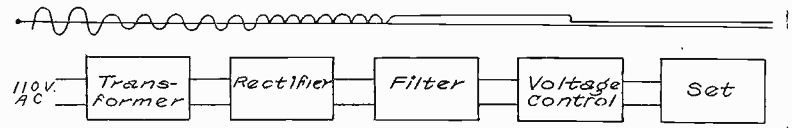


FIG. 1
This shows the sequence of the elimination process.

By Arthur H. Lynch

LAMP socket A power units are of two general types, the direct and the indirect. At this time the indirect A power units such as were described by the author in the last issue of Radio World are universally available, exceedingly satisfactory, reliable in performance, and quite inexpensive.

The direct A power units, in which no battery of any sort is incorporated are still rather expensive, cumbersome and not universally available. Nevertheless, many people prefer them because of the fact that they provide true A. C. operation.

A power units of this type, or as they are more often known, A eliminators, while having the disadvantages of high cost and lack of distribution, are capable of very satisfactory service. There are, to be sure, a number of little tricks to their operation as in the case of any new device, but once properly installed and regulated to meet any individual requirements, years of trouble-free service are to be expected.

What is the A Eliminator

The theory and the different component parts that go to make up the A eliminator are identical to those in the familiar B eliminator, except for the fact that whereas the B eliminator must supply a high voltage and low current, the A eliminator must supply a low voltage and very high current.

Fig. 1 indicates symbolically the various sections into which the A supply unit may be divided for purpose of explanation. The power transformer takes the energy required for the actual operation of the tubes in the radio set plus the energy that is to be lost as heat in the eliminator from the lampsocket at 110 volts and converts it into electrical energy at lower voltages. A transformer is a very efficient piece of electrical apparatus and very little energy is lost in passing through it. From the transformer the low voltage A. C. passes into the rectifier which converts it into a pulsating D. C. as indicated by the change in wave form in Fig. 1. The rectifiers at present available for A eliminator work are not exceedingly efficient and as a result convert a considerable part of the energy passing through them into heat. After having passed through the rectifier the current, while direct, is quite rough and known technically as pulsating D. C. Before this current can be used for lighting the radio tube filaments, the pulsations and variations must be smoothed out. This "smoothing" is accomplished by the filter. The filters used in different A eliminators vary considerably. All consist of several highly inductive series reactors and a number of shunt resistors or capacitative reactors.

How a Filter Works

The 120 cycle impedance of each choke must be considerably greater than the 120 cycle impedance of the shunt capacity or resistor preceding each series reactor. As the current to be passed by the chokes is quite high, even an inductance of a few henrys is bulky and expensive. Thus the inductance of the chokes must be kept low. As the inductance is a measure of the impedance, it will readily be seen that due to the low series impedance a still lower shunt impedance is necessary. Now while the series impedance varies directly with the inductance of the chokes, the shunt impedance varies inversely with the capacitance of the condensers, if such are used. To obtain a sufficiently low shunt impedance means a minimum capacity of close to 100 miirofarads, assuming an economical balance between choke and condenser bulk and cost. Even though the working voltage is very low, the cost of 100 microfarads or so of proper condensers is well nigh prohibitive. A very effective substitute, however, for low voltage work such as this, is the electrolytic condenser. The electrolytic condenser is very cheap to manufacture and can readily be made in enormous capacities occupying very little space. The reader who is interested in finding out more about this interesting device is referred to a paper entitled "Electrolytic Condensers" by James Millen and T. A. Smith which appeared in the December, 1925, issue of "Radio News."

Why Electrolytic Filters Are Good

Condensers, aside from acting as mere A. C. by-pass units which consume no D. C. also serve as storage tanks of electrical energy and thus reduce the total number of sections required in the filter. With paper condensers, two filter sections are generally enough, while with very high capacity electrolytic condensers, a single filter section is generally quite adequate.

To reduce the cost of an A power unit using paper condensers and to get away from the "liquid" of the electrolytic condenser, the "shunt" non-inductive resistor filter circuit has been developed. This circuit, which is used in the Davy A power unit and the Lynch-Davy A power kit, gives very satisfactory results. The objections to the system are that the resistors consume D. C. energy as well as the A. C. and thus lower the overall efficiency and increase the operating cost of the unit as a whole; that the D. C. consumed by the resistors must pass through some of the choke coils, thus requiring that they be made more bulky for a given value of inductance and that the air gap of each individual choke be adjusted to a different value; that resistors store no energy and thus a three or four

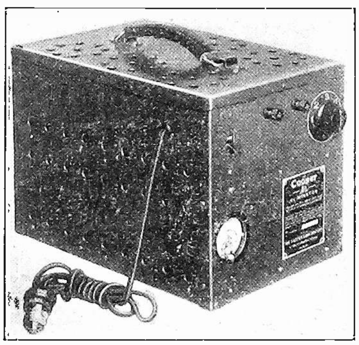


FIG. 2
A type of A battery eliminator.

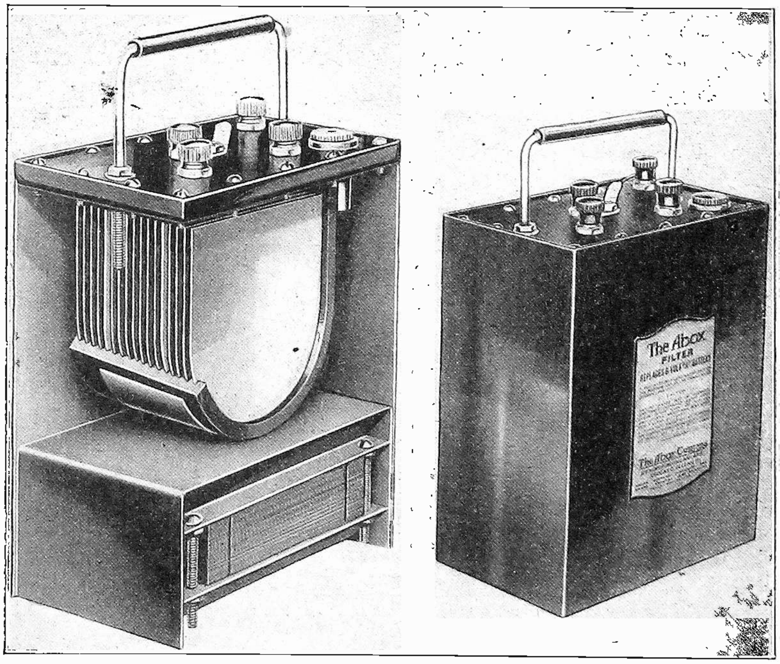


FIG. 3
The interior and exterior views of the Abcx. The author explains how this device is used, preferably with a Balkite charger.

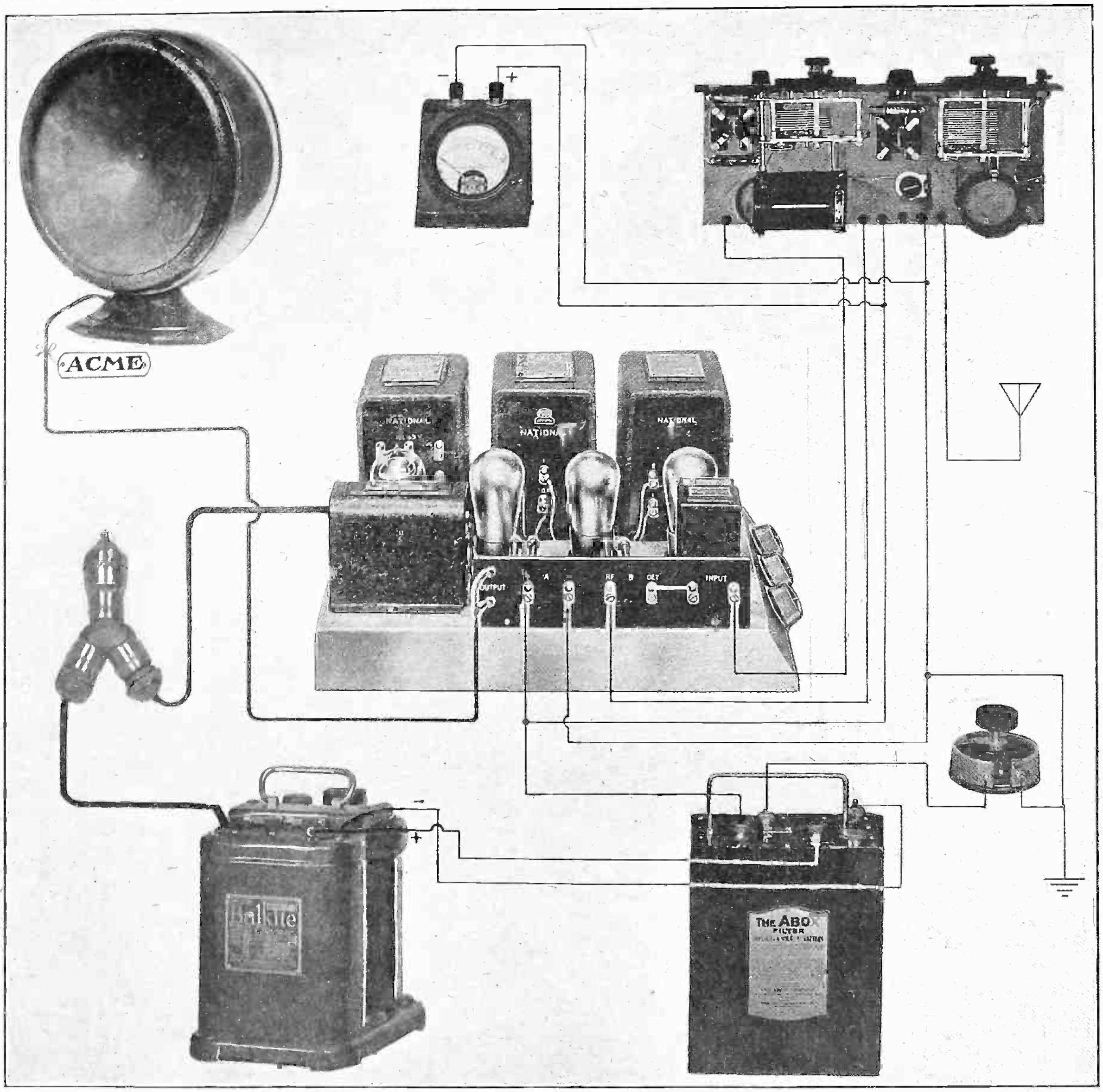


FIG. 4

Perhaps the most desirable charger for use with a filter to form an A power unit is the Balkite charger (2.5 ampere maximum)." This charger is shown connected to the Abox, or filter unit. The total diagram represents the powerized De Luxe Receiver. CeCo tubes are used in the 2-stage radio receiver and 3-stage audio amplifier.

rather than a one or two section filter is required.

How Constant "A" Voltage is Obtained

After the output of the rectifier has been filtered to a smooth, steady D. C., the voltage must be accurately adjusted by means of the rheostat and voltmeter to precisely the 6 volts required by the set. Herein lies the main objection to the present-day A eliminator. This voltage will vary slightly whenever a rheostat or other such filament control on the set is varied. In the De Luxe receiver system, any trouble due to this cause has been eliminated by the use of equalizors throughout for filament voltage control rather than the ordinary rheostat. Thus it is sufficient to adjust the A-power master rheostat until the meter reads precisely 6 volts. This meter must be a high grade instrument such as the No. 301 Weston shown in the illustration (Fig. 4).

When using the A eliminator with the De Luxe Receiver system it will, however, be necessary to keep the dial lights burning whenever the receiver is in use. In fact for the safety of the tubes it is well to remove the dial light switch from the panel. Because, if the dial lights were to be suddenly turned off after the master rheostat on the A eliminator had been adjusted so that the meter read 6 volts with the dial lights burning, the voltage would rise to such a value as to very materially shorten the life of the tubes, particularly the 199.

In line with this same idea is a warning against removing a tube from its socket or an equalizor from its mount while the set is in operation.

While the above remarks on voltage fluctuation with change of load might indicate a very undesirable characteristic of the A eliminator, such a characteristic need not necessarily prove annoying or otherwise troublesome for, once adjusted to any set, the voltage regulation may be promptly forgotten as there is no necessity for anyone to turn dial lights off and on or pull tubes from their sockets while the set is in operation.

Now that we have described just what an A eliminator is and how it functions, let us consider some of the various A power units of the eliminator types that are now on the market.

The Davy A Power

In regard to the Davy A power unit, this eliminator consists of a large transformer, two tungar rectifier tubes, and a three-section filter of the inductance-resistance variety. A voltage control or master rheostat is located on the front panel along with the two binding posts for the set. An unusual feature of this device is an automatic voltage control relay which shuts off the power if the voltage should rise above 6 volts for any reason, thus eliminating the necessity for a voltmeter and preventing any possible damage to the tubes. The entire outfit is contained within a neat perforated black enameled brass box.

The Cooper A Power

In Fig. 2 will be seen another complete power unit. This device also employs two Tungar tubes as rectifiers. The chokes differ from those in other units in that they are of the open-core variety. Furthermore, the filter system is of the

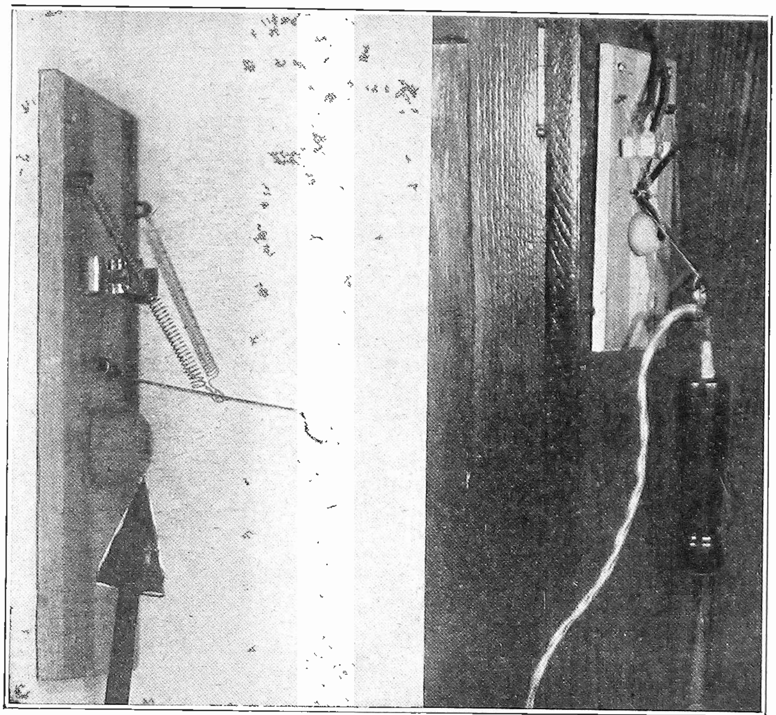
(*Concluded on page 8*)

Hook Simplifies Soldering

Hang Up the Iron and Juice Is Switched Off

By Sid Ton

EXPERIMENTERS and circuit builders who have continual use for a soldering iron will find this simple device extremely useful. A hook is provided from which the soldering iron may be suspended when not in use. Hanging it there automatically breaks the current which heats the iron. When the iron is to be used it is only necessary to remove it from the hook and the current is immediately turned on. The construction of the device is shown in the pictures. The spiral springs hold the connecting straps against the Fahnestock clips and make the circuit. When the weight of the iron is placed on the hook the springs yield and the circuit is broken. A rubber buffer is placed under the hook to prevent the hook from slamming.



(Hayden)

A HOOK and a circuit breaker for the soldering iron may be made simply as shown at left. The hook and circuit breaker are mounted on the wall and the iron placed on the hook (at right).

The hook may be formed out of a piece of brass strip one-sixteenth by one inch and about one foot long. A short piece of round brass is soldered to the hook at the right angle bend on the inside. This should extend about one inch outside either side of the hook and is to be used for a hinge. A couple of small staples driven into the wood mounting board will complete the bearings. The springs should be of steel and may be purchased in any hardware store. They are also fastened to the mounting board by means of a couple of staples. The entire device should be mounted in an upright position on the wall near the work bench so that it is handy at all times. A couple of wood screws are used in the present case for mounting the device on the door post to the laboratory. Of course leads should be brought from the nearest electric outlet to the clips.

The Choice of a Trickle Charger for Use With a Filter Unit

(*Concluded from page 7*)

inductance-capacitance variety rather than the inductance-resistance form. Still another variation is the meter mounted on the front panel, along with the master voltage control rheostat.

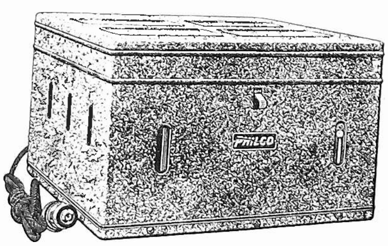
The Lynch-Davy A Power

In order that the radio constructors who are interested in A power units may obtain the necessary parts for experimental work, the present author has developed in connection with the engineers of the Davy Electrical Corporation, the Lynch-Davy A Power Kit. An A power unit assembled from this kit was shown in the Oct. 9 issue of RADIO WORLD.

Charger-Filter A Power Units

A study of Fig. 1 will show that the first two fundamental components of the A eliminator when taken together are nothing more or less than the familiar battery charger, a transformer and rectifier. If then, we add a filter and master rheostat to a suitable charger, an A power unit results. With this in mind, the "Abox" shown in Fig. 3 on page 6, was placed on the market. The "Abox" consists of a filter comprising a large choke coil and two very high capacity electrolytic condensers mounted within one small and neat metal box. Four terminals are provided, two are connected to the charger and two to the A posts on the set. In series with one of the leads to the set is connected a rheostat.

While good results can be obtained with most chargers some are totally unsuited for the purpose and others are not



A commercial type of power supply for radio receivers

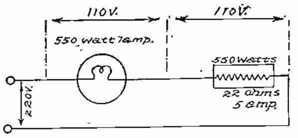
quite as good as they might be. The mechanical or vibrating chargers, such as the Apco, Home-Charger, Full-Wave, etc., are not satisfactory for this. The old type Tungars will give quite good results if care is used in connecting up. The ground connection must be removed from the set, as the old type Tungar and Rectigon chargers are grounded through the power line. The new Tungars are much better, however, as they are practically silent in operation and have no ground connection through the power lines so that it is not necessary to remove the ground lead from the receiver. For use with the average set the two ampere size is to be preferred. But perhaps the most desirable charger for use with a filter to form an A power unit is the double wave two ampere Balkite unit. Due to the use of double wave rectification the output is more easily and completely filtered, and due to the use of the electrolytic rectifier they are both silent and efficient in operation. Such an A power is also exceedingly economical to operate as power is only consumed from the line while the set is in actual operation and not practically continuously as in the case of the battery and trickle charger. Fig. 4 shows how the Balkite charger and "Abox" filter are connected to the De Luxe receiver.

The meter shown is essential for guidance in adjusting the master rheostat to the proper value of resistance. As the current consumed by a high grade voltmeter is but a few milliamperes, the length of the meter leads is of no real importance and the instrument may therefore be located on the panel of the set or any other convenient place.

Control of A Power Units

The conections to a set such as the De Luxe Receiver are greatly simplified when an A power unit of the batteryless type is employed, as the control relay is not used. In fact merely connect the A unit to the set and amplifier, as shown in Fig. 4, without thought of filament switches. The extra A post on the set which is ordinarily used for controlling the amplifier filament neet not be used at all. A two way socket adaptor is secured and the cord from the A eliminator and the power amplifier connected to it. The volume control on the panel of the set is never so adjusted as to open the filament circuit. Merely turning on or off the lamp socket switch controls the entire set in one operation.

An Insight Into Resistors
And How to Select Proper Ones for Circuits



If the source is 220 volts and a 550-watt, 110-volt lamp is to be lighted, a series resistor of 22 ohms, capable of passing 5 amperes is necessary, properly to heat the lamp filament.

By J. E. Anderson
Consulting Engineer

THE selection of resistors for radio receivers and other electrical apparatus is a subject that should be given some thought. There are certain things that should be known about a resistor before it can be safely placed in a circuit. It is not enough merely to know its resistance value; it is also necessary to know how much current it will carry without overheating.

The first question that should be asked when about to select a resistor is: How much current must it carry? That question must be answered before the value of the resistance can be determined. The next question should be: How much voltage drop must there be in the resistance? Knowing the voltage drop necessary in the resistor and the current that it will carry, the resistance value may be obtained by the application of Ohm's law, that is, by dividing the voltage drop by the current. For example, if it is known that the current which will flow in a given resistor is 250 milliamperes and that it is desired to drop the voltage from 135 to 90 volts, that is, the resistor is to cause a drop of 45 volts when a current of 250 milliamperes flows through it, then the required resistance value is obtained by dividing 45 volts by one-quarter ampere. This gives 180 ohms. Restated this problem reads: What resistance is required to cause a drop of 45 volts when one-quarter ampere flows through the resistance?

The Current Carrying Capacity

What else besides the resistance is it necessary to know about the resistor before it can safely be placed in the circuit? Its current carrying capacity. Will the resistor carry 250 milliamperes without burning out or heating up too much? Now, a 180 ohm resistor may be obtained by using a short piece of very fine resistance wire or by using a long and heavy wire. The short piece will get hot much more quickly than the long heavy wire. Hence from the point of view of safety the heavy wire should be used. But safety is not the only consideration. Cost and bulk must also be counted on. A high resistance made of very heavy resistance wire would be both expensive and bulky. From this point of view, then, it is desirable to use as fine a wire as possible. In a practical case it is necessary to compromise between the two opposing considerations. But it is always necessary to be on the safe side, with a wide margin left over.

What limits the current carrying capacity of a resistor? This question may be answered in one one word by saying temperature. In some cases it is the temperature at which the wire melts; in others it is the temperature at which the insulating associated with the resistance element melts or softens; and in still other cases it is the temperature at which the insulation would start to burn. When the insulation is porcelain, asbestos, or similar refractory substance, the limiting temperature is the melting point of the wire, or not far from that point. When the insulation is glass, mica and similar substances, the limit is the softening point of the insulator, if this point is lower than the melting point of the resistance element. When the insulation is hard rubber, bakelite, fibre and similar stuff the limit is rather low because the substances cannot stand much heat without softening or burning.

Carbon in a Vacuum

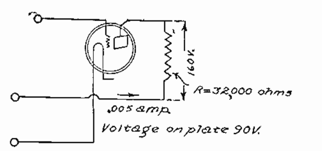
Other limitations of resistor units are imposed by the atmosphere in which they are placed. Thus, if carbon is the resistance element it will burn up if it is in an oxygen atmosphere, but if the same element is placed in a nitrogen atmosphere or in a vacuum it may be used to a higher temperature than any other substance. Similarly, certain metals, as tungsten, may be used up to a much higher temperature when in a vacuum or nitrogen atmosphere than if in oxygen.

Why does a fine wire resistor get much hotter than a heavy wire resistor when the two have the same resistance value and the same current flows through both of them? The answer to this question lies in the rate of cooling of the two resistors, and the rate of cooling depends on the surface of the conductors. A fine wire does not have very much surface per ohm of resistance and hence its rate of cooling is very slow. The long, heavy wire has a large surface from which heat may escape, and therefore this wire does not get hot. Suppose there is a certain piece of fine wire having a resistance of one ohm. Another piece of wire of twice the diameter and four times the length would also have a resistance of one ohm, provided that the two are of the same material. If the area of the surface of the fine wire is S then the area of the surface of the heavier wire is 8S. The same amount of heat is generated in both of them when the same current is flowing through them, but the wire of double diameter has eight times the cooling surface of the finer wire.

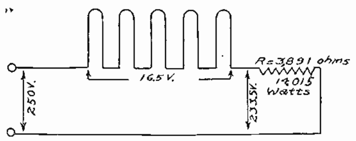
The rate of cooling also depends on the nature of the surface of conductor. Black and rough surfaces cool much more quickly than bright and polished surfaces. This also holds true of the insulators which are associated with the resistor elements.

The Watt Rating

The rating of resistors in terms of watts has caused a certain amount of misunderstanding. Why should a resistance be rated in watts and not merely in ohms? Neither the watt nor the ohm rating alone is a complete description of the resistor. When the resistance alone is given there is no indication of how much current it can safely carry or at what voltage. When the wattage rating is given no indication is given of the resistance.



With a 160-volt source and a 5 milliampere drain a resistor of 32,000 ohms is needed to cut down the voltage to the desired 90 on the plate of the tube.



From a 250-volt supply, what size resistor, at what voltage, is necessary to obtain 16.5 volts to heat the filaments of five CX-299 tubes? The answer is printed on the diagram. The method of solving is discussed in the text.

A resistor may be rated completely by giving two of its characteristics, and these may be given in terms of volts, amperes, ohms or watts. Thus it may be described by its wattage and ohmage, by its maximum amperage and ohmage, by its voltage and wattage, by its amperage and wattage and by its voltage and ohmage.

If the ohmage and the wattage are known, both the maximum current and the maximum voltage across the resistor are known. The same is true of the other combinations above. The relations connecting these quantities are $VA = W$ and $V = RA$, where V is the voltage across the resistor, A is the amperage through it, W is the wattage dissipated in it, and R is the resistance of the unit in ohms.

Wattage Discloses Heat or Light

Electric lamps, which are only resistors, are usually rated by the voltage and the wattage. The wattage tells how much heat or light comes out of the lamp per second under known operating conditions. The voltage tells how much voltage should be applied across the lamp terminals to get this wattage, and it also tells that no higher voltage should be used if the lamp is to last for any time at all. Household appliances are rated in terms of wattage and voltage, or in terms of voltage and current. The latter is not complete because it does not give the maximum safe current, nevertheless it is a practical rating and complete enough, as long as it is not put to any other use than intended.

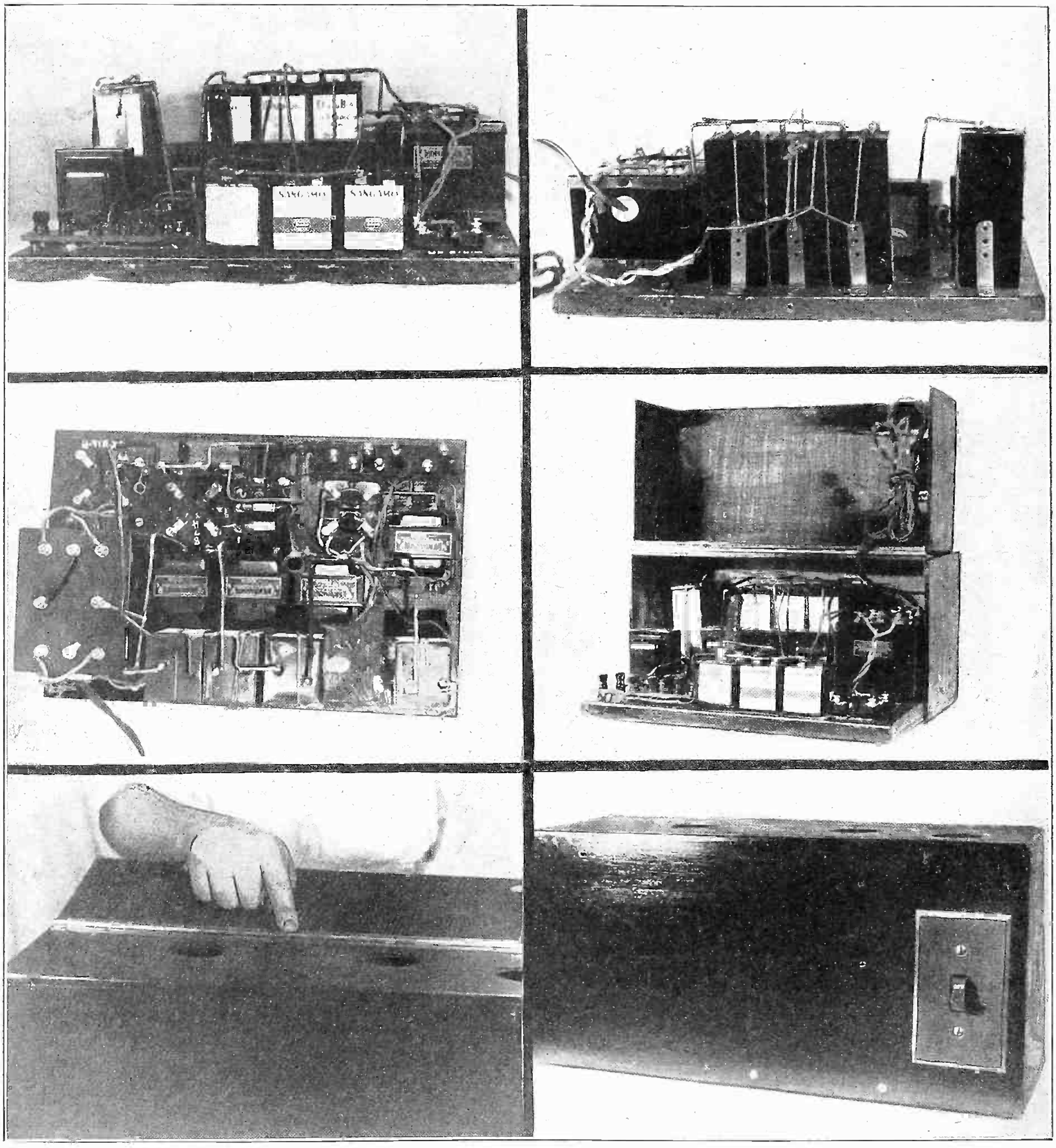
Sometimes a resistor is rated only by the wattage. In such cases it is tacitly understood what the voltage is, e. g., 110, for an electric light, because that voltage is the most common. The resistor in question will dissipate the given wattage when connected across the 110 volt line, if it is conected across a line of lower voltage it will no longer be dissipating the same wattage. If it is conected to a line of higher voltage, say 220, it will most likely burn out. When it is conected across the 220 volt line the resistor is called on to dissipate four times as much energy as that rated, because both the voltage and the current are doubled. The element melts because more heat is generated in it than is carried away by radiation or cooling.

A Few Examples

A few numerical examples of how to determine the correct resistors may be of help. The voltage of the supply line in a certain house was 220 volts. A 550 watt light was available for operating a projecting machine. But this lamp was intended for a 110 volt supply. What resistance should be put in series with the lamp to make it work at normal brilliancy when conected to the 220 volt line A 550 watt lamp on 110 volts draws 5 amperes.

(*Continued on page 28*)

A Circuit for Great Power
B Eliminator and Final Audio Comprise Unit



(Hayden)

UPPER LEFT photo shows a side view of the eliminator (Fig. 1). Upper right photo shows the opposite side, with angle irons and cord holding the condensers in place (Fig. 2). Center left photo can be used for determining the exact positions of all the parts (Fig. 3). Center right photo shows the hinged cabinet (Fig. 4). Lower left photo shows the position of the holes, as well as the hinges (Fig. 5). Lower right shows the position of the tumbler switch in the completed unit (Fig. 6).

By Sidney Stack

AN efficient combination B eliminator power amplifier, with which signals of tremendous intensity, yet of excellent quality are obtainable, is diagrammatically and photographically shown in Figs. 1 to 7.

In the B eliminator, a half wave rectifier tube (CX-316-B) is used. The plate of this Cunningham tube will stand a maximum AC voltage of 550 volts, allowing a maximum DC load current of 65 milliamperes. Therefore an enormous amount of power is available for the output, e.g., 400 volts at the plate current drain. The standard brute force method of filtering is used. The maximum voltage is applied to the plate of a CX-310 power tube. Due to the use of this power tube the signals obtained may still be powerful, and yet undistorted. The filament of this tube is supplied with AC, stepped down via the Thordarson transformer, which also supplies voltage to the filament of the rectifier tube, as well as the high voltage to the plate of the tube. The application of the high voltage to the plate of the rectifier tube may seem confusing, since it is not fed directly into the tube. It is fed through the plates of the tubes in the set.

Thordarson chokes, L1 and L2, (30 henrys each) in combination with three 2-mfd. high voltage fixed condensers, C1, C2 and C3, make up the fundamental

Hookup of the Big-Kick Unit

Shows How to Connect Leads for Best Results

LIST OF PARTS

One Thordarson Power Supply Transformer, type R-198.
L1, L2, L3—Three Thordarson 30-henry chokes, type R-196.
C1, C2, C3, S4—Four Dubilier 2 mfd. high voltage condensers.
C5, C6—Two Sangamo 1 mfd. fixed condenser.
C4—One Dubilier 4 mfd. fixed condenser.
R1—One Ward-Leonard 8,000 ohm resistor.
R2, R3—Two Tobe 10,000 ohm resistors.
R4—One Tobe 1,000-ohm resistor.
One CX-316-B rectifier tube.
One CX-374 rectifier tube.
One Thordarson Amplifying Transformer, type R-200.
One CX-310 power tube.
One Hart and Hegeman tumbler switch.
Binding posts, cabinet, screws, nuts, bolts, wire, angle irons.

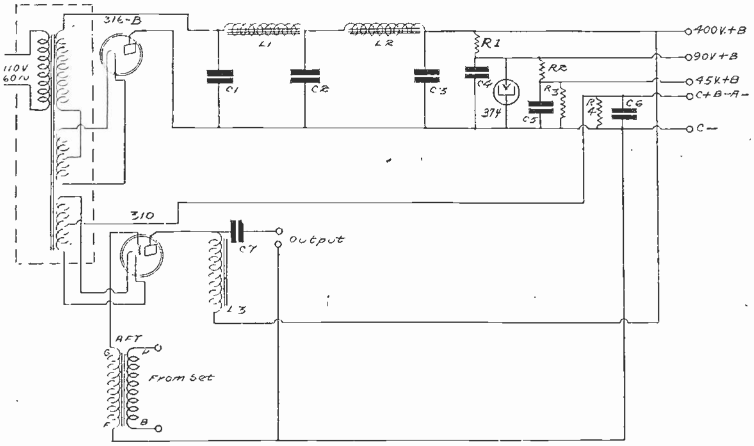


FIG. 7
The circuit diagram of the combined B eliminator and power amplifier.

(*Concluded from page 10*)

filtering system. R1 is an 8,000 ohm heavy carrying capacity resistor, used to reduce the 400 volts B to 90 volts B, and capable of carrying 40 milliamperes. Between the 90 volts B and the zero point, a voltage regulator tube (CX-374) is inserted. This is used automatically to adjust the output voltage so that it is never more or less than 90, regardless of the variation of the AC input. On any current flow from 10 to 50 milliamperes, the tube develops a voltage of 90 volts, plus or minus 10%. When this tube is operating, it glows with a pink color, which surrounds the cathode. If the tube connections are reversed, a distinct blue glow will appear at the anode terminal.

The constants of the other parts can be obtained from the list of parts. The C minus and plus posts go nowhere in the receiver itself, except to the power amplifier they being marked here for illustrating how the negative and positive points of the C battery are obtained. The C battery voltage is obtained through the drop in the resistor R4, which is a heavy duty type. The center tap on the filament winding in the power tube is brought to the C plus, B minus, A minus post.

L3 is a choke, 30 henrys or more, while C7 is a 2 mfd. fixed condenser. This combination is used to keep the direct current out of the speaker windings. The transformer in the input circuit from the set may be supplanted by any other form of audio frequency coupling.

Location of Sockets

All the parts are placed on a baseboard 12x18 inches, which has a thickness of about ¾ inches. Do not use a thinner board, since the weight of the parts is considerable, and will cause a thin board to snap. The parts are placed as shown in Fig. 3. The rectifier tube socket is placed in the upper left-hand corner, with the voltage regulator tube in a diagonal line a bit to the right. The amplifier tube socket is placed parallel to the voltage regulator socket, between the output plate resistors. For holding the large fixed condensers, either aluminum stripping bent into shape, or cord tied onto angle irons (Fig. 2) may be used. The binding post strip, containing binding posts mounted on Bakelite, are mounted in the rear of the right-hand portion (Fig. 2). The 8,000-ohm Ward-Leonard resistor is placed in a socket between the two chokes (B eliminator circuit) and can be indentified in Fig. 3 by the small circle.

After all the parts have been laid out the wiring is tackled. At the completion of this operation the cabinet is considered. It will be noted that this is a peculiar type, resembling very closely piano hinged covers. Each top portion should be 5¾" wide and 18½" long, there being two of these. Four side sections are used. These are each 5¾" wide, 7" high. Either white pine or white wood should be used. Coat the wood with shellac or varnish and then allow to dry.

What Holes to Drill

Arrange the pieces as shown in Fig. 4. Over the portions where the tubes are inserted drill 1-inch holes with a scroll drill. Now cut out two pieces of wood for the front and back. These should be 12" wide and 7" high. All the wood should be about ¼" thick. Cut out a section of the front portion of the wood to fit a tumbler switch. Connect the flexible lead which usually is connected direct to the 110-volt line to the terminals of the switch. Run the other two terminals of this switch directly to the line. These leads may be taken out from a hole drilled on the side portion to the right. The leads to the set are taken from the binding posts, through holes drilled in the rear portion of the cabinet. This can be seen in Fig. 4. The tumbler switch is shown inserted in Fig. 6. The portion of the cabinet near the tumbler switch is screwed down to the base. This will allow the other portion of the cabinet to be lifted up, so that tubes may be inserted or any other corrections may be made, etc.

Twist Filament Wires

When wiring up the filaments of the amplifier tube, twist them, so as to prevent any induction to any other portion of the circuit. Keep all power leads (raw AC) away from the filtered portions. This applies especially to the input from the line and to the output via the binding posts. Be sure to watch the connections to the output to the speaker. They do not connect directly to the B plus and plate posts. Instead the plate output is indirectly obtained through the condenser C7, while the other terminal is made to the C minus. The B plus is obtained through the choke L3. The 2 mfd. fixed condensers should be able to stand not less than 400 volts, while they should have been subjected to a 1,500 volt DC flash test. The 400 volts is a duration test.

Damrosch Asks Beecham to Debate on Radio Music

Replying to Sir Thomas Beecham's recent attack on radio music as a "ghastly travesty," Walter Damrosch challenged the British conductor to a debate on the subject as soon as he comes to this country. Beecham has announced that he intends to make his home in the United States due to the decline of music in England.

"I am delighted that so fine a musician as Beecham is coming to America, and I shall welcome him as a colleague," said Damrosch today.

"But I should like to take advantage of his presence to debate with him on the subject—'Is the radio a help or a hindrance to the spread of good music?'

"I promise that the only thing I shall do in defending radio music is to read two or three thousand of the letters which have been written to me on this theme by people in every part of the country, commenting on the Balkite Hour concerts which the New York Symphony Orchestra has been giving this season.

"No one maintains that a radio performance can take the place of an actual concert performance. Still, the heartfelt enthusiasm and intelligent understanding revealed in the letters which come to me about our radio concerts only serve to strengthen my original opinion that the radio is the greatest adjunct of modern times."

A QUESTION OF NOISE

The police of Elizabeth, N. J., have taken up the question whether the continual use of loud speakers by stores in business thoroughfares constitutes a nuisance under an anti-noise ordinance passed several years ago.

Loop Is Recalled to Favor
Because of High Amplification of Circuits

By *L. M. Clement*
Chief Engineer, F. A. D. Andrea

PERHAPS the mystery of loop operation always will stir the interest of the lay person! That a small wooden frame wound with a comparatively few turns of wire can act as an antenna for a receiver and pick up without any other connection a certain station, either local or distant, is indeed marvelous.

It brings to mind the story of the New England farmer who witnessed his first demonstration of the electric light late in the nineteenth century. He marveled long at the idea of light coming from a box connected by two wires to a small glass bulb. After deliberation, he admitted that it was wonderful, indeed, "what they thought up," but for the life of him could not understand how they made "the kerosene flow up the wires!"

A review of receiving set apparatus placed on the market within the last few months reveals the incorporation of several distinct and outstanding features which were not present a year ago.

Its Use Began Early

Among the more obvious changes is the increasing use of a loop, or, as it is technically known, a coil antenna. The coil antenna either has supplemented or wholly displaced the outside aerial for method of "pick-up" with certain types of receiving sets.

Curiously, the use of the coil antenna dates back to the time of the first radio experiments. In fact, the first designs of transmitting and receiving appartus called for a form of coil antenna. The lack of the modern means and practices of high amplification prevented successful experiments at that time except over extremely short distances.

Just before and during the war, with the advent of high amplification, the loop came into prominence, particularly because of its directional characteristics and its portability. To-day we find navigation depending somewhat on the advantages and use of the coil antenna in connection with directional compass work.

Loop Waxes, Waves, Waxes

A few years ago the loop antenna as a means of "pick-up" was resurrected and used in radio receivers for broadcast reception.

At that time, when the introduction of radio broadcast reception in itself was considered such a phenomenon, the loop probably enjoyed its favor in large measure due to its "novelty" appeal, rather than the possible advantages it possessed in simplicity of operation or installation.

In the final analysis the receiver of that day was usually of the four or five-tube design and did not permit the degree of satisfactory loop operation which could be obtained with the regulation outside antenna. Since performance is the predominant factor in determining the worth of a radio receiver in the end, the loop gradually but steadily waned in public favor.

Now Loop is Practical

Many recent improvements in receiver design have contributed to make the operation of a receiver on a loop antenna entirely practical, and this furnishes the impetus which is gradually but surely re-establishing the loop as a "pick-up" on the modern receiver.

Probably the most important development which has influenced the use of the loop in commercial practice once more, is the introduction of full and complete metallic shielding which permits the high radio frequency and audio frequency amplification necessary for its successful operation.

The coil antenna is not very efficient as compared to the outside antenna and only a fraction of the voltage induced in the outside antenna is induced in the loop. To obtain the same volume from the speaker with this smaller initial pickup sufficient amplification to compensate therefor must be obtained.

"Now It Can Be Done"

When loops first were in favor, the addition of more stages of radio frequency amplification to provide the sensitivity necessary for loop operation could not be satisfactory accomplished because of lack of the necessary knowledge. Since then, the employment of multi-stage tuned radio frequency amplifiers of the shielded type made possible the use of the loop as a means pick-up.

Even a casual observation of the styles in radio to-day brings to light the increasing use of the loop operated receiver, which employs only a small two or three-foot loop antenna and gives satisfactory operation in regard to the reception of even distant stations.

Thus we find the pendulum of public choice again swinging back, and the loop operated receiver is seen everywhere to-day. In the higher price apparatus where use is made of seven or eight tubes, the loop is used almost entirely for operation, as the amplification provided is sufficient for the reception of even the more distant stations.

The Theory of Loop Reception

Let us explain loop operation. The advancing radio wave is made up of two components, one electric and the other magnetic. The magnetic field spreads out from the station in horizontal rings ever widening from the transmitter. An apt illustration is the "pebble in the pond" analogy. When the loop is pointed towards the source, the magnetic field will strike the loop at right angles, and a maximum of the magnetic field will be enclosed by the loop. This field is changing and in similar fashion to the coil in a transformer has a voltage set up in it. This voltage is then amplified by the receiver. When the loop is turned at right angles to the line between it and the transmitting station, none of the field cuts through the loop and therefore no voltage is developed. Without a voltage set up in the loop there is no effect upon the receiving set.

This easily explains not only the pick-up action but serves to illustrate its directional properties.

The directional effect of loop operation naturally helps in obtaining additional selectivity. Under the present crowded air conditions full benefit can be taken of this directional effect by turning the loop to exclude the undesired station, provided the desired station does not lie in the line between receiver and the undesired station.

In the large cities, where but limited space is available, outside antenna construction is often impossible, and where barriers of steel precludes the possibility of proper reception with the inside antenna the loop then comes decidedly to the fore.

A large factor in the growing preference of loop operated receivers is the ease of installation and possibility of portability. Many such loop sets have found their way into other places than the home.

Good-Looking Now

Even in cases where loop operation has proved very successful, the "unsightliness" objection has been expressed by the critical set user.

Present day practice has done much to overcome this objection. The loop is now mounted on a bracket which can be swung out of sight or cleverly worked into the cabinet itself. Or, if it is to be permanently exposed, it is on the par from a furniture standpoint with the set itself.

U. S. Wave Jumping Interferes With Canada

The broadcast listeners in Canada and especially those in Ontario, are interfered with so seriously by certain stations in the United States that have jumped wavelengths that the Canadians can no longer receive their favorite stations. In particular, CFCA of Toronto is being interfered with by WKBW, of Buffalo, which is regularly broadcasting on the same frequency of the Canadian station.

As a result of this situation radio sales in the provinces has decreased. CFCA is considering changing over to another wavelength, but in doing so is not sure that some other station will not jump to the new wave. Legislation in the United States or some other authority to curb wave jumpers is looked to as the real solution.

Canadian fans have sent protests to United States Congressmen.

Advertising Revenue Object of New Station

Spokane, Wash.

Spokane's new broadcasting station, KGA, which is the fourth in a string of five to be linked up on the coast, has leased the 15th floor of the Old National Bank Building, where four rooms, approximately 1,400 square feet of space, are available for the studio.

"KGA does not expect to derive its revenue from Spokane alone," continued Mr. Jensen. "KGA will be in the national advertising business. The programs, while using some Spokane talent, will mainly originate in San Francisco, with a few in Seattle.

"We expect to have an entire Spokane personnel. So far the Northwest Radio service has a total investment of $105,000 in the Spokane station. More than $3,000 is being spent in fitting and furnishing the Old National Bank studio."

WEAF and WJZ Chains Sought By Northwest

Spokane, Wash.

Spokane radio fans have found more than a little cheer in the announcement that it is likely the WEAF and WJZ radio chain programs will be a reality in the northwest before many weeks.

Recently in N. Y. City representatives of stations KFOA of Seattle, KGW of Portland, and KHQ in Spokane conferred with A. T. and T. officials and owners of the radio chain stations on plans to bring programs to Spokane by telephone wires.

"UNCLES" IN DEMAND

Since the British Broadcasting Company abandoned use of sobriquets "Uncles" and "Aunts" for those telling children's bedtime stories over the radio, many protests have been received by the company saying that the children cry for the radio aunts and uncles.

Radio University

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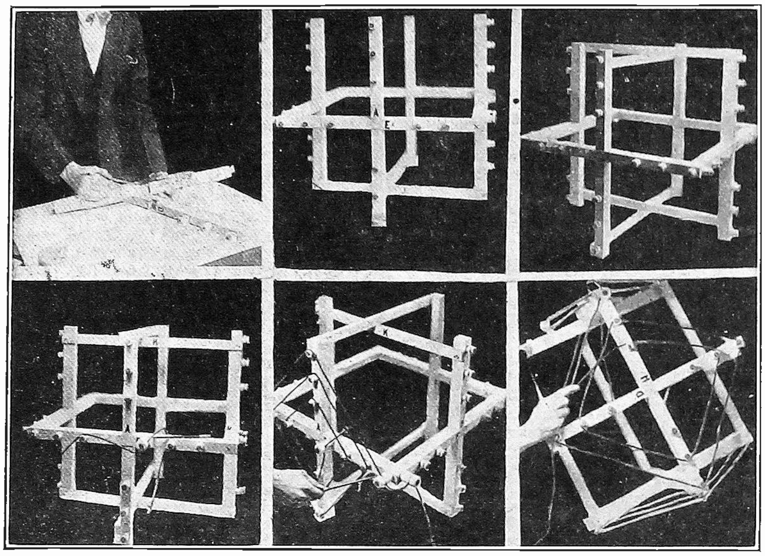


FIGS. 491 to 494 (left to right, top); Figs. 495 to 497 (letf to right, bottom).

I READ, with interest the description of the DX antenna system by A. K. Mench in the Oct. 2 issue. However no specific data was given. Would you therefore give data on the construction of such an antenna?—Robert Lincross, Plattsburg, N. Y.

Six pieces of white pine, 2 ft.x1½x⅞ ins., lettered A, B, C, D, E and G; two pieces of white pine, lettered F and H, 1 ft. 9 ins. by 1½x⅞ ins. having an angle iron mounted on each end; four more pieces of white pine, lettered I, J, K and L, 2 ft.x ⅞x1⅛ ins.; twelve nails for nailing centers; four finishing nails, 3 ins. long; 90 feet of triple tinned and double insulated wire; forty-eight porcelain knobs, ¾-inch high, and a 2x2-inch pole, about 10 feet high, are the materials necessary. Notch pieces A, B, C, D, E, F, G and H in the center with a ⅞-inch notch. An example of how it should be notched is shown in Fig. 491. Space the knobs, 2 inches from each other, on pieces A to H, beginning from the ends. This will leave a large space between the central points of the pieces, or where they meet at the centers. Now take pieces A and E and fit them together, so that the notch in piece A fits into the notch in piece E. Do the same with B and F; with G and C, and D and H. Now take piece F with the angle irons screwed on each end and fit it in between E and G. Take piece H with the angle irons and fit in between E and G on the opposite end. Now drive one nail through end of E into F; from G to F, G to H (opposite end), and E to H. Also drive a nail through the notched centers of each piece. Now nail K to D and B about ¾ inch from the top. On top of this place piece L and nail to A and C. The same operation is performed with pieces I and J at the opposite end. You then have a form which looks like that shown in Fig. 494. Now start to wire the frame. Begin at point E, shown in Figs. 492 and 495. Measure off a few feet of wire. Wrap the beginning of the wire around the knob and begin to wind. Wind around the insulators on pieces A and E. When you come to the end of E, wrap around the insulator a couple of times and begin to wind on F, by wrapping a couple of turns of wire around the insulator at this point. Bring this wire down to the lowest insulator on B. Continue bringing around the insulators on these pieces until you come to the center. Again wrap around the insulators at this point and bring over to the C and G junction. Wrap the wire around the insulator at this point. Bring the wire around the insulators on this strip, until you come to the end of G. Wrap around the insulator at this point and bring over to H. Wind the wire around the insulators, until you come to the junction of D and H. Run the end of the wire to the beginning of the wire at A and E. Scrape off the insulation at this point and join. Now run the 10-foot pole through the center of the square and nail. Nail a knob in this pole, just about where the bottom of the square rests. Run the bare wire here. Connect your leading wire to this point. The completed antenna is shown in Fig. 497. You will find when winding the wire around the insulators, that there is only one way to run the wire, when you get to the end of each section so you should have no difficulty in winding. Be sure to keep the wire away from the wood at all times. At such points where it is necessary to wrap the wire around the insulators, nailit knobs may be substituted. The wire can then be run through the slits in these knobs and hammered together to prevent slipping of the wire.

* * *

IT SEEMS to be that in the description of the Twin-Choke Amplifier on page 27 of the January 1 issue of RADIO WORLD, under the head "Operating the Amplifier," a slight error appeared. This statement appears: "Finally connect your 16-volt A battery, 135-volt B battery." Shouldn't this 16-volt battery be a 6-volt battery?—Leonard Varick, West New York, N. J.

Yes, this was a typographical error.

* * *

SHOULD ONE use flux sparingly when making a all-soldered joint? About how much solder should be used?—Eugene W. Feene, Atlantic City N. J.

Be extremely sparing with the amount of flux used and use just enough solder to run in the joint and make a firm connection. Large gobs og solder are entirely unnecessary making it both difficult to solder, and obtain a securely soldered joint.

* * *

IS IT possible to use any length antenna with the Hammarlund-Roberts Hi-Q receiver, described in the December 4, 11, 18 and 25 issues of Radio World? (2) Is the neutralizing system employed in this set efficient?—Martin Elsom, Jersey City, N. J.

(1)—The antenna coil itself is tapped and a switch provided in order to afford a further coupling variation to suit different length antennas and to provide extremely loose coupling in very congested areas. This automatic variable coupling feature made it possible to use a comparatively large number of turns in the primaries of the radio frequency transformers. This large primary allows great energy transfer and consequent loud signals on the longer wavelengths where the coupling between primary and secondary is closest. However, this large primary and close coupling would be totally unsuitable at the shorter wavelengths. This difficulty is overcome by automatically loosening the coupling as the receiver is tuned to the shorter wavelengths, thereby maintaining a high degree of selectivity without sacrificing signal strength, because the same amount of energy transfer can be obtained with looser coupling at short wavelengths as to tighter coupling at long wavelengths. Thus the Hammarlund-Roberts Hi-Q Receiver provides great signal strength and a high degree of selectivity throughout. (2)—Yes. In most so-called self-balanced circuits elimination of the tendency to oscillate has been attained at the sacrifice of efficiency. A method often used is to design the coils in such a way that the losses in the coils introduce enough resistance to prevent oscillation. This method is of course detrimental to efficiency. Some others make use of very low plate voltages in the radio frequency stages, thus reducing the tendency to oscillate, but again with a consequent lowering of efficiency. In order to permit use of more efficient stage coupling coils, equalization of disturbing potentials has been incorporated in the Hammarlund-Roberts circuit, thereby allowing a higher degree of amplification with consequent louder signals and greater distance getting ability, without the usual troubles caused by self oscillation. Radio frequency stages are equalized utilizing the familiar Hammarlund-Roberts equalizing system.

* * *

I HAVE a pair of tuned radio frequency transformers, having 15 turn primaries and 44 turns secondaries. Each primary and secondary is wound on a basket weave form, 3¼ inches in diameter, containing 15 spokes. The turns are wound under two and over two spokes. No. 22 double cotton covered wire is used. The primary is wound between the secondary winding. Could I have the circuit diagram of a three-tube receiver, using these transformers, and also two, three to one ratio audio frequency transformers? Please state what capacity variable condensers shoud be used, etc.—Henry Malrom, Newark, N. J.

Fig. 498 shows the circuit diagram of such a set, which you will note is a reflex. The first tube acts both as a radio and audio frequency amplifier. The radio frequency transformers are indicated at L1 and L3 (primaries) and L2 and L4 (secondaries). The secondaries of these transformers are shunted by .0005 mfd. variable condensers and represented as C1 and C2. AFT1 represents one of the audio transformers. The other is shown as AFT2. This is used in the standard straight audio coupling portion of the receiver, while the other is used in the reflexed portion. A C bias is placed on the grid of the reflex tube, with a value of about 4.5 volts,

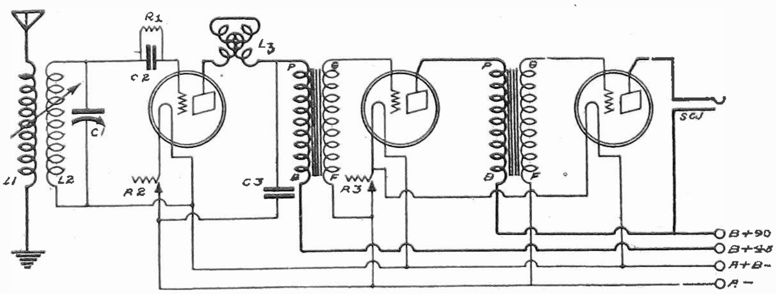


FIG. 499
The circuit diagram of a three-tube regenerative receiver.

the voltage being obtained via a series connection of three 1½-volt dry batteries. C4 and C5 are .0005 mfd. fixed condensers, using for bypassing radio frequency energy. A .00025 mfd. fixed condenser is also placed in between the grid return of the first tube and to the minus A post. C3 is a .00025 mfd. fixed condenser, while R4 is a 3 megohm grid leak. Amperites of the 1A type are used to control the filament temperature of all the tubes. Rheostats of the 10 ohm type may be substituted for the ballasts in the radio frequency and detector circuits. The C battery in the audio stage should be of the 9 volt type. B plus detector equals about 67½ volts, while B plus amplifier equals about 135 volts. S is the filament switch, while L is a light, which is used to indicate when the filaments of the tubes are being heated. The light is not a necessity. J is a single circuit jack. A radio frequency choke coil such as the Rabco is connected in series with the grid return of the first radio frequency tube. Place the primary winding away from the secondary winding on each end both sides.

* * *

WHILE LOOKING over the apparatus in my shop, I found a couple of audio frequency transformers, one of them being a six to one and one of them a three to one; a variocoupler, which has a 25-turn rotor and a 55-turn stator, the rotor being wound on a 2¾" diameter tubing, and the stator being wound on a 3¼" diameter tubing, No. 22 double cotton covered wire being used on both windings. Please give the circuit diagram of a three-tube set using this apparatus, giving all necessary data.—Michael Kinton, Poughkeepsie, N. Y.

Fig. 499 shows the circuit diagram of such a set. L1 is the rotor winding of the coupler while L2 is the stator of the coupler. C1 is a .00035 mfd. variable condenser. L3 is a variometer of any standard make. C3 is a .00025 mfd. fixed condenser. R2 is a 20 ohm rheostat, used to control the filament temperature of the detector tube. C2 is a .00025 mfd. fixed condenser. R1 is a 2 megohm grid leak. The three to one ratio audio transformer is used in the first audio stage, while the six to one is used in the second stage. R3 is a 10 ohm rheostat and controls the filament temperature of the two audio tubes. The rheostats are all placed in series with the negative leg of the filament. No filament switch is connected in this circuit. It may be inserted, though, in series with the positive leg of the A battery. SCJ is a single circuit jack. Binding posts or tip jacks may be used here also. No provision is made for the insertion of a C battery. It may be easily inserted, though. Break the F minus leads on the transformers, which now go to the A minus post. Connect the minus post of a C battery here. The plus post of this battery is brought to the minus A post. Two 4½-volt C batteries are connected in series. The minus post one of the 4½-volt batteries is connected to the minus F post of the first audio transformer. The minus 9-volt post of the combined batteries is brought to the minus F post of the last audio transformer. With this high C voltage on the grid of the last tube, it is advisable to increase the plate voltage. Therefore, break the lead from the bottom terminal of the single circuit jack, which now goes to the B plus 90 and bring it to a new 135-volt post. This will give a separate 90-volt application to the plate of the first audio tube. If you should desire to have more power in the output, you can install a power tube, such as the —71 or the 210. With the —71 the B voltage required can be supplied by B battery blocks. The other power tube (210) requires such a high B voltage, that it would not be practical to supply it with B battery blocks, a B eliminator being used here. Should you desire to use this tube, however, the unit described by S. Stack in this issue can be used. If you use a —71 tube, it will be necessary to install a 112 Amperite in series with the negative leg of the filament of this last tube. It is not necessary to change the rheostat R3, though. As to the proper B and C voltage to use, follow the directions enclosed in the carton. Be sure you don't use the high C voltage one the other AF tube.

* * *

HAS STATION WJBZ of the Union Course Laboratories, Woodhaven, N. Y., changed its call and wave length? If so, what is their new one? (2) Where is station WWAE, who owns it? (3) Have they just started?—William Baley, San Francisco, Cal.

(1) Yes, their new call letters are now WSOM. They have changed from 469.9 meters to 288.3 meters. (2)—This station is owned by Laurence J. Crowley, Chicago, Ill., operating on a wave length of 241.8 meters. (3) Yes.

* * *

PLEASE GIVE circuit diagrams of the three popular types of oscillators that can be used in Super-Heterodynes and explain the construction of each.—Morris Leon, East Pittsburgh, Pa.

Fig. 500 illustrates the various oscillator hookups. The Hartley oscillators are shown to the left and to the center, while in the right-hand circuit diagram we have the popular three-circuit tuner oscillator. The coil for the first oscillator to the left consists of forty-five turns, tapped at the twentieth turn. Twenty turns of this winding is connected in the plate circuit, while the twenty-five remaining turns are placed in the grid circuit. A .0005 mfd. variable condenser shunts the grid and plate winding. To prevent the direct current from entering the grid circuit, a .006 mfd. fixed condenser is inserted. The plate coil in the second oscillator from the left consists of twenty turns. The grid coil consists of twenty-five turns. Both windings are wound on a tubing 3" in diameter, using No. 22 double cotton covered wire. The grid and plate coils windings used in the first oscillator discussed, are also wound on a tubing 3" in diameter, using No. 22 double cotton covered

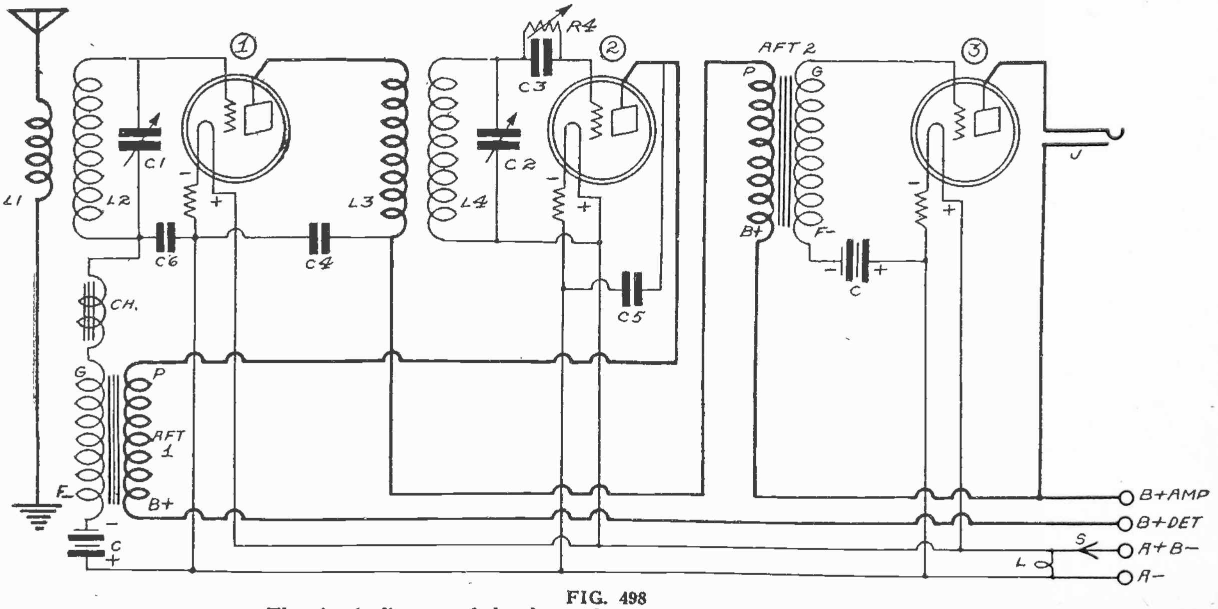


FIG. 498
The circuit diagram of the three-tube reflex, desired by Henry Malron.

wire. A .0005 mfd. variable condenser is used in the latter circuit. A .006 mfd. fixed condenser is again used to keep the direct B current off the grid. In the last circuit, the grid coil consists of forty-five turns, wound on a 3" diameter tubing, using No. 22 double cotton covered wire. The plate or tickler coil consists of thirty-six turns, wound on 2¾" diameter tubing, using No. 26 single silk covered wire. A .0005 mfd. variable condenser shunts the grid winding. The —01A tubes are used in each case. Apply 45 volts to the plates.

* * *

I RECENTLY heard a new station having call letters WMHA. They came in pretty loud. Have you any information regarding them?—Irving Morton, N. Y. City.

This is a new station and is owned and operated by the Young Men's Hebrew Association and Troop 707 of the Boy Scouts of America. They are located at 159th St., and St. Nicholas Ave., N. Y. City. They operate on 230 meters, and use thirty watts. They opened their station on Jan 17.

* * *

CAN A fixed 2 megohm grid leak be used instead of the variable model, specified in the Diamond of the Air? I wish to use this because I have it around the house. (2)—Can direct connections from the secondary winding of the radio frequency transformer to the variable condenser be made, instead of via the loop jack. If so how should it be connected? —Barnes Murrel, Palm Beach, Fla.

(1)—Yes. The variable grid leak, though, will give you more flexibility, in controlling the oscillatory action of the tube. (2)—Yes. The D post on the radio frequency transformer is brought to the stationary plate post of the variable condenser C1. The C post is brought to the rotary plate post of this same condenser. The C and D posts are connected to the beginning and end of the secondary windings respectively. Be sure these connections are followed. Note that the stationary plate post is also brought to the grid post of the first socket. The rotary plate post of the condenser is brought to the minus A post, before the current is fed into the filament of the tube, not after.

* * *

IN REFERENCE to the five-tube receiver shown on page 15 of the Aug. 28 issue of RADIO WORLD. (1)—Can tuned radio frequency transformers, having 12 turn primaries, and 44 turn secondaries each wound on a 3-inch diameter tubing with No. 22 double cotton covered wire be used? There is a ½-inch space between the two windings on each form. (2) —If so, what variable condenser should be employed? (3)—Will it be all right to use a 10-ohm rheostat to control the filaments of the radio frequency amplifier tubes; a 30-ohm rheostat to control the filament of the detector tube, and a 112 Amperite to control the filament of the last audio tube? (4)—Is C5 a .00025 mfd. fixed condenser? (5)—Can a Centralab 500,000 ohm variable resistance be used across the secondary winding of the last audio frequency transformer? (6)—Could I use the Twin-choke amplifier system, as described by Kenneth Harkness in the Jan. 1 and 8 issues of RADIO WORLD? (7)—In doing this, what changes would it be necessary to make? (8)—Can the entire set, when using the Twin-Chokes, be enclosed in a 7x21" cabinet?—James Harrisson, West New York, N. J.

(1)—Yes. (2)—.0005 mfd. variable type. (3)—Yes. (4)—Yes. (5)—Yes. (6)—Yes. (7)—Connect the input posts of the amplifier to the detector output posts of the receiver. Connect up the A, B and C batteries, according to the directions given in the descriptions in the Jan. 1 and 8 issues, using the proper automatic filament controls, with the proper tubes. The B voltages for the detector and the radio frequency amplifier tubes remain

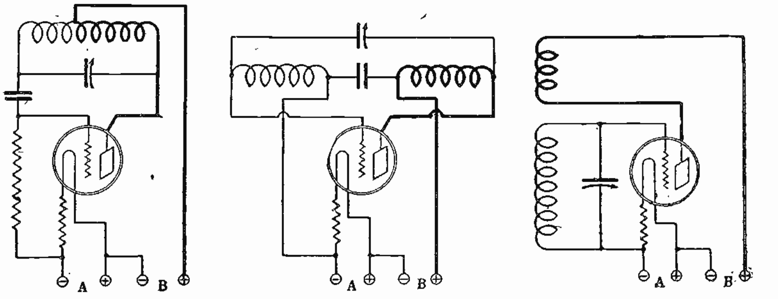


FIG. 500
The circuit diagrams of the three popular types of oscillators.

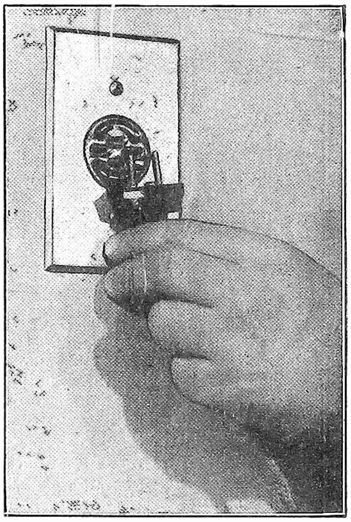
as per diagram. However, follow the circuit diagram of the amplifier in the above mentioned issues for correct B and C voltages for the tubes in this portion of the circuit. Don't forget to install a radio frequency choke (Rabco), in series with the plate output of the detector circuit, e. g., one post of the choke to the plate post of the detector tube socket, while the other one is brought to the P post on the Twin-choke. (8)—No. It is best to use a larger cabinet, of the standard 7x24" style. Using the other cabinets, will cram the parts, making it difficult to wire, and also producing a possibility of interaction between the coils, leads, etc. Keep the audio unit away from the radio unit. when mounting the coils, keep them about 5" away from each, and at the same time tipped. The exact angle that they should be tipped, may only be determined after experimenting, so mount the coils on angle irons.

* * *

REFERRING TO the circuit diagram, under Fig. 366, shown in the Radio University columns of the July 10 issue of RADIO WORLD. (1)—I notice that the grid return of the radio frequency amplifier tube is brought to the A plus. Shouldn't this be A minus? (2)—Can a single ½ ampere automatic filament adjustor be used to control the filaments of the first two audio tubes, both of which will be of the —01A type? (3)—I am going to use a cone speaker, and also a power tube in the last stage. Is it not advisable to insert a choke coil and condenser in the plate out of the last audio tube to prevent the windings of the speaker from becoming demagnetized? (4)—Will a 50 henry choke and a 8 mfd. fixed condenser perform the job?—Einor Juderson, East Pittsburgh, Pa.

(1)—Yes. (2)—Yes. The filament minus posts of both these sockets are connected to each other and thence to one terminal of the ballast. The other terminal of this control is then brought to the A minus. (3)—For connections see the article by S. Stack in this issue on the B eliminator and power amplifier. (4)—You should get great results from that combination. You might find it necessary to increase the plate voltage here, due to high resistance of choke coil.

* * *



MANY READERS have written into this Department, querying the current it is necessary to watch for proper polarity, when connecting up an eliminator. Only when you have D. C., is it necessary to watch the exact connections. With A. C. this is not necessary. With D. C., there is a single positive and minut output. With A. C. it is plus one second and minus the next.

Television Set on Way; General Electric Is At It

Not Yet Ready for Submission to Experimenters, Alexanderson Tells Bernard, After Explaining System to Institute of Radio Engineers—Pupin and Picard Address Body

By Herman Bernard

Associate, Institute of Radio Engineers

The General Electric Company is working on a television receiver and as soon as it is advanced to a satisfactory condition the receiver will be offered to the public, not as a perfected device but as something upon which experimenters may work. Dr. E. F. W. Alexanderson, consulting engineer of General Electric and of the Radio Corporation of America, told me so, in a chat I had with him after he had addressed the convention of the Institute of Radio Engineers, on television, in the Engineering Building, New York City.

Dr. Alexanderson has developed a device by which he broadcast "still" photographs very successfully over a two-mile area. He also tackled "motion" and exhibited a motion picture showing the result. It is the "motion" feature that introduces the difficulty, and this has not been solved practically, although Dr. Alexanderson has developed a principle which points to the road of progress. The film of the broadcast movies showed the doctor in the role of actor, gesticulating wildly, to emphasize action, in conversation with another engineer. You could see the movement and identify the two characters, if you were familiar with their features, but the result is nowhere nearly ready for presentation to the public, nor was any claim made that it is.

Radio Movies For the Home

The doctor was quoted as saying that within ten years radio movies in the home may be an accomplished fact. This will mean that not only will sound be reproduced in the home as originally produced at a microphone, but that a receiver will throw the actual scenes on a screen in the home, the motion being reproduced of course.

Dr. Alexanderson is a modest, mild-mannered and good-natured man, with a twinkle in his eye. His paper, delivered before the Institute, and illustrated by stereopticon slides, movies and a small physical model showing part of his device, was suggestive and addressed largely to theoretical expression. While there was considerable revelation of practical application, the doctor was merrily holding himself in check all the while. Once, during his talk, he said any amateur can attempt to follow the system he has been using. The axle of his device may be supplanted by "a piece of wood" and the drum "by a tin can," but details of construction were not given. Therefore after the lecture I discussed with Dr. Alexanderson the publication of constructional data, with blueprints.

The Doctor Replies

"Would you care to write an article for publication in Radio World, telling experimenters just how to build a television receiver along the lines that you have developed yours?" I asked. "If dimensional factors and blueprints were available, great interest would be stimulated."

"It is just as you have heard tonight," replied Dr. Alexanderson. "The theory and method of application were set forth, and it remains for the amateurs to adopt these in their experiments in television."

"With all due respect, doctor," I insisted, as I bathed in the reflection of that merry twinkle, "it would be almost impossible for any one to build a television receiver on the basis of what he heard and saw tonight, plus anything you revealed in your St. Louis address."

The doctor then got down to brass tacks in one quick sentence:

"The time is not ripe, but as soon as the receiver is developed by General Electric to a point justifying its release, it will be released, and experimenters can improve on that, as they surely will."

Alexanderson in Address Explains Television Theory

In his speech before the Institute, Dr. Alexanderson said that a beginning had been made toward television, and in the "not far distant future" a person at a telephone may see the person with whom he is conversing.

The audience watched seven little spots of light gyrate and blend as they fled across the screen, and were able to picture in their imagination a time when those spots of light, increased twenty-four-fold by mirrors, would cover the entire screen before the vision of the observer and by gradations of light and shadow produce a picture.

Radio Photography Established

Dr. Alexanderson's method of broadcasting pictures, which he predicted would come as soon as the public demanded it, was sketchily described by him. He indicated, however, that it is done by fastening the photograph to be sent on a rotating drum, and by reflecting light to it the various tone values are transmitted by electrical processes to the modulating carrier wave of a broadcasting station, which in turn actuates a photo-electric cell in the receiving instrument that paints, as it were, the tone values on a rotating film. The two rotating drums are synchronized so that they will always be in step.

Radio photography, Dr. Alexanderson said, is already an established fact, the only difference in the various methods being adaptations to varying conditions. His own method, for which he did not claim originality, but which grew out of experiments by other men for many years, produces under ideal conditions an accurate and smooth reproduction of a photograph, and its greatest value is its speed. It is made on a carrier frequency of 3,000 cycles. White is represented by 3,000 cycles modulation of full amplitude, gray by modulation of the same frequency by half amplitude, and black by no modulation.

Bad Effect of Fading

The Alexanderson method is affected by static and registers the defects of transmission, although the time may come, i[t] was said, when these errors may be eliminated.

"We may speculate about its practical usefulness, whether its greatest importance is going to be public amusements, transmission of pictures, or moving picture films to show the news features from distant parts of the world," Dr. Alexanderson said. "On the other hand, we may foresee that the facsimile telegraphy will supersede telegraph by code. We may even hope that it will take the place of some of the correspondence that is now carried by mail and typewritten sheets may be transmitted to distant points as far as they can be written."

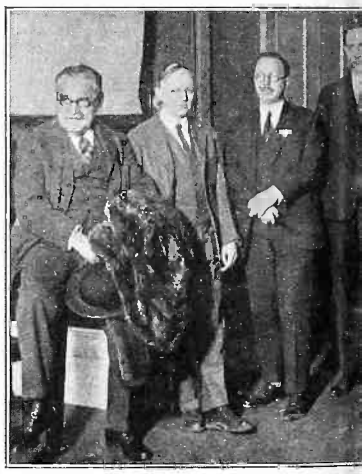
Pupin Makes Parallel

Dr. Michael I. Pupin, at a previous session of the Institute, likened the universe to a vast vacuum tube, in explaining the electrical disturbances due to sun spots. He was discussing the effect o[f]

BOWN GETS PRI

(Wide World)

DONALD McNICOL, retiring president (
$500 prize for work in short-wave phe

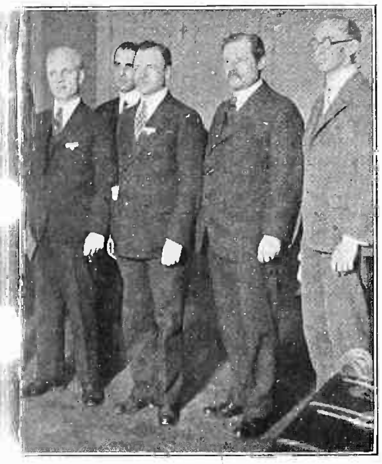


(Wide World)

AT the convention of the Institute of R
Pupin, R. H. Marriott, John V. L. Hog
the Institute; Donald McNicol, retiring
Dellinger, chief, radio laboratory, Burea
and L. E.

Z AT CONVENTION

hands Ralph Bown, incoming president, na, as Prof. Michael Pupin looks on.



Engineers. Left to right, Prof. Michael Ralph Bown, newly-elected president of esident; Warren F. Hubley, Dr. J. H. Standards; Dr. E. F. W. Alexanderson Wittemore.

solar activity on radio reception and its effect on other electrical means of communication and transmission.

Whenever there is a sun spot or great electrical disturbance on the sun, negative and positive electrons, the latter the much more powerful alpha particles, are thrown off and travel in a beam to the earth, reaching here in about ten minutes. They create such a great electrical disturbance that their presence is at once detected. They are probably the cause of static.

Picard Is Heard

Experiments in measuring the alpha particle beams from the sun were described by Greenleaf W. Picard, who has been making nightly observations in Newton, Mass., on the relationship between radio reception and solar phenomena. Mr. Picard showed charts which presented a remarkable correspondence between radio difficulties and solar activity. He supported the sun spot theory.

A Simple Explanation of Alexanderson Method

Television Theory Not Difficult to Understand, But Its Application Presents Big Obstacles to the Experimenter and, Besides, Broadcasts Are Lacking Now

A few years ago the prospects for television were not very bright. Scientists and engineers could see no immediate solution to the problem. Yet now television is almost a fact.

The process of transmitting photographs by wire or radio has been speeded up to such a point that one might almost say that television is an accomplished fact. It now appears that in a few more years the broadcasting of motion pictures will be a daily occurrence and that any radio fan who cares to equip himself with suitable receivers will not only be able to "listen in" but also to "look in" on an event taking place at a remote corner of the world. It is E. W. F. Alexanderson and his associates who have shown one way in which television might be brought about.

Case of the Still Picture

Suppose at first that a still picture is to be transmitted to a distant point by means of radio. The picture is first divided into a very great number of small areas. The amount of light that comes from these areas depends on whether the area lies in the high lights or shadows or in the various gradations. The light that comes from one area is passed into a photo-electric cell which converts the light value into an equivalent electric value, or electric current of a certain intensity. This current is used to modulate a radio frequency current in the same way that such a current is modulated with a current that comes from a microphone.

At the receiving end an ordinary radio receiver is used to tune in on the radio wave, and this wave is detected in much the same manner that a radio broadcast signal is detected. After detection a direct or pulsating current is obtained, and this is proportional to the intensity of the light value of the little area whose picture was transmitted. It may be used to actuate a local light source and to control the exposure of a light-sensitive surface to this source. The light-sensitive surface may be an ordinary photographic plate in the case of telephotography, or the retina of the eye in the case of television.

Needs Intense Source

The local source of light must be intense but the exposure of the light to the sensitive surface must be strictly proportional to the light value of the transmitted picture unit, or to the equivalent detected current. The exposure is the product of the light intensity by the duration of the light. At the present time this is controlled by a standard oscillograph. The detected light value current is made to operate the oscillograph in such a way that the exposure is proportional to the current.

This indicates how one picture unit, or area of the original picture, may be transmitted and received.

Having transmitted and received one picture unit the photo-electric cell is exposed to the next adjacent picture area, and this in turn is received by the light sensitive surface. Thus every picture unit in a strip across the transmitted picture is sent and received. When one picture strip has been sent the next strip of picture units is transmitted in the same way. Finally the entire picture has been covered.

The scanning of the picture to be transmitted is not done in jerks, or by units, in any one strip, but it is done continuously.

Uses 168 Per Inch Width

The picture, however, is covered by strips and the motion from one strip to the next is jerky. One strip is called a scanning unit. The clearness, or definition, of the received picture is proportional to the number of scanning units into which the picture is divided, hence it is desirable to divide the picture into as many scanning units as practical. At present the number used is 168 per inch.

The scanning of the picture is done by means of twenty-four revolving mirrors mounted on the periphery of a drum. Each mirror is responsible for one strip or scanning unit. The mirrors are set at such an angle on the wheel that the twenty-four cover the entire picture. That is, for each revolution of the mirror the entire picture is covered. The faster the wheel revolves the oftener the picture is covered by the scanning eye of the photo-electric cell.

It is apparent that as the wheel turns, and as different sections of the picture are exposed to the sensitive cells, the light intensity that falls on the cell varies with the lights and shadows of the picture.

Corresponding Variation

The output of the photo-electric cell varies in the same fashion, and therefore the detected current at the receiver also varies the same way. If the detected current is made to control a local source of light and this light thrown on a photographic film or on a screen the picture will be reproduced.

Every time the scanning wheel revolves, one picture is sent. If the wheel rotates fast enough it is to send the pictures so fast that the reproduced pictures on the screen will give the illusion of a continuous picture, moving or still.

The optical and mechanical arrangement for the projection of the received picture is almost identical with the transmitter system, with the exception that the oscillograph takes the place of the photo-electric cell.

So far nothing has been said of the limitations of the process. Why is it not yet possible to transmit and receive a moving picture? One limitation is the speed with which the oscillograph can be operated.

Another limitation is the speed with which the mirror can be safely rotated. Still another limitation is the intensity of the local light, and this limitation is at the present time the most serious. The faster the scanning and projecting mirrors move, the shorter is the exposure for a given intensity of the light. If the exposure is not great enough the picture cannot be seen, no matter how well it is reproduced.

A THOUGHT FOR THE WEEK

THE most beautiful theatre in the world will not draw patronage unless there is an appealing show on its stage. The finest radio made isn't anything about which to grow enthusiastic unless there are good programs on the air. There's our story and we're going to stick to it—and we freely acknowledge that the broadcasting stations have a big order on their hands in catering to a most captious public.

RADIO WORLD

REG. U.S. PAT. OFF

The First and Only National Radio Weekly

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

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Elevator Sticks, Scheduled Artist Climbs Out on Ladder

Gets Into Studio in Time to Fill Engagement, Woman Program Director Relates—Feminine Directors Plentiful At Stations as "Men Behind the Guns"

Springfield, Mass.

Program managers may be classed properly as the "men behind the guns" of the station, though the praise and plaudits of the listeners usually are lavished on artists and announcers. Nevertheless, programs of splendid balance and continuity are made possible largely through the untiring labors of the directors.

At WBZ, the "men" behind the guns are two charming misses—Mildred Hanifin of Springfield and Emilie Sturtevant of Boston. The station has two households, each with a main studio and transmitting station. The programs, however, are broadcast simultaneously on the same wavelength through a recently perfected method of maintaining the stations in synchronism over a balanced land line. Miss Hanifin directs the Springfield studio in the Hotel Kimball; Miss Sturtevant presides in the Hotel Brunswick studio at Boston.

Stuck in Elevator

Miss Sturtevant recalled that artists sometimes approached her with requests to broadcast personal messages to friends which obviously could not be granted.

"I remember one woman," said Miss Sturtevant, "who on her first broadcast started out with a 'Hello friends.' Fortunately the operator at the control panel intercepted it; all that was heard by her friends was the first syllable of the greeting.

"Even the artists sometimes are subjected to great inconvenience when about to appear. One evening when an artist was ascending to the studio the elevator became stalled between floors. The program was scheduled to go on the air in ten minutes, so a ladder was lowered to the elevator, and the artist obliged to clamber up.

"In the course of a day we receive calls from listeners that we do not present enough dance music, or not enough of monologues, or too much of one or another part of program."

A Difficult Task

"Obviously it is impossible for one or two persons to anticipate the likes and dislikes of the thousands of fans who daily listen to the programs, but we do make a conscientious effort to arrange a program which will appeal at different periods to the varied tastes of the radio audience. We cannot know how successful are our efforts except from the fan letters.

"In perusing the daily mail, we find that a certain percentage of those writing in, desires a particular type of program, and others something different. Taking note of these preferences we arrange a program to coincide in so far as is possible.

"I would like to add a sincere testimony to the loyalty of the regular entertainers from WBZ. Almost without exception those who are scheduled to appear at the studio feel it their bounded duty to complete their share of the arrangement, often refusing paid engagements in order that they shall not disappoint the greatest and most keenly appreciative audience any artist has entertained."

Arctic Circle Hears Music from KYW at 75° Below

Northern Lights Tuned Out by Close Adjustment of Loop Aerial —Eskimos Take Announcer's Voice to Be Devil's and Also Fight Shy of Sopranos

Chicago.

From far within the Arctic Circle, where the colorful Northern Lights shine upon bleak wastes and frozen seas, comes a report of perfect reception of programs from KYW and other powerful stations in the States.

It was borne in person by Grant Raymond, manager of the Hudson's Bay Company's post at Point Barrow, Alaska. Raymond came down to the States from his company's northermost post, and stopped in at KYW to pay his respects and look over the station.

With the thermometer blushing deeply at 75 degrees below zero, Raymond asserted, the post receiving set was tuned perfectly to KYW and KDKA, Pittsburgh, without static interference.

"At first we were bothered by the Northern Lights," he said, "but with closer tuning of the loop aerial, all interference was overcome.

"There are only six white men at the post, in two large igloos, and when the perpetual dark of the Winter comes on, there is nothing to do but read the classics and listen to the radio."

A large lot of batteries and tubes is taken up to the big igloo each Summer. To prevent their freezing at the extremely low temperatures, they are packed in blubber and kept close to the fire. Raymond explained that "the powerful radio set has become the greatest source of diversion, education and connection with the current affairs of the world. Radio is the slender thread by which we are connected with our rapidly changing, progressing world. Raymond added:

"Our eight-tube set, transported at great expense and labor, had to be packed carefully to prevent breakage, placed on a dog sled, and mushed for three weeks over ice and snow to Point Barrow.

Eskimos Like Jazz

"The Eskimos at first were afraid of the blasting human voice over the loud speaker, thinking it a strange devil. Finally they became used to it, and then were attracted by the foreign music. They show distinct partiality to simple ballads and jazz music, and, strangely like civilized radio fans, they will not listen to a soprano voice.

Radio Circuit Used To Test Auto Axles

The three-electrode vacuum tube is continually being applied to more and more industrial processes. The latest use is for testing the rear axle of an automobile for defects in the material and for flaws in the manufacturing. A microphone is used to pick up the soft whir of engaging gears and the current generated by this noise is amplified with a three-tube audio amplifier and the output impressed on a loud speaker. Any irregularity in the whirring indicates slight irregularities in the gears or in the bearings of the axle.

The effect of the current caused by the whirring is also made visible by means of a meter and a large dial. For constant whirring the deflection of the pointer is steady, but any irregularity will show up as a variation in the deflection. The more defects there are in the gears or in the bearings the more unsteady will the pointer be. A variation of only three points on the dial are permitted or the part under test is condemned.

The testing is done in the dynamometer laboratory of the Franklin automobile factory.

Set Builders Pave the Way And Help Guide Receiver Factories

By Hugo Gernsback

WHEN radio was young in this country you could not go out in the open market and buy a complete radio set. I refer to the time when radio first came into vogue; that is, after the appearance of the modern vacuum tube, in 1912. At that time such a thing as a radio cabinet was unknown. We used to mount our instruments of various descriptions on our table. The more room they took up, and the bigger the table was, the better pleased we were.

This state of affairs lasted for a number of years, and possibly culminated about 1923 in the first vacuum-tube sets of the multiple type, which then made their appearance. It is true that, beginning with 1918, we had possessed a few self-contained sets of the cabinet variety, which, of course, had been used, not for broadcast purposes, but for listening to code.

When broadcasting finally made its appearance, the factory-made set took the country by storm; and, while previously the home-built set had been in vogue, the factory set took the ascendancy immediately. Today, at least in this country, the factory-made radio set for broadcast purposes has far outstripped the home-made set in popular demand. By this I do not mean to imply that the genus of radio constructor who builds his own set has died out. Quite the contrary. There are more sets being built this minute than ever before.

Nearly 500,000 Experimenters

From the best available sources at hand, it seems that there are, at the present time, between 400,000 and 500,000 people who annually build sets, and this figure seems to be on the increase. Large as this figure may seem, it is small compared to the figure of factory-made sets annually turned out in this country (over 2,-300,000 at the last census of manufacturers); and it may be said that the manufacturers of ready-made sets today do not worry about the home-built set but, rather, encourage it. This, at first thought, is paradoxical; but it is true, nevertheless, for the following simple reasons:

Radio is an art which changes rapidly, as is well known. While no revolutionary improvements have been made in the past ten years, or are likely to be made soon, changing style, as well as improvements, keep the trade on the jump. New condensers come out, new dials are devised, new coils are produced. At the present time the shielding idea has attained great favor, almost overnight. Naturally, for this reason, set manufacturers are always anxious to incorporate the latest devices in their receivers.

But once the manufacturer is "tooled up" to turn out the season's supply, it is not always possible or desirable for him to make a change. In the meanwhile, the art and progress of radio goes on, and the manufacturer naturally wants to know, in plenty of time, what the tendency will be for the next year. By encouraging the set builders he gets a very good idea in what direction the tendency is heading; and he is able, at no cost at all to himself, to get this information, by simply watching the radio press and studying this tendency.

Gets Good Idea

When the new season comes along, the manufacturer is, therefore, likely to have a pretty good idea of what will happen, or what may be expected to happen next season. This is not to say that the manufacturer gets all of his ideas from the radio constructors. No such meaning is implied; but he gets valuable information; and for that reason most set manufacturers today openly encourage set building, because, first, they know that it cannot hurt their business and, secondly, because they derive from it valuable information which they would not have if there were no set building going on.

The set builders themselves, in the meanwhile, are having a mighty fine time, building to their heart's content, in which they are encouraged by the parts manufacturers, who are themselves always ahead of the set manufacturers who bring out new devices. These new devices are tried out by the set builders, and within six months it becomes known whether a certain device will "take," in the long run, or not.

This has been the case with the straight-line-frequency condensers, as it has also been with the new vernier dials. It is true of shielding the various parts and many other features; none of which would, perhaps, have become incorporated in ready-made sets as soon as they were, if the set builders themselves had not paved the way for such parts.

On the other hand, by encouraging the set builders, the parts manufacturers themselves get very valuable experience which they would not obtain otherwise; and, once the majority of set builders have adopted a certain article the set manufacturers in turn will adopt it as a rule. Such was the case, for instance, with the straight-line-frequency condenser, which was used by the set builders for some six to eight months before the set manufacturers adopted this type of condensers.

Ahead of the Times

It may be said, therefore, that the set builders are always ahead of the game; they are forever pioneering. If you wish to see the latest circuit, or if you wish to see the latest radio wrinkle applied, you will always find it in the best home-made sets. All of this does not mean that the set builder does not use the ready-made set; in most cases he does. There is hardly a radio constructor today worth his salt who does not own two or three sets that are in constant use.

For instance, I myself have two factory-made sets in my home, whereas the set which stands on my study table is one constructed by myself. This particular set probably does not stay there for more than a month at a time, because next month I shall be using a later model; but in the meanwhile the factory-made sets are doing their duty and are being used constantly by the household.

This condition is found all over the country, for it is duplicated in the home of practically every set constructor.

Radio set building may be said to be one of the greatest hobbies that ever came into existence. Unlike most other hobbies, it actually serves to advance a new art, and paves the way for better and bigger things. At the same time, the radio constructor not only gains valuable experience in building his sets, but he is enabled to build for himself a set that will meet each and every condition that comes along.

Changes Gradually Made

To be up to date, under conditions that change as quickly as do those in radio broadcasting, radio receivers must forever be kept up to the minute. Though the changes are gradual, they are constantly taking place, and their effect is cumulative. You would not think of using, in the midst of the heavy traffic on Fifth Avenue or State Street, a 1914-model car that had to be cranked by hand. No more can you expect the set of 1922, built when there were but a few broadcast stations, to give satisfaction, particularly in our congested centers. It is a well-known fact that every time a station changes its transmitter, or increases its power, thousands of sets nearby are immediately found to be inadequate, because they cannot tune sharply enough to cut out the station nearby and get others at will.

Investigation usually shows, on such occasions, that most of these unselective sets are single-circuit or crystal receivers, and others of ancient vintage, which are no longer suitable for present-day radio traffic. Furthermore, additional demands are being made right along on the selectivity of radio receivers, because the broadcast stations are continually increasing their power. The set builder, naturally, keeps pace with the evolution of broadcast conditions, and is forever ready to build a new and better set to meet future requirements.

Set building is continuing to increase rapidly, as it has done for five years, in this country; and, now that we stand on the threshold of television, I believe I shall not be contradicted in saying that set building will assume tremendous proportions, undreamt-of today, during the next five years.

Station Tests Fans On Names of Songs

How much do you know about music?

When you tune in a station do you recognize instantly the name of the selection even if the announcer didn't say beforehand what it was?

William C. Stoess, musical director of WLW, Cincinnati, has devised a feature to give the fans a chance to find out for themselves if they "know their stuff."

This feature has been named "The WLW School of Music Recognition." It works like this:

The announcer merely tells the listeners that the orchestra will play a few selections and he avoids mentioning the identities.

To simplify the matter the "school" program is divided into three sections—"chestnuts," operatic and old favorites.

The chestnuts include such numbers as "Sweet Adeline," "My Pearl is a Bowery Girl," "The Sidewalks of New York."

The operatic section includes favorite arias like "Anvil Chorus," and "Kiss Me Again."

Among the old-timers are such numbers as "Mocking Bird" and "Old Folks at Home."

Complaints from Fans Speed Work on Bills

Three-Quarters of Contents of Measures Agreed On By Senate and House Conferees as Compromise—Leaders Promise Legislation at This Session

Washington.

Senator C. C. Dill and Representative Wallace White, authors of the conflicting radio bills in conference between the House and Senate, are expected to reach final agreement on a compromise. Dill and White were appointed a special subcommittee of two to smooth out the remaining differences between the two bills.

Agreement was reached on about 75 per cent. of the contents of the bills. Dill and White, if they find they cannot agree on the remainder, will refer the final points of difference back to the entire conference committee for final decision.

The conference committee is taking its work more seriously than ever before. A flood of letters and telegrams complaining of station interference is pouring in upon members of Congress and they are beginning to appreciate the vast public interest in broadcasting and the extent to which it is looked forward to as a source of entertainment and instruction.

"We are going to get a radio bill out," say Dill and White. "It is only a question of time."

Early action was forecast.

Many Stations Face a Big Cut of Power Used

Restriction to Serving Local Community Discussed By Terrell—Use of Band Below 200 Meters Also Suggested—Protests Expected From Broadcasters Who Will Be Affected

Washington.

Chief Radio Supervisor W. D. Terrell is trying to put on about 50 pounds. Not that he needs it at present, but he wants it to worry away, if necessary.

Looking forward to the future with sad eyes, Mr. Terrell visions himself with neck band open and sleeves rolled up trying to help work out one of the hardest puzzles ever placed before him. It will be a problem of trying to accommodate about 750 stations to the waves assigned for broadcasting.

It will not be up to Mr. Terrell, of course, to decide what will be done with the stations, but he will be called upon to act in an advisory capacity. Mr. Terrell is conscientious and likes to see a job well done. He is searching his brains for an advance solution and it has evaded him up to the present time.

Old Classification Easier

"Last Winter we had stations divided into two classes, A and B," says Mr. Terrell. "The class B stations were those equipped mechanically and with the power to put out good programs. The class A stations were intended to serve only local communities and their power was kept low.

"By this method we were able to work the small power stations together on a few wavelengths, leaving the class B band reasonably clear from station interference.

"I think the public was pretty well satisfied with the way things worked then.

"It is impossible, of course, to work the same arrangement on the stations now. On July 1 there were 226 stations of 500 watts power or more. At the present time there are 285 such stations.

Three Possible Solutions

"In other words, there are more than three times as many of these powerful stations as there are wavelengths.

"I see three possible solutions, but there are a lot of objections to each.

"The stations might be compelled to divide time three or four ways. But such a scheme would be bound to result in inferior, if not actually, cheap programs. Because of the money required for upkeep, it is necessary for a good station to operate almost every day of the week to offset the expense.

"Again, many of the stations might be compelled to decrease their power and serve only their local communities. The stations called upon to curtail their power could be expected to raise a rumpus about it, and how are you going to decide which stations shall and which shall not?

May Go Below 200 Meters

"Or, the wave band below 200 meters might be opened up for some of the stations. While this might please the public and some of the broadcasters, the stations invited to make the change probably would not accept with alacrity. And again, how would you decide which stations to move?"

Two of Seven New Stations to Use 1,000 Watt Power

Washington.

Two new 1,000 watt stations, another of 250 watts, one 150 watts, one 50 watts and one 10 watts have received licenses from the Department of Commerce to broadcast. As an offset, one 100 watt station discontinued operation.

NEW STATIONS

Station Owner & Location	m.	kc.	pwr.
WGL—Internat'l Broadcast Corp., New York, N. Y.	442.4	678	1,000
WJAY — Cleveland Radio Broadcast Corp., Cleveland	435.7	688	1,000
WMBD—Peoria Heights Radio Lab., Peoria Heights, Ill.	279	1075	250
WSIX—Tire and Vulc Co., Springfield, Tenn.	250	1199	150
KGEL—E. W. Ellison, Jamestown, N. D.	225	1333	50
KGEK — Beehler Elec'l Equip. Co., Yuma, Colo.	252	1190	10

CHANGES

The call of WAHG, Richmond Hill, N. Y., has been changed to WABC.

KJBS, San Francisco, has changed its wavelength from 234.2 meters, 1280 kc. to 220.4 meters, 1360 kc.

WBRL, Tilton, N. H., has changed from 365 meters, 821.4 kc. to 420 meters, 714 kc.

WWAE, Chicago, has changed from 384.4 meters, 780 kc. to 241.8 meters, 1240 kc.

KLZ, Denver, Colo., has changed from 265.3 meters, 1130 kc. to 384.4 meters, 780 kc.

The call of WJBV, Woodhaven, N. Y., has been changed to WSOM, and its wavelength from 469.9 meters, 638 kc. to 288.3 meters, 1040 kc.

The discontinued station follows:

WTAB—Fall River, Mass., 266 meters, 100 watts.

RADIO VALUABLE TO ROADS

According to Sir Henry Thornton, chairman of the Canadian National Railways, radio has proven a valuable asset in railroading. His road was the first one to adopt radio in America and now has 10 broadcasting stations. Apparatus is carried on 50 trains.

GRID WIRING CRITICAL

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

Small Towns Play Big Part in Chain as Link Junctions

Probably not more than one-half of one per cent. of the radio audience which listened to the inaugural program of the National Broadcasting Company's "Blue network" ever heard of the towns Newton Square, Pa., Brushton, Pa., or Beaver Dam, Ohio. Yet these three hamlets, none of which contains more than a few hundred people, served as important links in the new broadcasting chain which tied together WJZ, New York, KDKA, Pittsburgh, KYW, Chicago, and WBZ, Springfield and Boston.

Special telephone circuits arranged for broadcasting purposes are like railroads in that, while they terminate in large cities, in many cases their junction points occur in the smallest towns. And, of course, these circuits are used to link together broadcasting stations.

The route of the "Blue Network" covers approximately 1,300 miles, from the studio of WJZ in New York City to the transmitters of the four stations in the chain. Programs originating in the studio of WJZ are carried first to the Bell System building at 24 Walker Street in New York by means of nine special wires. At this point, these circuits are subdivided into groups, each consisting of a special one-way circuit on which the program is carried and another a telegraph line for communication between operators along the line.

From Walker Street, one set of circuits travels direct to the Bound Brook transmitter of WJZ, where the program is fed into the station's antenna. A second group proceeds generally west to Pittsburgh and on to Chicago, while the third goes in a generally northeast direction to Springfield and Boston.

The western circuit passes from Walker street to Newtown Square, Pa., about fifteen miles from Philadelphia, and from that point to Brushton, Pa., approximately five miles from Pittsburgh. From here, another circuit carries the program to the transmitter of KDKA, while the program also travels on to Beaver Dam, Ohio, about ten miles from Lima, and on to Morrell Park, located about eighteen miles from Chicago, where a connecting circuit bears the music and speech to KYW's transmitter.

The third set of circuits which leaves Walker Street travels first to Hartford, Conn., and then on to Springfield, Mass., where it feeds into the Springfield transmitter of WBZ.

Sun Spots or No Sun Spots, Reception Is Very Good

Dire Prediction of Scientists Does Not Strike Layman as Having Come True, But Dellinger Insists the Solar Theory is Borne Out By Recent Experiences

By Thomas Stevenson

Washington.

Although the bad reception which was predicted from increased sun spots has not developed so far this Winter, physicists and scientists are sticking to their theories about it. They are positive that there is a definite connection between the two, and that the listener suffers therefrom.

Last Winter reception was the worst it had been since the inception of broadcasting. Many theories were advanced about it. Some said it was due to Western lights, to the Aureora Borealis, to Southern lights, to sun spots, etc.

Reception Better Now

If the poor reception last Winter was due entirely to sun spots, it should be worse this Winter. Instead were it not for the crowding together of stations, reception might be called excellent.

When asked last Winter to account for the poor reception, Dr. J. H. Dellinger. chief of the Radio Laboratory of the Bureau of Standards, said:

"There seems to be some effect of sun spots on radio reception. Sun spots throw out enormous eruptions of electrons and other electrical particles some of which reach the earth's atmosphere. When the sun spots are particularly intense, radio reception is likely to be disturbed and poor.

Calls Theory Borne Out

"This has not been conclusively proved but seems to be indicated by such observations as have been made. The sun spot cycle is 11 years, that is there is a minimum of spots on the sun for a time after which they gradually increase and pass through a maximum and return to a minimum, the whole occupying a cycle of 11 years. The last sun spot minimum was in 1922 and it would be inferred, therefore, that radio reception was at its best in 1922, should be progressively worse from 1922 to about 1928, and that in succeeding years reception conditions should improve and be at their best again in 1933."

Dr. Dellinger says that recent observations have borne out the sun spot theory.

"Our observations during the last few months," says he, "shows a fluctuation of signal intensity coincident with sun spot activities. Reception is better when sun spots are fewer, and conversely, worse when the sun spots are thicker."

BUREAU NON-PLUSSED

Washington.

Observations of the signals of stations at the Bureau of Standards are being badly handicapped by the difficulty in separating stations, according to Dr. J. H. Dellinger, chief of the Bureau Laboratory. Because of the crowding together of stations it is difficult to get a signal from one without interference from another even with the most selective set, says Dr. Dellinger.

MOTORBOATING REMEDY

Motorboating in a receiver served by a B battery eliminator may sometimes be stopped by placing a high impedance choke in the plate circuit of the detector tube, in series with the primary of the first audio frequency transformer or with the first coupling resistor.

Royal Hour Changes Music Type and Cast

Not only has the time of broadcasting the Royal Typewriter Hour of Music been changed, but also the artists and the method of presentation. The feature is broadcast by WJZ and the stations of the National Broadcasting Company's Blue Network, WBZ, KDKA and KYW at 8:30 o'clock E. S. T., Friday nights.

The featured artists under the new policy are Franklyn Baur, who continues to sing the part of the hero; Virginia Rea, who becomes the new heroine, while the instrumental part of the program will be carried by a group to be known as the Heralds. There are three men in this unit, Joe Green, well known xylophonist and vibraphonist; Frank Banta, pianist, and Andy Sanella, saxophonist. The program will be of one-half hour's duration instead of one hour as heretofore.

The type of music rendered by this group is largely of the popular and light ballad class, featuring recent hits from the successes of Broadway. Vocal solos and duets are interspersed with instrumental solos and ensembles.

Erva Giles, the former Royal heroine, made a great success, due to her fine voice, and fans wished the talented Miss Rea the same success.

Woman Will Review Plays From WAAM

A new Monday 7:45 p. m. feature at WAAM will be talks on outstanding productions and personalities of the New York stage. These talks will be given by Mitzi Kolisch, formerly assistant editor of "Theatre Magazine" and music editor of "The Boston Independent." Miss Kolisch is one of the youngest women reviewers in New York. Each week she will see all the more important new plays in New York, interview the star of the play if possible, and will give her estimate of the play as well as anecdotes of backstage. The talks will convey some of the color and glamor of Broadway dressing rooms, rehearsal halls, and producers' offices.

Good U. S. Reception Enjoyed in England

Owing to excellent atmospheric conditions which have been prevailing over the Atlantic, reception of American stations was never better over in England, reports K. L. Allardyce Arnott, managing director of the Freed-Eisemann Radio Ltd., who arrived in New York on the S. S. Berengeria.

British interest is keen in the simplification of receivers and the results of American uni-control and duo-control in sets are being carefully watched.

"Thousands of British radio fans sit up until quite late in the morning in the effort to pick up American stations," Mr. Arnott stated.

2,000 Pupils Learn Spanish From WGN

Chicago, Ill.

More than 2,000 pupils are learning Spanish by radio over WGN. Prof. Angel A. Braschi, of De Paul University, who is giving the course, says he is particularly well pleased with the interest shown by his unseen scholars, and believes that they are going ahead just as fast as classroom students. Anyone can join the Spanish course by sending in his name and address to WGN, and tuning in every Tuesday afternoon at 5 o'clock for the lesson.

Radio Controlled Auto Called Hoax by Bureau

Investigating Agency Asserts Man Was Concealed Behind the Panel of the First Car and Steered It Under Instructions From Man on Trailing Machine

Investigation of Francis P. Houdina by the National Better Business Bureau, Inc., led the bureau to assert that his recent radio controlled automobile "stunt" at Indianapolis was actually carried out by workmen concealed in the car.

Houdina, who has appeared before radio fairs and exhibitions in different parts of the country, corresponded with officials of the Indianapolis Broadcast Listeners' Association. As a result the organization engaged him to hold a demonstration.

Shortly afterward, J. R. Massell, said to be Houdina's agent, appeared in Indianapolis. Men who responded to Massell's newspaper advertisement for electricians state that Massell required a $15 deposit from each employe. He engaged five local men, whom he agreed to pay $25 a week.

According to those men, two automobiles were used. It was represented that in the demonstration, the front car, while in motion, was controlled from the following car by radio. One man was concealed behind the "control panel" of the first car, says the bureau, and guided it according to signals received from the second.

Six hundred dollars was the fee obtained by Massell and Houdina. The demonstration was apparently convincing in every detail.

"Radio control is possible, as has been demonstrated by the U. S. Signal Corps, but few organizations would care to pay so large a fee for a clever imitation," says the bureau.

In his negotiations with the Indianapolis Broadcast Listeners' Association, Houdina gave his address as 1476 Broadway, New York City. Investigation by the bureau revealed that he has had no office at this address for considerably more than a year, R. F. Murphy, of the bureau, said.

Grid Blocking a Mystery That Baffles Expert on Vacuum Tubes

By Brunsten Brunn
Consulting Engineer

ONE thing in radio that I cannot understand is the blocking of grids when the grid leak has insufficient conductance. The classical explanation of the phenomenon runs something like this: When the grid goes positive electrons flow to the grid, lowering its potential. Then when the positive voltage is suddenly withdrawn the negative charge remains on the grid because the conductance to the filament is insufficient to let it escape. Again the grid goes positive by the application of the positive half of the signal voltage. More electrons flow to the grid, lowering its potential still more. When the signal goes negative, thus withdrawing the positive voltage on the grid, the new charge of electrons remains on the grid, making the grid potential still more negative. This process goes on until the grid potential is so much negative as to cut off the plate current completely.

It is easy to see how the grid accumulates a negative charge by attracting electrons when the grid is positive. But this is what I cannot see: How can the grid be both positive and negative at the same time, which the explanation demands. Unless the grid is positive no electrons flow to it. They continue to flow until the grid is negative, or until it is no longer positive. How, then, can blocking go on until the plate current is absolutely stopped, which requires a very large negative potential on the grid? It would seem that blocking would stop when the grid is so much negative that the peaks of the incoming voltage can no longer drive it positive.

Comparison of Severity

This would make the mean grid potential negative to the amount of the amplitude of the impressed voltage, a constant value for an unmodulated wave but a continually variable value for a modulated wave. But that is not the case. The grid keeps on accumulating a negative charge until the plate current stops, or until it varies between zero and a very small positive value. This requires a negative bias of the grid much greater than the amplitude of the impressed voltage. This is the case when the blocking is very severe.

When the blocking is less severe the operation may be watched with a milliammeter in the plate circuit. The mean voltage of the grid may be anything from a small positive value to a negative value which almost cuts the plate current to zero. This is what happens. The plate current gradually increases, indicating that the grid is gradually accummulating a positive charge. Then at a certain value of plate current, and therefore of grid potential, the plate current suddenly jumps to a low value. This indicates that the grid went negative suddenly. As soon as the current has jumped down to the minimum value it begins to climb again, only to jump back when it has reached a certain value, and this value is the same every time. If the rate of climbing up and jumping down is very rapid the result is an audio frequency squeal of very unpleasant quality. Its pitch may have any value.

This slow climbing up and jumping down of the plate current would seem to show a state quite the reverse from the classical explanation. But in reality it is fully in accord with it. The current creeps up slowly because the leakage is slow. It jumps down quickly because the electrons jump to the grid and the grid condenser instantaneously. In other words, the so-called slow accummulation of a negative charge of the grid is extremely rapid, and the leakage through the grid leak, which determines the rate at which the grid loses its negative charge, is comparatively very slow.

But there is one difficulty about the process. What pulls the trigger, so to speak? What determines the voltage of the grid at which the jump occurs? Why does it not jump any lower than it does? Why does the jump occur at the same value of grid potential every time, and why does it always jump to the same negative value? That is, why is the blocking so regular under certain given conditions? Why does the jump occur at all when the input voltage is perfectly regular? Why is the climbing and jumping regular when the input voltage is not?

Some light may be thrown on these questions by the behavior of a blocked tube toward DC bias voltages. Suppose that a high voltage battery be connected in series with a very good condenser placed in the grid circuit, with the negative terminal of the battery toward the grid and the positive toward the ground. The plate current is stopped just as if the condenser had not been used. Remove the battery and the plate current will appear in a few moments, the length of time depending on the voltage of the battery used, on the capacity of the condenser and on the stray leakage through the insulation.

Now reverse the battery, everything else being the same. The plate current shows that the plate is positive, or at least as positive as it can get with a practically infinite resistance in the grid circuit. Remove the positive grid bias. Instantly the plate current jumps to zero and then begins to climb slowly to the value it has when the grid is zero. If the positive bias on the grid is applied and removed rapidly, the plate current may be held very close to the zero point, indicating that the mean negative potential of the grid is very nearly equal in magnitude to the applied positive bias.

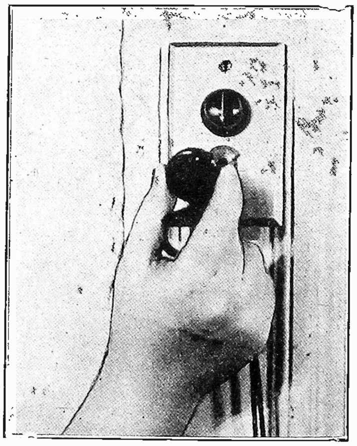
While the positive voltage is applied, the grid accumulates a charge which makes its voltage about zero, or equal to ground potential. When the positive voltage is withdrawn the condenser and grid become charged negatively by electro-static induction in the same manner that a gold leaf electroscope may be charge negatively by withdrawing a positive charge.

This may show how the grid may be kept negative by alternately applying and removing a positive voltage, but it does not seem to explain why blocking is so jumpy, and why the jumping may occur at frequencies which have no relation to the frequency with which the positive voltage is applied and removed.

How to Answer It Practically

After having taken the classical explanation of blocking, having made an attempt at explaining the explanation and adding some to it, the questions still remain. Why does the grid keep on going negative when it can only go negative if it goes positive? Why is blocking so jerky and jumpy? What pulls the trigger?

The practical answer to all these questions is to give the grid an adequate negative bias and at the same time to provide a certain amount of leakage to the grid and not to overload the tube. Then the blocking will not occur and no answer need be given.



(Hayden)

SO THAT you may control the volume and also shut the set off at will, from a distant point, the device shown in the above photo, has been recently put on the market.

Power Lines Assist In Putting Radio Gold Back in Gate

San Francisco

An active campaign is being carried on for relieving the interference noises, due to power lines in this city, by the Pacific Radio Trades Association, who are co-operating with the local power companies, e. g., Pacific Gas and Electric Company and the Great Western Power Company. Great confidence was expressed by officials of the three organizations, the power companies stating that they would help financially, or otherwise.

A prominent engineer has been hired by the trade association. Complaint blanks have been furnished to all the local dealers. The public through the press have been instructed to obtain these blanks from their nearest dealer, or from the one from whom their set was bought. After this is filled out, it is given to the dealer, while the dealer sends out a service man to find out if the difficulty is due to some defect in the set itself or to external conditions. If the fault is found to exist outside, the dealer informs the association. When the association receives this notice, they send out a man to determine the exact couse of complaint, again reporting back to the association. The special report is then sent to the company to whom the lines, causing the trouble, belong.

The Northern Radio Press Association, headquarters in Minneapolis, Minn., are using the same scheme. Other types of interferences are also being studied.

EAR UNEQUALLY SENSITIVE

We can hear beats between two musical sounds separately produced in air because the ear distorts. It is less sensitive to loud noises than to weak. This is probably due to fatigue of the ear mechanism. The ear does not recuperate as fast on intense stimuli as on weak ones.

THE RADIO TRADE

Pittsburgh, Pa.

The All-American Radio Corporation announce their appointment of the Highway Service Company as the exclusive distributor of Rauland receivers and All-American radio products. Willard storage batteries and power units as well as General Electric Tungar chargers are among the well known products they have distributed.

Salt Lake City, Utah.

Turning out more than 30,000 speakers a week, the Utah Radio Company, manufacturers of the famous Utah Loud speaker, are now employing more than 400 people.

Chicago, Ill.

The Rola speaker, famous for its tone reproduction, is now being handled by the Wiswell Radio Company of this city.

The Standard Radio Corporation, manufacturers of a popular model six-tube receiver, has contracted with the Radval Company, manufacturers of the Multi-Val tube for exclusive manufacturing and distributing rights for the receiver using this tube. The agreement was made between Ben. W. Finke, vice president and general manager of the Standard Company, and R. E. Emerson of the tube company. The set will be built in a cabinet, having a panel 7x10 inches. The output of this set will be equal to a five tube set, using four dry cells for filament heating and a standard B battery for plate supply.

Decatur, Ill.

Comparatively speaking, there are 4,800 radio receiving-sets in operation in Decatur and Macon counties.

The above estimate is given as the result of a canvas, conducted by the Review, of the leading radio dealers in the city and is thought to be fairly accurate.

Minneapolis, Minn.

The radio industry is on a sounder basis today that it has ever been, programs are being improved and sets are of a higher quality, J. Cameron Thomson, vice president of the Northwestern National bank, told members of the Northwest Radio Trade association at their meeting recently.

"With proper caution to avoid overselling, and good crops during 1927, this district should be a very prosperous one for radio dealers in the northwest," Mr. Cameron said.

La Belle, Mo.

The carpenters and painters have transformed the barber shop and radio store of William Hawkins, into a very attractive place. The room has been enlarged and redecorated and an elevated floor put in the front and surrounded by a railing on which will be shown the radio handled by Mr. Hawkins. His storage and work room where radios will be assembled and repaired will be in a rear room.

Oklahoma City, Okla.

Anouncement of the establishment of a new radio factory for Oklahoma City was made recently by L. R. Schenck, president of the new concern, known as the Beacon Radio Laboratories.

The new factory, which is located at 916 N. Stiles Ave., is now in commercial production of five-tube radio sets embodying the latest engineering principles, which will be offered in several different styles, including table models and two console types. The sets will be sold directly to the users and will be furnished fully equipped with batteries, tubes, speakers and other accessories, Schenck said. The sets have several unique features, including illuminated tuning drums, locking switch and a new style volume control.

According to Peter Samson, of the Samson Electric Company, radio has definitely won its place in the home, and during 1927 the market should be very lively. The improvement in broadcasting will aid this, while the present chaotic condition of the air will be adjusted shortly after the beginning of the new year.

Des Moines, Ia.

Some indication of the rapid progress made this season by the Federal Radio corpporation may be seen in the number of promotions in company personel effected since last July. These included the election of L. E. Noble to the office of president; L. C. F. Horle, now vice president; L W. James, assistant to the president; E. S. Hilber, assistant sales manager, and several others of similar importance. In all, about a dozen noteworthy advances have been officially anounced in the past six months.

Observers of the radio industry will recall the radical reorganization accomplished in the Federal Radio corporation in 1925, and the popular success of the Ortho-sonic line under the direction of L. E. Noble, then vice president and general manager.

Atlanta, Ga.

Al H. Bailey, president of Bailey & Co., distributors of Atlanta, was elected unanimously the other day as president of the Atlanta Radio Trades Association to serve through 1927.

Mr. Bailey succeeds Samuel D. Katz, head of the Automotive Sales and Service Company, Splitdorf distributors in this territory, during whose term the association staged the south's most successful radio-electrical exposition. Mr. Katz automatically becomes a member of the board of directors as past president.

Serving in official capacities with Mr. Bailey will be Forrest M. Bosler, head of the American Electric Lamp company, first vice president; I. M. Morehead, director of radio merchandising for the Georgia Railway and Power Company, second vice president; W. D. V. Hopkins, president of the Hopkins Equipment Company, treasurer, and Henry L. Reid, of Henry L. Reid & Co., secretary.

The Atlanta Radio Trades association, founded just two years ago, now represents a diversified affiliation of Atlanta business interests backed by millions of dollars of commercial capital and has rapidly assumed an influential part in forwarding Atlanta's standing as the distribution gateway of the southeast.

Indianapolis, Ind.

At a meeting of the new Indianapolis Radio Distributors' Association at the Chamber of Commerce recently, show legislative and constitution and by-law committees were named.

Those on the various committees are: L. L. Banford, E. L. Kruse and Adolf Wagner, show; L. D. Ginger, George A. Riser and Frank J. Argast, legislative; Adolf Wagner, C. F. Connell and C. E. Callendar, constitution and by-laws.

The object of the association, President Ginger stated, is to study and discuss useful information relating to practical uses of radio receiving instruments; to disseminate such information among radio dealers, and to eliminate interference and conflicts in radio broadcasting.

Literature Wanted

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

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

Name ....

Address ....

City or town ....

State ....

Frank Hoeflich, 247 North 13th St., Philadelphia, Pa.
George Warren, 209 West 102d St., New York City, N. Y.
Hubert Kamer, 201 Blarkhawk St., Swissvale, Pa.
J. Stonestreet, 538 Barnett, Kansas City, Kans.
Carlo Maioriuo, 157 Zabriskie St., Jersey City, N. J.
J. W. Hoehler, 91st and East Glissen St., Portland, Ore.
Joseph A. Vogt, 28 Parkview Terrace, Newark, N. J.
Charles A. Phildius, 510 East 120th St., New York City, N. Y.
L. J. Shine, 331 West 83d St., New York City, N. Y.
Jack Allman, 109 Cornelia St., East Rutherford, N. J.
H. S. Jacobs, 430 West 116th St., New York City, N. Y.
Wiley Blair, Jr., 37 North Washington St., Hinsdale, Ill.
Louis Sanders, 147-04 Boynton St., Jamaica South, N. Y.
A. W. Chaplin, 167 Third St., Newport, R. I.
Thomas F. Creed, 111 East 130th St., New York City, N. Y.
George S. Hunter, 24 South Whipple St., Chicago, Ill.
Charles B. Peterson, 70 Bayard St., New Rochelle, N. Y.
Fred Ledig, Union, Union County, N. J.
E. H. Farance, 86 7th St., Midland, Pa.
C. L. Close, 4020 Fairview Drive, Toledo, O.
T. E. Clement, 1437 N. W. 51st St., Miami, Fla.
Fred J. Merklein, 321 Marion St., Bklyn., N. Y.
Corbell Radio Co., Drawer 88, Duncan, Okla.
Louis Manfredonia, 9428 86th St., Ozone Park, Long Island, N. Y.
C. A. Lancaster, 11 North 13th St., Colorado Springs, Colo.
Cyde G. Horton, 7213 Indiana Ave., Cleveland, Ohio.
Lawrence Lewis, 4901 Page Blvd., St. Louis, Mo.
Donald Norbeck, Box 341, Shelton, Wash.
M. F. Davis, Alabama Pipe Co., Anniston, Ala.
Joseph Rogel, 450 Sterling, La Salle, Illinois.
William E. Rosenlieb, Box 264, New Matamoras, Ohio.
Ben F. Davis, Box 514 Picher, Okla.
P. I. Perkins, 425 Old Main, Newton, Kans.
Harry W. Schaad, 17 West Second St., Rittman, Ohio.
Peter Meuse, 423 8th St., West New York, N.J.
W. C. Meuse, 411 18th St., West New York, N. J.
J. H. Meuse, 2520 Webb Ave., N. Y. City, N.Y.
F. W. Brinser, 3421 Crawford St., Philadelphia, Pa.
Frank O. Post, Box 157, Wyalusing, Pa.
John S. Morrison, 93 Hempstead, New London, Conn.
Leo J. Therrien, 682 Summit St., Lynn, Mass.
George Guertler, 1326 Jerome, Philadelphia, Pa.
John Korbbelik, 6423 Surbaban, St. Louis, Mo.
J. Richard Kearns, care The Sioux Falls Press, Sioux Falls, S. D.
John Milkovis, 416 Ohio Ave., Midland, Pa.
F. MacDonald, L. E. Myers Co., Weleetka, Okla.
Frank S. Brunson, 724 West Adams St., Jacksonville, Fla.
C. Disbro, Carey, O.
B. C. Lindemam, 252 Spear St., San Francisco, Cal.
R. F. Fay, 420 Detroit St., San Francisco, Cal.
William Tofte, Box 371, Oelwein, Ia.
Orville Houser, Jr., 2317 12th St. and 24th Ave., Meridian, Miss.
Fred Martin, 1216 24th Ave., Meridian, Miss.
John Gregorski, 357 65th Ave., West Allis, Wis.
Ernest Frischknecht, 1058 3rd St., Milwaukee, Wisc.
B. E. Wilson, Vaudvette Theatre, Springfield, Ill.
C. A. Johnston, 23 Y. M. C. A., Adrian, Mich.
M. E. Huvett, 3332 Holmaes Ave., Minneapolis, Minn.
Charles Gaugh, 326 Hancock St., Louisville, Ky.
E. S. Robbins, Apt. 28, 364 Belmont Ave., Springfield, Mass.
F. Allem Clough, 203 Kirk Ave., Syracuse, N. Y.

Instalment Plan Sales Leap to Fore from 13%

1926 Figures for Industry Will Show About 25 Per Cent., R. C. A. Executive Predicts—Evidences Radio's Acceptance as A Home Commodity

"During 1926 the demand for instalment sales of radio has greatly increased and it is probable that when the figures have been compiled they will show that radio sales made on the instalment plan last year will have practically doubled. It is only natural that this should be so. The very high percentage of instalment sales generally, are all for commodities used in the home and radio has taken its place among them."

So said H. T. Melhuish, sales administration manager of the Radio Corporation of America.

Considering instalment sales in all fields, in 1925 dealers sold for cash 20 per cent of all phonographs, 25 per cent. of all automobiles and washing machines and 35 per cent. of all vacuum cleaners and furniture. The remainder were all sold on instalments.

During the same year practically 87 per cent. of all radio sets were sold for cash, hence only 13 per cent. on the instalment plan.

GEM DEVELOPS RF POWER TUBES

Gem Tube Co., 16 Hudson Street, has designed a special purpose tube for use in radio frequency stages only. This tube increases selectivity and separates interfering stations in a way that seems magical, the manufacturer claims. A very ingenious glass bead construction supporting the elements within the tube results in the elimination of three lead wires. In addition, the plate and grid are much smaller than in the A type tubes, thereby eliminating capacity and grid-to-plate effects and losses. Weak signals are passed on to the detector without being absorbed by the capacities of the internal elements of the tube. By cutting down grid-to-plate capacities strong signals are passed on to the detector with a minimum of distortion. The bead construction supporting the elements tends to eliminate microphone noises that may be caused in the RF stages. This tube will fill a long felt need, and full information may be had from the above concern.

New Fenco Giant Cone

Another three-foot Cone Kit has been placed on the market by the Fenco-cone, 57 Murray Street, New York City. This is a double cone, full 36 inches in size and is said to give fine tone reproduction. The unit is of the free floating, poised, armature type; will take up to 500 volts; has an extremely powerful horseshoe, permanent magnet of high-grade imported Tungsten steel, terminating into four magnetic poles, sturdy and durable with an adjustment for centering the vibrating stylus. The unit is self-polarizing and is said to match the impedance of any of the tubes on the market today, particularly with all classes of power tubes. It is also adjustable to any receiver so that it matches the audio output perfectly. The front and back papers for the cone are cut circular to correct size and the cutting and pasting dimensions are printed thereon. The complete kit contains one special Fenco-cone unit, two sheets Alhambra Phonotex low frequency paper, back baffle ring, wooden mounting base, can of Ambroid cement, inside metal unit support, Apex fittings, gold edging braid and full instructions. Descriptive literature will be sent by the above concern to all who write for it.

K. W. RADIO EXPANDS

The K. W. Radio Co., Inc., 98 Park Place, New York City, due to the great increase in their business last year are compelled to take extra storage space to take care of this growth and the advance orders for 1927 Among the lines carried by K. W. are Marco, Carter, Victoreen products, the full line of Mathieson-Sandberg loops; the Wave-Cone, a new and remarkable reproducer at a low list price, and a complete line of Ce-Co tubes, always on hand. This is a livewire concern, well and favorably known to the trade.

QUICK ACTION

At practically the same time that a certain word or note of music passes into a microphone in the studio of WJZ in New York City, the same sound is being heard in loud speakers scattered over the eastern two-thirds of the United States. And yet, in the small fraction of a second interval, that sound has traveled by wire almost half-way across the United States —and it has visited Newtown Square, Brushton and Beaver Dam.

WATCH EXPIRATION OF YOUR SUBSCRIPTION!

Subscribers will note that the end of their subscriptions is indicated on the labels on wrappers. If your wrapper shows a date earlier than the current issue, please send payment for renewal. Changes in expiration dates on wrappers appear two weeks after receipt of renewal.

RADIO WORLD, 145 West 45th St., New York City. (Phones: Bryant 0558-0559.)

U. S. Is Fourth In Goods Sent to Dutch Trade

The United States ranked fourth in importance in the list of nations supplying the Dutch imports of radio equipment in the first seven months of 1926, says an announcement by the Department of Commerce. The text follows:

During the first seven months of 1926 Dutch imports of radio equipment totaled 1,974,000 florins (1 florin equals $0.402), an increase of 562,000 florins, or about 43 per cent. in value above that for the same period of 1925, according to a report from Consul Edward A. Dow, Rotterdam. Germany supplied about 31 per cent. of those imports, Great Britain 27 per cent., France 17 per cent., United States 16 per cent., and Belgium 6 per cent.

Exports of radio apparatus from the Netherlands during the first seven months of 1926 showed an increase of 777,000 florins, or about 175 per cent., the total being 1,222,000 florins. Shipments to France constituted about 49 per cent. of the total exports, Great Britain received 26 per cent., Germany 11 per cent., and the Dutch East Indies 10 per cent.

Cry of Chaos Called Extreme

Wichita, Kans.

"The cry of radio chaos is exaggerated as it is aplied to wavelength confusion," says Bob Sutton, manager of the Southwestern Electrical Company, 123 North Market.

"There is some trouble in a few of the larger cities, in stations duplicating other station wave lengths, but this exists only in a very few instances. Here in Wichita we are fortunate. Radio fans here may tune in on stations in all directions and we are not limited to the confines of Wichita. In Chicago there are so many high-powered stations on the air that it is a difficult matter tuning in outside stations. So what troubles Chicago fans does not apply to Wichita.

New Corporations

William Waldman, New York City, pianos and radio, $10,000; W. and S. Waldman, M. C. Kantrowitz. (Atty., M. L. Kantrowitz, 261 Boradway, N. Y. City.)

General Broadcasting Company, Newark, N. J., operate radio stations, etc.; 15,000 shares, no par value; Ralph W. Appleby, Charles W. Oathout, Newark; Edward J. Malone, Jr., Montclair, N. J. (Atty., Seymour J. Solomon, Newark, N. J.)

Wandrie Mfg. Co., 4317-N. Western Ave., Chicago, Ill.; $25,000; manufacturing and dealing in radio and automobile supplies, equipment, apparatus and accessories; Thomas J. Davis, Charles G. Mann, Robert A. Bollett, Louis Wandrie. (Attys., Tenney, Harding, Sherman & Rogers, 137 South LaSalle St., Chicago, Ill.)

D. L. G. Mfg. Co., 2941 West Lake St., Chicago, Ill., $20,000 manufacture and deal in radio sets, parts, supplies and accessories; T. Dissinger, R. Barnett, J. E. Barnet, J. C. Lane and H. H. Lane. (Atty., Lane Manufacturing Company, 2941 West Lake St., Chicago, Ill.)

Supercraft Products Corp., New York City, radio supplies, 150 common, no par; J. M. Torrisi, M. Haimes, A. Siegel. (Attys., Dawson & Dawson, 36 West 44th St., New York City.)

Illinois Stock Medicine Broadcasting Corp., Quincy, Ill., $10,000; operate and own a broadcasting station, $10,000; R. E. Whitfield, F. W. Crane, H. G. Kreitemeyer, Robert E. Companton, and W. Emery Lancaster. (Incorporated under the laws of Illinois.)

H. E. Maytag Co., 1835 D St., Granite City, Ill., to manufacture and deal in washing machines, radio, electrical devices and motors; Margaret W. Hehner, O. E. Hehner, Margaret Evans. (Attys., The Maytag Stores, 1835 D St., Granite City, Ill.)

Koenig & Koch, Glendale, N. Y., radio shop, $50,000; C. and M. Kock, A. Koenig. (Atty., T. E. Dugan, Ridgewood, N. Y.)

Caffrey & Warner, N. Y. City, radio apparatus, $1,000; W. M. G. Watson, V. R. Foley, R. C. Lutz. (Attys., Phillips & Avery, 41 Park Ave., N. Y. City.)

Dresdner Radio Mfg. Corp., N. Y. City, $1,000; S. Ackerman, B. Jacobson. (Atty., B. Jacobson, 41 East 42nd St., N. Y. City.)

Ford and Glenn Busy Entertainers at Station WLW

Ford Rush, of Ford and Glenn, is up and about again after a serious attack of pneumonia. He and Glenn are appearing regularly at WLW, with their "Lullaby Time" and other features.

They are on the air at noon, every weekday, with a "dinner bell" feature intended especially for the farmers. Every night, except Friday, Cincinnati's silent night, they put on the "Lullaby Time." at 8 (E. St. T.). Sunday nights they are on the air at 7:20 and 10 with "Hymn Time" and twice every week they put on afternoon programs for shut-ins.

The De Luxe Lamp Socket Receiver

Of course
Arthur Lynch designed the
De Luxe Lamp Socket
Receiver
for use with

Raytheon
LONG LIFE RECTIFYING TUBE

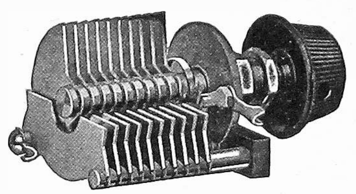
CeCo TUBES

SPECIFIED BY
ARTHUR H. LYNCH
FOR THE TWO TUBE
DE LUXE RECEIVER

Type H—Special Detector.....$2.50
Type BX—199 ....$2.00

Ready to Mail in Special Mailing Carton Upon Receipt of Money Order.

K. W. RADIO CO., Inc.
98 Park Place New York



PRECISE 940 MICRODENSER
Series Antenna Balancing Condenser
Especially Designed for the Browning-Drake Receiver
Selected and Specified by
Arthur H. Lynch
for the De Luxe Lamp Socket Receiver
100 Mmf. Capacity, $1.75
A Precise Laboratory Quality Instrument
Also made in 10, 20, 30, 55 and 135 Mmf. Cap.

PRECISE MANUFACTURING CO.
ROCHESTER, N. Y.
New York Office: 126 Liberty Street

See Page 7 of this Issue!

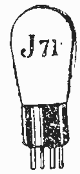
E·C

Specified

for The De Luxe Lamp Socket Receiver

TYPE "F"
Storage Battery
Power Amplifier
Price $4.50

TYPE "J-71"
OUTPUT TUBE
for
High Power Amplifiers
Price $4.50



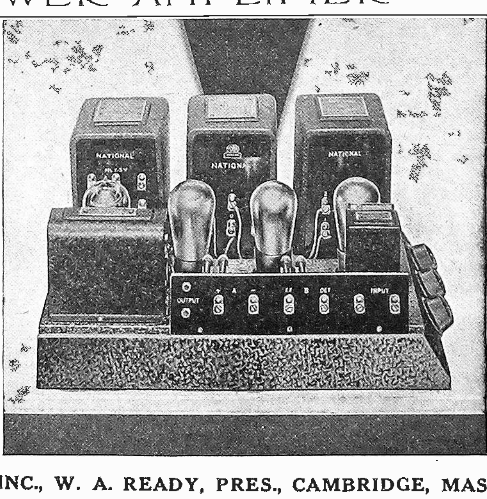
There's a CeCo Tube for Every Radio Need
Write for compete data sheet
C. E. MFG. CO., Inc., PROVIDENCE, R. I.
Largest Plant in World Making Radio Tubes Exclusively

NATIONAL
POWER AMPLIFIER

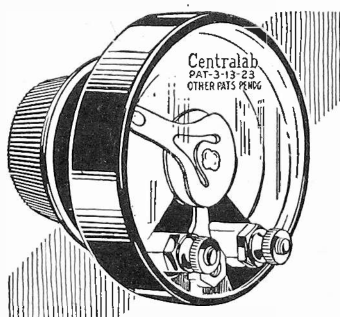
Designed in collaboration with Arthur H. Lynch and James Millen, it gives perfection of quality to any set and supplies all the B-Current, too. Price Completely Assembled and tested, without tubes

$89.00

Send for Bulletin 116-RW



NATIONAL CO., INC., W. A. READY, PRES., CAMBRIDGE, MASS.



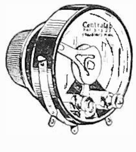
STANDARD
Centralab RadiohM

INSURES clearer, louder reception with most any radio circuit. It holds perfectly the sensitive regenerative position which immediately precedes the oscillation point.

Dependable, noiseless in adjustment, and full resistance variation with a single turn of the knob. Resistance values remain exact for life of set. **$2.00** for any resistance.

Arthur Lynch has selected the Radiohm to control his new Wonder Set.

SWITCH TYPE
Centralab RadiohM



With Switch
$2.30

Has an "A" battery switch, also controlled by the knob, giving a double purpose control. Is variable from zero to 500,000 ohms. Also furnished in Modulator, for tone volume control in all audio circuits.

CENTRAL RADIO LABORATORIES
13 Keefe Ave., Milwaukee, Wis
Makers of a full line of variable resistances for 69 makers of leading standard sets.

Centralab

How to Figure Values of Rheostat Resistance

Selection of a Series Unit for Operation of Tubes From High Voltage Source Considered in Expert Analysis of Important Topic

(*Continued from page 9*)

Therefore the resistor to be used must carry at least 5 amperes without overheating, since it will be called on to handle this current continuously. The voltage across its terminals will be 110 volts, since the line has 220 volts and the light takes 110 volts. The resistance must therefore be 110 divided by 5 or 22 ohms. The energy which it will dissipate is 110 x 5, or 550 watts. Therefore another 550 watt light may be used for the resistor, or any other 550 watt heating unit, that is, one that gives 550 watts on 110 volts.

Another example may be taken from a radio set. Suppose that the supply line which feeds the plates has a voltage of 250 volts and that only 90 volts are required on the plate of the tube. A resistor is required which will drop the voltage from 250 to 90 volts, that is the voltage across the resistor will be 160 volts. To determine the resistance required it is necessary to know how much current will flow in the resistance. Suppose that the tube in question will pass five milliamperes when the plate voltage is 90 volts. The current through the resistor will then also be five milliamperes, provided that only the current from the one tube flows through it. Now the current and the voltage are known, and the resistance is 160 divided by .005, which equals 32,000 ohms. The energy dissipation in the resistor will be 0.8 watt. If the resistor used has a rating more than this it is safe to use in the circuit.

Series Connected Filaments

Suppose that the same 250 volt supply line is to be used for heating the filaments of a number of 60 milliampere (.06 amp.) tubes, say five of them connected in series. What resistor is necessary in series with the filaments to cut the voltage down to the proper value? Now, each tube requires a terminal voltage of 3.3 volts (use 3-volt for other than Cunningham —99). Then five such tubes will require 16.5 volts. The difference between 250 and 16.5 is 233.5 volts. The problem then is to determine what resistance is required to cause a voltage drop of 233.5 volts when 60 milliamperes flow through it. By Ohm's law we have 233.5 divided by .06, which equals 3,891 ohms. The energy dissipation in the resistor is 233.5 multiplied by .06, or 14.01 watts. If the wattage rating of the resistor is greater than this it is safe to use in the circuit, but should it have a rating of say 5 watts, the resistor unit will burn out the instant the current is turned on.

In selecting a resistor for any purpose first determine what current is to flow in it when it is connected into the circuit. Then determine what voltage drop there must be in the resistor. The voltage drop divided by the current gives the resistance of the resistor. Then select a resistor having the required resistance and which will carry more current without heating than the current which it will carry in the circuit. Make the factor of safety at least 400 per cent, that is, if the current which the resistor will carry in the circuit is 5 milliamperes make the maximum carrying capacity of it at least 20 milliamperes. This will make ample allowance for errors in the rating and for variations in the load.

Application to Rheostats

The selection of rheostats for the filament circuit of a receiver may be made

(Concluded from page 28)

on the same principles as the selection of any other resistor. The first question to ask is: What current will the rheostat carry? If it is to handle the current of a single tube then the normal filament current of that tube should be used. For example, if the tube is a CX-301-A the current is one-quarter ampere. The next question is to determine what the voltage drop in the rheostat is to be. This naturally involves the voltage of the A battery or other source used for the purpose. Suppose that a standard six volt storage battery is available. Since the voltage required by the tube is five volts and that of the battery is six volts, the drop in the rheostat must be one volt. We then have one volt and one quarter ampere from which to determine the resistance of the rheostat. Ohm's law immediately gives four ohms (1 divided by .25). This is the minimum resistance the rheostat should have. It is well to add several ohms for good measure.

Now if the rheostat is to carry the filament current of two 301-A tubes, or the filament current of a single CX-112 tube, then the current through the resistance will be half an ampere. In this case the minimum fall resistance of the rheostat would have to be only two ohms, but for good measure a few more ohms are included. If the current in the rheostat is one ampere, that is, the filament current of four 301-A tubes, the required resistance is one ohm, since one ohm will cause a drop of one volt when one ampere is flowing. In this case a two or three ohm rheostat would be used in order to allow for some variation.

The question of current carrying capacity also comes in when selecting rheostats. The more current the rheostat is to carry the heavier must be the wire with which it is wound. The limit in the case of ordinary rheostats is low for a given size wire because the wire is usually mounted on an insulator which will not stand a great deal of heat before it begins to melt or soften. But this question has been answered by the manufacturers of the rheostats and will usually take care of itself automatically. It is only when using unusual sources of filament voltage that trouble might arise from the use of an improper rheostat.

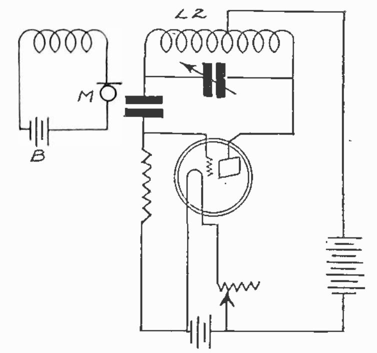
The choice of ballast resistors is exactly the same as the choice of a filament rheostat, except that the exact ohmage is used and nothing is added for good measure. That is, for a single one-quarter ampere tube (e. g. 301-A) on a six volt battery the ballast resistor (e. g., No. 1A Amperite) has a resistance of four ohms.

Tube and Plate Resistor Determine Amplification

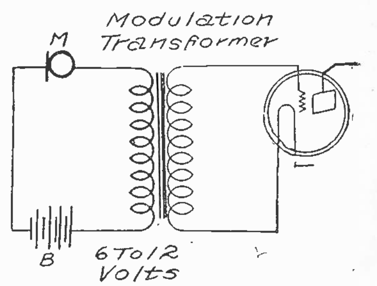
The Higher the Mu of the Bulb the Greater the Volume, While the Coupling Medium Has Same Sort of Effect in Resistance Audio

The amplification obtained with resistance coupling depends on the amplification constant of the tube and on the output or coupling resistance. The higher the mu of the tube the higher the amplification with any one coupling resistance. Also the higher the coupling resistance, within limits, the higher the amplification with any given tube, that is, with mu constant. The plate, grid and filament voltages also affect the amplification to a certain extent, but not very much within usual working limits. To get the maximum volume out of a resistance coupled amplifier, high mu tubes should be used in two stages. The coupling resistor between the detector and the first amplifier should be the highest, and may be as high as 250,000 ohms. The coupling resistor between the first and second amplifier tubes should come next in order of magnitude. The third coupling resistance should be the smallest. The second may be about 150,000 ohms while the third should not exceed 100,000 ohms.

Two Uses for Simple Microphone



A MODULATED oscillator.



HOW to connect to audio input. B is the battery.

(Continued from page 5)

phragm is not vibrating, but as soon as the diaphragm vibrates the deflection on the meter is changed.

If a transformer is used the variation in the current in the primary sets up a varying electromotive force in the secondary, and if this emf, or voltage, is impressed on the grid of a vacuum tube amplifier, speaking against the diaphragm will cause a change in the plate current of the tube, just as any other voltage change on the grid will do.

The diaphragm may be set into vibration by mechanical means just as well as by acoustic means. In other words, it is not necessary to pick up the sound through the air. The diaphragm may be connected directly to the sounding body. For example, if the vibrating string of a violin, or the body of the violin itself, be attached to the diaphragm, the vibrations will be communicated to the carbon and the current in the circuit will be varied in accordance with the vibration of the violin. In the same way, the diaphragm may be connected to an organ pipe for picking up its sound. The coupling medium may be a wire of a string stretched between the microphone and the pipe.

Another way of using the microphone is to couple it with the needle of a phonograph for picking up the sound recorded on the record. The current variations thus obtained may be amplified by any audio frequency amplifier and delivered to a loud speaker for reproduction. This may in some cases improve the quality of the reproduced sound, especially if a high quality amplifier in connection with a cone type loud speaker is used.

Modulating an RF Wave

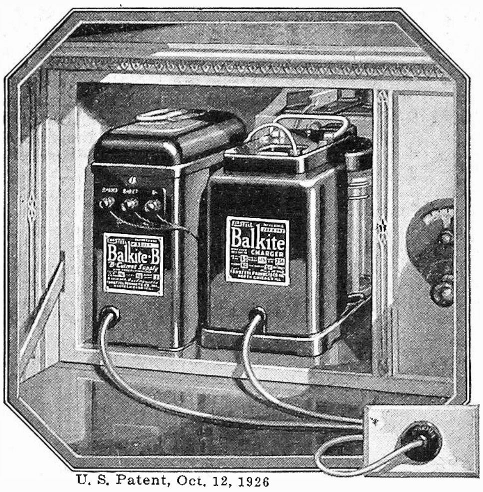
One simple use of the carbon microphone is for the modulation of a radio frequency current in a simple transmitter. One way of doing this is shown on page 30. The oscillator is a typical Hartley circuit in which L2 is the oscillating coil. Coil L1 is a winding of one or two turns of wire on the same form that L2 is wound. It is connected in series with the microphone M and the low voltage battery B. When sound impinges on the microphone button an audio frequency current is set up in L1, and this introduces a variable resistance into the oscillating coil. The amplitude of the oscillations in L2 varies as the intensity of the current in L1. The microphone circuit acts as an absorber of energy from the oscillator. If L2 is also coupled to an antenna, a modulated wave will be radiated.

Rebroadcasts from WCCO Stopped

The National Broadcasting Company, which is controlled by the Radio Corporation of America, the General Electric Company and the Westinghouse Electric and Manufacturing Company, which owns Station WEAF and leases WJZ, recently protested against the rebroadcasting of its programs by way of telephone connection through WCCO, Mnineapolis-St. Paul. The order was immediately heeded by the Program Service Company, which leased the line. According to M. H. Aylesworth, the president of the N. B. C., the Program Service Company was rebroadcasting the WEAF programs by hooking up with special telephone wires, which were leased from the Tri-State Telephone Company of St Paul. Besides WCCO using this line, it was said that 1,000 subscribers paid $5 a month for a loud speaker connection to a special telephone switchboard.

Objections by other stations, using the WEAF chain and paying a handsome sum for such use, was the cause of the action. Mr. Aylesworth denied that the use of its programs was not allowed over this wired wire system, because it interfered with broadcasting. National programs are distributed throughout via land lines to stations contracting with the National Broadcasting Company's service. He stated that the signals "could not be used for profit, either by tapping wires, or by picking up the broadcast."

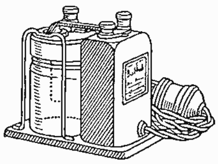
As to the possible "menace" to broadcasting by wired radio, J. D. Ellsworth, assistant vice president of the American Telephone and Telephone Company, said that New York and a great many other sections of the country had no immediate prospect, except through telephone lines. No commercial demand for this type of service had been found to exist, he said.



U. S. Patent, Oct. 12, 1926

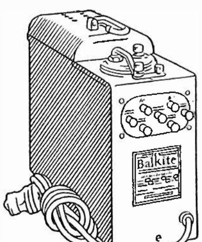
Silent, permanent radio power from the light socket

with Balkite "B" *and the* Balkite Charger



Balkite Trickle Charger

With 6-volt "A" batteries can be left on continuous or trickle charge thus automatically keeping the battery at full power. With 4-volt batteries can be used as an intermittent charger. Or as a trickle charger if a resistance is added. Charging rate about .5 ampere. Price $10. West of Rockies $10.50. (In Canada $15.)



Balkite Combination

When connected to your "A" battery supplies automatic power to both "A" and "B" circuits. Controlled by the filament switch already on your set. Entirely automatic in operation. Will serve any set now using either 4 or 6-volt "A" batteries and requiring not more than 30 milliamperes at 135 volts of "B" current—practically all sets of up to 8 tubes. Price $59.50. (In Canada $83.)

All Balkite Radio Power Units operate from 110-120 volt AC current with models for both 60 and 50 cycles. Also 25-40 cycle model Balkite Charger.

Over 650,000 radio sets are now equipped with Balkite Radio Power Units because they provide silent, infallible, permanent power from the light socket. They are noiseless in operation and can be used during reception. They employ no tubes. They have nothing to wear out or replace, and no dials to complicate tuning. They are built to conform with the Underwriters' Standards. They are based on the same Balkite principle now commonly used in railway signaling, hospital lighting and numerous other systems where power must be infallible.

One way of equipping your radio set with Balkite is to add Balkite "B" and the Balkite Charger. Balkite "B" eliminates "B" batteries entirely and supplies "B" current from the light socket. It is the proved popular "B" power supply. Of the 75,000 now in use, to our knowledge not one has ever worn out. Balkite "B"-W serves sets of 5 tubes or less requiring 67 to 90 volts, Balkite "B"-X sets of up to 135 volts and 8 tubes and Balkite "B"-Y any standard set.

The Balkite Charger, with both high and low charging rates, is a trickle and rapid charger in one. In effect it makes your "A" battery a light socket "A" power supply. Its high rate provides a ready reserve for heavy duty use.

Add these Balkite Units to your radio set now. Then it will always perform at its best. Ask your dealer. *Fansteel Products Co., Inc., North Chicago, Illinois.*

> *The* Balkite
> *Radio Symphony Concerts*
> *with* WALTER DAMROSCH
> *and the New York Symphony*
>
> Every other Saturday Evening a symphony concert. On intervening Saturdays, one of Mr. Damrosch's famous piano recitals on Wagner's great Music Dramas on 13 stations: WEAF, WEEI, WGR, WFI, WCAE, WSAI, WTAM, WWJ, WGN, WCCO, KSD, WDAF, WOC.
>
> *Balkite Hour*
> SATURDAY EVENINGS
> 9 P.M. *Eastern* (8 P.M. *Central*) *Standard Time*

Balkite "B"-W $27.50; "B"-X $42; "B"-Y $69; *Balkite Charger* $19.50, *West of Rockies* $20. *In Canada* "B"-W $39; "B"-X $59.50; "B"-Y $96; *Charger* $27.50.

Balkite
Radio Power Units

THE BALKITE LINE OF ELECTROLYTIC DEVICES IS PROTECTED BY EDGAR W. ENGLE U. S. REISSUE PATENT NO. 16,438, DATED OCT. 12, 1926