SEPT. 18
1926.

TUNING SUPERS EFFICIENTLY

By

Herman Bernard

Reg. U. S. Pat Off.

RADIO WORLD

America's First and Only National Radio Weekly

Vol. 9 No. 26

15 CENTS

Illustrated

THE 1927 VICTOREEN

By

Arthur H. Lynch

THE 1927 VICTOREEN PROVES VERY DELIGHTFUL—LYNCH LAMP SOCKET AMPLIFIER IS AT RIGHT

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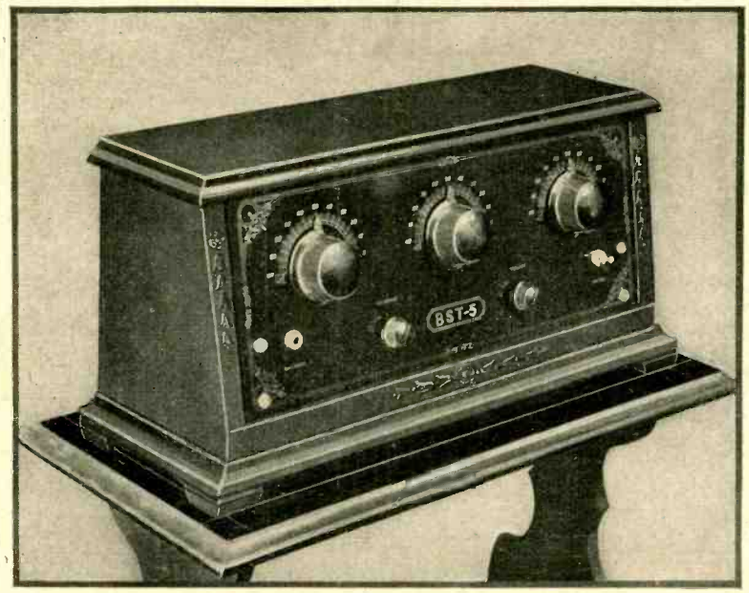

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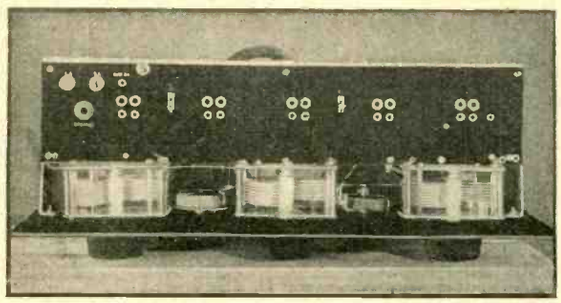
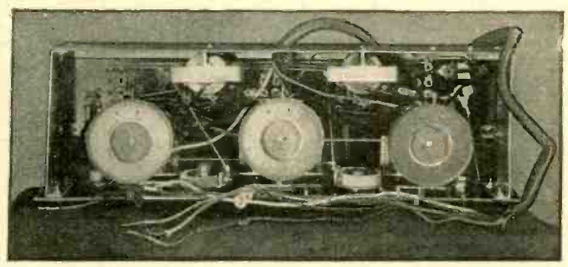


Top inside view showing compact aluminum shielded indestructible chassis.



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Arthur H. Lynch Describes How to Build

THE 1927 VICTOREEN

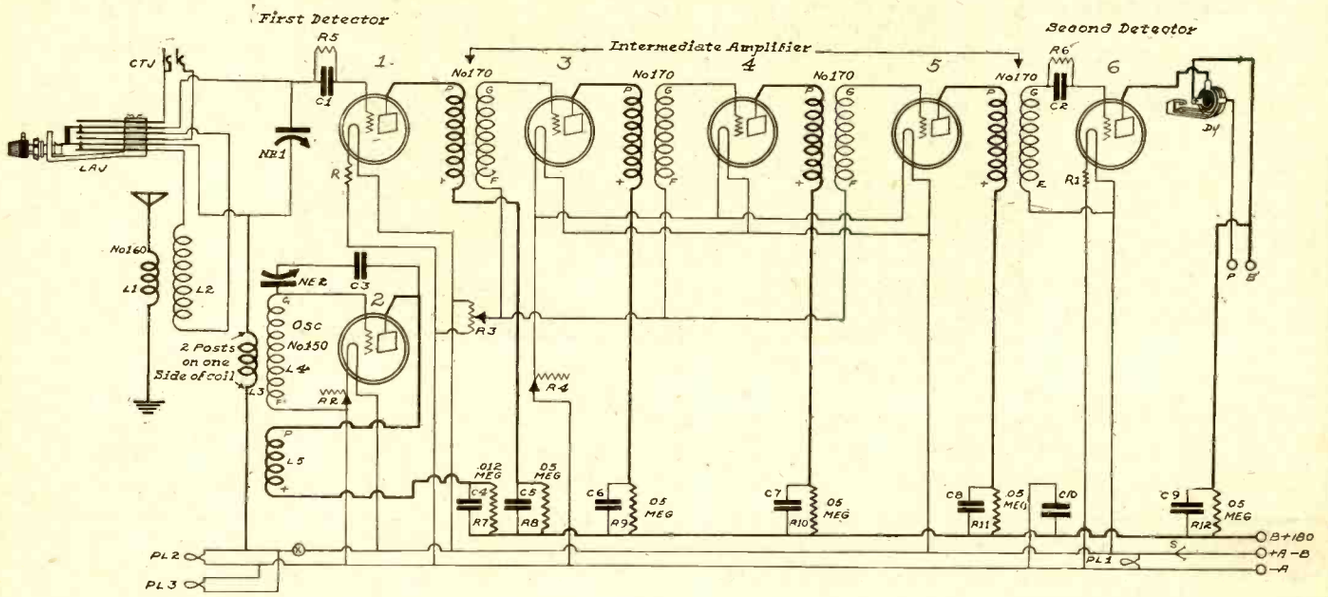


FIG. 1

The 1927 Victoreen as designed by Arthur H. Lynch. The audio amplifier is to be constructed separately.

Construction Advice and Wiring Diagram Published Herewith for First Time in This or Any Other Country—Noted Radio Author and Designer Gives Result of Six Months' Constant Laboratory Experimenting With Remarkable Receiver.

By Arthur H. Lynch

FROM the time Armstrong introduced the Super-Heterodyne in this country and Paul F. Godley used it with such great success in hearing American stations in Scotland, this type of receiver has increased in winning the attention of experimenter, engineer and layman alike. Many variations in the fundamental Super-Heterodyne circuit introduced by Armstrong have been suggested by other engineers from time to time and in many instances they have actually been improvements whereas in other instances they have been nothing more than changes. In casting about for a suitable Super-Heterodyne for use during 1927 and after having looked over the field very thoroughly from almost every angle which must be taken into consideration by the experimenter and home builder, we decided on the use of the Victoreen Kit as the fundamental around which quite a number of new developments have been woven.

Some will wonder how any improvement has been brought about when the fundamental circuit remains the same and the changes are not very material changes. The fact is that the changes have been introduced with two objects in view, more efficient operation being the first and simplicity of operation being the second. It would be hard to find a Super-Heterodyne which has given the home constructor more joy and less trouble than the Victoreen. Many articles describing other types of Super-Heterodyne receivers have been followed by their sponsors with elaborate articles telling how to eliminate the buzz which these receivers develop. In almost every instance, the builder of a Victoreen Super-Heterodyne has been pleased with its performance from the beginning and the ordinary buzz has been noticeably absent.

Several Improvements

We have therefore decided upon a circuit and a group of components which are inherently good, and using these as a basis we have made several improvements which are now possible because of recent developments in connection with vacuum tubes and the application of new uses for fixed metallized resistors.

Because so much has been written concerning the performance of the Super-Heterodyne as well as the theory of its operation, there is little reason for repeating this matter here. The Super-Heterodyne has been in existence for long enough and has performed well enough to require no certain introduction. Therefore we may as well get directly to the problem in hand and consider the changes made in the 1927 model Super-Heterodyne over Super-Heterodynes which have been described hertofore.

In Fig. 1 we have the 1927 model Super-Heterodyne, with audio amplifier omitted, and from the circuit diagram itself it will be seen that very few changes have been made from the established circuit. The principal change comes in con-

Wiring Simplified, Efficiency Improved—High Mu Tubes Used in Intermediate Frequency Amplifier — Established Circuit Retained With Few and Helpful Changes but a Weather Eye Is Kept to Beauty—National Illuminated Dials Help This Considerably.

Simplicity in Whale of a Set

nection with the plate voltage supply of each one of the tubes comprising the six which make up the receiver. It will be seen that in series with each one of the plates of these tubes we have used a fixed resistance shunted by a rather large fixed capacity. The object of the resistance is to enable us to use a single and somewhat high plate voltage which is reduced by the resistance to the desired voltage for each individual plate. The object of a capacity around each of the resistances is to reduce to a minimum the resistance in the alternating current path as indicated in the solid line B in Fig. 2. The direct current follows the path A.

Resistors in B Lead

Let us suppose that we would operate our receiver from one of the Raytheon battery supply devices having an output voltage of something like 180. We know that a voltage as high as that would not do for the first six tubes of a Super-Heterodyne. For this reason some means must be provided for reducing this voltage and the simplest way of doing it is to use in series with the eliminator or current supply device, as it is sometimes called, some form of resistance. If the resistance is mounted directly in the receiver instead of being in the eliminator, as has ordinarily been the custom, it is possible to use a definite resistance value in connection with each tube instead of being confined to the use of a single voltage controlled by a variable resistance in the current supply device itself. This does not mean that the variable resistance in the eliminator is useless. It may be put to real work in connection with and in series with the fixed resistors in the receiver itself, provided of course that the variable resistance is capable of handling the amount of current necessary for supplying the plate of six tubes.

As will be explained a little later on, the choice of the tubes has a great deal to do with the total current consumption and therefore with the amount of current it is necessary for the resistors to carry.

The fixed resistors in series with the plate of each of the tubes may be of the regular metallized core type which will carry a great deal more current than ordinary resistors. If, however, special tubes are used, and in some instances their use is desirable, metallized resistors of the heavy duty type are recommended for this work.

The values recommended for various plate voltages are indicated in Fig. 1. The values of the fixed condensers, C4, C5, C6, C7, C8 and C9, which shunt these resistances, is 1.0 mfd.

Choice of Tubes Important

One of the greatest improvements made in this Super-Heterodyne is obtained by the proper choice of the tubes employed. We have been able to obtain complete satisfaction by using an ordinary 5-volt 201A type for the oscillator, which for the sake of convenience we will call tube No. 2. Tubes No. 1 and No. 6, which are the first and second detectors, may be of the ordinary type but, to have the receiver as sensitive as possible two of the new CeCo detector tubes have been found to give the best result. Other super-sensitive detector tubes have been employed but it was found that their use, although greatly improving the sensitivity of the receiver over ordinary tubes, caused reproduction to suffer because of the accompanying hush or needle scratch with which most of these

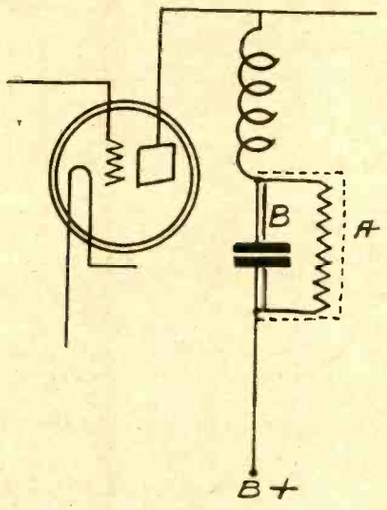


FIG. 2

How the direct and alternating currents go separate paths, "A" being DC.

tubes seem afflicted. When the CeCo special detector tubes were used, it was found that this hush disappeared. Special detector tubes of this type require a greater plate current than is the case when ordinary tubes are used, and for this reason the resistors in series with their plates cannot be of the standard fixed resistor type. They should be fixed metallized resistors of the heavy duty type, capable of carrying from 7 to 8 milliamperes. Of course when the ordinary type tubes are used in these two detector positions, ordinary fixed resistors will be found to function satisfactorily, as they are capable of carrying the necessity current.

The selection of tubes for use in the intermediate frequency amplifier is a matter of some importance. To have the output of the second detector as great as possible it is necessary that the radio frequency amplifier preceding that detector be as sensitive as possible. In the 1927 model Super-Heterodyne this sensitivity is provided by using three CeCo high mu tubes.

Increased Sensitivity

The use of these tubes has the effect of increasing the sensitivity of the receiver by approximately the same amount as would be obtained by the use of ordinary tubes if an additional stage of intermediate frequency amplification were added. Since the power consumed by these tubes is not any greater and in most instances somewhat less than would be the case with ordinary tubes, the advantage gained by their use is very obvious.

In connection with Fig. 1, the value of the grid leaks recommended for use in connection with the first and sixth tubes of the receiver is 10 megohms. This value has been found to function best in connection with the special detector tubes used in these positions. When ordinary detector tubes are used, such as the UX 201A, or CX 301A, these grid leaks may be of any resistance between 2 and 5 megohms, depending more or less on the characteristics of the individual tubes, and the best value is determined by experiment.

The fixed metallized resistors in detector grid circuits do not become noisy after prolonged use nor does the value of their resistance vary, to cause disagreeable noises coming from the receiver which sometimes are mistaken for static.

If the building instructions which follow are carefully carried out, the performance of the 1927 Victoreen Super-Heterodyne in every instance should be approximately the same. The simplicity with which it may be operated is remarkable and the ease with which distant stations are brought in is a matter which has been commented upon very favorably by a number of radio experts who have heard the receiver in operation.

There are a few precautions which may be followed so that the most may be had from a receiver of this kind.

For instance, it was the present au-

LIST OF PARTS

Inductor Unit

One Victoreen antenna coupler, No. 160 (L1L2).
Four Victoreen No. 170 RF transformers (Intermediate Amplifier).
One Victoreen No. 150 coupling unit for oscillator (L3L4L5).

Non-Inductor Unit

Two National equicycle 270 degree variable condensers, .0005 mfd. (NE1, NE2).
Two National velvet vernier illuminated dials, type C, with pilot lamps (PL2, PL3).
One Bruno A battery light switch (S), less pilot lamp (PL1).
Two Lynch metallized resistors, 10 meg each, for grid leaks (R5, R6).
Two Sangamo .00025 mfd. grid condensers with clips (C1, C2).
One Sangamo .006 mfd. fixed condenser (c3).
One .012 meg. Lynch metallized resistor (R7).
Five .05 meg. Lynch metallized resistors (R8, R9, R10, R11, R12)*.
Seven Tobe 1.0 mfd. bypass condensers (C4, C5, C6, C7, C8, C9, C10).
One 30-ohm Victoreen manganin rheostat (R2).
One 20-ohm Victoreen manganin rheostat (R4).
One Victoreen 400-Ohm potentiometer (R3).
Two 1-A Amperites (R. R1).
Six Eby push-type sockets (1, 2, 3, 4, 5, 6).
One Carter No. 6 jack switch, DPDT (LAJ).
One Carter single closed circuit "short" Jack, No. 2A (DJ).
Two Carter IMP cord tip jacks (CTJ).
One 8x22" or 7x21" drilled and decorated Lignole or Bakelite panel, by Century or Insulating Co. of America.
One baseboard, 9" deep.
One pair of Bruno adjustable brackets.
Twelve lengths of Acme Celatsite wire.
Three Eby marked binding posts (A+, B—, A—, B+).

Accessories

One Corbett or Blandin Victoreen cabinet.**
Two Ceco type H special detector tubes (1 and 6); three Ceco high mu tubes, type G (3, 4 and 5; one Ceco type A tube (2).
One Mathieson-Sandberg loop.
One Electrad antenna kit, including aerial wire, insulators, etc.
Sources of A and B current.
Lugs, nuts, solder, screws, etc.

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

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

B Leads Reduced to One

Where to Send Questions

ALL questions regarding the 1927 Victoreen, or any adjunct used therewith, such as the audio amplifier and B eliminator (known as the Lynch Light Socket Amplifier) or the A battery eliminator, as well as all questions on trade aspects, should be addressed to Victoreen Editor, RADIO WORLD, *145 West Forty-fifth Street, New York, N. Y.*

thor's unhappy experience to turn the filament voltage on the three intermediate frequency amplifier tubes too high and he spent a rather unhappy half hour trying to locate the trouble. The wiring seemed to be without flaw.

The connections to the A and B batteries seemed to be perfect. The loop seemed to be connected in the proper place but no signals could be heard. Most receivers will perform in a satisfactory fashion when the rheostates are turned about three-quarters of the way on, and where no meters are provided in the circuit preliminary tests are generally made with the rheostat in about that position.

In connection with this particular receiver and in connection with the radio frequency or intermediate frequency amplifier of this receiver, it was found that the rheostat should be just about one-quarter of the way on. When this change was made, everything was satisfactory.

Set Is Not Critical

From this the conclusion must not be drawn that the receiver is critical in operation. It is not. The proper regulation of the rheostat is a very simple matter. Under normal operating conditions it will be found that all three rheostats will run about in the same position.

For a given plate voltage it will be found that a given filament current will be required to give the best results. For instance, if the voltage on the plate of the two detector tubes, No. 1 and No. 6, is increased by cutting down the resistance of the resistors in series with these plates, it will be necessary to turn the detector filament rheostat slightly to the right. Where the plate voltage on the intermediate frequency amplifier is similarly increased, it will be found that the filament current should also be increased and greater volume may be obtained by also turning the volume control —potentiometer for regulating the grid bias on the intermediate frequency amplifier tube—to the right.

Tubes Govern Resistance

The value of the plate resistors depends more or less on the type of tubes used. In most of the writer's experiments CeCo tubes have been employed and he has used the type A, which is equivalent to a 201A or similar tube, type G, which is a 20 mu tube and type H, which is a special detector tube and is much more sensitive than the ordinary detector tube.

An A type tube is used for the oscillator (tube 2). Where the plate supply of this oscillator is fed from the Lynch B Supply, the resistance in series with the plate should be in the neighborhood of .012, although the receiver has been found to function satisfactorily with resistors ranging as high as .07. Where type A tubes are used for the detector, that is tubes 1 and tube 6, one of the standard metallized resistors of a value between .03 and .06 has been found most satisfactory, and the grid leaks used in connection with both these detector tubes may be anywhere from 5 to 10 megohms. On weak signals, it has been found most satisfactory to use 10 meg.

Special Detector Tubes.

Where the special detector tube of the 200A or 300A, or CeCo type H is used, the plate resister used in connection with tubes 1 and tube 6 should be of the heavy duty type, capable of carrying at least 6 milliamperes because detector tubes of this character require a greater current in their plate circuit than ordinary type tubes, and the ordinary type of resistor will not carry sufficient current to function satisfactorily with them, so substitution is necessary. Where the CeCo type G or other high mu tubes are used in the intermediate frequency amplifier, that is tubes), 4, and 5, the effect of using two super-sensitive detector tubes is not very apparent on local stations, but where distance stations are being received the effect is very pronounced.

In operating the new receiver, it will be found that the rheostat R4 controlling the intermediate frequency amplifier and the potentiometer R3 controlling the grid bias on the intermediate frequency tubes must be varied in rather close relation with each other. This is, if the filament current is increased by rotating the rheostat to the right, it will be found that most satisfactory operation will be had by turning the grid bias potentiometer to the right.

For any given plate voltage and its proper filament current on the radio frequency amplifier it will be found after a certain volume has been reached by turning up on the volume control further movement of this control to the right will not provide increased volume. There is a limit beyond which the volume, instead of being increased, will decrease quite rapidly.

Dials Tune Alike

The new type C dials developed by the National Company of Cambridge, Mass., are used to great advantage in this receiver. These dials are provided with a small light, mounted behind the panel, and the lighting effect is of the pleasing indirect character, now so popular on the dashboards of cars. The velvet vernier action has been improved, as has the variable ratio arrangement, the two original refinements which has made the dials so popular. Then, too, they are extremely easy to mount and they make fitting additions to any receiver de luxe.

It will be found that the oscillator dial and the loop tuning dial will hold approximately the same position for given stations if the loop used has been designed for use with a .0005 variable condenser. On strong signals it will be found that an additional place on the oscillator dial will also be found where a given station will come in. This second setting of the oscillator dial will be somewhat below the first setting. This does not correspond to the second harmonic of the wave of the transmitting station, as one may suppose, but is due to the use of the higher, instead of the lower, oscillator frequency to beat with the signal frequency for production of the difference or intermediate frequency. To have as great a range as possible over the existing band of broadcast wavelengths, the author has selected for use in connection with this receiver the National Equicycle variable condensers with National illuminated velvet vernier dials. This combination provides convenience and beauty in the appearance of the receiver and spreads the wave band in a straight line over 270 degrees on the dial instead of over 180, which is the case when ordinary straight line frequency condensers are used.

Parts Carefully Chosen

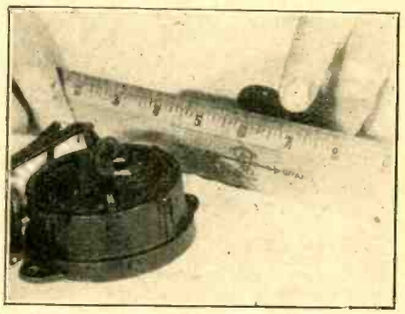
Aside from these improvements little need be said to the experienced home constructor or experimenter

To provide the home constructor with a receiver which would fit in almost any type of cabinet the author has selected the Bruno adjustable bracket because the panel may then be set at any angle to fit the particular cabinet available to the constructor.

[In the September 11 issue of RADIO WORLD *was published an article describing generally the features embodied in the 1927 Victoreen, a 6-tube Super-Heterodyne, up to and including the second detector. Also in that article the Lynch Lamp Socket Amplifier with B eliminator, was touched on. The series of articles consists of five. The one last week was the first and comprised a general summary. This week the 1927 Victoreen is described. Next week Arthur H. Lynch's article in this series will deal with the Lynch Lamp Socket Amplifier. It is an amplifier because of the three expertly designed stages of audio frequency amplification embodied therein. The "lamp socket" part of the title well conveys the idea that a B eliminator is embodied. This supplies all B current not only to the three amplifier tubes but to the Victoreen set as well. Besides, the last audio tube's filament is heated by AC from the lamp socket source, from an extra winding on the National Power Transformer. And that's not all. The 40-volt negative bias for the last audio tube (CX371) is obtained from the eliminator. So that's next week's article (September 25.) In the following week's issue (October 2) novel means of using available manufactured products in the set and in the Lynch Lamp Socket Amplifier will be discussed, and will be freely illustrated. The October 9 issue will show how the set may be operated directly from the lamp socket (AC), without use of batteries. As you may imagine, the A battery eliminator problem has been solved. Keep in mind, too, that the eliminators and the audio amplifier may be used in conjunction with any other good receiver. Don't miss a single one of Mr. Lynch's superb articles!]*

1927 Victoreen photos next week

SPEAKER CURE



(Hayden)

BY PLACING the diaphragm of your phones against the edge of a ruler, it is possible to note if the metal is bent. This is the cause of distortion and poor volume output. By replacing the diaphragm the other way around, or after flattening it out, original good results will follow.

Super-Heterodyne Tuning

How to Gain an Advantage from the Repeat Tuning Points on the Oscillator — Some Distant Stations Come in at One of the Alternate Positions and Not at the Other — Second Harmonic Does Not Figure In This Phenomenon

By Herman Bernard
Associate, Institute of Radio Engineers

ONE of the simplest sets in the world to tune is the Super-Heterodyne. It has only two tuning controls, and if each dial is worked by one hand you will have no trouble at all in tuning in stations all over the country.

As for dial manipulation, the Super-Heterodyne differs from any other two-control set only in the fact that some stations may be brought in at repeat points on the oscillator dial. Theoretically this repeat system should be applicable to all stations, but the fact that such is not true in practice proves that under some circumstances one oscillator dial setting is more efficient than the other. Hence the repeat points may be regarded as advantageous, because on faint signals either the higher dial reading or the lower one, on the oscillator tuning control, will result in increased sensitivity. Just why this should be so is a subject of debate. It is one of the phenomena of Super-Heterodyne operation.

Two Ways to Beat

The reason why from theoretical considerations alone any station might be expected to come in at repeat points on the oscillator is that there are two ways of establishing the intermediate frequency which is to be amplified in the intermediate channel.

While this amplifier is not very sharply tuned it is not broad enough to admit any wide band of frequencies. In the most effective types of Super-Heterodyne, as for example the 1927 Victoreen, the intermediate amplifier is peaked at about 3,400 meters, although not sharply so, for if it were exclusive of adjoining frequencies it would cut the side bands which represent the variations of the original radio wave caused by imposing the audio fluctuations upon it. The Victoreen intermediate channel passes all useful side bands, that is, all frequencies above and below the intermediate frequency that could possibly actuate a speaker.

The two ways of establishing the intermediate frequency are by having an oscillator frequency that is higher than that of the modulator or first detector frequency, to the extent of the intermediate frequency, and a frequency that is equally lower than that of the modulator frequency.

A Concrete Case

Assuming that the intermediate channel is 10,000 meters, just to make the arithmetic easier, you would therefore have a frequency equal to (300,000 kilometers, the speed of light and of the radio wave, divided by the length of the wave in meters, i. e., 10,000) or a frequency of 30,000 cycles (30 kc.) The modulator dial at left, tuned to the frequency of the broadcast station, may be anything from 500 kc to 1,500 kc, and it is obvious that any setting of the modulator dial will be resonant with a frequency vastly too high to pass through the intermediate amplifier. Indeed, the lowest broadcast frequency would be about twenty times too high, compared with the frequency of the intermediate amplifier. Therefore we must use some system of changing the original or signal frequency. This we do by means of the oscillator. We set up what amounts to a minature transmitter and we couple it inductively to the grid circuit of the modulator or first detector tube. What is the result? The oscillator tube is hooked up to a tuning system of its own. The variable condenser, in conjunction with the secondary of the oscillator coil, permits the generation of frequencies near those of the broadcast station, and by mixing the one frequency (the station frequency tuned in by the modulator) with the other frequency (that generated by the oscillator) we get a frequency equal to the difference between the two.

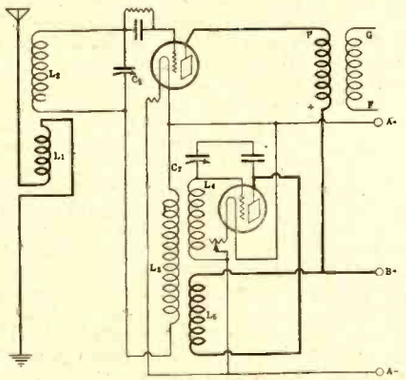


FIG. 1

L2 is hooked up to the modulator tube and L4 to the Oscillator tube. C1L2 is tuned to the station's frequency and C2L4 to a frequency differing from the station frequency by the intermediate frequency. L3 is common to both circuits.

Example in Beating

Taking another concrete example, if we tune in on the modulator a broadcast station operating on 300 meters, which is 1,000,000 cycles or 1,000 kc, we must mix with that frequency an oscillatory or regenerating current that differs from 1,000 kc by 30 kc to develop a frequency that will pass through the intermediate channel and be properly amplified therein. Now, as it is obvious that what we desire to establish is a difference between the modulator and the oscillator frequencies, we naturally come to the conclusion we can have the oscillator frequency either higher or lower than the modulator frequency, e. g., the oscillator may be tuned to 1,030,000 cycles (1,030 kc) or to 970,000 cycles (970 kc). In either instance the difference between the two is 30,000 cycles, (30 kc), hence the very intermediate frequency desired for enabling proper response in the intermediate amplifier.

The process of combining the two frequencies is called "mixing" and the resultant intermediate frequency is called a "beat frequency" because it is obtained by beating the one frequency against the other. It is not a "beat note," since the intermediate frequency is a radio or inaudible frequency.

Not Second Harmonics

Therefore the repeat points on the oscillator dial have nothing to do with second harmonics, which are multiples of stated frequencies, or fractions of stated wavelengths. While for a part of the broadcast range it is possible to reach the second harmonic by the conventional tuning system (since 1,500,000 cycles is more than twice 500,000 cycles, or since 200 meters is less than half of 600 meters), it is never possible to establish the necessary intermediate frequency by beating the oscillator's second harmonic with the fundamental of the station frequency, because the intermediate amplifier will not respond to the resultant frequency, which is entirely too high. For example, if a station has a frequency of 750,000 cycles, (wavelength 400 meters) and the second harmonic of that frequency, let us say for convenience, is utilized on the oscillator, then the oscillator would be tuned to 1,500,000 cycles (wavelength 200 meters), a difference of 750,000 cycles, or 750 kc, as compared with the desired 30 kc in the instance previously taken for granted.

Now, 750,000 cycles would have no more effect on an intermediate amplifier tuned to 30,000 cycles than an ordinary receiver would have on a 600-meter station when the set was tuned to 300 meters.

The Real Second Harmonic

Therefore the second harmonic explanation, often given, is erroneous. There is such a thing as a second harmonic Super-Heterodyne, but it has an intermediate channel of a frequency that will pass the beat frequency resulting from mixing the fundamental station frequency with the second harmonic of the oscillator. Under this system the repeat tuning on the oscillator does not take place.

To derive the benefit of the repeat system it is advisable to pay strict attention to the tuning in of weak signals, and this means distant stations exclusively. As for local stations, or generally any stations within a few hundred miles by air line, it will make little or no difference which oscillator position you use, because you get all the volume you need or desire in either case. But when you are tuning in a station that is a few thousand miles away you should pay strict regard to the results.

First, of course, you will tune in the station and that will disclose to you that it can be brought in well at the particular oscillator dial setting that is established at the moment. Now the question arises as to whether you can get better sensitivity, hence more volume and clarity, by using the alternative oscillator dial setting, or whether it is possible to bring in the station at all when using the alternate. Keep a log sheet, record the dial settings, and make notation on distant stations only as to which oscillator setting is preferable for that particular station. You will find, as a rule, that a given standard may be followed, because, for instance, the lower dial readings on the oscillator will produce superior results. This means you are using a lower wavelength on the oscillator than on the modulator or station wavelength, hence a higher frequency.

The Log Sheet

To carry on this work properly it is necessary to have four ruled columns. In the first column, at left, will be the station's call letters and wavelength. In the next column will be the setting of the

Chart Helps You With DX

Difference Between the Modulator and the Oscillator is the Frequency Of the Intermediate Channel — All Super-Heterodynes Except One Utilize the Difference Method, as the Other Runs Into Ultra-Frequencies — Helpful Hints on Bias, Volume Control and Filament Heating

modulator dial, which will always be the same for the same wavelength or frequency, in conjunction with a given inductance. In the third column will be the oscillator dial setting for all stations received strongly, meaning locals or semi-distant stations, while the far-distant stations usually will have their preferable oscillator setting in the same column as the locals. But on distant stations, if the signal is heard at two oscillator positions, then record in the third column the one that gives the better response, rubbing out a previous notation in that column, if one existed. Then in the fourth column write the less efficient oscillator dial reading, or, if the station can not be brought in alternately, then make some such record of that in the fourth column. If the station comes in poorly or not at all on an alternate oscillator setting I usually write "N. G." in the fourth column.

Great for DX Work

This understanding of oscillator tuning is valuable, but one may derive keen enjoyment from a Super-Heterodyne even without paying any regard to it. The Super-Heterodyne is a popular receiver in the family, no less than in the laboratory, because of the great sensitivity combined with tuning simplicity, and these prevail at all hazards. It is only the experimenter, most keenly desirous of tuning in stations all over North America, and even receiving foreign countries, who will want to pay attention to the benefits that may be enjoyed from an understanding of the oscillator tuning option.

Every Super-Heterodyne should be equipped with some sort of volume control, because of the great amplification that precedes the second detector. Often the output of this tube is strong enough to operate local stations on a speaker, without any audio frequency amplification as such. It must be understood that as the power is being developed in successive stages of radio frequency amplification the modulated wave is being amplified, first at the original frequency in one stage (for the modulator is like a stage of tuned RF), and then at the intermediate frequency in the 4-tube chain. This amplifier bestows its tremendous magnifying faculties upon the frequency it receives. Even in the detector itself amplification takes place, the output being approximately the square of the input.

Volume Increased Via RF

All this amounts to the building up of the variations imposed on the original carrier wave and later on the local carrier wave or intermediate wave, and develops the voltage of the wave, in each case, in its entirety, with the so-called audio imprint on it, too. Hence the amplification at radio frequencies not only adds to sensitivity but builds up the volume, because the amplitude of the wave is increased as a unit, audio imprint and all.

From this it is easy to deduce that the intermediate frequency is a modulated carrier wave, just the same in nature as the wave sent out from the station, and differing from it only in frequency.

Bias and Filaments

Hence as a radio amplifying agency the first tube alone, or modulator, or first detector, whatever you may call it, has a rising characteristic, that is, the greater the frequency, the greater the amplification. This is only one stage out of five, hence uniform energy transfer and amplification at this one point are not necessary. The intermediate channel amplifies equally, because it amplifies at only one frequency. Where four out of five stages amplify uniformly, and where about 95 per cent. of the amplification is in that uniform channel, you have a receiver that gives to the ear equal volume at all broadcast frequencies, other factors, like transmitting power, distance, etc., being equal.

But to obtain full efficiency from the intermediate channel it is necessary to have the correct bias on the grids of these tubes and also to heat the filaments at the proper corresponding temperatures. The bias question is solved by the potentiometer, which is used as the volume control, while a single rheostat governing the three intermediate amplifying tubes gives the correct filament heating. On distant stations it may be advisable for greatest response to alter the filament heating of the intermediate amplifying tubes, or even to adjust the oscillator tube's filament heating, but for local reception these need not be touched.

The two detector tubes, that is, modulator and the so-called second detector, need no rheostat, although if you have a rheostat you may operate the filaments of both from the same rheostat. Otherwise use an Amperite in series with the negative leg of each of these "detector" tubes.

The "First Detector"

In point of fact perhaps it is not true to call the tube the first detector, since this is the tube where the mixing occurs, and is really a modulator tube. Because the hookup is the same as for detection this tube has been called the first detector, but if you put a pair of phones in series with its plate circuit, while the oscillator is going, you would not hear anything, so it is doubly hard to understand where the detection comes in. A theory I heard is that the station's wave is rectified and the resulting pulsating direct current is impressed on the intermediate frequency or carrier in the plate circuit of that tube. But that is not what happens, since the grid modulation system is used in nearly all Super-Heterodynes, including the Victoreen, and it is the station's modulated carrier that is mixed with the oscillator frequency, the result being the modulated intermediate frequency.

All Super-Heterodynes, except one, use the difference frequency for intermediate amplification. Besides this frequency any mixing process produces another frequency, equal to the sum of the two frequencies. Naturally this is a very high frequency, around 3,000,000 cycles. No single channel can utilize both (the sum and either of the differences.)

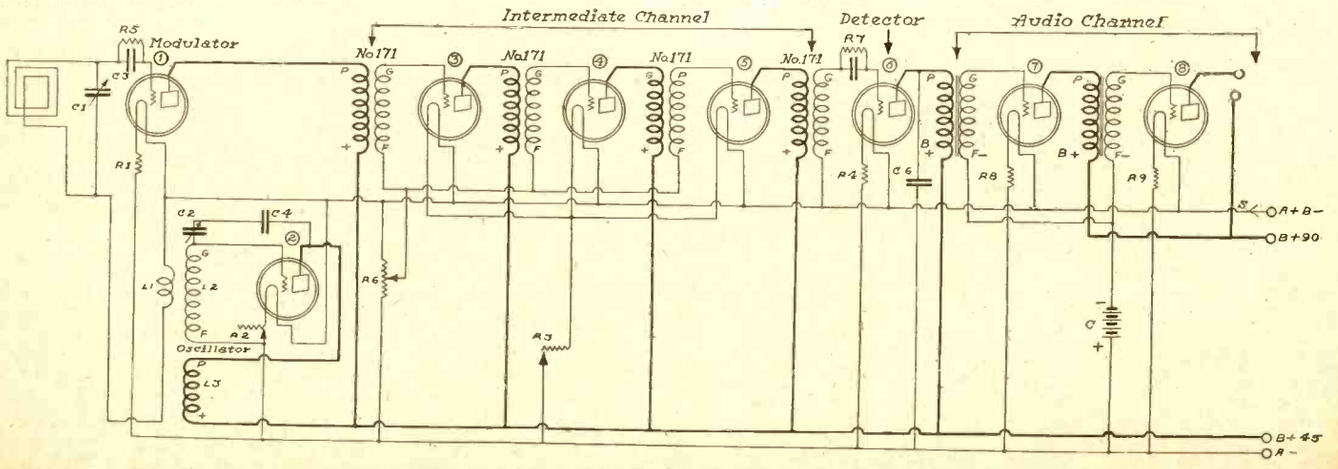


FIG. 2

Last year's model Victoreen, usually built for a 7x24" or 7x26" cabinet installation. This year's model is a radio receiver without audio, which is independently constructed so any audio option may be adopted.

Draperies Help Speaker

Horn or Cone Functions Best When Placed in Proper Acoustic Position —Extension Affords Freedom of Location

By Ernest Snider

A GREAT deal of discussion takes place on the subject of circuits. So rapid is circuit information available that perhaps we have missed or else forgotten to investigate what happens when we look from our last stage of audio frequency into the loud speaker.

To many who are well trained in radio circuit workings, a mental picture ever must be present of the over-eager radio fan assembling and reassembling his equipment to keep pace with all the circuits published.

Radio will find a place with all the family when the majority of experimenters discover that the radio frequency waves, collected by the aerial or loop, cannot be educated to pass through vacuum tubes two and three times and still maintain the quality of transmission sent out from the broadcasting stations.

Retaining Quality

A problem confronts thousands of radio users, and that is, when they plug into the detector jack of their set with the head phones, the quality seems perfect, but when the loud speaker is plugged into the last stage, quality may be ruined, and tinny rasping frequencies are injected into speech and music. It is also well known that many of our eminent radio critics are compelled to glue themselves to the ear-muffs, in order to survey the programs intelligently.

The most common cause for the failure of the transmitted frequencies to get through into the loud speaker is overloading of the tubes.

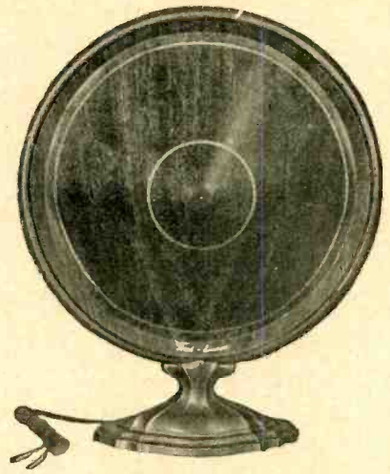
In the regenerative tuner, one of the principal causes of overloading of the tubes is likely to be brought about by excessive regeneration, with the operator adjusting the feedback coils to a point where the greatest volume is obtained. In the minds of many radio fans there exists a misplaced conception of their two stages of audio frequency following the regenerative detector. In other words, they expect the volume output of this equipment to equal that of an electric piano or phonograph with a loud needle.

Tube Has Limit

This is a great mistake and is piling up more trouble than the tubes will stand, and furthermore, there is no commercial receiving tube on the market which will handle that amount of volume without distortion, and by that I mean no matter how many tubes are utilized in any circuit there is a limit to the output of the last tube, when faithful reproduction of speech and music is desired.

This condition has been thoroughly investigated by engineers long ago, and was the only reason for the design of push-pull amplifier, which makes use of two tubes instead of one working into the loud speaker, each tube carrying half of the output load.

In receivers with tuned radio frequency stages the causes of overloading are mostly found in the type where no neutralization exists, and each stage is tuned



WHERE should you place your speaker?

to a point where the tube commences to over-oscillate, and quite frequently to an amplification point where the whole circuit is set into over-oscillation. A potentiometer often is used to prevent howling.

While this is one of the most sensitive detecting circuits in expert hands, the novice is likely to make too frequent use of his potentiometer, which will quickly overload the detector tube, causing a corresponding overload in both the audio frequency stages.

Neutralization of stages prevents overloading of the detector, as the losses sustained by this method are profitably suffered, but here other causes will have the same effect. For instance, using two transformers with high ratio windings will overload the last tube, and in many cases, one high ratio transformer followed by one with a lower ratio will produce trouble for the last tube, if the detecting portion of the circuit is efficient.

A good many devices have been recommended for this trouble, and the most popular seems to be a resistance shunted across the secondary of the last transformer, which somewhat decreases its efficiency.

Since the transformer is already there, we may use it to a better advantage from a quality standpoint, and instead of decreasing its usefulness, we may arrange a high quality stage of impedance coupling, by connecting the primary and secondary windings in series-aiding. The only extra equipment required will be a .25 mfd. condenser and a 50,000 ohm resistance.

Increased Plate Flow

The impedance coupled stage will be found in every handbook of radio and circuits, but the values of resistance and capacity should be the same, as stated above, for 201A and 301A type tubes. Volume may not be so great, but this arrangement will permit the increasing of the detector gain without sacrificing quality.

My personal opinion is that one transformer couple stage of audio frequency should be the limit for any radio set designed to produce high quality, and either resistance or inductively coupled stages should follow, even if an extra tube is required, for the addition is well worth while, if the broadcasting programs are to be enjoyed.

With the impedance couple stage of audio frequency, the resistance value will be somewhere near 7,000 ohms, permitting about 15 milliamperes to flow into the plate of the tube. However, we get only the amplification of the tube itself in resistance and impedance coupled stages, no voltage increase being obtained, thus keeping all transmitted characteristics constant through all the band of frequencies.

The commercially made sets of today have been greatly improved from a quality standpoint by the matching of transformers with equal amplification characteristics, and more attention given to the frequency ranges rather than the high voltage gain, so if owners of these sets follow out the manufacturers instructions carefully, with regard to the B battery voltage, no overloading should take place, and if piano frequencies are reproduced with hollow sounds, the troubles lie elsewhere—principally in the loud speaker.

I made numerous experiments on quality reproduction, taking as a basis the various acoustic properties of the average room, and knowing full well that the receiver was producing good quality up to the last output jack.

I was attracted by the offering of the De Luxe Extension Cord and connector, one of which was obtained in order to place the loud speaker at different positions around the room. I had used previously only the five feet of cord supplied with every speaker, and the horn was near the cabinet.

Got Cross-Talk

In the early part of the experiment it was found that this arrangement was faulty, as the coils of the loud speaker, being in close proximity to the receiver, would produce a cross-talk effect, and this was more noticeable in the metal diaphram type of speaker. Its presence also was noticed in the armature type, with perhaps a little less effect.

When the extension cord was connected to the set the volume dropped only slightly and transmission came through with more tone quality than we had expected. This was due to the slight capacity of the 30 ft. of braided wires, which rounded off the wave-shape of the output current, cutting off the unnecessary peaks, and acting as a by-pass condenser, preventing stray radio frequency currents passing through the loud speaker coils.

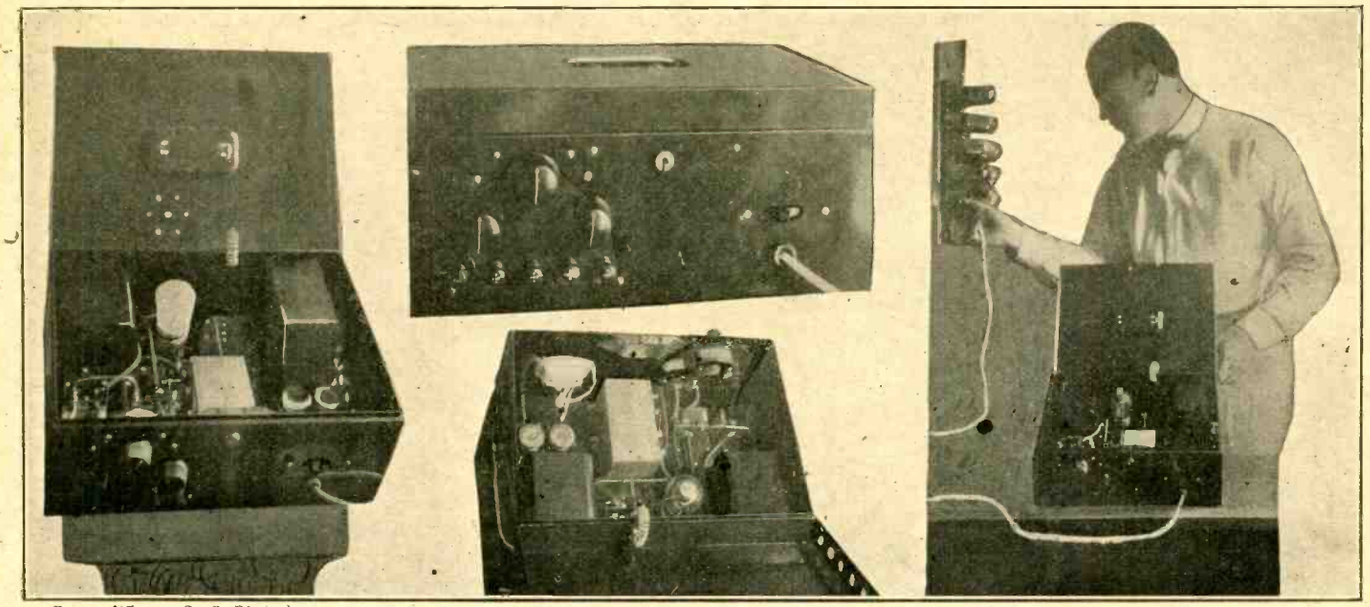
The horn was then taken into an adjoining room away from the radio set, this room being heavily carpeted and thickly draped with portieres. The room, being free from echoes, produced speech and music with a refinement comparable to the acoustics of the concert hall.

Puts Speaker Near Draperies

The loud speaker was placed in different positions around the room, to determine if the acoustic properties were equal, but it was found that the best results were obtained when the loud speaker was set up anywhere near hanging draperies. This arrangement perhaps is not conveniently adapted to every room, but it was also found that when the loud speaker was placed on the rug well away from the radio set, a pleasing tone quality was obtained.

The most peculiar results were experienced when the speaker was hidden, and this was done between double portieres. The effect may have been merly imaginary, but the quality of sound, especially speech and orchestral music, would seem subdued, and the effect analagous to the mysteries of the conjuror's platform. This effect has made so deep an impression on many visitors that the scheme has been adopted in their homes with marked success, while a good many unsightly horns have been hidden away in places where they rightly belong.

Eliminator in a Cash Box



(RADIO WORLD *Staff Photos*)

FIGS. 1, 2, 3 AND 4.

TO THE left is a three-quarter view of the completed Cash Box B eliminator. The air holes for the tube can be clearly seen, right above the top of the tube. In the center top, is a front panel view, showing the resistors, binding posts, toggle switch, keyhole and electric cord. At the bottom is a top view. Note the flexible lead. This is to insure contact between cover and box, for grounding both. At right a photograph shows the input plug being connected to a socket of the AC line.

Compactness and Security Obtained—Special Slot Is Cut Out of Front and a Hard Rubber or Bakelite Panel Used for Mounting Resistors and Switch

By Paul R. Fernald

FOLLOWING the electrical data and the circuit diagram, shown in Fig. 5 of the B eliminator, using the Raytheon tube, as described by H. G. Silberdorff in the June 26 issue of RADIO WORLD, Frederick C. Lanz of 281 Wadsworth Ave., N. Y. City, constructed it in a Samson steel cash box, as shown in the photographs.

The box, which is 13½ x 9¼ x 6", provides an excellent means of grounding, and is very compact. There is plenty of space in the box for each item, facilitating the wiring. Since the tube generates heat, small holes are drilled directly over the top. This allows air to seep in, keeping the tube cool, and also the condensers, which are close by. A built in handle at the top makes the entire case portable.

Three variable voltages, detector, intermediate amplifier and high voltage amplifier are obtainable through resistors. A single pole toggle switch connects and disconnects the line. The line cord is connected through the front of the case.

So that no one may tamper with the internal wiring or units, the case may be locked. Fuses protect the line from a blow out, in case the condensers, chokes or transformer are shorted. The fuses are in the right-hand portion of the case, with the transformer directly in back of it. The tube socket is adjacent to the filter choke unit. The positions of the other units may be clearly noted from the photographs.

The variable rheostats and binding posts are mounted on a piece of hard rubber, not directly on the panel. This is to prevent a possible short circuit. Holes are drilled both on the cover and at the bottom, to allow air to enter, to keep condensers, chokes, etc., cool, as a further preventative from blowout or short circuit. At the bottom of the case, on both sides, "domes of silence," such as are used under the chairs and table legs, are placed. This is to prevent scratching of a surface, and also to keep the receiver further from being affected by the vibrations of the eliminator, if the two are located near each other.

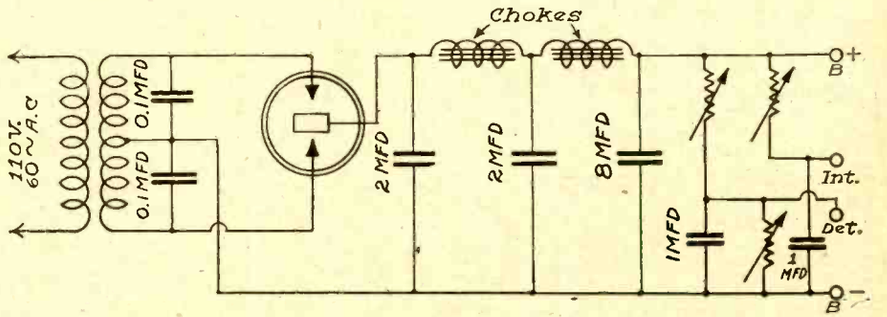


FIG. 5

The circuit diagram of the B eliminator, built in a cash box. The eliminator passes 40 milliamperes at 135 volts.

New Wave Meter, 14 to 224 Meters

In keeping with the General Radio policy of introducing the latest in precision apparatus for radio amateurs and scientists that organization has recently announced the introduction of a new type amateur wave meter. Type 358 wave meter is particularly designed for amateur and experimental use and covers the wavelength range from 14 to 224 meters. It is believed this is the first general offering of a wave meter that records waves of less than one hundred meters at a price anywhere within the reach of the average experimental operator. With the present much accentuated interest in changes of wavelength, broadcasters throughout the United States are perhaps today paying more attention to sharpness of broadcasting and trueness to wavelength than ever before. To shove another broadcasting station in between those now operating in the larger cities requires some rather accurate transmission. Listeners have given more attention to sharp transmission than ever before and it has been unfortunate in a number of instances that on their first ventures on new waves some broadcasters for a few nights have found it difficult to stay on the wave chosen.

In an entirely different field radio transmitters are tuned as sharply as in the broadcasting field and amateur radio operators who use the low waves down below broadcasting find as much difficulty in keeping their stations on their selected and assigned waves as do their broadcasting companions on the higher waves.

RADIO RATES FOR MUSIC

The fees charged by the Society of Composers, Authors and Publishers for use of the repertoire of its members in broadcast program range from $250 to $2,500 per annum. For strictly "advertising" programs, if the music of its members is used, it charges an average fee of $20 per hour.

How Radio Receivers Work

Use of Radio Frequency And Audio Frequency Amplification in Conjunction With a Detector Is Explained for the Novice—Main Purpose Is to Build Up Weak Signals so They May be Heard on Speaker

By R. M. Klein

HOW does a radio set work? Let us keep off all technical language and treat this in simple everyday English with no further entrance into mathematics than the plain two-times-two, which everybody can comprehend.

Before radio became "complicated" we used to speak of a "detector" and that's just where we want to start right now if we want to get a good mental picture of what a radio set does.

A detector is generally some kind of a tube, so let's just call it that—a tube.

This tube, broadly speaking, causes an inaudible signal to become audible. It changes an alternating current incoming signal to a direct current signal, pulsating, but direct current, nevertheless.

Detector Aids Speaker

The modern apparatus for reproducing broadcasting, known as a loud speaker, or a horn, or a cone, will respond to direct current impulses, but it will not respond to alternating current impulses. Therefore, a detector is used to permit the horn, or whatever we may call our reproducing device, to give audible signals.

Before this detector can work, however, it must have something to work on. If you wish to convert a dollar bill into four quarters, you cannot get your four quarters until you have your dollar bill, and it must be a full dollar to entitle you to the four quarters because the four quarters are worth a dollar. You could not expect anybody to give your four quarters for 98c.

Now a somewhat similar situation exists as regards this detector. It must have an incoming signal of a certain strength before it will act.

Suppose you are near a powerful broadcasting station and that you have a good aerial. Under these conditions your detector would get enough signal strength from the aerial to permit it to act. It can detect. Your signal strength is of the full dollar value, so to speak.

But suppose you are at a distance somewhat remote from the broadcasting station, and your aerial will not give you "full dollar" signal. Then you have to increase the value of this signal before it is strong enough to make the detector respond.

Use of RF Amplication

There is only one way you can increase this signal, and that is by means of radio frequency amplification.

How do you accomplish this radio frequency amplication?

Here again you make use of a tube. It is true the tube may be constructed differently internally than the detector tube, or may be the same kind of tube as the detector tube but with different connections to its terminals, but for our purpose let us consider it as just a tube, nevertheless.

Now, this tube when properly connected in the radio frequency end of the receiver, will materially increase the signal strength which comes down the antenna. It will not convert it from alternating current to direct current as the detector tube does, but it will merely convert it from alternating current value of a low degree to alternating current value of a high degree.

So we take the signal which comes down the antenna, and which is of very low value, and put it through this radio frequency tube, which will build it up to such value that when placed into the detector tube it will enable the detector tube to convert it from alternating current into direct current.

Suppose now you are still farther away from the broadcasting station, or the broadcasting station is very weak, and the signal it sends down your antenna even when increased by the multiplying value of this radio frequency tube is still too weak to cause the detector to respond. What are you going to do?

That is perfectly simple. All you do is to use another radio frequency tube.

Theoretically you may continue along these lines indefinitely, and have three, four, five, six or even more stages of radio frequency, each amplifying its signal to a certain extent, with the result that with an incoming signal down the antenna of next to nothing you can obtain sufficient power to cause the detector to respond.

Practically, however, it has proven very difficult to use more than two stages of satisfactory radio frequency amplification. Modern and up-to-date receiving sets have satisfactorily achieved three stages and four staves, and it is found that four stages are about all anyone would ever have occasion to use.

Amplification 8 Per Stage

Generally speaking, a well-designed stage of tuned radio frequency will increase a signal in a ratio of about 8 to 1. Therefore the signal coming out from the first tube is eight times as strong as the signal coming down the antenna. Going into the second tube with a value of eight, it comes out with a value of sixty-four. Going into the third tube with a value of 64 it comes out with a value of 512. Going into the fourth tube with a value of 512, it comes out with a value of 4,096.

Now, if we consider this value of 4,096 gives us our "dollar value" for the detector tube, it means the signal coming down the antenna was less than one-four thousandth of this dollar, and we will all agree that is a pretty small signal and a pretty small figure for anyone but a scientist to conceive.

We now see how even a very weak signal coming down the antenna will cause the detector tube to respond; we multiply it as necessary by successive stages of radio frequency.

Now we have our detector tube to detect and to convert the very weak antenna signal through radio frequency tubes into a direct current signal; i. e., a signal of a character which will cause the modern reproducing device such as the loud speaker or horn to deliver something which is audible.

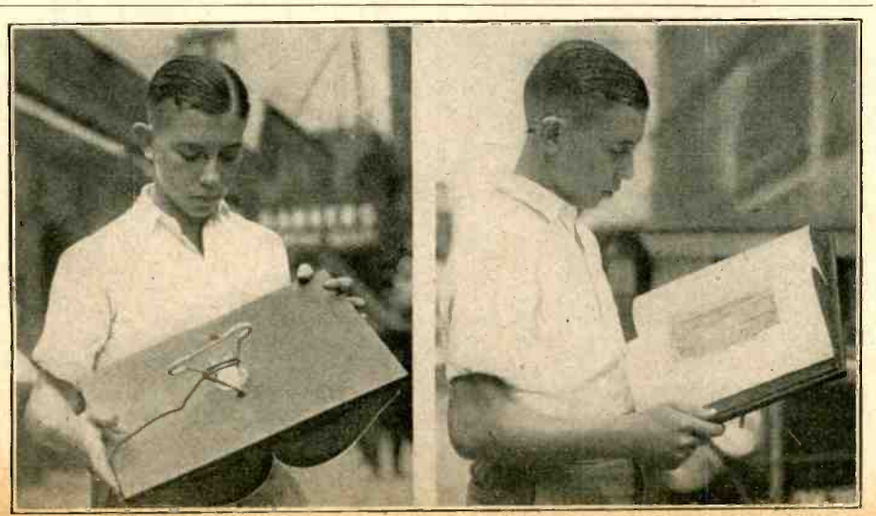
Use of Audio Amplification

Suppose, however, and it is in general in line with fact, that a signal of this character which comes down the detector tube, although the signal be of the direct current variety, is still too weak to make a horn pick up loud enough and we want to increase the sound from the horn.

Then we have to use some more tubes. Only this time, instead of being used as radio frequency tubes, or as detector tubes, they are used as audio frequency tubes, and the derivation of the audio appendage to this tube designation is, of couse, apparent, because, now we are dealing with a signal which is of the audible variety. It is something which, when put through the loud speaker, will enable us to hear.

Then, as the radio frequency tube would take a weak signal coming down the antenna and increase it in value, so does the audio tube take the low value signal coming from the detector and increase its value.

If one audio tube does not give us enough increase, then we follow the same practice we followed on the radio end and run the signal through the second audio tube. Here again, theoretically we could use three, four, five or six audio tubes, each contributing its corresponding increase in value to the value of the signal which is put into it, but again we are stopped by practical limitations, and three stages of audio frequency amplification are about all that can be practically accomplished.



A SPEAKER was built on the style of a book by Milton Gabler. A unit actuates the pages for omnitonal effects.

The Truphonic Amplifier

Case Presented for the New Form of Audio Coupling, Where Chokes Function Non-Magnetically in Plate and Grid Circuits, and Condenser Affords Coupling

By A. N. Clifton

WHEN a transformer is used in audio frequency amplification, the grid potential has to be kept negative. When this is done no grid currents are present. The reason that grid currents are not permissible with transformers is because as soon as the grid goes positive there is a partly shorted circuit in the secondary of the transformer and a temporary reduction of the magnetic coupling. The result is distortion, evidenced by the presence of an over-emphasized first harmonic.

H. P. Donle, well-known scientist and inventor, has invented the efficient Truphonic system of audio-frequency amplification, in which there is no magnetic coupling. Fig 1 shows condensers through which the audio frequencies pass directly from the plate of the preceding tube to the grid of the following tube. The effect of this coupling condenser is not changed by grid currents. Consequently, with this system, we can use the entire portion of the curve, left to right, in Fig. 3. As point B on the curve is the mid-point, we can utilize twice as much of this curve as you can with a transformer. As the comparative power output is the square of the voltage fluctuations, we are able, therefore, to obtain the square of 2, or 4 times the power output as compared with a transformer.

The Regular Impedance

With the usual impedance circuit it is not possible to obtain large volumes without tube blocking. Another term for tube blocking is "volume limit." The usual circuit consists of a plate impedance, a coupling condenser and a resistance grid leak. If the coupling condenser is made large enough to pass the low frequency, then the grid leak must be made with a low enough resistance to keep the volume limit above that desired in operation. When this is done very little amplification per stage is obtained. That is why in the speech amplifiers of broadcasting stations they use so many stages of amplification and special types of tubes which have inherent high amplification characteristics. That is also why the single impedance method is not practical for receiving sets. The Truphonic Audio system completely eliminates this trouble, by replacing the resistance grid leak with a low DC resistance impedance coil.

This coil is a happy combination, affording a volume limit 250 times that of the single impedance circuit using a .5 megohm grid leak, and at the same time, the impedance to the signal is over a million ohms at ordinary frequencies. This latter feature enables each stage to have an amplification factor which is very high compared with either resistance or single impedance circuits.

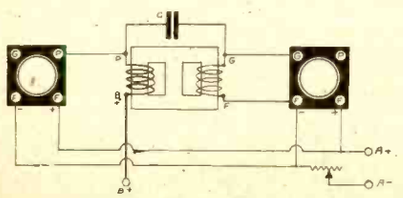


FIG. 2
The same laminations used for both windings

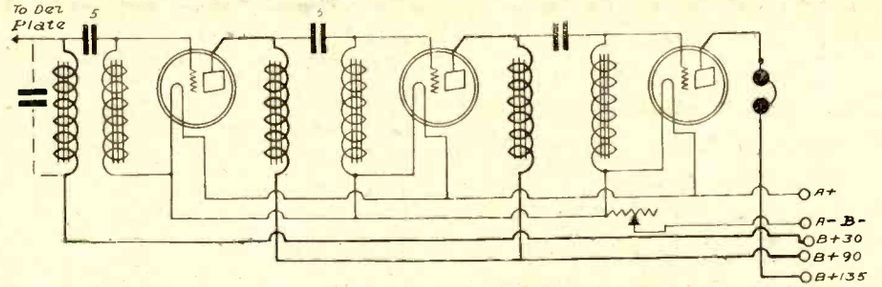


FIG. 1
The double impedance audio amplifier. The coupling condensers are 0.5 mfd. each. The grid returns, shown at negative F, may be placed instead at negative A (the other side of the rheostat) if greater "free bias" is desired.

All frequencies are faithfully reproduced. This means that the amplification factor is kept constant within a very small percentage from the lowest notes received to the highest harmonics or overtones. Professor Morecroft of Columbia University made some measurements proving this fact.

Two on Same Lamination

In Fig. 2 is shown a diagram of a single unit and illustrates the "Figure 8" lamination by means of which the two choke coils are mounted on the same lamination. Tests have shown that there is absolutely no magnetic coupling between these two coils. If there were any magnetic coupling between them the advantage of power output of the system would be reduced in proportion to the ratio between the capacity coupling and the magnetic coupling.

Regarding the amount of amplification obtained, three stages of the new Truphonic audio will give a greater amplification than two stages of transformer in a ratio of about 5 to 4; therefore, three stages of this system can be used in place of two stages of transformer on any set regardless of the radio or detector circuits used.

Indirect Output

Maximum speaker operation is supplied by the three stages recommended. In addition an output unit for the protection of the loud speaker is advisable where power tubes are employed. The use of this output unit, which separates the direct from the alternating current of the output circuit, is desirable at all times, as it prevents demagnetization of the speaker, eliminates the possibility of burning out the speaker and also serves to eliminate distortion and preserve the delicate balance of the well-built speaker units. Any standard tubes may be used. Dry cell tubes may be used with entire satisfaction, although storage battery tubes are recommended for maximum results. The units are such that the only limit on undistorted output lies in the tubes and speaker. For this reason when maximum volume is desired the use of the power amplifying tubes, such as the 120, or equivalent for dry cells, or the 112, or 171, or equivalent for storage batteries is recommended.

A circuit consisting of two stages of tuned radio frequency amplification, a tube detector and three stages of Truphonic audio was published in the September 11 issue of RADIO WORLD. The Naald Localized Control was used for tuning in conjunction with shielded Sickles coils. The control unit includes the three variable condensers, mounted on a frame.

Full Utilization of the Grid Voltage-Plate Current Curve of the Vacuum Tube Claimed—Theory of Avoiding Overloading or Volume Limit

Condenser Values

The best value for the fixed condenser C8, as shown in the hookup published in that issue, has been found, after various experiments, to be .002 mfd. The value of C11 preferably should be 2 mfd.

It has been found helpful to the overall efficiency of the circuit to add a fixed resistor of 25,000 ohms, connected between the F post of the first Truphonic coupler and the common ground and A minus lead, in other words in series with the grid coil, a connection that will be readily understood by reference to Fig. 4 in last week's issue. Of course the other radio grid returns go directly to F minus, without inclusion of the resistance on their circuits.

The form of audio amplification represented by the Truphonic system became popular very swiftly, and it is a certainty that it will gain in popularity with great strides. Those whose sheer delight is tone quality, and who yet desire full volume without any sacrifice of the richness, will find in Truphonic audio something that will please their exacting tastes to a nicety.

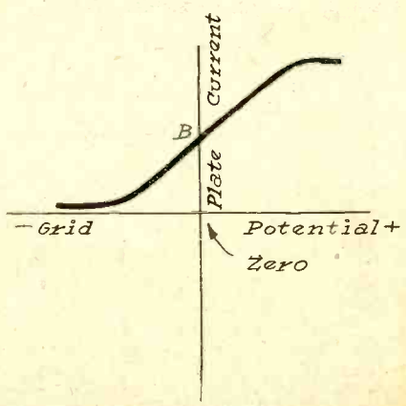


FIG. 3
Grid voltage, plate current curve of a vacuum tube.

Untangle the Ether, Dr. Dellinger Pleads

New Stations Heighten Congestion—Fewer Broadcasters, Four-Way Time Division or Less Power Suggested as Only Possible Remedies

WASHINGTON.

Because of the recent increase in the total number of broacasting stations, some radical step must be taken if good reception is to be preserved, according to Dr. J. H. Dellinger, chief of the Radio Laboratory of the Bureau of Standards.

According to Dr. Dellinger, there are entirely too many stations for the limited number of wavelengths and an entirely new system of allocation must be worked out, otherwise, considerable interference will result.

There are three solutions, he says. One is a sharp decrease in the total number of stations. Another is for the stations to divide time three or four ways. The other is for all stations to cut down their power to the absolute minimum necessary to serve their local community.

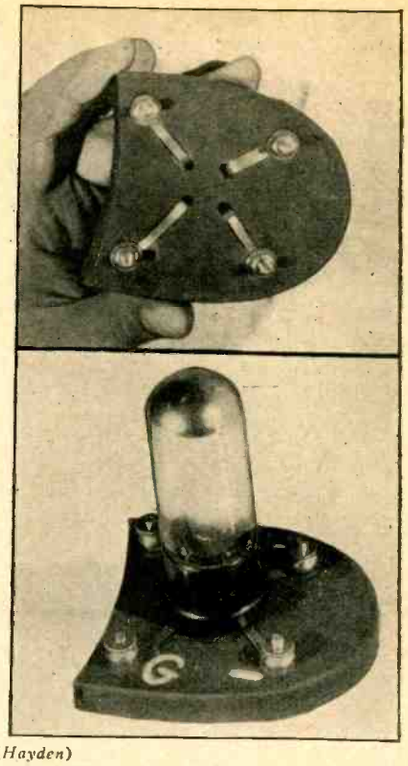
"There are only 95 channels at present," says Dr. Dellinger. "Five of these are in use by Canadian stations, so that leaves the United States 90 wavelengths. These are no more than enough to accommodate 90 national stations, or stations with sufficient power to be heard throughout the country.

"Nearly one-half of the broadcasting stations consider themselves national institutions, that is, they claim to serve several states. They are constantly doing everything in their power to increase their service range.

"Now, it stands to reason that 200 powerful stations cannot operate simultaneously on 90 wavelengths without causing a lot of interference to each other.

"The Fourth National Radio Conference worked out a decent allocation of wavelengths with a 10 kilocycle separation between stations. With the breakdown of regulation, this scheme has been abandoned and most of the stations are now separated by only a few kilocycles."

WELL HEELED

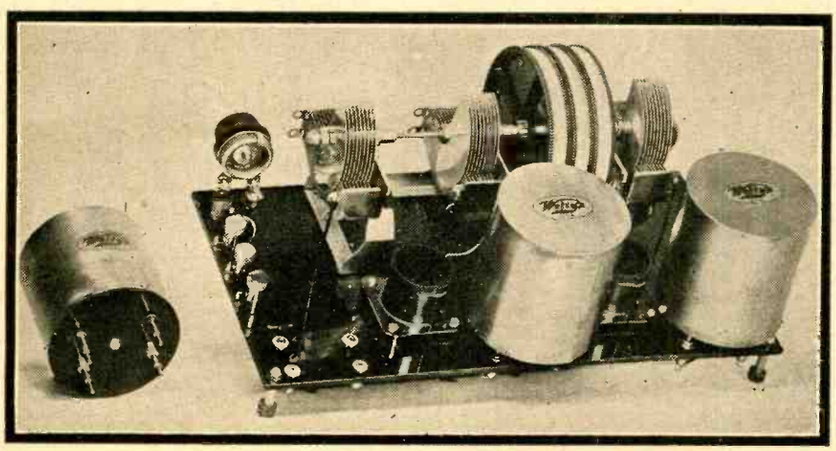


(*Hayden*)

HAVING nothing more important to do one night, a radio fan built a push type socket, using a rubber heel, as shown above. His defense was that the heel was not new.

Assembled RF Unit Has Plug-in Coils

Localized Control Used in Tuning Inductances Are Either of the Shielded or Unshielded Types—Product Very Compact



A VIEW of the Welty RF unit, showing the interchangeable RF coils and the localized control tuning. Note the rugged construction of the sub-base. A coil with the four terminals at the base is shown to the left.

Using the Alden localized control and a shielded or unshielded interchangeable solenoid coil system, the Wm. Welty & Co., of 36 South State St., Chicago, Ill., have designed an excellent RF amplifier unit, as shown in the photo. The unit is neat and compact and from tests made in RADIO WORLD's laboratories, it ranks as electrically and mechanically efficient.

Three separate drums control three condensers, which may be turned individually or at the same time. This one dial operation is obtained. The coils are of a special solenoid construction, shielded by burnished copper sheeting. These coils are physically much smaller than the run of those on the market last year. This and the shielding feature make the compactness possible.

Each coil has a mount, with four terminals, resembling that of a tube base. In this way, it is possible to plug the coils in or out at will. The complete unit is wired beneath the sub-base.

WEAO Is Sending From New Studio

With the evening program of September 1, WEAO, Columbus, Ohio, opened its new studio in the Neil House. This studio off the campus was authorized by the Board of Trustees of the Ohio State University late in the spring and work has been rushed to get equipment and furnishings in place.

The studio suite is located on the sixth floor of the Neil House overlooking the Scioto River, the Central High School, and Columbus' new civic center development. In the suite are reception room, studio, and operating room.

Entrance is into the reception room where guests and artists will be welcomed and from where those not actually broadcasting may see what is going on in the studio through a glass partition.

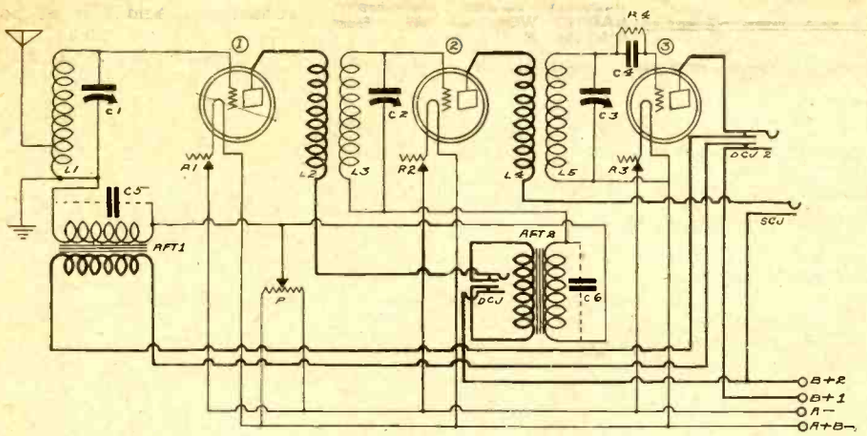
The operating room is adjoining the studio and allows for observation of every point in the studio. Here the operating equipment is installed with direct connections to the dining room and ball room as well as to the radio station on the University campus.

The studio, the largest room in the suite, is hung with a rich new shade of brown, harmonizing exactly with the plan of decoration carried out in the hotel parlors.

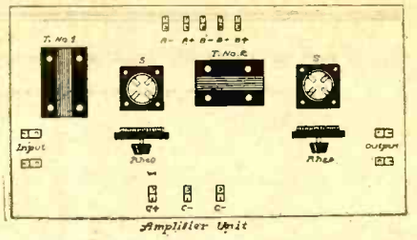
The draperies and furnishings were designed and planned by the Neil House decorator.

The opening of a downtown studio marks another step in WEAO's policy of service to the public and Manager F. W. Bergman has spared no effort or expense in linking with the expansion of the broadcasting station. The new studio will make possible feature programs and talent which have not before been available and also gives the people of the state opportunity to hear one of Columbus' best hotel orchestras.

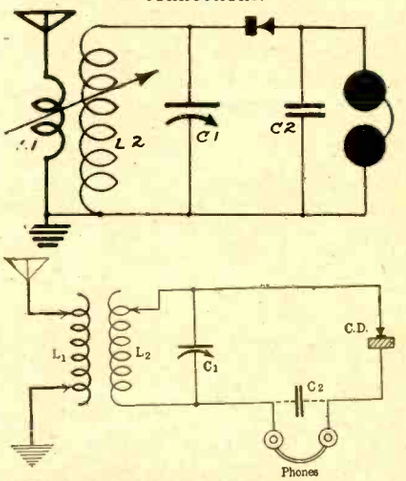
Circuits for Tests and Tested Circuits



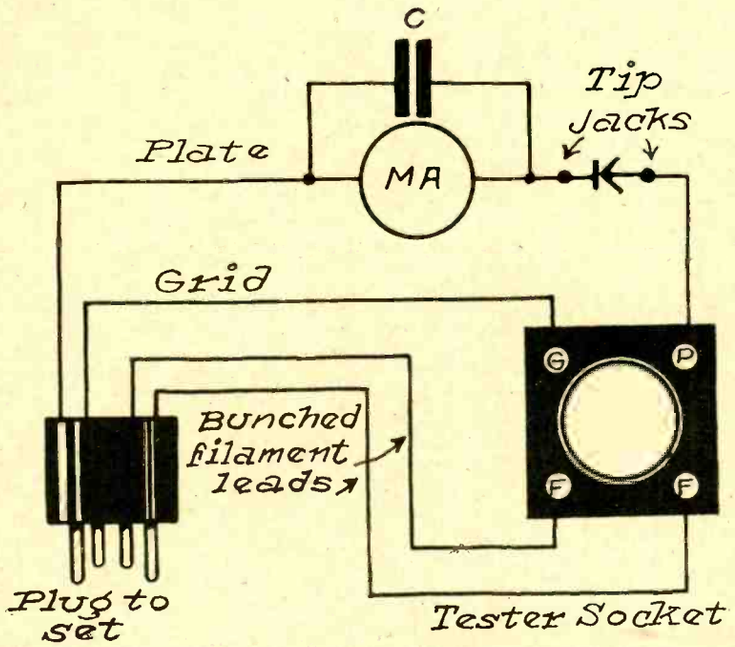
A 3-TUBE reflexed receiver, wherein the two RF tubes act both as RF and AF amplifiers, in conjunction with a non-regenerative detector.



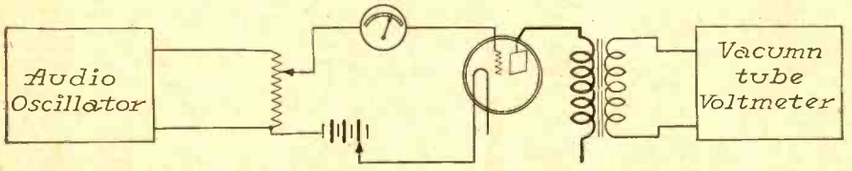
A TEST board layout for a 2-stage transformer coupled audio frequency amplifier. Clips are used instead of binding posts, to facilitate external connections.



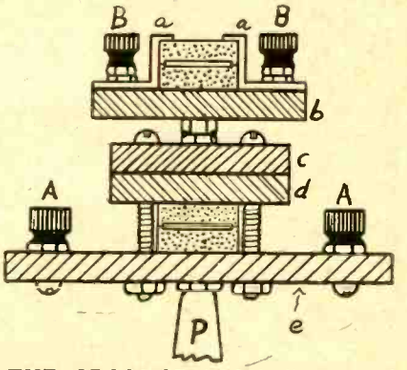
CIRCUIT DIAGRAMS of two selective and voluminous crystal receivers. Inductive coupling is used in the top diagram while conductive coupling is used in bottom one. An antenna coil having a variable primary may be used in the upper circuit, while an RFT with a large primary (20 turns) tapped at every second turn, should be used below.



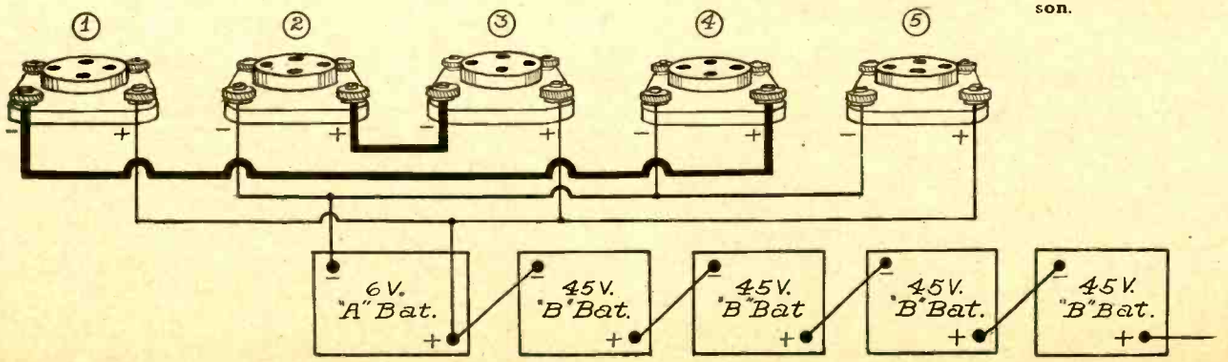
AN OLD socket base, connected up as above, may be used as an efficient tube tester. MA is the milliammeter Tip jacks afford a listening post.



THE EXACT characteristics of a tube may be obtained with the aid of the instruments and circuit diagrammed above.



THE CROSS-SECTION diagram of the base of the double duty loop antenna, described in the July 17 issue of RADIO WORLD by J. E. Anderson.



HOW TO connect the filaments of the first RF and the first audio amplifiers and the detector and the second audio amplifier in series, the filament of the last audio tube being connected in parallel, in the Browning-Drake, described in the Aug. 14, 21 and 28 issues of RADIO WORLD.

Radio University

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

When writing for information give your Radio University subscription number.

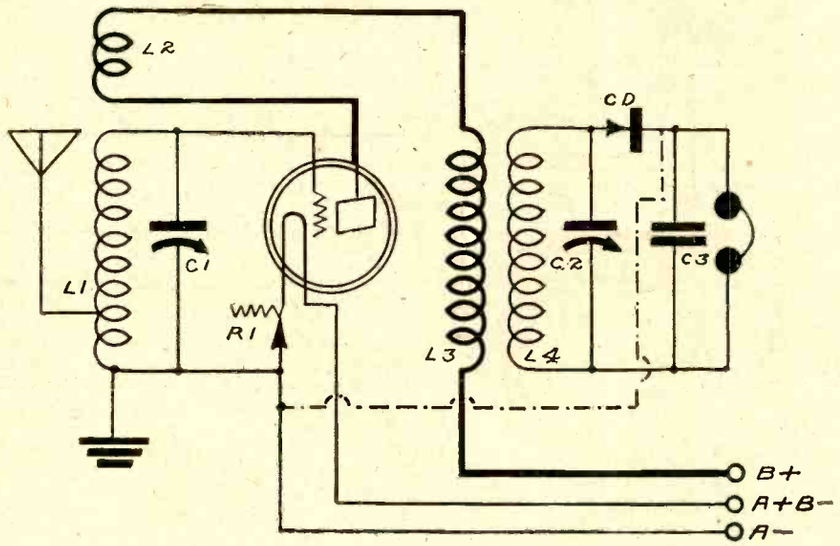


FIG. 429
The circuit diagram of the 1-tube reflex desired by Wallace Kingle.

I HAVE a variocoupler and two .0005 mfd. variable condensers. The stator winding of the coupler consists of 50 turns. The rotor winding consists of 40 turns. The stator winding is on a 3¼" diameter tubing, using No. 22 double cotton covered wire, while the rotary winding is on a tubing 1¾" in diameter using No. 26 single silk covered wire. I would like to have the circuit diagram of a single tube receiver, using this coupler in regenerative fashion in a stage of RF amplification followed by a crystal detector. Please give the constants of the coil and condenser used in the detector stage.—Wallace Kingle, Bronxville, N. Y.

Fig. 429 shows the circuit diagram of this receiver. The coupler, you will note, is used in the 3-circuit tuner fashion. The stationary winding is used in the antenna circuit, while the rotor winding is used as the tickler. The stationary winding is tapped at the 8th turn from the beginning of the coil. At this point the antenna connection is made. The beginning of this portion of the winding is brought to the ground. The other terminal of the winding is brought to the grid post of the socket. The antenna-secondary winding, L1, is shunted by the .0005 mfd. variable condenser. The primary of the new coupling coil, L3, consists of 10 turns. The secondary L4 consists of 42 turns. These are wound on a tubing 3¼" in diameter, using No. 22 double cotton covered wire. No separation need be left between the windings. Across this secondary a .0005 mfd. variable condenser is shunted. C3 is a .0005 mfd. fixed condenser. CD is the crystal detector. A rheostat is used to control the filament temperature of the RF amplifier. The type of rheostat used is dependent upon the type of tube you wish to use. If a -01A tube, with a 6-volt A supply, is used, then a 20-ohm rheostat should be incorporated. If the -99 with a 6-volt supply is used, then a 50- or 60-ohm rheostat should be used. If the latter tube is used with a 4½-volt battery, a 25-ohm rheostat will do. The control will be found quite critical. The dotted line connection is experimental and dependent upon the type of crystal used, it having a greater effect with the synthetic type.

The plate voltage should be about 45, although it is well to experiment here.

IN REGARD to the Erla-Duo Reflex, which appeared in the Radio University columns of the August 7 issue of RADIO WORLD. (1)—Would it be possible to use a .00035 mfd. Amsco straight line frequency variable condenser, instead of the .0005 mfd. variable condenser specified? (2)—If so, will you give me the number of turns to place on the tuned RFT? (3)—Please give the number of turns, size of frame and kind of wire to use to make a loop to be used with this .00035 mfd. condenser. (4)—Can a Dubilier Duratran RFT be used?—Horace M. Bainster, R. F. D. 1, Keyport, N. J.

(11—Yes. (2)—The primary consists of 5 turns, when not using the taps and 20 turns with the taps. This is the same number as used with the .0005 mfd. variable condenser. The secondary consists of 60 turns. (3)—Use a 2-foot frame, and wind 26 turns, using No. 18 bell wire or loop wire. (4)—Yes.

* * *

I WOULD like to have some information regarding the old style Victoreen Super-Heterodyne. (1)—Could I use Bremer-Tully .0005 mfd. SLW variable condensers? (2)—Could Rauland-Lyric audio frequency transformers be used with success? (3)—Would the 200A work satisfactorily in both detectors? Will there be any improvement?—J. T. Reed, 511 Center Ave., Lock 4, Pa.

(1)—Yes. (2)—Yes. (3)—No, too much noise.

* * *

SHOULD DIFFERENT C voltages be applied to the AF tubes in the DX Double Regenerator, described in the July 10 issue of RADIO WORLD? The -01A type tubes are used. On the plate of the first AF tube 67½ volts are applied, while to the plate of the second AF tube 90 volts are applied.—Thomas Clowt, Chicago, Ill.

Yes. About 3 volts for the first AF tube and 4½ volts for the second AF tube.

* * *

IN THE June 26 issue, there appeared in the Radio University a circuit diagram of a 2-tube reflex which attracted my attention. I built this set for a friend of mine, with a crystal as a detector, according to directions. It works all right, but the condenser in the detector stage has no effect upon the tuning. In other words, this portion of the circuit is dead. I have tried a few crystals (not the manufactured type) but with no change in results. Could it be possible that these crystals were dead? I have tried other condensers, but to no avail. Any suggestions would be appreciated.—James Conners, New Brunswick, N. J.

The trouble probably lies in the crystal. Suggest you try Carborundum. Also check the wiring.

* * *

I HAVE a 5-tube receiver. The panel in this set is shielded with copper lining. The shield is cut away at such points where the condensers, etc., are mounted. I have soldered a bus wire to the shield and connected it to the A minus post. All the rheostats are connected in the A minus lead. The A minus side of the battery is grounded. As soon as I place my hand on the resistance wire of the rheostat connected in the detector circuit, the volume increases and the signals clear up. The receiver consists of a regenerative detector and three stages of audio frequency amplification. (2)—What usually causes frying noises in the speaker?—Charles Reese, McGurdy Hotel Barber Ship, Evansville, Ind.

(1)—Reverse the secondary lead connections. You probably have the antenna connection adjacent to the filament return winding. Also, you have a minus grid return. You then have a high potential near a low potential. Test your ground lead. It may be poorly contacted. (2)—Rundown B batteries, rundown A batteries, poor contact between the terminals of the tubes and prongs of the sockets, one of the wires in the speaker cord near the tip broken, improperly adjusted armature or diaphragm in the speaker. Of course these are only the general causes. Suggest you read the Trouble Shooting Article by Manly & Garity in the Aug. 21, 28 and Sept. 5 issues of RADIO WORLD for more complete data.

* * *

I WOULD like to have data as to the construction of a 50 kc. intermediate frequency transformer.—Harold Maines, Louisville, Ky.

The primary consists of 2500 turns of No. 36 enameled wire. This is wound in a slot 3/8" in width and about 4" high, over a core of soft iron laminations or filings 1" in diameter. The secondary consists of 2600 turns of No. 36 enameled wire. The winding is also made in a 3/8" slot adjacent. The windings then are covered with a couple of layers of Empire cloth. This transformer will have an approximate peak of from 50 to 60 kc.

* * *

WHERE CAN I obtain information on the construction of the Ultradyne model L2?—Norman M. Bathrick, 1701 Dixwell Ave., New Haven, Conn.

See the July 10 issue of RADIO WORLD, Radio University columns.

* * *

WHAT ARE the capacities of the bypass condensers shown in the circuit diagram of the resistance coupled AF amplifier in the August 28 issue, on page 15?—D. M. Smith, 200 5th Ave., N. Y. C.

.00025 mfd.

* * *

I HAVE read with interest the articles by Herman Bernard describing the Browning-Drake receiver in the August 14, 21 and 28 issues of RADIO WORLD and would like to ask a question. At present I have a home-made Browning-Drake receiver which has given me very satisfactory results. I have always used the -99 type tubes. Now I notice that in the Improved Model, the -99 type tubes still are used, but in conjunction with a 171 tube and a 6-volt storage battery. I have always used the dry cells. Please

advise if the Improved Model would work equally as well with the -99 type tubes and a 120 power tube in the last stage, with dry batteries, instead of a 6-volt storage battery. What changes in the filament wiring would have to be effective?—Glenn Connelly, Independence, Kan.

Using the -99 tubes in conjunction with the 120 will give satisfactory results. The parallel filament wiring should be used, not the series method. Suitable Amperites would drop the 4½-volt source to 3 volts (four 4V99 and one 120).

* * *

I HAVE a fixed radio frequency transformer of the air core type and a tuned radio frequency transformer. The tuned RFT has a 20 turn primary, tapped at every second turn and a 55 turn secondary. These are both wound on one tubing 3" in diameter. It seems as if No. 24 double silk wire is used. Could I have a circuit diagram of a 4-tube receiver, using these transformers, the fixed one in the detector stage and the tuned one in the antenna stage. (2) What method of oscillatory control could be employed in the RF stage? (3) I would like to listen at the detector, first AF and second AF outputs individually. Could this set be so wired so that these advantages can be obtained? I would like to use transformers in the AF stages. — Henry Georges, Pawtucket, R. I.

In Fig. 430 you have the diagram of a voluminous and selective set, containing the suggestions that you made. The secondary winding of the tuned RFT is shunted by a .0005 mfd. variable condenser, this being again shunted by a .00004 mfd. midget variable condenser. This condenser is used for balancing and vernier action. A potentiometer is used to control the oscillatory action of the tube. The resistance wire is connected across the A minus and plus post, while the arm is connected to the grid return. In this way you obtain a greater or lesser negative or positive bias on the grid. The fixed RFT is used to couple the RF output to the detector input. One-half the taps on the primary coil is connected in the antenna circuit, while the other half is connected in the ground circuit. Rheostats are used to control the filament of each tube. The transformer used in both AF stages may be of the same ratio, not higher than 4-to-1. Usually 45 volts are applied to the detector plate, 67½ to the RF and 90 to the AF plates.

* * *

I HAVE built several of the Loud Boy 1-tube receivers described in the Feb. 6 issue of Radio World. All these sets work great, receiving many distant stations without any tuning difficulty and with tremendous volume. I request a description of an audio amplifier that can be added to this set.—Jackson Edwards, Fort George, N. Y.

Fig. 431 shows the circuit diagram of a simple 2-stage transformer coupled audio amplifier which can be added. This consists of two low ratio AFT, two ballast resistors, two sockets, a single circuit jack

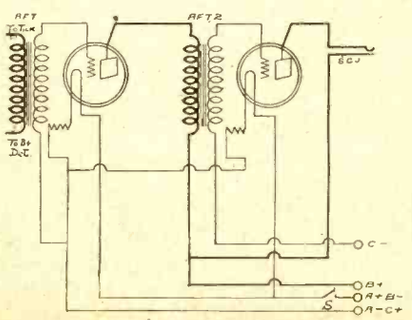


FIG. 431
The circuit diagram of the 2-step AF amplifier.

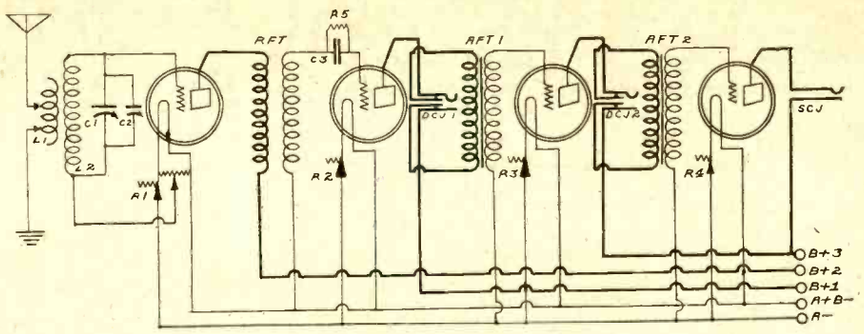


FIG. 430
The circuit diagram of the 4-tube receiver requested by Henry Georges

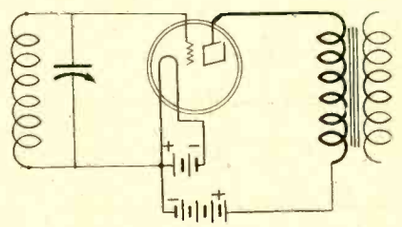


FIG. 432
The diagram of the grid return of a detector.

and tubes, batteries, filament switch, wire, etc. The end of the tickler winding is connected to the P post on the first AFT. The B post on this AFT is brought to the B post on the terminal strip. Here the detector B voltage is applied. The G post on this AFT is brought to the G post of an added socket. The F post on this AFT is brought to the A minus post. The P post on this socket is brought to the P post on the second AFT. The B post on this AFT is brought to the B plus Amp. post on the strip. The G post on this AFT is brought to the G post of the second additional socket. The F post is brought to the A minus post. The P post on this socket is brought to the top terminal of the single circuit jack. The bottom terminal is connected to the B plus Amp. post. To this terminal is connected the B plus 90 volt post. To the detector terminal, the same voltage as is now used, e.g., 45, is employed. If the -01A type tubes are to be used in both stages, then ¼ ampere ballast resistor should be used to control the filaments. If a power tube is used in the last stage, such as the 112 or 171, then a ½ ampere ballast resistor will have to be used. These are connected in series with the F minus and the A minus posts. The F plus posts are connected together and thence to a terminal of the filament switch. The other terminal of the switch is connected to the A plus, B minus post. No changes have to be made in the battery wiring of the detector unit.

* * *

I HAVE circuit diagram of a 5-tube tuned RF receiver. The grid return of the detector tube is connected as per diagram. I have always thought the grid return should be brought to F minus. Am I right?—Harold Jones, Newport, R. I.

No. The detector grid return is to positive, except for the 200 A or 300 A tube.

* * *

I WISH to build the 2-tube reflex, requested by P. Lators in the Nov. 28, 1925, issue of Radio World, using .00035 mfd. variable condensers, instead of the .0005 mfd., as specified. Please give the proper number of turns required for the primaries and secondaries, using 3" diameter tubings and No. 22 double cotton covered wire.—Clent Rogers, Butte, Mont.

The primaries consist of the same number of turns, e. g., 10, as previously stated. The secondaries consist of 60 turns.

* * *

USING THE UX-210 in the last stage of a 2-step transformer coupled audio frequency amplifier, at 425 volts plate voltage, what C voltage is necessary? (2) How many miliamperes does this tube draw at these B and C voltages? (3) What is the highest B voltage that can be applied to the 171? (4) What C voltage is necessary at that B voltage?—William Forrest, Des Moines, Ia.

(1) 35, (2) 22, (3) 180, (4) 40½.

* * *

PLEASE GIVE a brief descrption of the Smee battery.—Charles Klein, New Brunswick, N. J.

The Smee battery uses diluted sulphuric acid as the active solution. This solution is made up of seven parts of water to one of sulphuric acid. Zinc composes the positive plate. The negative plate is composed of a silver plate which has a black coat of platinum.

STUDIO STAFF KEENLY ALERT TO FILL GAPS

ERNIE GOLDEN, director of the Hotel McAlpin orchestra, WMCA feature, who also fills occasional gaps with skill and generosity.

In no line of business is the motto "Be Prepared" more frequently used than in the broadcasting station. For instance, every member of the staff of WJZ is on the alert for any sudden change in conditions which will affect the programs "on the air." The spirit of preparedness extends from the messenger boys to the chief executive of broadcasting.

In discussing the alertness of the staff of WJZ, Charles B. Popenoe, the manager of broadcasting, said:

"We have to keep our eyes open constantly. Engaged in an infant and rapidly growing industry, we find innovations and improvements that come with suddenness and frequency. There is no place in radio broadcasting today for the laggard. The staff of WJZ is trained to watch for opportunities to improve our service. The studio manager, Keith McLeod, and his staff of announcers and artists, must be extremely alert to prevent any break in the smooth continuity of a program once it has gotten under way.

"To be prepared in case an emergency arises wherein it becomes necessary for the staff artists to fill in, Mr. McLeod has his plans laid in advance and merely puts them into execution. Several times recently, due to local storms, it has been necessary to discontinue some piece of outdoor remote control broadcasting. The task of supplying a program has then fallen on the shoulders of the studio staff and I think I can say without boasting, and I am upheld in this opinion by the response from the radio audience in the form of applause mail and favorable comment in the press, that the staff carried off great honors."

WINS A PLACE

EVELYN CARR, with her "radio horse," ycelpt listener-in. They were granted a place in the Los Angeles Radio Exposition.

May Breen Falls; Injures Her Thumb

In response to many inquiries as to why May Singhi Breen and Peter de Rose have failed to keep several of their scheduled dates, Miss Breen wishes to state that due to severely injured ligament in her thumb, suffered in a fall, she was unable to "take the air" for two weeks.

BEAUTY ON AIR

(*Foto Topics*)

HOW it feels to be beautiful is modestly told by Ruth Patterson tc the radio audience. She is "Miss New "York in Atlantic City beauty test.

Expert Thinks Press Will Solve Programs

William F. Hart Looks to Newspaper Poll to Disclose What the Public Wants As to Entertainment and Education

The newspapers of this country will eventually prove to be the instrument which will make possible the answer to broadcasters' present query, "What Does the Public Want?", in the opinion of William F. Hart, vice-president of the Commercial Broadcasting Corporation, 331 Madison Avenue, New York, former newspaper man in New York City.

According to Hart, the reading public which makes up 90% of the radio audience of this country would gladly avail themselves of the opportunity of expressing their likes and dislikes of local programs if their community newspaper would publish a coupon for just that purpose.

Hart states: "A newspaper has always been viewed as a powerful force for the moulding of community opinion, and it is acknowledgedly the most prominent medium to which the average citizen looks for the championing of his cause. It is certain that the radio review columns conducted by the majority of newspapers are carefully read every day anc their comments are generally accepted as authentic by the readership of those papers."

"If the newspapers of the United States would simultaneously print a coupon requesting their readers to signify those forms of entertainment desired on the air, and the editors of the papers would in turn forward the replies to the Department of Commerce for instance it is certain that here would be a system that would give the broadcasters of the country a summary of public opinion which would be authentic and sufficiently comprehensive as to represent the likes or dislikes of an entire nation."

According to Hart, the Commercial Broadcasting Corporation extend every courtesy and facility to the publishers of papers of the United States in an effort to bring about this nationwide poll.

"TROUBING" A WEEKLY DELIGHT

THE IPANA TROUBADOURS, who entertain every Wednesday evening from Station WEAF and stations linked with it. They gave a special program at the Third Annual Radio Industries Banquet

President of France Tunes In Pittsburgh

Doumergue Hears KDKA—Tells of Delight of DX Reception—Sorry to Return to Paris, Where He Can Get Few Stations

Special to RADIO WORLD

RAMBOUILLET, FRANCE.

"C'est Pittsburgh!"

This ejaculation came from the excited frame of a DX fan in the castle here that was once occupied by the pompous kings of France and previously by the feudal barons of medievalism.

Pittsburgh it was! KDKA, of course! What joy, what glee, what thrills! A small boy, with nothing more important on his mind than the supper dessert, could not have been more energetically delighted than this DX fan in the castle—none other than Paul Doumergue, the President of France, here for a brief vacation.

In the castle where King Francis I died, the Presidents of France for the last decade or so have been spending their vacations, but none of them turned out to be a radio fan in the real sense of the term.

New Convert

Even President Doumergue could not have been so classed until he went to the historic castle for the parliamentary vacation. He found there a set on which he could tune in London, Berlin, Rome, and of course Paris, and keenly enjoyed being in contact with the European world, especially as news dispatches were summarized in many of the broadcasts. But all other comparisons of joy were swept aside by the newly converted radio fan when he, with his own Presidential hands, tuned in KDKA, the Westinghouse station in Pittsburgh.

"Well, what do you think of radio?" the President was asked.

He clapped his hands as he replied: "It has come to be a passion with me. I tune the set myself. I suppose it's that way with all real fans—they don't want any one except themselves to turn the dials! Thus is human nature ever selfish in its supremest joys!"

There was a merry twinkle in his eye as he spoke.

"I simply delight in hearing the entire world discourse over the radio. I jump from one capital to another. And when I tune in an American station my heart nearly stops beating, I'm that much of a devoted distance enthusiast.

"Only the other day I heard Pittsburgh plainly. I am sorry my vacation is ending, as I can't hear distant stations from the Elysee Palace."

Paris is not a good point for distance reception, although in some spots excellent results are obtained. Unfortunately for the President, the palace is in a poor radio location.

Jazz Craze Origin Claimed by Edwards

The origin of jazz music was an accident, declares Eddie Edwards, formerly leader of the Original Dixieland Jazz Band, who claims that his organization started the modern craze. He is now head of the Eddie Edwards' Southerners Orchestra, which broadcasts dance music regularly over WHN, New York City, from the Silver Slipper.

He explains that when he and his former pals were just starting out as an orchestra they tried to play like the musicians in a New Orleans Theatre. Their efforts were well-meant but produced noises which were far from the original. Despite this "noise," Eddie states, someone in the audience cried "jazz it up" and the cry was taken up by others. The word jazz was adapted and everyone knows how it has stuck. "This is the truth about jazz," Edwards adds.

RADIO DEBUT GROWS TO BE BIG OCCASION

MARY LEWIS, soprano, whose radio debut was accompanied by receipt of flowers and hundreds of congratulatory messages, and was followed by her appearance with the Metropolitan Opera Company.

Radio is offering new opportunity to aspiring young singers and radio debuts are assuming new import in professional circles since the first radio appearance of Mary Lewis, whose singing under the auspices of A. Atwater Kent was followed almost immediately by her Metropolitan Opera engagement. Under Mr. Kent's sponsorship she was heard by 33 radio stations as the headliner at the Radio Industries banquet, at the Hotel Astor, New York.

A debut by radio is accompanied with all the fanfare of a first appearance in a concert hall, even to the sending of flowers and telegrams of congratulation. There is this important difference—the audience while unseen is surer and vastly larger than ever attended professional debuts in pre-radio days.

Wrist Bone Broken, Actor Goes on Air

The actor in the radio drama may have broken bones or even be minus a leg or two, and, providing he has retained his voice the audience will enjoy his work quite as much as if he were sound in body and limb. Ten Eyck Clay, the director and leading man of the WGY Players, recently endeavored to start his car by cranking, after the starting battery had become exhausted. The car started but at the price of a broken bone in the right wrist. He broadcast nevertheless.

Scientists Gloomy About Next Winter

Not Optimistic Regarding Reception, Fearing Sun Spots Have the Better of Us Until 1933—Theory Not Proven

By Thomas Stevenson

WASHINGTON.

Scientists are not very optimistic about radio reception this Winter.

Poor reception last Winter was generally attributed to sun spots. If the theory was correct, reception this Winter will be worse. This is the opinion of Dr. J. H. Dellinger, Chief of the Radio Laboratory of the Bureau of Standards, and Dr. Charles G. Abbot, director of the Astrophysical Observatory of the Smithsonian Institute.

Dr. Dellinger is one of the strongest advocates of the theory that poor reception last Winter was due to sun spots. He believes that sun spots throw out enormous eruptions of electrons and other electrical particles, some of which reach the earth's atmosphere and interfere with radio signals.

Not Absolutely Proven

"When the sun spots are particularly intense," says he, "radio reception is likely to be disturbed and poor. Sun spots throw out electrical impulses, some of which does come close enough to the earth to interfere with radio. This has not been conclusively proven, but seems to be indicated by such observations as have been made.

"The sun spot cycle is eleven 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 eleven 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. It will be interesting to see whether this occurs and whether future observations on sun spots will show a closer correlation with radio reception conditions."

Dr. Abbot, who has specialized on the sun for more than twenty years, says that sun spots are accompanied by other solar effects which sometimes make it impossible to anticipate their appearance.

Warning of Spots

"As we watch the sun revolving on its axis," says he, "we sometimes see bright patches appear, and then we know a sun spot is due. Usually a spot will break out right where the bright patches appear. Some sun spots last only a few days, others for months, and we see them again as the sun revolves, carrying them out of sight to bring them back to view two weeks later. Sun spots range in size from a few hundred miles to tens of thousands of miles.

"One of the remarkable things that we have learned about sun spots is that they vary in their comings and goings in fairly regular cycles of 11⅛ years. For a while there were no spots at all observable, something that hadn't happened in a hundred years. After this inactivity in 1913 spots began to appear, and by 1917 there were more than a hundred of them visible. From 1917 they began to decrease until around 1924 we had again reached the minimum and could find only a few small spots.

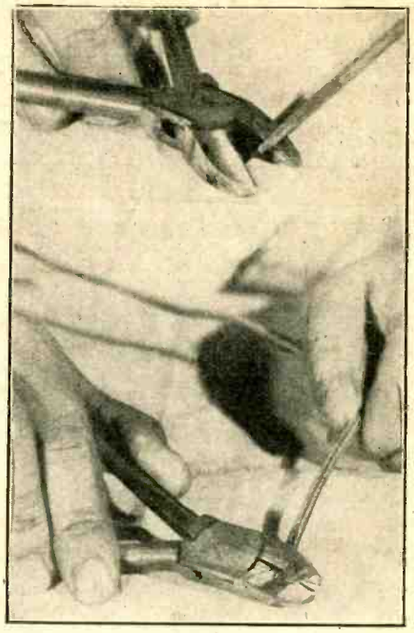
The Faster Progress

"We are now emerging from this period of few sun spots and may expect to reach the maximum by 1928. The progress from minimum to maximum is faster than from maximum down to minimum. In other words, the solar storms come up more rapidly than they die down. We had a large outburst in June, 1925, and may expect the spots to increase during the next two, three or four years.

"Even though the spots are outbursts more than 92,000,000 mile away, they seem to affect the earth and interfere with many of our activities. At periods of numerous spots or of large spots the aurora borealis, or northern lights, flare out with great brilliancy and the solar storms are accompanied by magnetic storms on the earth interfering with the operation of ocean cables, land telephone and telegraph wires and radio transmissions.

"A recent instance of this phenomenon occurred in 1921, when on the night of the fifteenth of May long distance telephone service throughout the United States was demoralized and other frequent serious interruptions were experienced in succeeding days.

WIRE IS SPARED



(Hayden)

SIDE PLIERS, used for wire cutting, may be filed at one edge (top photo) so as to leave a gap. When cutting, insert insulated wire in the slot and press (lower photo). Thus the insulation alone is cut, not the wire, and the excess may be "skinned" for making a joint.

High Wattage Hurts Windings of Speaker

Burnout May Result When Large Capacity Power Tube Is Used, So Isolation of DC Component Is Advisable

By W. J. McCord

The season of 1926 has brought the power receiver into the full measure of its popularity. With the advent of transformers of large primary impedance and large current carrying capacity, impedance coupled amplification, resistance coupled audio amplification and the various combinations of these, together with the possibilities opened up by the use of high voltage due to rectification of house current for plate supply, quality reproduction has taken on a new aspect. New tubes have been designed which will handle this increased load, and it seems to be the ambition of every listener to make the new tube function to the limit of its ability. Within the receiver everything has been strengthened and designed to meet and carry this extra load.

Outside the set, however, a different situation exists. The speaker in most instances is groaning under a load that it was never meant to carry. The result is a siege of inquiries as to "Why my loud speaker has ceased to function since I put in the new power tubes and B eliminators."

Fine wire, such as is found in a speaker, develops resistance to electric current, and resistance develops heat and heat in excessive quantities burns out speaker windings.

The solution is to buy a new loudspeaker or have the burned out one repaired if possible and then admonish the unfortunate owner to keep his 400 volts at 50 milliamperes out of the coils of his speaker.

There are means of doing this. One of the best is the so-called choke coil and condenser arrangement.

This insurance can be obtained easily by the fan who wants to build a unit. But for the fan who wants this device factory-made there are several good models on the market, such as the Tone Bridge. This is plugged into the output of the set and the speaker is plugged into a jack provided therefor, thus realizing the full benefit of speaker protection and tone control. The speaker, if adjustable, needs a new setting under this plan.

Aerials Directional, Experimenter Finds

Replies to General Invitation Extended By Humphrey for Discussions of Subject—Tests Made Over Long Period Convince L. M. Church

EDITOR, RADIO WORLD:

Regarding K. B. Humphrey's article in RADIO WORLD of August 28 on the subject of directional effect of aerials, during the winter months of 1922, 1924, I did nothing but experiment with aerials. Having a roofage of 200 feet by 70 feet in the southwest part of this city near the water front (Potomac River) and within two miles (air line) to the hills of Virginia, southerly direction and poles being 40 feet off tin roof, I had an ideal location for testing. I started out with four wires on spreaders, wires spaced four feet apart, joining wires at north end and bringing down lead in wire 32 feet to set, ground wire being five feet to cold water pipe in bath room. Wire used was No. 18 bell cord wire. Results on one week's test, included volume on distant stations, such as Memphis, Tenn., and KDKA, Pittsburgh, WGY, and a few others, on phones. The Hams (code) at this time were very bothersome. I changed the aerial to three wires, moved aerial more to the west. Results about the same, although some nights I did pick up more west stations than on previous aerial. Changed to two wires, moving wires to two feet apart, having an aerial of 100 feet in air with 32 ft. leadin. Reception much improved. Changed to one wire, 7 strand copper, same length and leadin, and found that reception was a little stronger.

One Better Than Four

By this time I came to the conclusion that a single wire was better than four, three or two wires. With this in mind I began to experiment with single wires of various makes, starting out with the No. 14 insulated and running 132 feet continuous to set with a break, results good, distance good, locals come through loud. Next I changed direction, to east and west. Very little difference was noticed except where I used to get Cuba, PWX, I failed to do so east and west.

To make sure that this aerial was responsible for my not getting Cuba, I put up two more poles 40 feet high and 200 feet apart. I put up aerial using 7 strand copper wire, 125 feet continuous and first night up pulled in Cuba and 6KW. Immediately switched over to east and west and could not find them. Had a few of the Canadian stations on east and west aerial. Found that I could get them on north and south, but not so good. So it seems that location has a whole lot to do with directional effects. A friend of mine, also experimenting, in the country about 54 miles from me, found that his single wire aerial, using No. 12 enamel wire 98 feet in air with a running distance of 148 feet including the 98 feet leadin, brings him in stations all over the country, including the English stations and Canada. Also the west coast stations.

Uses Braided Enamel

I now have the same kind of set as he had and am using an aerial of 85 feet including leadin. That's 55 feet of air line, using the new braided enamel wire approved by Herman Bernard of your staff. I find that this wire is superior to any other wire manufactured, more volume, better distance, and it does to a radio set what a Scribler carburetor does to a Hudson.

L. M. CHURCH,
300-11th St., S. W.,
Washington, D. C.

THE FALLACY OF WIRELESS

Radio is still referred to by some of the old-timers as wireless. To show the folly of "wireless," if all the wires used in broadcasting a WJZ program were connected in a single piece, it would be more than encircle the globe at the equator. This wire varies in size from less than a hair in certain magnets and resistances to half an inch in the antenna.

NEAT IN GLASS

(RADIO WORLD *Staff Photo*)

THE Improved Browning Drake looks neat in a glass cabinet. Paul R. Fernald is shown tuning such a set, which he built.

How Pacent Sockets Go On Diamond

Experimenter Reveals Valuable Kink in Constructing The New and Improved Model— Receiver Delights Fans

Results Editor:

In building my New and Improved Diamond of the Air I found an important detail which I wish to pass on to the hundreds of other fans, all over the country, who I know are also building this wonderful set. In mounting the five Pacent sockets, the first step is to take the socket apart, by loosening the back screw of the socket before mounting on sub-panel strip. The socket is pushed up through the mounting hole and the bottom is then fastened on. Before fastening tightly, however, we must put a washer under the screw, between the lug and the sub-panel. We then have a solid, secure and highly efficient socket installation.

I will be pleased to go into deeper constructional details later on, for the benefit of the newly-made fans who will sooner or later take up the building of this desirable circuit.

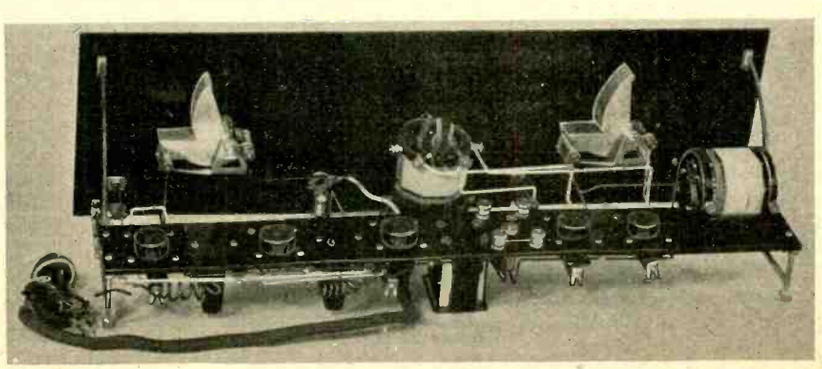
JAMES H. CARROLL,
937 Park Place,
Brooklyn, N. Y.

* * *

RESULTS EDITOR:

Using an 18" loop with a Diamond of the Air on the evening of Aug. 27 I tuned in KOA, Denver, Col., on the loudspeaker with the same volume as a local. I think this set is wonderful. Besides this station, many other DX stations have been tuned in. The volume on the Chicago stations is too loud for comfort.

W. E. GOODRICH,
East 13th,
Covington, Ky.



THE REAR VIEW of the New and Improved Diamond of the Air. The antenna coupler is at right (Bruno No. 99RF). Note socket strip support is on the AFT.

A THOUGHT FOR THE WEEK

TO poraphrase the crafty Richard: "Now is the season of our real content, made glorious Autumn by the lessened Sun—" and so we enter on a new and better realization of what radio really means when the breezes blow and we no longer spend our hours looking at time tables that lead away from the music of the set. Let's go!

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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Paris, France: Brentano's, 8 Avenue de l'Opera
Chicago: William T. Diehl, 30 North Dearborn St.
Los Angeles: Lloyd B. Chappell, 611 S. Coronado St.

EDITOR, Roland Burke Hennessy
MANAGING EDITOR, Herman Bernard
TECHNICAL EDITOR, Lewis Winner
ART DIRECTOR, J. Gerard Sheedy

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Entered as second-class matter March 23, 1922, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

A Federal Patent Claim

WHO owns the regenerative patent? Any one who can answer the question at this ime deserves the Nobel prize, even if that award was established in recognition of work for the peace of the world. No matter what answer might be offered there would be a hundred interested parties ready to spring forth with a complete denial of the answer. Perhaps the final solution will not come until the United States Supreme Court has lifted its authoritative voice.

As the situation stands now, assuming that the words are spoken as within the Pennsylvania or the District of Maryland jurisdiction, Dr. Lee De Forest is the inventor of regeneration, although whatever patent rights he possesses thereunder were transferred long ago to a company. He was upheld in a District of Columbia decision and again in a Philadelphia decision, in both instances in the Federal Court, and Major Edwin H. Armstrong, whom the world had come to know as the real inventor, was ruled out.

Therefore, by sheer numerical weight of recent decisions, let us say that Dr. De Forest invented regeneration, and that the De Forest Radio Company owns the patents thereunder (for there were two in his case.)

There rise the voices of the Radio Corporation of America, the Westinghouse Electric & Manufacturing Company, and others associated with them in the large and important group that has done so much for radio. They point, perhaps with a politician's stock pride, to decisions in New York, where Federal courts of higher authority than those that rendered decisions in the District of Columbia and in Philadelphia, sustained Major Armstrong, who sold his rights, if any, to Westinghouse et al.

And then, out of a well of silence, comes the voice of the United States Government, speaking through the Navy Department, saying that neither Dr. De Forest nor Major Armstrong invented regeneration, but that the real inventor was Alexander Meissner, the German, and that the Federal Government owns his patent (filed April 9, 1913) by virtue of seizure during the war and subsequent sale to the Navy Department by the Alien Property Custodian.

So while two conflicting patents have been sustained by the Federal courts of different jurisdiction so that in different parts of the country each of the personal contenders may seem serenely supreme, the Government is going quietly on its way trying to establish its own claims. The Government asserts that Dr. De Forest's circuit (supposedly conceived in 1912), was not regenerative at all, for the hookup did not produce oscillation or amplification in the tube, but only a whistle due to gas within. This allegation is made by the Government in a suit now being waged by it as plaintiff against Dr. De Forest, in Wilmington, Del.

The question of dates is a very important one in the whole three-sided dispute. The De Forest application was filed September 23, 1915, and the Armstrong claim December 18, 1915, or less than three months thereafter. (The date of conception, not the date of filing, is controlling.) On October 6, 1914, Armstrong was granted a patent (1,113,149). The World War was then two months old, and the hectic conditions at that time forced patent disputes into abeyance. Particularly a couple of years later, when the United States entered the war, were all forms of commercial rivalry swept aside, with the contenders of previous days now allied side by side to aid the Government in the prosecution of the war. These facts account for the lapse in the De Forest efforts to have himself proclaimed the inventor.

The war over and patent litigation having attained its everyday standing in American commercial politics, De Forest went ahead with his deferred suit, and the District of Columbia court handed down the now famous decision, awarding him the patent on regeneration (1,507,016), as of September 2, 1924, and sweeping aside the grant to Major Armstrong.

The subsequent decision in Philadelphia, handed down a few weeks ago, was to the same effect.

Therefore De Forest decided he was entitled to an injunction restraining all not licensed under his patent from making or selling sets using regeneration. And apart from receivers there are many other designs in radio using regeneration, for instance all transmitters of broadcasting stations.

Dr. De Forest is full of confidence and he promises to prosecute his claims to the utmost, but some experts figure that the chances are two-to-one against him. They say that the Government has at least as good a case as he has, and that Armstrong's case is good enough to keep up a fair average of victories for the Major's side in the multifarious jurisdictions within the United States. Hence, like in politics, Major Armstrong may carry the New England and some Middle Atlantic States, but De Forest is sure to carry the Solid South and a great part of the Southwest. The Midwest and the Pacific Coast are in doubt, but the Armstrong organization in those domains is conceded to be powerful!

This situation is made possible by conflict of laws, whereby Federal jurisdictions act more or less independently, hence often conflictingly, until the corrugations are ironed out at the ponderous laundry of the United States Supreme Court. And it is assumed it will take five years before a decision will be rendered by that lofty tribunal. As the Armstrong patent, if any, has less than six years to run, it is conceivable that the opinion would be rendered after the patent had expired! And then there might be merely a lot of accounting of back profits to be done.

Supposing De Forest won, he is sure to go after all the gold obtainable from his bitter commercial enemies of these long years. Supposing the Government won, would it be free with patent grants, or would Congress pass an act restoring the patent to the inventor, Meissner, and his assigns? If that happened, inspection might prove that the R. C. A. had an agreement with the Telefunken Company, Meissner patent assignees, so that in these United States the R. C. A. would still be the regeneration patent controller, with De Forest's long efforts fruitless.

The Lamp Socket Set

MANY persons say that what they prefer in a radio receiver is something that requires only a plug to connect to the electric light socket, to furnish all power to operate the set, including even the antenna energy, so no aerial need be erected nor even a loop used. This preference may be indulged even now, although it would be rash to say that the self-contained receiver and power plant has reached the apex. In fact this is the first year in which such a device has been seriously commercialized, due largely to trouble with the A battery eliminator.

When convenience is served many complications must be introduced. This does not mean that inefficiency need prevail, but it does mean that it is comparatively costly thus to cater to the desires of particular persons. It is folly to entertain desires for things that are relatively expensive, and expect to have them appeased at next to no cost. So one finds many who ask for the convenience of lamp socket receivers expecting to pay only a few dollars for them. The rule is that where economy is the controlling factor, batteries are the cheaper, especially B batteries, and persons who must watch every cent need not sway far from the battery field.

Other considerations arise, however, and often there is a conflict between convenience and economy. Which desire is uppermost? Can a little sacrifice be afforded, so that the latest development may be included? Quite often the little sacrifice is made. The puzzle ends when the self-debater buys a kit of parts to make his own electrified receiver, with necessary eliminating equipment, or buys a factory-made set of that sort.

There are many persons who hesitate to put "real money" into a radio receiver. The reasons are numerous. Besides the most frequent cause, inability to afford the outlay, there are such excuses as expectation of some revolutionary development that will antiquate the expensive set, and doubt that radio has reached such a stage that reception can be depended on to give value received for money spent. This is indeed a good time to put "real money" into a set, for a receiver, made of good parts and consistent with a proven circuit design, will be a source of usefulness and joy for years to come.

Enjoy Rich Tone

WHILE tone richness and quality have improved in radio receivers of late development, it must not be forgotten that most of the sets in homes today are not of the better kind, but are distorting devices, some of them serious offenders. About as severe a test as could be imagined is the broadcasting of symphonic concerts, and yet the majority of sets on which these programs are tuned in is unable to cope with the exacting demands, not to mention the speakers.

It is folly to suppose that anything akin to justice can be done to a symphonic broadcast with receivers numerically constituted as they are today. It behooves the possessors of badly distorting sets to avail themselves of the latest improvements in radio that afford richness of tone, even if these users are not particularly interested in symphonic music. While many instruments difficult to reproduce properly by radio are present in a symphonic orchestra, these same instruments make their appearance elsewhere, and one is quite likely at any time to tune in a program that one's receiver is incapable of reproducing properly, unless the set is one that has kept pace with radio's advancing strides.

The chief causes of distortion are the audio amplifying system, the tubes and the speaker. As to the audio amplifier, it is relatively simple to get a good one. If two transformers are used they must be large in size, for their virtues are approximately in proportion. The tube problem is solved satisfactorily by use of a power or semi-power tube in the last stage, with suitable negative grid bias, and necessarily high plate voltage. The 112, a .5 ampere 5 volt filament tube, or equivalent, is suitable in most instances, but the 371 is still better, although it requires so much B voltage and current that it is scarcely economical to use it in conjunction with B batteries. As to the other tubes in the set, they are seldom trouble sources.

In the speaker division the horns of yesteryear are no comparison even with the cheaper cones of today. The cone is a great improvement, but not because it is a cone. Horns are coming back with new signs of strength, due to the solution of acoustical problems related to their structure and manufacture. While sales show cones are a three-to-one favorite over horns, the new season may produce a change, if recently developed horns live up to the fine promise borne by the first few factory models.

The problem with speakers is to have them pass the low notes, without attenuation of the high ones to a discomforting degree. Otherwise expressed, the speakers resist the passage of low notes much more than they do the passage of notes of the middle or upper scale. One way of attacking the problem is to use enough power to overcome the antagonism shown by speakers to low notes, but a better way is to have the speaker omit the antagonism and not be too friendly with the high notes, either.

When one has an installation properly designed and equipped he has something that amazes visitors to his home. They know radio as it sounds in the majority of homes and are startled by what they call the "perfect reproduction" heard in the domiciles of the favored.

ME MEANS MO HERE

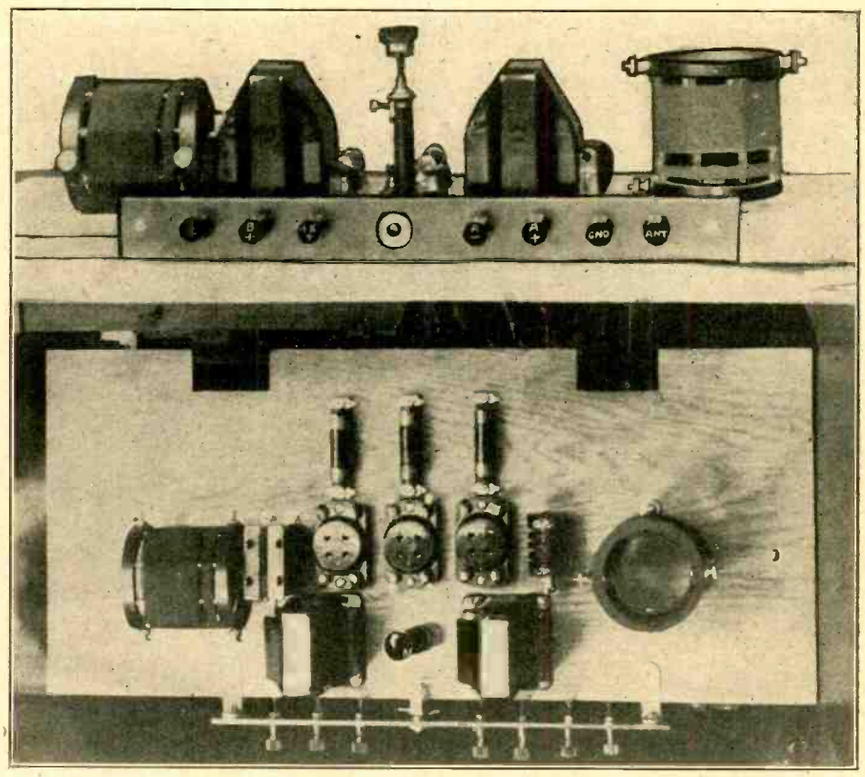
The New York City telephone directory, Manhattan and the Bronx, contains the following listing:

Try-Me Radio Co., 9 W. Bway..COR tland 5079

This company is owned by Moses Lager, and its correct name is Try-Mo Radio Company, a title that has received much comment for its originality and power of invitation.

Hints on Wiring Up The 3-Tube Beacon

Kink Is Straightened Out for Those Not Familiar With the Principle—Safeguards to Insure Set Working Well



(RADIO WORLD *Staff Photos*)

FIG. 4

In the top photo, an excellent rear view of the Beacon is obtained. Note the variable grid leak standing upright between the two audio transformers. How the parts should be laid out, are shown in the bottom photo, which was taken before the set was wired, so that each part may be viewed clearly. Note the right angle position of the coils. Also notches in the baseboard. This prevents the dial from hitting the board.

[*Last week, September 11 issue (Show Number), the building of the Beacon was expounded. In the following trouble shooting and other points of interest are discussed.*]

By James H. Carroll

Two little items which are of great importance, and without which the circuit positively will not function properly, are the by-pass condensers, C4 and C5, the products of Tobe Deutschmann. The recommended value for each is .00025 mfd.

If one desires to experiment with an additional fixed condenser, it might be of the same value, and located across the secondary of the first audio transformer (GF at lower left, Fig. 1). The object is to insure bypassing radio frequencies across this secondary, in the dubious event that the choke coil did not block these. The tone of the receiver may be changed slightly if the condenser is put across the secondary, due to attenuation of the higher audio frequencies. One should not use a large capacity condenser here, or it will cause audio feedback, or partly short-circuit the secondary in respect to AF.

An excellent plan in the construction of the set is to put a phone cord tip on the plate post of the detector socket, without anything else there except one side of C5, and connect the other phone tip to B plus amplifier detector voltage, normally 45. When you hear signals you know the set is functioning up to that point, and if any trouble develops it must be in the audio aspects of tube 1 or in tube 3.

As for the unusual representation of rotor plates going to grid, obvious in Fig. 1, this is the only correct way to wire up the set if the Bruno straight-line frequency condensers are used. These have a clear Bakelite shaft, which is the means of insulating the stator from the rotor. The frame is common with the stator, and as it is the frame that should be at ground potential, the rotor must go to grid. This is individual to the Bruno condenser, necessitated by the type of construction and used as an anti-body capacity effect. These statements are not to be regarded as in derogation of the efficiency of variable condensers that have the rotor grounded, instead of the stator.

The circuit itself is simple to tune, as there are only two controls—the Mar-co illuminated models—and no squealing.

Chosen by EXPERTS

GLENN H. BROWNING, Laurence M. Cockaday, Gerald M. Best and many other eminent radio designers use the Lynch Metallized Resistor in their experimental circuits and receivers. These men *know* radio; they have laboratory and testing equipment with which quickly to make accurate comparisons. There could be no better proof of the true merit of the Lynch Metallized Resistor than the endorsement of these experts.

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Because the fixed resistor is small in size, do not underestimate its vital importance.

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.25 to 10 Megohms	.50	Single Mounting	.35
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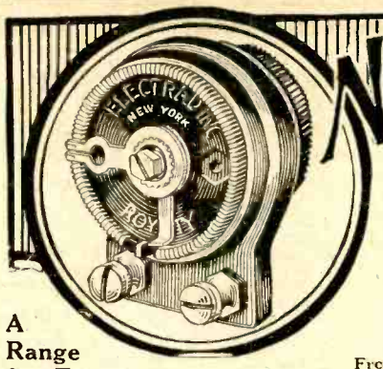

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Licensed by Technidyne Corporation under U. S. Patent 1593685, July 27, 1926.

A Range for Every Purpose

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Type B—1500 to 100 000 ohms.
Type C—500 to 50,000 ohms.
Type D—10,000 to 700,000 ohms (Detector control for B Eliminator).
Type E—Compensator, 500,000 ohms. Potentiometer.
Type F—0 to 2,000 ohms.
Type G—0 to 10,000 ohms.
Type H—0 to 25,000 ohms.
Type J—0 to 200,000 ohms
Type K—0 to 5,000 ohms.
Type L—0 to 500,000 ohms.
Type E—$2.00.

All other types $1.50.

From these 11 types you can select the range of resistance exactly adapted to your set. Note these important features of superiority:

1. Resistance element is not exposed to any mechanical operation.
2. Electrical contact is made positive by metallic arm on wire-wound strip.
3. The same resistance is always obtained at the same point.
4. Resistance value is under control in process of manufacture and does not change in use.
5. Entire range of resistance is covered with less than a single turn of the knob.
6. There is no mechanical binding and shaft is turned smoothly over entire range.

Ask your dealer for the genuine ELECTRAD Royalty High Resistances and insure satisfactory results.

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ELECTRAD Inc.

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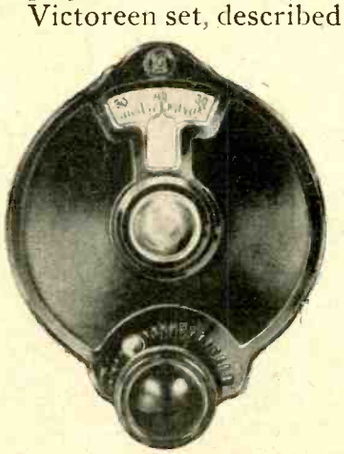
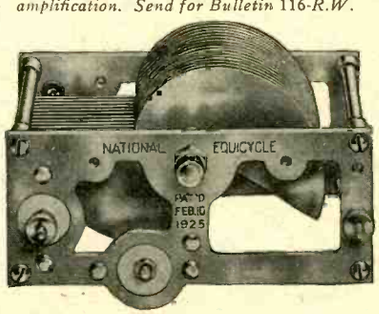
VELVET VERNIER ILLUMINATED DIALS, TYPE C "EQUICYCLE" CONDENSERS

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

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





THE NATIONAL ILLUMINATED VELVET VERNIER DIAL, TYPE C

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

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

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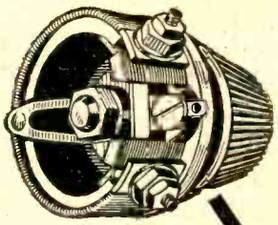
.00035 Mfd.	$7.75
.0005 Mfd.	$8.00

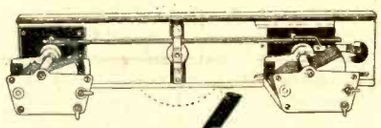
NATIONAL COMPANY, INC., makes the NATIONAL Tuning Units comprising NATIONAL VELVET-VERNIER DIALS, genuine NATIONAL Browning-Drake Space-wound coils and R. F. Transformers, and the NATIONAL Variable Condensers in a large number of different combinations suitable for the construction of practically any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

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

VICTOREEN

Radio Products





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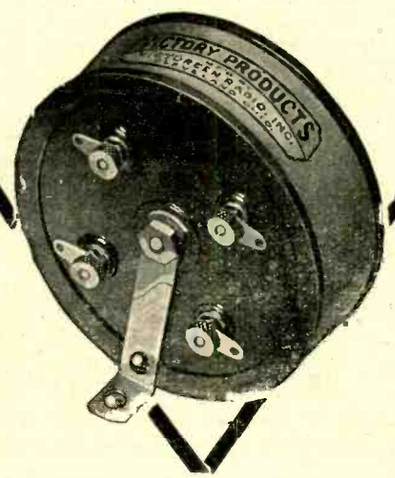
The only Rheostat with zero temperature coefficient—no matter how warm the unit becomes the resistance remains absolutely constant. Victoreen Rheostats have double the number of turns of wire used on ordinary Rheostats—that means twice as fine adjustment.

Genuine Manganin wire used in all Victoreen Rheostats.

This three terminal Rheostat simplifies wiring. Made with 5 resistances—2, 6, 10, 20, 30 ohms $1.20 each.

Victoreen Potentiometers

200 and 400 ohm resistances, $1.50 each.



Victoreen No. 170 R. F. Transformer—neat and compact—3 in. in diameter, 1 in. thick

VICTOREEN
Master Control Unit

A completely assembled, convenient single control unit for use in any circuit employing 2, 3 or 4 condensers.

Easy to mount and can be used on any layout without changing the wiring. Standard unit has 2 condensers. One or two more can be added, or it can be rearranged by the fan to suit his requirements.

Simplifies tuning—stations can be logged to one dial setting, whether loop or aerial is used. Unit as shown:

For Victoreen Super or any 2 .0005 condenser set.....$19.50
Extra condenser ready to mount..... 4.50

VICTOREEN R. F. TRANSFORMERS

are made with air core construction. They are not merely "matched," but are actually tuned to a guaranteed precision of ⅓ of 1%.

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

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

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

The Heart of the Circuit

4 Victoreen No. 170 R. F. Transformers, each....$7.00
(No. 171 Transformers when dry cells are used)
1 Victoreen No. 150 Coupling Unit, each..... 5.50
Should the use of aerial be preferred to loop, Victoreen No. 160 Antenna coupler is required, each 3.50
1—400 ohm Victoreen Potentiometer..... 1.50
2—6 ohm Victoreen Rheostats, each..... 1.20
2—30 ohm Victoreen Rheostats, each..... 1.20
1—Type V. S. Master Control Unit.....19.50

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

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TO KEEP YOUR FILES COMPLETE, you can order your newsdealer to put a copy aside for you each week while on your vacation. Or, send $1.00 for RADIO WORLD from now until the end of August, and in this way you will not miss any copies. SUBSCRIPTION DEPT., RADIO WORLD, 145 W. 45th St., N. Y. C.

Canton Radio Show

The second annual radio show, under the auspices of the Canton Radio Association, dealers and jobbers in receiving sets and equipment, sponsored by "The Canton Daily News," will be held October 6-7-8-9, in the city auditorium.

Louis E. Deuble, manager, "Canton Daily News," Canton, O.

BUCKLEY JOINS JAYNXON

B. Erle Buckley, expert in radio and acoustics, has entered into partnership with W. J. McCord of the Jaynxon Laboratories, 57 Dey Street, New York City. Mr. McCord has served the trade there for several years in all lines of radio research. The new concern will operate a fully equipped laboratory for repairing, rebuilding and designing sets, speakers, A and B eliminators and power amplifiers of every description. The research department for advance developments in radio and technical apparatus will be in charge of Mr. Buckley, consulting engineer.

CONSTRUCTION OF RADIO PHONE AND TELEGRAPH RECEIVERS by M. B. Sleeper sent on receipt of 75c. Guaranty Radio Goods Co., 145 West 45th Street, New York City.

All Parts for the 1927 Model Victoreen

Exactly as Specified
By ARTHUR H. LYNCH

One Victoreen Antenna Coupler No. 160	$ 3.50
Four Victoreen No. 170 Transformers	28.00
One Victoreen No. 150 Coupler	5.50
Two National .0005 Equicycle Condensers	10.00
Two National Type C illum. v.v. Dials	6.00
One Bruno A Battery Light Switch	.75
Two Lynch 10 meg. Resistors	1.00
Two Sangamo .00025 mfd. Fixed, with Clips	1.00
One Sangamo .006 mfd. Fixed Cond.	.85
One .012 Lynch Resistor	.75
Five Lynch .05 meg. Resistors	3.75
Six Lynch Single Mountings	2.10
Seven Tobe 1 mfd. By-pass	5.60
One 30-ohm Victoreen Rheostat	1.20
One 20-ohm Victoreen Rheostat	1.20
One Victoreen 400-ohm Potentiometer	1.50
Two 1-A Amperites	2.20
Six Eby Push Type Sockets	3.60
One Carter No. 6 Jack Switch DPDT	1.60
One Carter SCC No. 2A Short Jack	.30
Two Carter IMP Cord Tip Jacks	.30
Two Terminal Strips	.50
One 8x22" (or 7x21") Drilled and Engraved Lignole or Bakelite Panel	8.00
One Pair Bruno Adjustable Brackets	1.25
Twelve Lengths Stiff Acme Celatsite	1.20
Three Eby Binding Posts	.45
Lugs, Nuts, Solder, Screws, etc.	.25
	$92.35
Corbett Victoreen Walnut Cabinet, 8x22", for 25° Sloping Panel	$15.00
CeCo Type A Tube	$2.00
CeCo tubes, Types G and H	$2.50 each
Electrad Aerial Kit, complete	$3.50
Mathiesen-Sanberg Victoreen Loop	$12.50
Victoreen 9x21" Baseboard	$1.00

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Four Stages of RF New Accomplishment

Up to about two years ago the most modern type of radio set, the most powerful type of radio set, was limited to two stages of radio frequency amplification, then the detector, and then two stages of audio frequency amplification.

Modern developments, however, now permit the use of three stages of audio amplification, and the best types of present-day high powered receivers involving four stages of radio frequency amplification, detector, and three stages of audio frequency form instruments which can accomplish wonderful results which even a year ago were considered impossible.

When atmospheric conditions permit, a receiver of this character is practically unlimited in its range, and when located amid adverse surroundings, such as tall buildings and remote distance from a broadcasting station, or where the broadcasting station is extremely low in power, will give a superabundance of volume, and when properly designed, a fidelity of reproduction which is a revelation to those who have heretofore been accustomed to sets of lower power.

Such a receiver will accomplish on a small loop what other receivers cannot accomplish even on a large antenna.

INTERMEDIATE TRANSFORMERS

You can easily build a set of four real D. X. Intermediates with our kit of Matched Coils, Silicon Steel Laminations, Cases, Screws, Nuts, Filter Condenser Instructions, Etc. Powerful Amplifiers with superb tone — a satisfying combination when you

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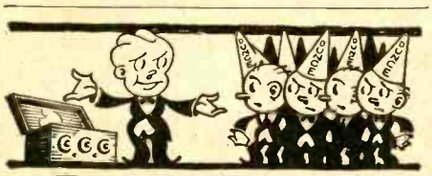

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Gentlemen:—Send me details of your method of construction and prices of the "Kustombilt Kits" that are marked below:

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CONFESSIONS OF A SUPER BUG, by James H. Carroll, appeared in RADIO WORLD dated May 22. 15c per copy, or start sub. with that number. RADIO WORLD, 145 W. 45th St. N. Y. C.

SIX NEW STATIONS

WASHINGTON.

Six new stations have been licensed by the Department of Commerce, while three stations have changed their wavelengths, one station its location and two stations their call letters. Three stations of small power are reported as having discontinued operation.

NEW STATIONS

KGCI, International Radio Co., San Antonio, Tex., 1,250 kc 239.9 meters.

KGCG. Moore Motor Co., Newark, Ark., 1,280 kc 234.2 meters

WBBC, Peter J. Testan, Brooklyn, N. Y., 1,200 kc 249.9 meters

KTUE, Uhalt Elec., Houston, Texas, 1,140 kc 263 meters.

WGM, Verne & Elton Spencer, Jeannette, Pa., 806 kc 372 meters.

KGCH, Wayne Hospital, Wayne, Neb., 666 kc 450 meters.

CHANGES

WCRW, Chicago, Ill., wavelength changed from 239.9 meters to 416.4 meters.

KOIN, H. B. Read, Sylvan, Ore., owner changed to KOIN, Inc.

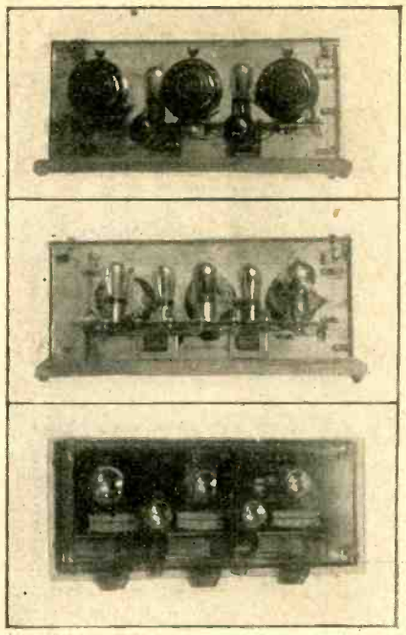
WQAM, Miami, Florida, wavelength changed from 263 to 285.5 meters.

WKBA, Chicago, Ill., wavelength changed from 288.3 meters to 209.7 meters.

KFLZ. Anita, Iowa, has changed its call, formerly KICK.

The deleted stations follow: KFWA, Ogden, Utah; WTAP, Cambridge, Ill.; WRW, Tarrytown, N. Y.

PROUD OF SET



(RADIO WORLD *Staff Photos*)

ABOVE WE have three views of the receiver built by R. H. Bachmann, which typifies excellent work.

RESULTS

RESULTS EDITOR:

I have constructed the 5-tube TRF set described by Capt. P. V. O'Rourke in the Dec. 26, 1925, issue of RADIO WORLD and am more than satisfied with it. After three years of experimenting with various circuits this one has given utmost satisfaction.

R. H. BACHMANN,
922 Bryant Ave.,
Bronx, N. Y. C.

WILLING INVESTOR WITH SALES ABILITY to manage chain store, must have $5,000 to invest in a well-established radio and hardware concern needing capital to open a series of chain stores; no previous experience necessary; complete instructions given; every prospect must be willing to submit to training in one of our stores before taking over complete management. Phone Cortlandt 0677 for appointment with Mr. Pering. Excellent opportunity for right party.

THE NEW AND IMPROVED
DIAMOND OF THE AIR

ASSOCIATED PARTS MANUFACTURERS

BUILD YOUR DIAMOND NOW—*the New Season Offers Nothing Better for Simplicity and Efficiency*

APPROVED BY HERMAN BERNARD

HERMAN BERNARD'S GREAT CIRCUIT
Guaranteed by us and by the Manufacturers of the parts used therein.

Panel View of the Improved Diamond of the Air
Manufactured by the Clapp-Eastham Co.

Licensed Under ARMSTRONG PATENT No. 1,113,149 Exclusively for BRUNO RADIO CORPORATION

PARTS FOR THE NEW AND IMPROVED DIAMOND OF THE AIR KIT

1 Bruno No. 99 R.F. Coil
1 Bruno No. 99 Tuning Coil
2 No. 101 .0005 S.F. Bruno Condensers
1 Bruno Pilot Light Switch
3 Bruno Bakelite Vernier Dials
3 ¼ Amp. Amperites (mounted)
1 ½ Amp. Amperite (mounted)
1 3½-1 Bruno Trutone Model D Transformer
2 .1 meghom resistors (General Resistor)
1 1 megohm leak (General Resistor)
1 .5 megohm leak (General Resistor)
1 Bretwood Variable Grid Leak
2 Double Circuit Jacks
1 Single Circuit Jack
1 Century 7x24 drilled and engraved Panel
5 Pacent U.X. Spring Sockets
1 Century Drilled Socket Strip
1 Pr. Bruno Brackets
2 .25 mfd. Aerovox By-Pass Condensers
1 5 strand De Luxe multi-colored battery cable
1 Push Pull Battery Switch
1 .00025 mfd. Aerovox fixed condenser
4 Bruno Binding Posts
5 Battery Cable Markers
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4 Mounts
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OUR PRICE to RADIO WORLD readers $37.50

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THE BRUNO BASIC DIAMOND KIT

The Heart of the DIAMOND

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Consisting of:
1 Bruno .0005 Condenser
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1 Bruno R. F. Coil
3 Bruno Vernier Dials
1 Bruno Light Switch

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Century Panels Beautify the Diamond of the Air
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TABLE FOR CONVERSION OF FREQUENCIES AND METERS appeared in RADIO WORLD dated May 1, 1925. Sent on receipt of 15c, or start your sub. with that number. RADIO WORLD. 145 W. 45th St., N. Y. C.

The Bretwood Variable Grid Leak
Selected After Exhaustive Tests by Herman Bernard
for the "NEW AND IMPROVED"
DIAMOND OF THE AIR

BLUE PRINT and Book, DIAMOND OF THE AIR sent on receipt of 50c. Guaranty Radio Goods Co., 145 West 45th Street, New York City.

HERMAN BERNARD, managing editor of RADIO WORLD, broadcasts every Friday at 7 p. m., from WGBS, Gimbel Bros., N. Y. City. 315.6 meters. He discusses "What's Your Radio Problem?" Listen in!

Broadcasting Helps Church, Says Straton

Denying that radio has hurt church attendance, the Rev. Dr. John Roach Straton, pastor of Calvary Baptist Church, New York City, which broadcasts weekly over WHN, declares that his membership has been greatly increased through this medium. Dr. Straton is strong in his praise of the radio. He was one of the first of the prominent pastors to begin broadcasting services. It was declared by other pastors as well as by some of laymen that when radio began to gain in popularity the theatre and church alike would suffer. The theory that it would be easier to sit at home and hear the same thing would keep people away was advanced. Many believed this and many still do, but not Dr. Straton.

He states that his active membership has been greatly increased since his services were put on the air. Not only have former members returned to the flock but persons who never could be reached before now attend services. Then the broadcasting of the hymns during regular morning and evening services augmented by the special Inspiration Hour in the afternoon have grown in popularity. This is easily attested to by the increasing number of letters and phone calls requesting special hymns to be played by the organist or sung by the choir. On one occasion, the pastor states, another church's pastor phoned to him to say a receiving set had been installed in the church and broadcasting from Calvary Church had been incorporated in his services.

When the hymns were sung the church which had installed the set joined in the singing as if its own organist was on hand and its own choir leading.

Many other interesting examples of the help churches receive from radio could be cited. There are other pastors who back Dr. Straton's praise, including some of the evangelists who formerly were forced to reach their people through other media.

One of these is the Rev. Edward Haines, who also broadcasts from WHN now. He declares that he has received thousands of letters from persons whom he has reached through radio. One of the letters was from a woman who wrote that she had been despondent and planned to end her life, until she heard his messages on her radio.

RADIO WORLD'S QUICK-ACTION CLASSIFIED ADS.

10 CENTS A WORD. 10 WORDS MINIMUM. CASH WITH ORDER.

NO MORE CORROSION WITH NOKORODE storage battery terminal. Fits all batteries. Give terminal size when ordering, $1.00 pr. Asco Sales, 2131 W. 28th Street, Los Angeles, Cal.

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MALE HELP WANTED
A PAYING POSITION OPEN TO REPREsentatives of character. Take orders shoes-hosiery, direct to wearer. Good income. Permanent. Write now. Tanners Shoe Mfg. Co., 8-710 C Street, Boston, Mass.

PATENTS—Write for free Guide Books and "Record of Invention Blank" before disclosing inventions. Send model or sketch of your invention for our Inspection and Instructions Free. Terms reasonable. Radio, Chemical, Mechanical, Electrical and Trademark experts. Victor J. Evans Co., 924 Ninth, Washington, D. C.

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

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

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

STEINMETZ' LAST DAYS RECOUNTED

[*This is the sixth and final instalment of the life of Charles P. Steinmetz.*]

Many types of lightning arresters were designed for the purpose; and they sometimes provided this protection, but failed to operate at other times, from causes not understood.

Realizing the great need of better lightning protection, Dr. Steinmetz began to study this whole broad subject. He perceived, however, that before better protection from lightning could be found, electrical engineers would have to know more about lightning itself. Therefore, his first work in this investigation was to study lightning, what causes it, how it behaves and how much electrical energy it may obtain.

After he had done this for many years, Dr. Steinmetz came to know so much about lightning—how it was caused, how much power it could produce and how it behaved—that some people called him the "friend of lightning." It is certain that he was never afraid of it.

Instead of wanting to hide during a thunder and lightning storm, he enjoyed watching the lightining as it flashed across the sky.. He always knew it was dangerous if it struck close to where a person happened to be; but he had discovered that the chances of this are small, and that there is not as much reason to be afraid of it as most people believe.

As he went on with his studies of this tremendous thing, which has always so awed human beings, Dr. Steinmetz gathered all the data he could about lightning storms and places that had been struck by lightning. And, strangely enough, his very best chance came when lightning struck his own camp on Viele's Creek, one day during the summer of 1920.

Rushes to Camp

Rather fortunately, perhaps, Dr. Steinmetz was not there at the time. But within a day or two, he had heard about it. He at once put everything else aside in order to go out to the camp and see what the lightning had done.

He examined the damage and went over the ground just like a detective at the scene of a crime. He took careful notes of the path followed by the lightning, and secured photographs.

Most singular of all, he carefully collected the fragments of a looking-glass which the lightning had smashed into many pieces. These fragments were like a Chinese puzzle; yet Dr. Steinmetz managed to put them together, so that the looking-glass would be restored. He believed that thereby he could discover how it had been marked by the lightning. He was sure this would give him important information.

All this led up to the time, in 1921, when Dr. Steinmetz designed and had built for his use a piece of electrical apparatus for producing lightning in his laboratory, although on a much smaller scale, of course, than actual lightning.

He called this machine a lightning generator. It was built from data and knowledge which Dr. Steinmetz had gained through years of lightning studies. It was just as carefully designed as the great electrical generators used for producing electric current in power stations.

(*Concluded on next page*)

LIFE OF STEINMETZ

(*Concluded from page 29*)

The last few years of Dr. Steinmetz's life were unusually busy and pleasant. To feel that he was being useful made him happier than did the knowledge that he was famous, or that people called him a "wizard." It made him feel he had lived a life that really counted.

Calmly he kept on with his brilliant work. He never hurried, never did anything in a whirl; but he accomplished a great deal of work, or rather did a great deal of electrical engineering. That was a kind of activity that he did not regard as work, because he enjoyed doing it so much. It did not seem a burden, which is the way people sometimes feel about work. Dr. Steinmetz once said that the only thing he had to do which was really work to him was to answer his correspondence.

Met Other Great Men

His life frequently brought him into touch with other men of prominence. Early in the twentieth century, he had met Elbert Hubbard, the famous philosopher and writer, whose admiration for Dr. Steinmetz was immense. He had also met, in the regular course of his work, Thomas A. Edison, the great inventor, and the two had formed a deep liking for each other. When Prof. Albert Einstein, the noted German scientist, came to America, in 1922, Dr. Steinmetz was one of those who received him and assisted to entertain him. Dr. Steinmetz was also a friend of Signor Gugliemo Marconi, the "father of the wireless." When Marconi paid a visit, in 1922, to the General Electric works at Schenectady, he and Dr. Steinmetz had a friendly talk together, during which Marconi inquired after one of Dr. Steinmetz's pets, a Gila monster, and expressed regret to learn that the reptile had died "because," as Dr. Steinmetz said, "he was too lazy to eat."

Dr. Steinmetz predicted that some day the industrial world would not require men to work longer than four hours a day. But he made it clear that he believed the leisure which people would enjoy under such a plan ought to be wisely spent in sensible amusements and the kind of recreation that improves the mind and raises the whole standard of life.

He was naturally a strong believer in the use of electricity for everything. He predicted that some day all the railroads of the United States would be run by electricity instead of by steam. He predicted also that America would soon have to harness all her waterfalls to produce electricity by water-power, in order to make her coal supplies last longer.

On one occasion he said: "We call this the age of electricity, but it isn't. The age of electricity hasn't begun. All that we have yet done is but preparatory to the ushering in of the electrical age.

"When the age of electricity comes—as it will—electricity will do for everybody all that it *can* do for everybody. It will do all this in addition to doing a multitude of things of which we have not yet dreamed.

Death of Steinmetz

"I came to America in 1889. It seems a long way back to think where the development of electricity was at that time. It seems a long way ahead to think where it will yet be. For the age of electricity is yet to come. And it will be a great age."

He belonged to a church—the congregation of All Soul's Unitarian Church of Schenectady. He had his own peculiar views about religion, but he liked to go to the church where the Hayden family went and was always there when a children's entertainment was to be given.

After a trip west in the fall of 1923, Dr. Steinmetz felt very tired; he seemed to be well, although the doctor would not let him go out. Then, quite suddenly, on the morning of October 26, 1923, shortly after eight o'clock, he died at his Wendell Avenue home, of heart disease.

His death was a tremendous shock to the entire world, but especially to the electrical engineering profession, and to the great organization of the General Electric Company.

Charles Proteus Steinmetz was laid at rest in Vale Cemetery, Schenectady. A simple stone marks the grave—for his life was simple and without showy display.

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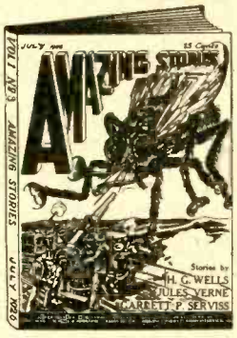

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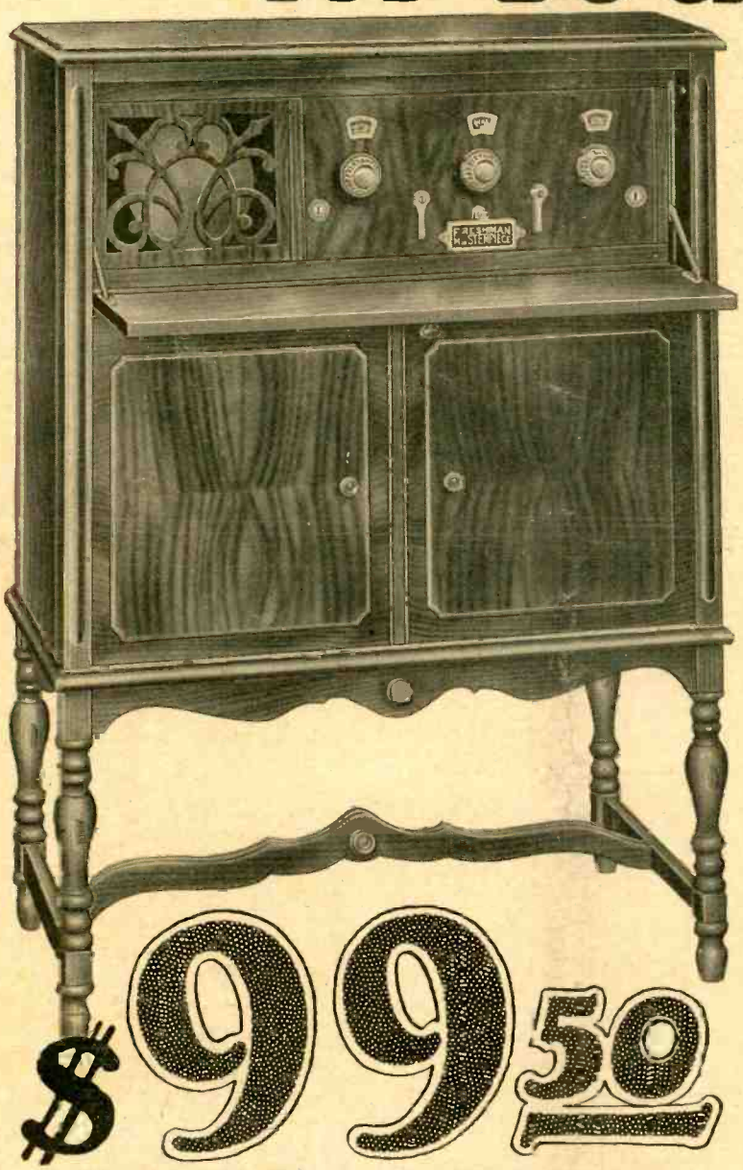

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