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THE NEWSPAPER FOR THE HOBBYIST OF VINTAGE ELECTRONICS AND SOUND

THE HORN SPEAKER

MORE PAGES EVERY QUARTER

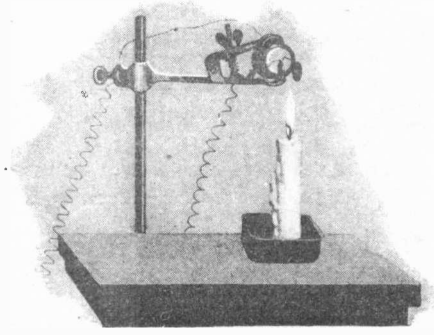
To give more needed space in The Horn Speaker, especially after going to the smaller format, the March, June, September and December editions will be planned for 12 pages. During the period of a year the newspaper will have more space.

Radio News for June, 1925

How a Detector Detects

By Vernon C. MacNabb

It is an extremely difficult matter to explain the action of the detector plainly, but Mr. MacNabb succeeds very well in this article.



An experiment showing the principle of the electron valve. Two electrodes are placed in a candle flame.

THE detector is indeed the soul of the radio set, without which it would be mute. There have been many articles written on detectors, particularly concerning the vacuum tube used as such, that were excellent but did not cover the field thoroughly and simply.

This article will take up the radio currents at the point where they enter the set and carry them through a detector to the phones. Detection by a crystal and two methods of detection by vacuum tubes will be discussed here.

Just how an antenna picks up a radio wave is too complicated to be explained here, so we will start by saying that a wave is induced in the receiving antenna. Assuming a hook-up like that shown in Fig. 1, a circuit S is tuned to the incoming wave. This wave is made to follow around the tuned circuit. The word "tuned" may mean to a number of people simply the turning of a dial, so a brief explanation by the use of a mechanical analogy will be given.

TUNING

Take, for example, a system such as that illustrated in Fig. 2. C is a closed container with an elastic diaphragm D fastened across the middle. L is a long coil of pipe and P is a pump, both being connected to C, as illustrated. The whole system is airtight and filled with a viscous liquid, such as heavy oil. Suppose that a force F acts upon the piston (p), causing it to move up, forcing the oil to flow into chamber C at the top. The oil may take either of two courses, one to flow around through pipe L and return to the other side of the piston, the other to crowd into the space above D and cause the diaphragm to stretch downwards. It chooses to do the latter because the inertia of the long column of oil in the pipe causes it to take a long time to get started. The oil below D, which must of course be removed to allow D to stretch downwards, flows into the space left in P by the upward motion of the piston. The oil in the pipe, L, does finally get started, however, and flows around to the lower half of C, allowing D to resume its neutral position. But the law of inertia states that a body in the state of rest or motion will not change that state unless acted upon by some outside force. So just as the oil in L did not want to move when it was at rest, so it does not want to stop when it is in motion. The result is, it continues to flow and causes the diaphragm to be stretched upwards. When the oil is finally stopped by the diaphragm, its tension causes it to recover and so sends the oil back through L in the opposite direction.

Thus the oil would oscillate back and forth continuously if there were no losses in the system. But due to friction in the passages, this oscillation gradually dies out and the system is at rest. Suppose that, at the same instant, as the diaphragm started the oil on its return trip through L, the piston "p" was pulled downward. It would tend to help the diaphragm push the obstinate oil back through the coil. So if the piston moved in such a manner as to always help the diaphragm, the pump and oscillating oil system would be synchronized or in "tune."

IN RADIO

This is what actually happens in the radio receiver. The pump can be likened to the antenna which supplies the power and starts the system working in the first place. L is analogous to the coil of wire or inductance, and C, the condenser. The oil represents the current flowing in the circuit and F the voltage on the antenna. The resistance of the circuit, like the resistance of the pipe, supplies the losses. If the voltage on the antenna aids the condenser in sending current around through the coil, the system is in tune.

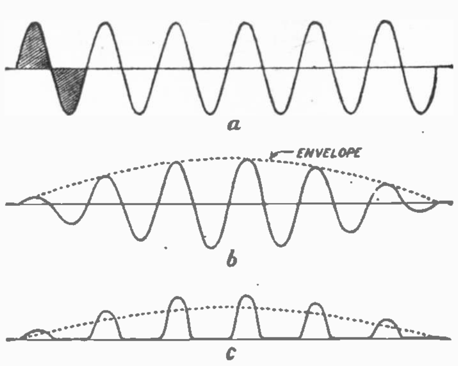


Fig. 3. The curves show resulting action of current through a radio circuit.

Going back to the mechanical device, it is easy to see that when the diaphragm is distended it possesses in itself a force, which is due to the force on the piston. Thus when the condenser is charged by the antenna, it has a voltage across it. Now as the diaphragm forces the oil around through L, the diaphragm straightens out, its tension decreases, and when it is straight the tension is zero. Thus as the condenser succeeds in making current flow through the coil, its voltage falls to zero. As explained before, the diaphragm stretches in the opposite direction, therefore reversing the action. The same phenomenon occurs with the condenser and its voltage builds up in the opposite direction.

Thus we see that we have the voltage rising, falling, reversing, etc., across the condenser and the result can be plotted as a curve shown in Fig. 3a.

Let us now look for the last time at our oil system. If the piston is caused to reciprocate through a distance equal to only half the length of the cylinder, the distending and, therefore, the maximum force of the diaphragm will be less than if the piston made the entire stroke. The same idea applies to the condenser, for if the maximum force (voltage received on the antenna) changes, so will the maximum voltage across the condenser vary in some such manner as curve b, Fig. 3, which is an actual plot of a wave as sent out by a broadcast station.

The reason why a radio wave has this shape can be explained as follows: The transmitter, when no one is causing a disturbance in the microphone by speaking into it or playing a musical instrument, radiates or sends out from the antenna a pure "sine" wave, as that in Fig. 3a, and is known as the carrier wave. The frequency of this wave, *i. e.*, the number of times that it repeats itself per second, is 1,000,000 times for a wave-length of 300 meters, which is in the range of broadcasting wave-lengths. Musical notes that we can hear range from a frequency as low as 20 cycles per second up to about 15,000 cycles per second.

When someone speaks into a microphone these lower frequency waves are superimposed upon the high frequency or carrier wave, and the resultant wave is their product. Due to the fact that the high frequency wave is always the same, the outline or envelope of the resultant wave is of the same general shape as the musical wave, as shown by the dotted line in Fig. 3b.

By referring to Fig. 1 it will be noted that the condenser is connected across the crystal and phones of a, and from the grid to the filament of the tube in b and c. Since we have determined the nature of the voltage across the condenser, we can replace the antenna coil and condenser by an alternating current generator, as is done in 1 d, e, f, having the required alternating voltage wave 3b, and we are ready to consider the subject of detection.

Detection is related to rectification inasmuch as it is the converting of an alternating current or voltage whose average value is zero to a current or voltage of such a nature that the average is a finite quantity and must therefore be unidirectional, or as it is generally called, direct current or direct voltage.

What the average value of such a wave is may not be clear to everyone, but is quite simple. Referring to the two equal shaded areas of the wave of Fig. 3a, it will be noted that one is above the axis or positive and the other is below the axis or negative. Since they are equal but opposite, their average, over a complete cycle, is zero, just as a company having assets of a $1,000 and liabilities of the same amount has nothing left. But in Fig. 3c, which we will discuss in the next paragraph, all the areas are above the axis and their average, which for each area is the area divided by the length of the base of that area, is some value which is not zero.

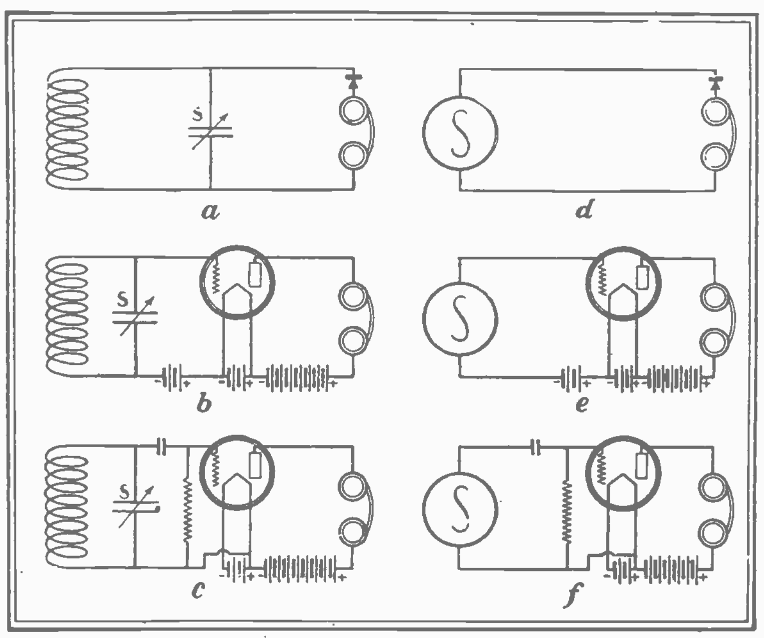


Fig. 1. In a, b and c are shown fundamental circuits for receiving. In d, e and f the inductance and tuning condenser are replaced by a source of alternating emf.

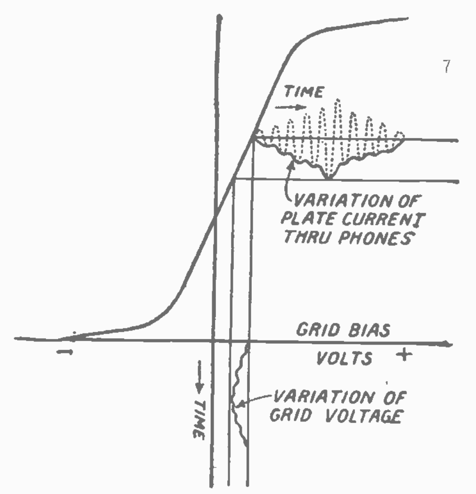


Fig. 5. Characteristic curve of vacuum tube with mechanical analogy in Fig. 6.

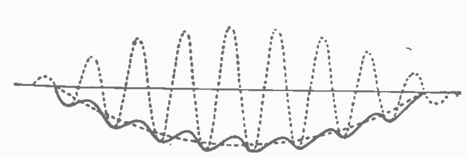


Fig. 7. Resultant curve of the variation of force on the diaphragm of a phone.

(Continued on page 3.)

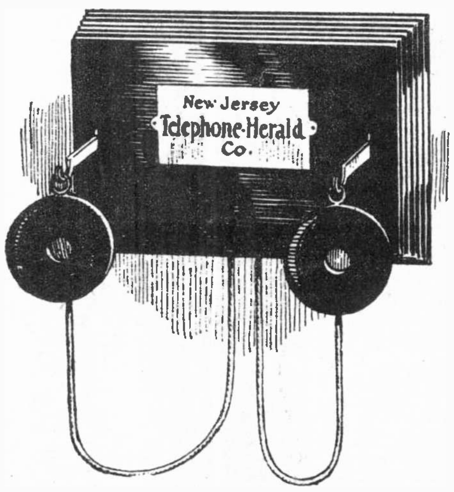
Radio News for June, 1925

Broadcasting in 1912

By G. C. B. ROWE

Very little is known now of the first commercial broadcast venture in the United States. This article chronicles its history. It was over telephone lines.

IN the age of science in which we are living people take the wonders that surround them as a matter of course and are wont to say: "How the world is progressing!" True enough, but it should be remembered that there is an old saying—"There is nothing new under the sun." How about the music, bed-time stories, news items and all the other programs that can be listened to without leaving the home, may be asked. Nothing new, is answered, nothing new, someone tried that a quarter of a century ago in Europe and thirteen years ago in Newark, N. J.



The subscriber's home installation was little more than a pair of receivers, as may be seen from the above sketch.

"What?" we can almost hear gasped, "could people hear the same sort of programs we hear today without stirring from their firesides?"

The answer is in the affirmative. If a person in Newark in the fall of 1912 wanted to learn how his pet stock was behaving or if he wished to hear the latest happenings reported by the newspapers, or some snappy cabaret music, he put on his headset (even as you and I) and there was the program he wanted. Hardly seems possible, does it? But here is the tale.

In the early part of 1912 there were several gentlemen of New York traveling in Austria-Hungary and while they were in Budapest they were surprised to learn that they could listen to concerts or lectures without leaving their rooms. Being progressive Americans, they investigated this system of broadcasting programs and ascertained that it was not patented in the United States. They decided that such a system would be an excellent one to introduce at home, so they persuaded the Austrian engineers to tell them how it was accomplished.

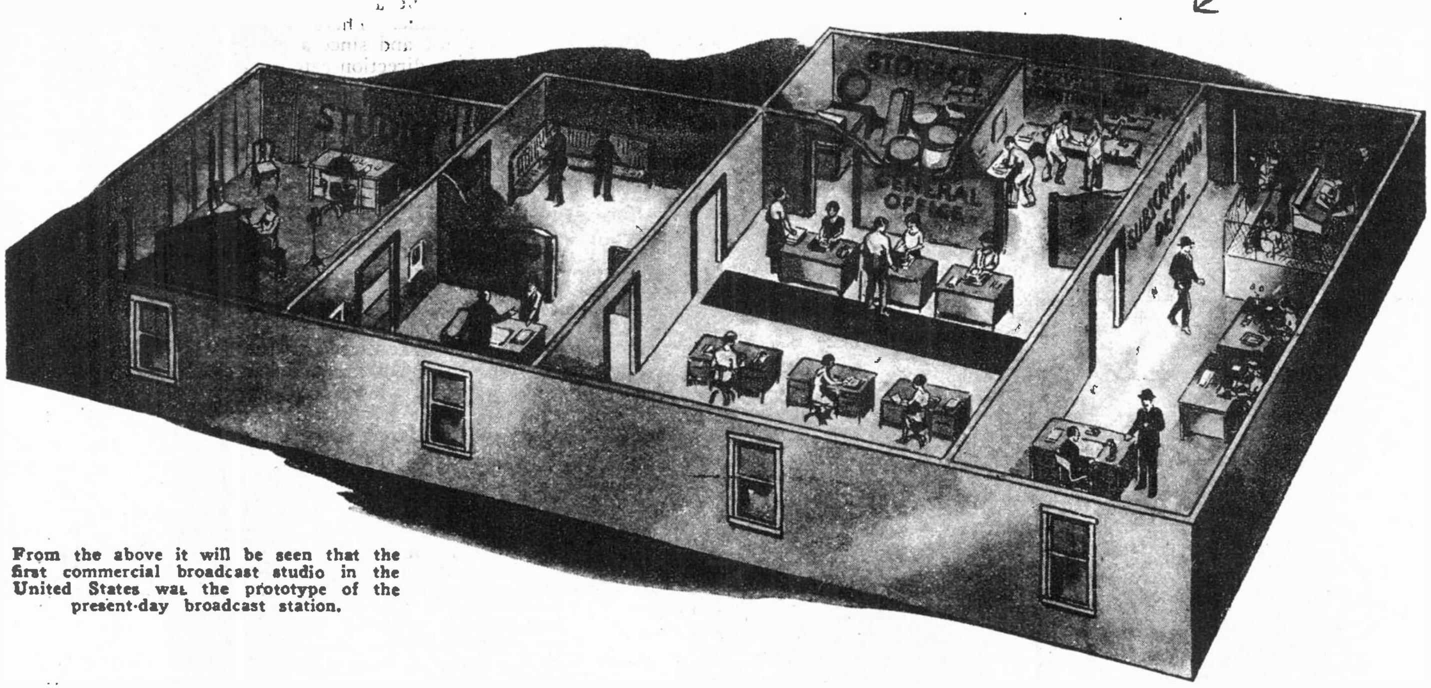
These traveling gentlemen being of Wall Street, naturally attacked the new venture in the Street's usual manner. They formed the New Jersey Telephone Herald Company. In the charter it was stated that the company was formed to provide subscribers with entertainment by using telephone lines. Among the gentlemen who were heading the venture were Percy R. Pyne, 2d, H. B. Hollins and Charles E. Danforth.

It was decided to install the system in Newark, N. J., with the idea that if it was successful in that city, it should be introduced in New York. Wires were leased from the telephone company and the work of installation was started early in the Spring of 1912 and regular programs were being broadcast by July.

These programs started at nine o'clock in the morning and continued without interruption until 11 p. m. As has been mentioned above the same sort of programs that are broadcast today were sent out over the wires in 1912. Every fifteen minutes during the sessions of the Stock Exchange, quotations were given, supplied by ticker service from the Stock Exchange in New York. News items were read as soon as they were reported to the papers. There were fashion talks, sport talks, and bed-time stories for the children. The musical portion of the programs were under the guidance of Frank Clegg, who had his own orchestra at the studio and several times a week, in the evening, dance music was broadcast from one of the cabarets. Then, as now, managers of the theatres had the problem confronting them of whether they should broadcast their productions, because several plays in the local theatres were put on "on the wire."

John P. Rainbault, who was the general manager of the first broadcast company.

However, the apparatus supplied by the Austrian engineers was not adaptable to American telephone engineering practice and the reception of the music and talks was not as clear as it should have been. The use of twisted pair in the distribution resulted in a capacity effect that had not been encountered in the installation in Budapest. The directors of the company then called in Mr. John P. Rainbault, a telephone engineer of New York and the present Eastern representative of the Fansteel Products Co., who revised the entire system according to American engineering principles. In a short time, due to his efforts, the people of Newark were able to enjoy the first broadcasting that had ever been attempted in this country. Mr. Rainbault was retained by the company as their general manager, which position covered everything from arranging the programs and seeing that they were transmitted properly, to getting new subscribers.



From the above it will be seen that the first commercial broadcast studio in the United States was the prototype of the present-day broadcast station.

The central offices, the studio, and the switch rooms were located in the Essex Building in Newark. Performers in that studio of 1912 would be surprised if they should walk into a present day studio of a broadcast station, because they were just the same in nearly every detail. The walls of the room were hung with heavy drapery to eliminate any echos, there was a piano in its usual place, and then the most necessary of all, the "mike." It was in the latter instrument that the old-timer would notice the only difference, as the microphone then used was of the Erickson type. The operation of the station was also the same. Announcers, who were called "stentors," told the audience what the next numbers were to be, just as their contemporaries do today.

The layout of the apparatus and lines were in accordance with the best engineering principles of the day. The signals were picked up by the Erickson microphone and went to the switch room. Here they were connected through a switchboard to sub-distributing centers in the Branch Brook, Waverly and Market districts. The necessary apparatus of the broadcast company was placed in a building adjacent to the district exchanges, where the monitors of the system checked up on the different circuits to see that they were in proper operating condition. The lines that were leased from the telephone company were used only from the switch room to the three districts and from the district exchanges to the different sections. Each section was a city block and all the headsets in a section or block were in series with the line from the district exchange, these circuits being all carefully balanced. Inside the houses that were equipped with the service there was a small moulded insulation block with two hooks on which were hung the head-phones. However, there was no switch to turn off the music and so whenever the phones were placed on the ears between the hours of nine and eleven something was heard.

The price of this service was $1.50 a month and the first two or three months the subscription department was swamped with orders for installations. Within the first three months about 5,000 subscribers were on the books of the New Jersey Telephone Herald Co. However, as with everything else, people soon tired of their new toy, mainly because loud speaker reception was not available, although the signals that were received were very clear and of excellent head-phone volume. New subscriptions continued to come in, yet there were a large number of subscriptions canceled. The management of the company realized where the difficulty lay and Mr. Rainboult and his chief engineer, Mr. J. L. Spence, worked on the perfection of a mechanical amplifier. However, they realized that the results obtained were far from satisfactory, so in December of the same year it was decided not to fight any longer against such odds.

It is an interesting fact to note that if there had been the vacuum tube as we have it today, this scheme would have worked satisfactorily in every way.

PROBLEMS

There were many problems then that are interesting to review. One of the large department stores of Newark wanted the New Jersey Telephone Herald Co. to read a résumé of their advertisements daily to the subscribers, but the directors of the company refused to comply with their requests as they feared that it would cheapen the broadcasting. The mechanical amplifiers used were nothing more than a mere diaphragm with a rod attached to its center, which energized another diaphragm. Naturally an amplifier of this type was far from being satisfactory, as the distortion present in the amplified signals was considerable. Mr. Rainboult and Mr. Spence, did considerable research work on these repeaters, but the company closed their business before any satisfactory results were obtained.

As has been mentioned above, if there had been some means of amplifying the signals that were sent out over the lines, the company would doubtless have been successful. However, there occurred the family argument that is recurring today in the homes where there are receivers using crystals for detectors—who gets the phones? Even though the reception of the signals was clear, yet the people in general could not be educated up to the idea. Advertising in Newark's papers had increased the subscription list to over the five thousand mark, yet the public refused this initial trial of broadcast entertainment. There had been an outlay of over $200,000 and so the New Jersey Telephone Herald Co. was closed and the headsets removed from the homes of Newark.

This was a scheme that has proved to be one of the most popular types of entertainment that has ever been devised, but to be so popular it needed the vacuum tube of the present day to amplify the received music so that entire families could listen in at the same time. This Newark venture of 1912 was just another one of those things that are devised a few years ahead of their time, in this case not more than five or six.

OH MY!

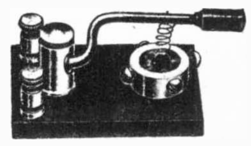
Irate Captain—What! You admit striking the wireless operator?

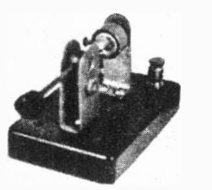
Passenger—Yes, sir. I gave him a radiogram to send and he started to read it.

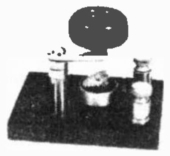
—Contributed by Jack Bront.

1924 ad

How a Detector Detects



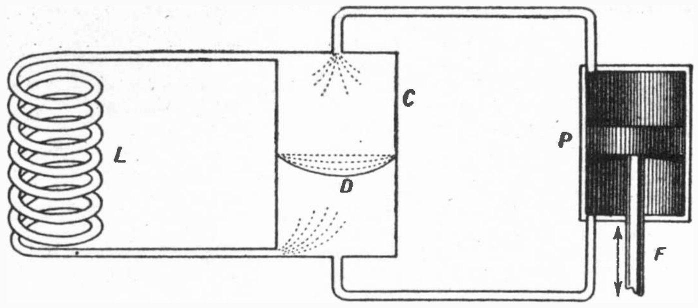




RECTIFICATION BY CRYSTALS

The crystal detector, used with the familiar catwhisker, has the peculiar property of offering a very high resistance to the passage of current in one direction and very little opposition to current flow in the opposite direction. The alternating current generator tries to send current first in one direction, then in the other, but it succeeds in getting current through in one direction only. This gives the effect of cutting off half of the waves, as is shown in Fig. 3c, and the average of this part that is left is direct

Fig. 2. This shows a simple mechanical analogy of the current passing through a tuned radio circuit.

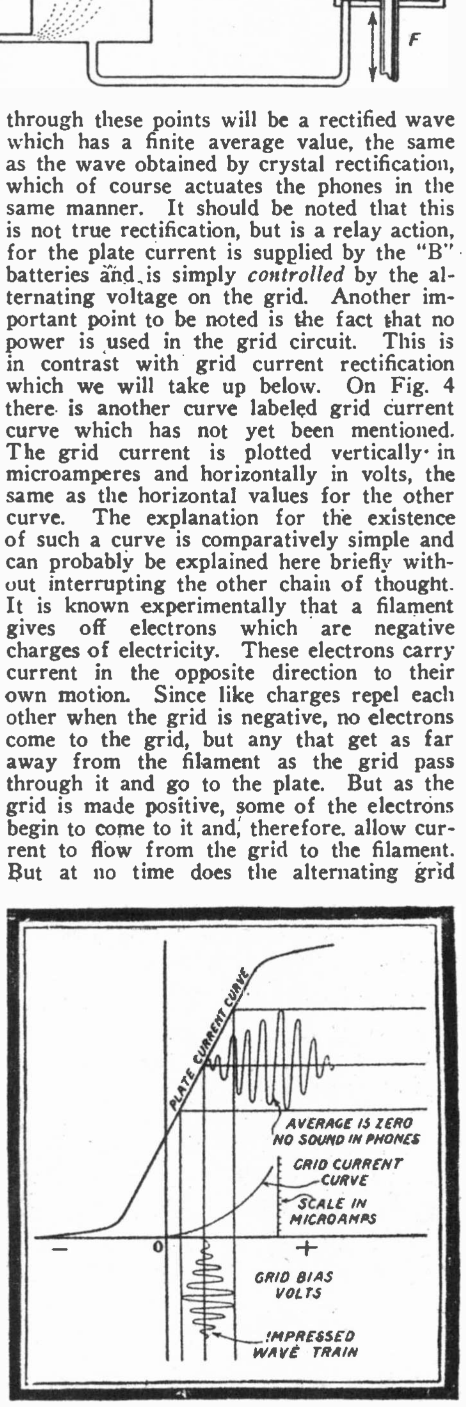


current and passes through the head-phones. The diaphragm of a telephone is comparatively sluggish and will not respond to the rapid changes of current, but does respond to the average change. The dotted line in Fig. 3c is this average change, which is the same shape as the frequencies of the musical notes impressed on the microphone at the broadcast station.

VACUUM TUBE DETECTORS

Now that we have had this little review in fundamentals, we are ready to take up the main subject of the article, namely, detection by means of the three-element vacuum tube. There are two well-known methods of detecting, known as the plate current rectification and grid current rectification. The first is much simpler than the second and the one most commonly described, whereas the second one is much harder to understand, but is the one most commonly used in sets.

Plate current rectification depends on the bend at the lower part of the well-known characteristic curve of the vacuum tube. Vertically is plotted the plate current in milliamperes and horizontally is plotted the grid voltage (Fig. 4). It can readily be seen that the bend occurs at a point where the grid voltage is several volts negative. If we wish our alternating grid voltage obtained from the generator to have its average value at this point, we must provide some way of making the grid negative with respect to the center of filament, which should be considered as a datum point. If we bring the grid return back to the negative filament, we have a negative bias on the grid equal to half the voltage drop across the filament. In the ordinary 3- and 5-volt receiving tubes this drop is generally insufficient to give the required negative bias, so an additional voltage, supplied by a "C" battery, is used, Fig. 1b. If we now take the curve of Fig. 3b and place its axis vertically at this point, we have a graphical representation of the alternating voltage impressed on the grid of the tube by the generator. If at the point where this vertical line hits the curve, a horizontal line is drawn, the curve of plate current which is dependent upon the grid voltage will be obtained. This can be done by drawing a number of horizontal and vertical lines and projecting the points from the grid voltage curve as is shown for three points as x, y and z in the figure. A curve drawn through these points will be a rectified wave which has a finite average value, the same as the wave obtained by crystal rectification, which of course actuates the phones in the same manner. It should be noted that this is not true rectification, but is a relay action, for the plate current is supplied by the "B" batteries and is simply *controlled* by the alternating voltage on the grid. Another important point to be noted is the fact that no power is used in the grid circuit. This is in contrast with grid current rectification which we will take up below. On Fig. 4 there is another curve labeled grid current curve which has not yet been mentioned. The grid current is plotted vertically in microamperes and horizontally in volts, the same as the horizontal values for the other curve. The explanation for the existence of such a curve is comparatively simple and can probably be explained here briefly without interrupting the other chain of thought. It is known experimentally that a filament gives off electrons which are negative charges of electricity. These electrons carry current in the opposite direction to their own motion. Since like charges repel each other when the grid is negative, no electrons come to the grid, but any that get as far away from the filament as the grid pass through it and go to the plate. But as the grid is made positive, some of the electrons begin to come to it and, therefore, allow current to flow from the grid to the filament. But at no time does the alternating grid



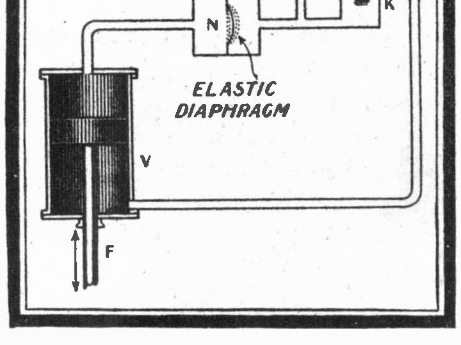


Fig. 4 above shows the characteristic curve of a vacuum tube. Fig. 6. Left. Mechanical analogy of Fig. 5.

voltage (*i. e.*, the impressed wave train) swing far enough to the right so that any of its points lie underneath the grid current curve, or, in other words, go sufficiently positive to attract electrons. With this condition no current can flow in the grid circuit, and since power is the product of current and voltage, the power absorbed by the grid is zero.

GRID CURRENT RECTIFICATION

We will now consider the question of grid current rectification which employs the use of a grid condenser and leak resistance and is the system generally employed in receiving sets. It will be noticed in Fig. 1c that the "C" battery is missing, a condenser and leak are in the grid circuit and the return connection, instead of being connected to the negative filament, is now connected to the positive. This puts a positive bias of half the filament voltage on the grid of the tube, which is generally sufficient for this system of detection. If we place the axis of our alternating voltage at the point of this bias (Fig. 5), and continue it up to the plate current curve, it will be observed that at this point the plate current curve is a straight line, and if the alternating voltage be replotted horizontally, as was done in Fig. 4, it would be the same above as below its axis and its average value would be zero and give no sound in the phones.

But if we look at the grid current curve we will notice that at the point where the axis of our alternating voltage intersects it, current is able to flow. So with these facts in mind we will go to a mechanical analogy to explain the phenomenon of grid current rectification.

ANALOGY

In our previous discussions we have assumed an alternating current generator connected between the grid and filament tending to send current first one way, then the other. So in our analogy we can assume our generator replaced by a pump which tends to send oil first one way, then the other. Connected in the circuit with the pump (Fig. 6) is a container M having a diaphragm N stretched across it, and a check valve K. Connected around this valve is a pipe having a constriction at O. The pump is our generator, the valve K is analogous to the space between grid and filament, for it allows oil to flow only one way, as does the grid with currents. (From previous explanation it should be clear that current can flow from grid to filament, but not from filament to grid.) The diaphragm N takes the place of the grid condenser and the constriction O corresponds to the grid leak.

There is an alternating force which tends to move the piston of the pump up and down. Referring to Fig. 3b we have an alternating wave of voltage which we can take as an alternating wave of force acting on the piston. As this force starts up from zero it forces the piston up. This displacement of liquid causes the diaphragm N to stretch and that in turn forces oil through valve K around to the space left below the piston by its upward motion. If the force were removed from the piston, the system would not remain in this state because the stretched diaphragm tends to force the piston down. However, this could not happen unless some oil was removed from below the piston. This *can* occur because oil is able to leak through the constriction at O, but this is a slow process and very little leaks through compared with the amount moved by the piston, so the downward motion of the piston is slight.

We left the piston in an up position to discuss the effect of the leak, so referring again to curve 3b we notice that the force starts to decrease to zero, then reverses and becomes negative. This reversed force tries to pull the piston down, which would necessarily force oil down on top of valve K. But valve K does not open in this direction, so the only oil that can flow is the small amount that gets through the constriction at O, and, therefore, the piston can move down only a very small distance. When the force on the piston again reverses and pushes up, the piston can move up a little farther because this next force is slightly larger than the first upward force and the diaphragm is stretched farther. It might be well to call to mind that as the diaphragm stretches it exerts a back pressure on the piston and stretches just enough so that its force equals the force on the piston. This continued upward motion of the piston and the greater stretching of the diaphragm goes on as each successive upward force increases, until the peak values of force reach a maximum and start to decrease. Here is where the leak through O plays its important part. It will be remembered that oil was continually leaking, tending to relieve the pressure on the diaphragm, but could not take care of the rapid increases in pressure caused by the pump. But now since each successive upward force gets less and less and therefore is continually less than the force caused by the stretched diaphragm, the leak gives the diaphragm a chance to assume a neutral position and to force the piston back to its original central position or starting point. We have now passed through a wave train and are back to the same condition as we started from and are ready for another wave train. Remembering that the force of the diaphragm is opposed to that of the piston, if we plot the variation of force on the diaphragm we will get a curve below the axis like that of Fig. 7. The ripple is due to the leak through O allowing the force to decrease a little before the diaphragm received its next push from the piston.

APPLICATION OF ANALOGY

Now to apply this mechanical analogy to the electric circuit. Remember what the different parts correspond to as explained above. The generator tries to send current around through the circuit from grid to filament and succeeds because current can flow from grid to filament, just as the valve K allowed oil to flow. This flow of current charges the grid condenser just as the flow of oil stretched the diaphragm. This charge induced on the condenser made the side toward the grid become negative and, therefore, the grid itself is made negative. Another way of looking at this action is by considering the electrons. Electrons, which are negative, come to the grid and are isolated there because of the grid condenser and, therefore make the grid potential become negative. When the current tries to reverse it finds itself blocked by the space from the filament to grid just as the valve K blocked the oil. Thus as the voltage trying to send the current around gets larger and larger, the grid becomes more and more negative until it reaches a maximum just as the diaphragm reached a maximum distension and therefore force. Of course, during this time the grid leak, corresponding to the constriction at O, has allowed some of the charge to leak off, but not much compared to what was being supplied at each impulse. But now, as the successive voltage impulses decrease, this grid leak allows the charge to leak off because the voltage that tends to charge the grid condenser is less than the voltage of the condenser itself. The reader will find a sentence similar to this as regards the diaphragm and pump. So at the end of the wave train the grid voltage is back to its starting point ready for the next wave train. If the voltage of the grid during the wave-train is plotted it will be identical with the wave of Fig. 7 except that it now is voltage on the grid instead of force on the diaphragm.

If we now place this variation in grid voltage in a position to notice its effect on the plate current, as is done in Fig. 8, it will be seen that it produces a similar variation in plate current, which falls to a certain value and then rises again to its original value. There is then a change in plate current and since a change of plate current in one direction causes a sound in the phones, they respond to this average change, which is of the same nature as the sounds which strike the microphone in the broadcast station. This, then, is the oft-mentioned but obscurely spoken of phenomenon of grid current rectification using a grid condenser and leak.

Notice that in this form of rectification the grid circuit has current flowing in it which was induced by a voltage, and therefore power (the product of current and voltage) was used in the grid circuit. It will be remembered that no power was used in the grid circuit in plate current rectification. Another striking difference between these two methods of rectification is the fact that plate current rectification produces its effect on the phones by an increase in the plate current, whereas grid current rectification produces its effect by a decrease of plate current. The system using grid current rectification actually rectifies the current flowing in the grid because the grid allows current to flow in one direction only. This system also is by far the more sensitive, because the effect of the little individual waves of the wave train are accumulative and additive in their effect on the plate current, therefore producing a larger change in the plate current than does straight plate current rectification.

In conclusion, it is the sincere hope of the writer that this article in its elementary form of explanation has made itself clear to the uninitiated but interested reader, and that it has not been too simple to clear up a few points of obscurity in the mind of the man who had a general idea of rectification with the vacuum tube.

SO HE WOULD!

Enthusiastic Son: "Dad, I got Honolulu on my short wave set! What would I get if I had the Super-Het?"

Grouchy Father: "I would get a larger bill from your dealer each month."

Radio News for June, 1925

Cylinder Graphophones

1906

TWENTIETH CENTURY GRAPHOPHONE

Suitable for all ordinary Cylinder Records and the new Columbia Gold-Moulded Twentieth Century Records (half-foot long).

CANNOT BE USED FOR RECORD MAKING.

Ideal for reproducing records made at home.

Requires Special Horn and Stand. Prices extra.

54-inch brass horn $15. or, 36-inch silk finish floral horn $10. Nickeled Horn Stand $2.

Style Premier
Type BC, $100.00
Without Horn

COLUMBIA PEERLESS

Type BF
$40.00

Cylinder Graphophones

COLUMBIA SOVEREIGN

Type BG
$50.00

COLUMBIA LEADER

Type BE
$30.00

COLUMBIA JEWEL

NOTE—Ready for delivery March 1st, 1906.

Type BK
$20.00

Columbia Phonograph Company, Gen'l.
SOLE SALES AGENT FOR THE
AMERICAN GRAPHOPHONE COMPANY

1906

Disc Graphophones

Aluminum Tone Arm Graphophone

COLUMBIA CHAMPION, Type BH, $30.00

ALUMINUM TONE ARM.
Spring Motor.
Can be wound while playing.
Dark Oak Cabinet, highly polished.
Ten-inch Turn-table, suitable for disc records of all sizes.
Columbia Analyzing Reproducer.
Automatic Needle Clamp, doing away with thumb screw.
Japanned Steel Floral Horn. Black enamel with gold bands. Satin finish.
17¾ inches long and 19-inch bell.
200 Needles.
Two-Part Needle Box for new and used needles.

ALUMINUM TONE ARM GRAPHOPHONE
COLUMBIA MAJESTIC, Type BD, $100.

ALUMINUM TONE ARM.
Powerful Spring Motor.
Will run ten or more records at one winding.
Can be wound while playing.
Solid Mahogany Cabinet, highly polished, piano finish.
Twelve-inch Turn-table encircled with an ornamental aluminum rim.
Columbia Analyzing Reproducer.
Automatic Needle Clamp, doing away with thumb screw.
Nickel Silver Finish Floral Horn
23-3/4 inches long, 23-1/2-inch bell.
200 Needles. Two-Part Needle Box for new and used needles.
Above machine equipped with motor to run three records, $75.00.

catalog quotes

ALUMINUM TONE ARM GRAPHOPHONE
COLUMBIA STERLING, Type B1, $45.00

ALUMINUM TONE ARM.
Double Spring Motor.
Can be wound while playing.
Plays three or more records with one winding.
Very Elaborate Cabinet of Choicest Oak, Piano finish.
Ten-inch Turn-table, suitable for disc records of all sizes.
Columbia Analyzing Reproducer.
Automatic Needle Clamp, doing away with thumb screw.
Nickel Silver Finish Floral Horn
17½ inches long, and 21¼-inch bell.
200 Needles. Two-Part Needle Box for new and used needles.

illustrations of disc machines on the cover

Cylinder Graphophones

The Twentieth Century Graphophone

A REVOLUTION IN TALKING MACHINES

ENTIRELY NEW PRINCIPLES! EXTRAORDINARY RESULTS!

WE GUARANTEE IT TO REPRODUCE THE HUMAN VOICE WITH ALL THE VOLUME OF THE ORIGINAL. It not only increases the volume of cylinder records so as to make the reproduction as loud as the human voice but improves the tone, making it richer as well as fuller. Splendid for dancing parties. A perfect substitute for the orchestra. The machine used by Lew Dockstader as interlocutor; by John Drew in "De Lancey," Empire Theatre, N. Y.; at Lew Fields' Theatre, N. Y. and on Keith's Circuit. Can be heard perfectly in the largest auditoriums and theatres.

A great money maker! Suitable for either home or public entertainments.

Style Premier, Type BC, $100.00 (Without Horn)

LYRIC REPRODUCER GRAPHOPHONE
Columbia Peerless, Type BF, $40.00

Improved Lyric Reproducer (Genuine sapphire).
Extra Sensitive Recorder (Genuine sapphire).
Very Elaborate Oak Cabinet with oak carrying cover. Same general style as "Leader" but larger.
Quadruple-Spring Suspended Motor, can be wound while playing, and plays about eight records at one winding.
14-inch Brass Horn.
Extra Long Mandrel, making machine suitable for use with all ordinary cylinder records and especially adapted for Twentieth Century (style BC) Cylinder Records.
Can be used for making records at home.

LYRIC REPRODUCER GRAPHOPHONE
Columbia Leader, Type BE, $30.00

Improved Lyric Reproducer (Genuine sapphire).
Extra Sensitive Recorder (Genuine sapphire).
Handsome Oak Cabinet with oak carrying cover.
Triple-Spring Motor, runs about four records at one winding. Can be wound while playing.
14-inch Brass Horn.
Suitable for use with all ordinary cylinder records.
Can be used for making records at home.

LYRIC REPRODUCER GRAPHOPHONES
COLUMBIA SOVEREIGN, Type BG, $50.00

Improved Lyric Reproducer (Genuine sapphire).
Extra Sensitive Recorder (Genuine sapphire).
Solid Mahogany Cabinet, hand polished, piano finish, with solid mahogany curved carring cover.
Machine handsomely nickeled throughout.
Quadruple-Spring Suspended Motor, can be wound while playing, and plays about eight records at one winding.
14-inch Brass Horn.
Extra Long Mandrel, making machine suitable for use with all ordinary cylinder records and especially adapted for Twentieth Century (style BC) Cylinder Records.
Can be used for making records at home.

Cylinder Graphophones

Lyric Reproducer Graphophone

Columbia Jewel, Type BK, $20.00

EQUIPMENT

Improved Lyric Reproducer (Genuine sapphire).
Oak Cabinet with oak carrying cover.
Tandem-Spring Motor, runs about three records each winding, can be wound while playing.
14-inch Brass Horn.

Recorder for making records at home, can be used with this machine, price extra, $5.00.

All Columbia Lyric Reproducer Graphophones are sold with 14-inch brass horns. Other horns of greater dimension and varied shapes can be used if desired to increase and improve the volume of sound. Special Circulars sent on request.

Radio Service

THE UNDERSTANDING AND ALIGNMENT OF NEUTRALIZED AMPLIFIERS

By John Alford

Before the pentode there was the tetrode. Before that there was trouble.....at least for the radio engineer of the 1920's who was attempting to develop effective radio-frequency amplifier circuits using the available triode tubes of that time. The problem, of course, was the grid-to-plate capacitance which was 8 picofarads for a typical triode like the Type 01-A. While this amount of capacitance was negligible at audio frequencies, it created a real problem in designing stable r-f amplifiers for the 200 to 600 meter wavelengths.

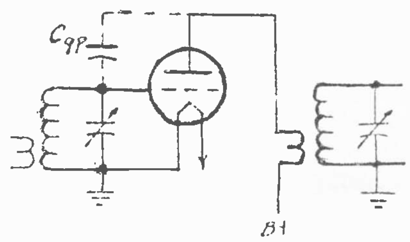


Figure 1
TRIODE R-F STAGE

Figure 1 shows a typical triode r-f stage with the grid-to-plate capacitance, C_{gp}, emphasized externally with dotted lines. Because both the grid and plate circuits are tuned or else coupled to tuned circuits, the circuit contains the necessary elements for oscillation with C_{gp} providing the feedback path from grid to plate. This circuit will always oscillate if enough energy can be fed back from the plate to the grid in the correct phase to overcome circuit losses. Unfortunately, the conditions for best gain and selectivity are also those which promote oscillation. In order to prevent oscillation in r-f amplifiers it was necessary to reduce the stage gain to a level that insured circuit stability. This could be accomplished in several ways such as lowering the Q of tuned circuits; stagger tuning, reducing filament voltage on the amplifier tube, loose coupling between stages or inserting a "losser" element into the circuit. While all of these methods reduced gain, detuning and Q reduction had detrimental effects on selectivity. Variation of filament voltage was, of course, a universally used method for gain control in the battery sets of the 1920's.

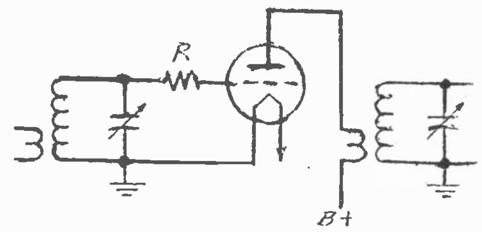
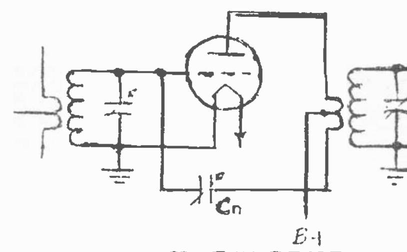


Figure 2
R-F STAGE WITH
LOSSER RESISTOR

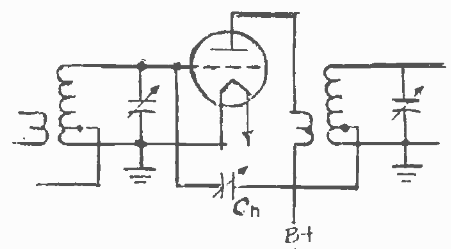
Probably the most common technique used to inhibit feedback was the "losser" resistance, R, shown in Figure 2. This circuit was widely used and is typified in the Atwater Kent receivers of the 1920's. Since R appears in series with the grid-to-plate capacitance of the tube, it interrupts the feedback path. If made sufficiently large, R will prevent oscillation. Typical values of R ranged from 50 to several hundred ohms or more depending on the other circuit parameters. With good design, a stage gain of 5 could be obtained on the 200 to 600 meter broadcast wave-lengths using the gain limiting techniques. Useful amplification at short wavelengths (below 200 meters) was considered impractical or impossible by most radio engineers at that time. Thus was the state of the art until Prof. L.A. Hazeltine introduced the famed Neutrodyne circuit in which the troublesome effect of the grid-to-plate capacitance of the tube was "neutralized" by introducing into the grid circuit a signal which cancelled the signal coupled through the grid-to-plate capacitance..... Figure 3a shows one variation of the Hazeltine circuit. In this circuit the primary winding of the r-f transformer is tapped. With this arrangement, the primary coil end opposite the plate has a voltage out of phase with the r-f voltage at the plate. The neutralizing capacitor, C_n, is adjusted to couple the proper amount of "out-of-phase" voltage into the grid to nullify the signal fed through the grid-to-plate capacitance. By neutralizing the effect of grid-to-plate capacitance, higher stage gains without oscillation were possible. Because of difficulties in maintaining neutralization over a wide tuning range, stage gains were limited to not more than 10 with good stability. Doubling the stage gain did mean that a three-stage amplifier could achieve a stable gain of as much as 1000 compared to 125 for a simular amplifier without neutralization. A signifigant improvement indeed!

The typical Neutrodyne circuit is shown in Figure 3b. The neutralizing capacitor is connected to a tap near the ground end of the next stage grid coil. In principle, the circuit functions in the same manner as the circuit of Figure 3a with the advantage that the neutralizing capacitor does not have the B voltage across it. The primary and secondary windings of the r-f transformer must be properly polarized to allow neutralization to take place. Additionally, the primary was frequently interwound with the ground-end portion of the secondary coil to obtain tight coupling.

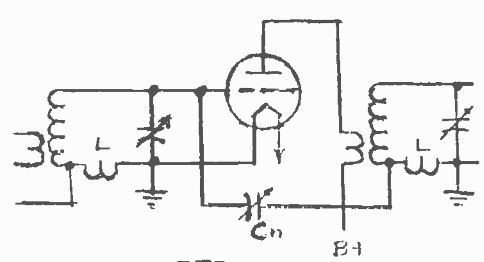
Figures 3c and 3d show two other neutralizing circuits employed in receivers of the 1920's. Figure 3c is the RFL (Radio Frequency Laboratory) circuit used, for example, in the Majestic Model 70 chassis. In Figure 3c, L is part of the tuned circuit at the next stage grid but is oriented for minimum coupling to the other windings. L is wound on a separate form and is mounted at right angles to the coupled windings. If the windings are properly polarized, the voltage across L due to the circulating current in the grid circuit will have the proper phase to cancel the signal coupled through the grid-to-plate capacitance. Again,



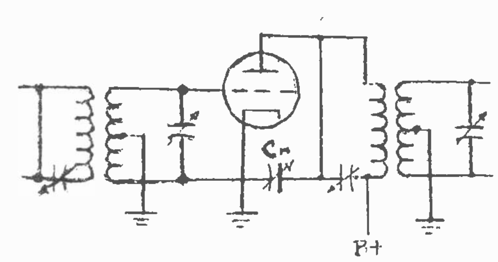
a. HAZELTINE



b. NEUTRODYNE



c. RFL



d. RICE

Figure 3
NEUTRALIZING CIRCUITS

balance is achieved by adjustment of C_n. The Rice circuit of Figure 3d uses a center-tapped coil in the grid circuit. With this arrangement the signal voltages at the ends of the tuned grid coil are equal and out of phase. C_n is then adjusted to equal the grid-to-plate capacitance of the tube to effect complete neutralization. Figure 3d is the type of circuit used in the Radiola 60 and 62 i-f stages. The principal disadvantage of the circuit is that the tuning capacitor is not grounded and makes the circuit difficult to employ in gang-tuned r-f stages.

The circuits shown in Figure 3 all fall into a general class of neutralizing circuits known as "bridge" circuits. That is, the circuit is electrically equivalent to a balanced electrical bridge network where C_n is adjusted to achieve a balance. When C_n is properly adjusted, circuit gain is due to the amplifying properties of the tube alone as the feedback path through the grid-to plate capacitance is balanced out so to speak. Many variations of bridge neutralizing circuits exist and still find application today, especially in r-f power amplifiers for transmitting equipment.

Up to now, neutralization has been discussed for what it is and does. Of equal importance to the collector is "how to do it" when aligning the old neutralized triode TRF or superhetrodyne receivers. As a licensed radio amateur for many years, the author has read much on neutralization as applied to transmitting circuits but has seen almost nothing that related to the alignment of the early BC sets. My first experience at neutralizing the BC set was as a teen-age radio nut in 1947. I had a part time job in a radio shop which was rather handy as I was an avid builder and experimenter and my boss gave me lots of junk to work with. One day one of the "old" AC TRF sets came in--about a 1928 set, I think. The owner claimed that it was the first time in twenty years that the set had quit. The main problem was a bum filter capacitor which was promptly replaced. After that, I attempted alignment but the set broke into oscillation when the timmers were peaked. I asked the boss about it and received my first lesson on neutralizing BC sets using a "dummy" tube.

The Neutralizing procedure which follows uses the "dummy" tube technique and should provide generally acceptable results on most if not all of the neutralized triode r-f and i-f stages. Before continuing however, the term "dummy" tube should be explained. A "dummy" tube is merely a good tube of the type used in the amplifier stage to be neutralized, but having one filament pin removed. If you didn't know before, now you know what those tubes with the missing filament pin were used for. Do not use a tube with shorts or open filament as a cheap substitute. Also a bad tube may have enough gas content to affect the results. If you simply can't part with one of your beloved 26's, 27's, 01-A's, or whatever is used, just put a piece of Scotch Magic Mending Tape over one filament pin and use that for a dummy tube. Another method is to put a paper shim in the tube socket so that one of the filament pins doesn't contact the socket.

Alignment consists of peaking the trimmer capacitors of the stage to be aligned using a signal generator or broadcast station as a signal generator or broadcast station as a signal source. The signal generator is preferred since both frequency and strength of the alignment signal are adjustable. Alignment should always be done with all shields and covers in place. The r-f trimmers are usually peaked somewhere between about 1000 KHz to 1400 KHz--wherever gives the best tracking and gain compromise. If the capacitor has slotted end plates, these can be adjusted starting from the high end and working down to obtain nearly perfect tracking. This can turn into a lot of work and generally isn't necessary unless the tuning capacitor was damaged. The i-f stage should, of course, be adjusted to the recommended i-f frequency which, if not known, can usually be quickly located with the signal generator. If during alignment the amplifier breaks into oscillation, the alignment must be stopped and neutralization attempted. Note that the amplifiers must be checked at maximum gain for oscillation. AC sets using 26's ran at maximum gain since the gain control was in the antenna. Most battery sets used filament control so the r-f gain must be advanced to maximum. Likewise, the cathode gain control used with 27's must be advanced. Back off the trimmer adjustment that caused the oscillation until oscillation ceases or else reduce gain until oscillation stops. Tune to a strong station (or set generator) around 1000 to 1200 KHz and then plug the dummy tube into the neutralized stage nearest the detector. Not all sets neutralized all stages. Be sure any shields and covers are replaced before proceeding. Using a non-metallic adjusting tool, adjust C_n for minimum signal output from the stage. Usually this point is very well defined. What has been done is to cancel out the signal coupled through the grip-to-plate capacitance of the tube.

Plug a "live" tube back into the stage just neutralized and plug the "dummy" tube into the next neutralized stage back. Again be sure all shields are in place and repeat the neutralizing procedure. Repeat for other stages until all have been adjusted. At this time repeat the r-f trimmer adjustment. It may be necessary to repeat the neutralization and r-f trimmer adjustment two or more times as the adjustments interact. Also, neutralization in these circuits is not perfect at all frequencies and the amplifier should be checked for oscillation across the entire tuning range. Tuner r-f amplifiers are more prone to oscillation toward the high frequency end of the band so neutralization is usually carried out in this region.

The service literature, when available, should be followed. Sometimes the adjustment procedure will be somewhat different than the procedure described, although end results will be the same. Some RCA sets for example, employ one neutralized stage which is simply adjusted until the set doesn't break into oscillation anywhere in the tuning range.

If trouble is encountered with r-f or i-f alignment and neutralization, check to see that all bypass capacitors are in good condition and all grounds are solidly connected. All tube, coil, and capacitor sheilds must also be in place. If these conditions don't exist, efforts to adjust the circuit may well be wasted.

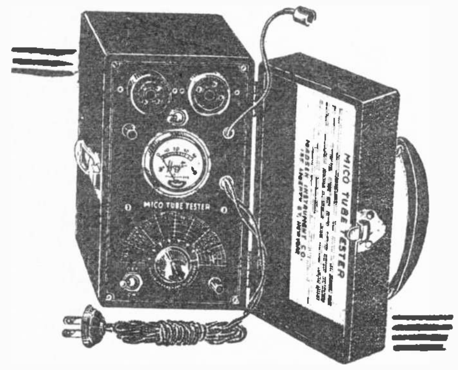
For those readers who have access of QST magazine, the article "R. F. Amplification—A Re-Hash" by Lyford in the November 1926 issue makes interesting reading. This article is adressed strictly to the problems of r-f amplifier stability in receivers.

John Alford, W5TXL, is an electronic engineer who is an avid radio collector with a strong interest in "cathederal" shaped radios.

The editor is seeking information about the first Audio Fair held in New York in 1949.

Yesterday RADIO SERVICE

Some nostalgic reminiscences about Mr. M. N. Beitman's long career as an engineer, inventor, author, and mainly as the "Mr. Diagram" responsible for supplying low-priced diagram manuals and at one time offering for 25¢ (yes, one quarter), a diagram and helpful hints of any problem-radio needing repair. MNB is still around and is active (you guessed it, with diagrams), and this article has been submitted by his younger son, Lawrence, a senior at the University of Illinois.



THE OLD DAYS OF RADIO SERVICING
MY FATHER WAS THERE

By Lawrence Beitman

Humor, nostalgic recollections, and technical facts about early radios of the 20's and 30's.

Forty years ago my father, M. N. Beitman, became active in radio in a serious way, that is he started to earn regular money from his hobby. Before this, while still in high school, he made a stab at fixing the the new fangled "all electric" radios with his home-made analyzer. These were the days when quotations were "gladly" given free of charge, and servicemen made house calls, examined the sick radio (already looked over by several others) and quoted their price with high hopes of undercutting the competition.

Later on, at college, my father built for the school a self-designed public address system, complete with a carbon microphone suspended on springs and the amplifier using type '50 tubes in push-pull for 8 watt output, considered a very high audio output in those days. Unfortunately, this unit never worked right, something with the wrong bias produced a noticeable difference between what went into the mike and came out of the two speakers, and using 2 mfd. filter condensers in the power supply (these 1,000 volt units were really expensive, so why use 8 mfd.) guaranteed a continuous hum not easily tolerated. This equipment was never put right, in spite of the many hours my father spent with his baby, and it was finally sold to a saloon in 1933 when prohibition went out, and where no one seemed to notice any fault as polkas and Irish melodies were played.

What knowledge of electronics my father had at this stage, he felt he should share with others, and his successful writing and publishing career was started in this mediocre way. After his first check for a short article on placement of speakers, he began to write like mad and, surprisingly, he was published in what passed in that period for technical radio periodicals. At present, it is hard to tell if this outburst of writing on topics such as a recording system** using aluminum blanks for instant replay, or new (1936!) facts on vacuum tubes, or a "56 MC" Airplane Tranceiver (in the old Radio News),*was due to my father's need for money or plain vanity, or perhaps the need to publish or perish from jobs he held during those years at Stancor, the old Allied Radio, or Radio Wire Television***.

There is a strong and growing interest in antique radios and related topics of early radio manufacture, sales, and service. My father was active in this period, first as a serviceman, then as a sales engineer, starting the first kit department at Allied, and finally as an author and publisher, recording these very events. I have been fortunate to hear many, many interesting, humorous, and instructive stories over the years, and to have read hundreds of magazine articles preserved by my father of this early period of radio. So below you will find some tales that may entertain you.

During 1935 and 1936 my father had his creative work published in almost every monthly issue of Radio World (the last issue out in 1938 had his article on a photo-cell relay with a picture of the unit on the cover). This publication was always on shaky ground financially, and my father was given advertising space instead of cash payment. At first he had his Public Address pamphlet to advertise and then he added others to make the best use of the space. And so Supreme Publications was born.

These articles secured for him his various positions in pioneering electronic firms, and finally permitted him to devote full time to publishing in his own firm. But all this is another story and I want to stick to servicing in the early days of radio.

In the late 1920's battery radios were passing out of popularity and hi-boy and low-boy all-electric sets with screen grid tubes were in. This was the period of large sales of Grigsby-Grunow Majestics and similar sets. Some of the hand-carved cabinets of the period are something to behold. This was the period when my father, still a high school boy, and using a home-made single milliampere meter tester began to offer his services to some unlucky neighbors. Actually considering the state of the art of repairing and the commercial equipment available (Readrite was common, Weston was the cream) he was worth his bargain rates.

"What went wrong with the sets in those days?" I asked. "Just about everything. Tubes actually burned out like electric bulbs do now days. But power transformers was expensive and common problem." My father explained that everywhere in radio parts stores and the early "jobbers," tubes were tested free of charge. Some of these tests were actually made under applicable voltage conditions to all elements and measured important constants, but most were simple emission and short tests. So by the time my father was called to quote his price for the repair, the tubes were usually tested by the owner and proved not the fault. So back to the power transformer. Replacements were of a type that had windings to provide the correct voltages and power requirements, but had universal mounting and somehow could be fitted into the space of the old transformer. There was also available the "exact replacement" purchased from the factory or soon to be made by the old Stancor (and my father had a hand in that too at a later date). Why anyone would want an exact replacement transformer, when one just like it burned out, and not a larger rated (and lower priced) suitable unit, was never clear to my father, but he was glad to oblige at a higher price and the coded leads like the old ones made the installation easy.

Of course, transformers were not the only items at fault. Early carbon resistors changed their values with age and often were fried to a crisp, by-pass condensers would short or open and sometimes act up and cause an intermittent. But all this was in the days work, or rather work after school hours, so let's turn to his unusual service calls. There was one where the set played on and off and finally stopped. What could you expect from two i.f. stages with a mouse nest built between them? And there is the one where a separate speaker was left unconnected, but the set played on. To explain this miracle my father agreed to make no charge at all. Indeed the set played without the speaker. The loose laminations of the poorly made power transformer moved in unison with the plate current to the output tube.

This was the period when new type tubes were released like new issue stamps by practically all countries. Metal tubes made their appearance and I was surprised to learn that these were really glass tubes inside a metal can. The more tubes the better the set, at least so assumed the buying public. Their correct deduction proved not workable as the one needed ballast tube was added in some sets. As you probably also know the cheaper, smaller sets had the tube filaments wired in series and this did not add up to 110 volts of the supply. To drop the extra voltage, at first a resistor was used, then it was placed in the line cord itself (third wire, but a ground), and finally a ballast tube was employed. This item looked just like a metal tube, had a type number all its own, but included resistors only, sometimes with a tap for connection to a pilot light. If one is good, why not use two ballast tubes of sizes to fit, and increase the number of tubes in the radio by one more? My father recalls that one set with "12 tubes" sold by a mail order house actually had no less than eight ballast tubes. This practice was finally stopped by government action. Whatever was the number of ballast tubes, if one needed replacement it was often repaired on the spot by opening the metal can and junctioning the broken wires. I suppose the same trick will work today if such a set comes into your possession and has a defective ballast.

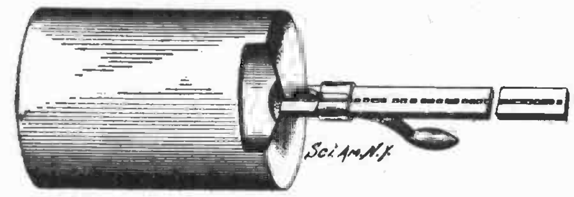
My father's service work was coming to an end, he now rated as an engineer although his degree was in mathematics, but in those days there were no courses given in electronics. What followed is an interesting career in electronic design and sales, teaching, and of course, publishing.

If you want more, tell the editor.

PHONOGRAPH

ODDITIES IN INVENTIONS.

TOY PHONOGRAPH.—It has long been desirable in the manufacture of toy dolls to obtain an economical yet efficient apparatus by which the doll can be made to talk. Such an apparatus seems to have been discovered by the inventor of the device here illustrated. A sounding box of cup-shape is employed, and extending vertically from the top of this box is a strip of celluloid or hard rubber. On this strip the desired sound record is indented. This may be done by softening the strip



TOY PHONOGRAPH.

and engraving by the usual method with the stylus of an ordinary phonograph. A slide block is mounted on the sound-record strip, and is provided with a stylus held by tension of the spring against the sound-record. A handle is provided on the slide block, and by moving this up or down the sound recorded will be reproduced. The construction of the apparatus is so simple that it may be used even in the cheaper toys to reproduce trite sayings and the like in articulate speech.

SCIENTIFIC AMERICAN,
November 29, 1902

Club News

MID-AMERICA MEET

The Mid-America Antique Radio Club reported that they had a great meeting at Loose Park on July 13 in Kansas City. Bob Lane described the event in his letter of July 14, 1975.

"We had around 60 at our summer meet. Gary Vierk was there to talk about his Indiana club and A.W.A. Dale Goodwin talked on Zenith. Mr. Stein (son of the Steinite manufacturer) could not come so I talked on him and Mr. Percell also spoke on him - as a friend of his.

We had great displays - a wireless spark set transmitters on down.

Contest winners were as follows.

Crystal sets:
- First; Donald Yoder
- Second; Bob Lane
- Third; Everett Boese

Battery sets;
- First; Mike Chatfield (Kennedy 281)
- Second; Brian Cook (Grebe CR-1)
- Third; Mike Chatfield (RFL)

A/C Sets:
- First; Bill Flateland (AK Cathederal shaped)
- Second; Jim Robinson (Majestic automatic)
- Third; Dennis Fellers (Philco Cathederal shaped)

Non Radio:
- First; Dennis Fellers
- Second; Donald Yoder

We had people from 200 miles and more, come from Omaha, Central Kansas, Central Missouri, St. Joseph, Topeka and Denver.

Later we had a pot luck dinner.

I lately picked up a Crosley Pup in original box, a DeForest CS-5 1930 shortwave set with all coils, Steinite crystal set and a Radiola 7.

We discussed which was first factory built in A/C set and when. Zenith said they were first in 1926, Steinite says they were first in 1926 too. But Argas Radio Co. made Parver Electric set in October 1925 - any earlier?? Rogers Batteryless in Canada was 1925 - Ask members if they know of any others - also who made first portable with speaker inside -- Zenith 1924??

Bob Lane's professional address is: 2301 Independence Ave., Kansas City, Missouri 64124, Phone: (816) 241 6796.

SOUTHWEST VINTAGE RADIO AND PHONOGRAPH SOCIETY

Old radios and phonographs will be placed on the auction block September 20, 1975 about 7 p.m. at Electronic Center, 2929 N. Haskell, Dallas, Texas.

Everyone is welcome. Everyone is expected to benefit; a chance to get an oldie you have wanted for a long time, cash for the seller and some proceeds for the club.

For advance information call or write John Alford at (214) 352-8834 or Walt Jackson at (214) 262-7855.

The Southwest Vintage Radio and Phonograph Society is looking forward to a coming event of a phonograph and radio contest combined with other activities at a later date.

LETTERS

EDITOR'S MAILBAG

Dear Jim;

Thanks for your prompt reply. Have now received Feb. & March copies of "The Horn Speaker," so they are coming through OK.

I recently aquired an Edison Red Gem Phonograph model D with model 4 reproducer which has a badly worn sapphire. I wonder if any of your readers could give advice on a suitable replacement. Any information would be appreciated.

Regards,
John Jeremy
9 Turimetta Ave.
Campbelltown 2560
N.S.W. Australia

Dear Jim;

Enclosed find check for $4.50 for renewal subscription to Horn Speaker.

I think you have a very good paper, also a fair amount of ads. I do regret the emphasis some of your advertisers place on getting the highest bid for something they want to sell. I don't answer those ads.

Collecting old radios etc. is a hobby with me. I'm retired (as I imagine some others are also) and can't afford to pay auction prices for what I buy.

I wonder what others think about this.

Sincerely,
Bill Irvine
314 Hamilton St., Rt. 6
Gulfport, MS 39501

Classic FIND OF

New and better columns of these subjects are coming.

MART

Classified ad rate: 6¢ per word.
Photo ads: $2.00 extra.

MISC.

PHONOGRAPH COLLECTORS, join the American Phonograph Society. Receive the quarterly Journal and four Newsletters. Receive free reprints and stereoscopic phonograph cards. For more information send 10¢ stamp. For one year membership, send $6.50. The American Phonograph Society, P.O. Box 5046, Berkeley CA 94705.

MISC.

WILL DUPLICATE exactly, the mutilated panel for your antique radio. Send sketch or rubbing for quotation, or will trade for antique radios of equal value. Norman A. Parsons, 22 Forest St, Branford CT 06405.

All collectors who want to belong to the Southwest Vintage Radio and Phonograph Society will qualify as a charter member if their dues are paid by October 1, 1975. Walt Jackson, secretary; P.O. Box 19406, Dallas, Texas 75219.

ATWATER-KENT SERVICE INFORMATION, Schematics, picture, etc. Model 10 - 67 H1, H2. Priced $1.00 up each IBM reproduction. John Whiting, RD 2, Dover, N.J. 07801.

COLLECTORS: Auction at Electronic Center, 2929 N. Haskell, Dallas TX September 20, 1975 at 7 p.m.

FOR SALE OR TRADE

FOR SALE: Aeriola Sr. receiver with replacement tube $60. Motorola T.V. with 8" screen, working, late 1940's $65. Telegraph sounder in glass case $20. Brandes headphones $10. Tungar battery charger $5. 01A tubes $5. each. Also have other tubes. Books and magazines - I.C.S. radio operators handbook 1924 $6. Radio Simplified 1925 $6. Montgomery Ward catalogue 1924-1925 $18. Life for Nov. 1912 $5. Popular Mechanics for Feb. 1925 $3. Radio News for May 1925 $3. QST for Oct., Nov., Dec. 1924 $3. each plus postage, extra refunded. Lonny Simonian, 6222 E. Townsend, Fresno CA 93727.

SPEAKER GRILLE CLOTH, fine, silky, 20's - 30's style fabric from an old warehouse. Nice, unobtrusive woven pattern (reversible) in muted gold and dark brown. Nothing like the heavy, coarse stuff they sell today. 24" wide, $4.00/yard. A yard will do about 6 Philco Baby Grands. Please add 25¢ for mailing. SASE for sample. Warren Dewey, 5021 Ambrose Ave., Los Angeles CA 90027.

TOP PRICE OR TRADE: Plug-in coils, audio trans., cushion sockets for Grebe CR-18. Bakelite chassis, duo-coupler trans. for National SW-4, No. 16 solid 5cc/dcc wire. C. Byrnes, P.O. 25, Pismo Beach CA 93449.

SEND LARGE SASE for list 75-2 of Antique Radios, parts, speakers and ham radio equipment I have for sale or trade. Enclose your want list for parts, Mags., radios (etc.) I may be able to help. D. McKenzie, 1200 W. Euclid, Indianola, Iowa 50125.

RADIO drive belts; state make and model, $1.50 postpaid. Puett Electronics, P. O. Box 28572, Dallas, Texas 75228

FOR SALE OR TRADE

OLD TIME REPAIRMANS COLLECTION from 30's on. Auto radios, recorders, portables, many wooden table models, novelty types, consoles, early Atwater-Kent Breadboard "4". World War II fighter plane receiver & transmitter complete to trailing ant. Medical equipment, testing units, parts, tubes, books galore. Some museum items. Complete $1000. No lists. SASE for information. Henri Wohnsen, P.O. Box 30, Port Richey, Florida 33568. Ph: 813 996-2644.

CLOTH COVERED POWER CORD, new 2-conductor cord as used on AC sets of the twenties, thirties, forties. From old stock, limited quantity. In brown or gold, 25¢/foot. Please add 50¢ for mailing. Warren Dewey, 5021 Ambrose Ave., Los Angeles CA 90027.

FOR SALE: Radiola 64, Walnut Cabinte, mint condition, full tube complement. Best offer. S. Brissey, 414 Bloom, Highland Park, Ill. 60035.

WD11 Adaptors, use UX199, 120, VT24. No wiring changes, Radiola III's battery hook-up included $5.25 pp., 2 for $9.25. Keith Parry, 17557 Horace St., Granada Hills CA 91344.

SELL OR TRADE: Scott All Wave Hi fidelity, 1936, perfect SASE. Steve Raymer, 365 E. Curtice, St. Paul, Minn. 55107.

FOR SALE: Brand new in original carton a reproducer for an Edison Disc Phonograph made by Jewel Phono Parts Co. of Chicago, $30.00. Also UX-201A tubes, pear shaped at $6.50 each and chimney shaped at $5.00 ea. Dan Gaidosz, 342 West River Road, Orange, Conn. 06477.

SELLING OUT after 40 years. Many bargains. Cash. Open Thursday, Friday and Saturday. Pat Cutini, 969 Genesee St., Buffalo N.Y.

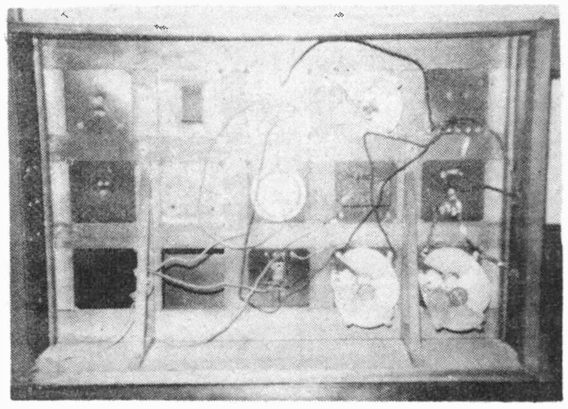
FOR SALE: Rubber stamp with your name and address plus AK Radio and speaker $3.00 pp. James Fred, P.O. 42, Rossville IN 46065.

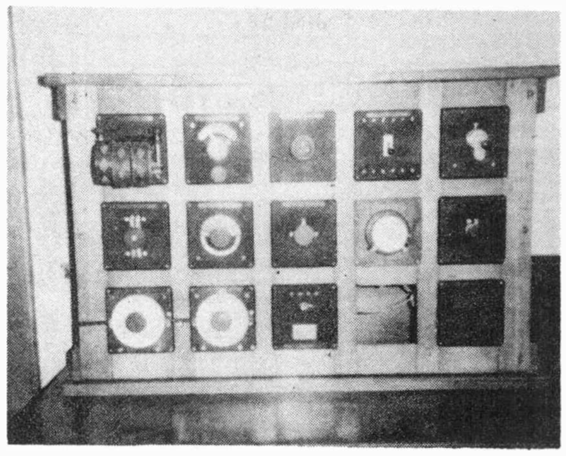
FOR SALE: Have many old radios. Also parts, no list. Please name your wants. John F. Whiting, RD 2, Dover, N.J. 07801.

FOR SALE: Scott 800 B-6 in chippendale console cabinet $150.00. SASE for details. Walt Sanders, 15 Todd, Terre Haute, Indiana 47803.

FOR SALE: Heavy green record sleeves, for 10-inch and 12-inch 78's. Contact Warren Dewey, 5021 Ambrose Ave., Los Angeles, California 90027.

HUNDREDS of old radios for sale. Also have old magazines and parts. Send $1.00 for big list. Large SASE please. Radio Americana, Box 128, Woodstock, N.Y. 12498.





FOR SALE: De-Forest - 15 unit panel set with crystal detector and one VT. One panel missing, complete otherwise. Best offer over $1500. For more information write Everett L. Berry, 800 Kendon, Lansing Mich. 48910. Or phone 1-517-882-5905.

Miscellaneous

DON'T DIE without a WILL! Blank will form protects your family. Only $2.00 guaranteed. Order today! COE Enterprises, Box 259, 75 Coe Dr., Mesquite, Texas 75149.

WANTED

NEED worm base, eccentric gear, reduction gear, chain drive, coin mechanism, other parts for electro-mechanical Rosenfield AZ coin-operated phonograph. Frank Adams, 700 West Burleson, Marshall TX 75670.

WANTED: Edison phono "OPERA" case, Edison "Fireside" case lids, Edison CYGNET horns, Zonophone "Concert" rear mtg. horn bracket, and extended turntable, XI Kennedy chassis, AK-5, AK-12 audio cluster, Radiola "25" loop ant., dial escutcheon, Radiola X both dials complete or junk chassis, Astatic #2 cartridge. C. Ferrett, 39400 DeAnza, San Jacinto CA 92383.

WANTED OUTSIDE horn phonographs, any parts or horns, also any size Victor dog, small needle cans, Record brushes, phonograph catalogs, Price and condition please. Jack Hanson, 15107 Little Spokane Drive, Spokane, Wash. 99208.

WANTED: AK 33 parts, grid leak, power cable, small trimmer cap knob, AK service manual. Also Philco model 70 parts, 4 knobs, tuning dial, escutcheon plate. Lawrence R. Moser, 5925 W. Florida Ave., Lakewood, Colo. 80226.

WANTED: Radio News magazines 1925 March, May, June, July, August, October and December. Popular Radio magazine, 1926 December. Electronic Digest magazines 1972 - January and February issue. J. Albert Warren, Box 279, Church St., Waverly PA 18471.

WANTED: Kennedy XV, Paragon RA 10 Stromberg Carlson 1A, Tuska 225, Clapp-Eastham ZRF, Crosley 51-P, Loops for DID, FE800, Kennedy 281 knobs, Coupling & antenna coils. R. Wolven, 2614 Reno Rd., Castleton, N.Y. 12033.

HELP! Would like MICHIGAN RADIO MRC-2, two tube regenitive in good shape, w will pay very good price or trade. Thanks. Del Hambly, 8910 N.W. Lovejoy, Portland, Oregon 97229.

RADIO items and toy trains wanted. Write Box 161, West Hurley, N.Y. 12491.

WANTED: Radio - all 1920, 1921, Oct. 1922. Many wireless age 1920, 1925, Q.S.T. Feb, March 1920. Radio Craft Aug. 1929, Feb. 1931. Thompson, 2930 Delavina, Santa Barbara CA 93105.

WANTED: Crystal sets, battery and electric radios and televisions Mfg. before 1935. Need all related items. Will buy one set or complete collection. Young, 11 Willow Court, Totowa, N.J. 07512.

WANTED: Wire recording items--unusual only, not Webster or Silvertone. Pre-1940 television and pre-1950 disc recording books. Layer, AV-SFSU, 1600 Holloway, San Francisco CA 94132.

WANTED: Speaker cone and Antenna for RCA Radiola 18. Please send information and asking price to John W. Helser, 38895 Dodge Park Road, Sterling Heights, Mich. 48077.

WANTED: Pre 1930 radio, wireless, wire telephone, and wire telegraph gear, sets, books, magazines, artifacts. Bill Nangle, 761 No. 29th St., Milwaukee, Wis. 53208.

WANTED: Plastic circular main dial assembly for Hammarlund Model HQ-120. Will buy a junker if the dial is OK. John L. Glisson, 1303 Pump Road, Richmond, Virginia 23229.

WANTED: CONCERTONE Model 20/20 tape recorder amplifier, two needed, condition unimportant, will take tape transport also. B. Ostosh, 4134 Twiggs St., San Diego CA 92110.

WANTED: Loose coupler Crystal sets, any Grebe or AK radios, also need radio magazines of 1920's. David M. Bryan, 1880 Gage, Topeka, Kansas 66604.

WANTED: Sig Corps radio set SCR 131 or 161, Mfg. Xtal sets. Lee Kemp, Rt. 10, Box 13, Frederick, Maryland 21701. (301) 662-3482.

PUETT ELECTRONICS

P.O. BOX 28572 DALLAS TEXAS 75228

PUBLISHERS OF
THE CLASSIC RADIO NEWSLETTER

LIST NO. 12

<u>HOW TO ORDER</u>

(1) Make checks and money orders payable to PUETT ELECTRONICS.

(2) Please state whether new or used tubes are desired and whether a half-price used tube is desired when a new tube is out of stock. <u>REFUNDS</u> are mailed with your invoice for out-of-stock tubes, or when, by customer request, a used tube is substituted for an out-of-stock new tube.

(3) ALL ORDERS ARE SHIPPED PARCEL POST. NO C.O.D. INCLUDE 15% FOR POSTAGE AND HANDLING. INSURANCE RATES ARE 30¢ FOR ORDERS UNDER $50.00. TEXAS RESIDENTS ADD 5% STATE SALES TAX.

MINIMUM ORDER $3.00

<u>CUSTOMER SATISFACTION GUARANTEED</u> - If you are not satisfied with your order for any reason, tubes may be returned within ten days for refund or replacement with exception of tubes which are shorted or have open filaments. It will be assumed that returned tubes with open filaments or shorts were damaged in shipment. Shipping damage claims will be handled promptly through the post office on insured orders. PUETT ELECTRONICS assumes no liability for orders which are not insured, and no liability beyond that which is covered by postal insurance. <u>ALL TUBES ARE THOROUGHLY TESTED</u> ON A MUTUAL CONDUCTANCE TUBE CHECKER BEFORE SHIPMENT.

<u>SCHEMATIC DIAGRAMS</u>

WE CAN FURNISH SCHEMATIC DIAGRAMS AND TECHNICAL DATA ON ALMOST ANY RADIO FROM 1920 TO 1954 FROM OUR LIBRARY OF ORIGINAL MANUFACTURERS SERVICE DATA. Send a self-addressed stamped envelope and $1.50 per radio set. This offer is limited to five photocopied pages. If the data on your set exceeds five pages, we will send you a quote. State mfg. & model number.

<u>THE CLASSIC RADIO NEWSLETTER</u>
<u>E.H. SCOTT & McMURDO SILVER:</u>
Send a self-addressed stamped envelope for a sample issue. Send 30¢ in stamps plus a self-addressed stamped envelope for our list of classic radio literature. We sell, buy & trade classic radio literature.

<u>TYPES 01A, 99, WD-11, etc.</u>
We sometimes have these tubes in stock in very limited quantities. Send a self-addressed stamped envelope for information.

<u>BALLAST TUBES</u> - We can supply many types of ballast tubes or their equivalents. Send a self-addressed stamped envelope with your inquiry.

<u>OLD RADIO TECHNICAL BOOKS</u> - Send a self-addressed stamped envelope.

TABLE 1 - OLDER TYPE-NUMBER TUBES   Prices listed for new tubes. Used tubes are half new tube price.

OA2	$2.	1LE3	$4.	5Y4	$3.	6F6	$3.	6U7	$4.	7Z4	$3.	14B5	$3.	35W4	$2.	81	$6.	5654	$2.
OA3	$2.	1LF3	$4.	5Z3	$3.	6F7	$6.	6V6	$2.	10	$6.	14B6	$3.	35Y4	$3.	82	$3.	5686	$3.
OA4	$2.	1LG5	$4.	5Z4	$3.	6F8	$3.	6V7	$4.	12A5	$4.	14B8	$3.	35Z3	$3.	83	$3.	5691	$3.
OB3	$2.	1LH4	$4.	6A3	$5.	6G5	$4.	6W6	$3.	12A6	$3.	14C5	$3.	35Z4	$3.	83V	$3.	5703	$3.
OC3	$2.	1LN5	$4.	6A4	$6.	6G6	$3.	6X4	$2	12A7	$4.	14C7	$3.	35Z5	$3.	84	$3.	5749	$2.
OD3	$2.	1N5	$4.	6A5	$4.	6H6	$2.	6X5	$2.	12A8	$3.	14E6	$3.	35Z6	$3.	85	$3.	5751	$2.
CY4	$3.	1N6	$4.	6A6	$4.	6J5	$3.	6Y5	$3.	12AH7	$3.	14E7	$3.	36	$3.	89	$3.	5814	$2.
OZ4	$2.	1P5	$4.	6A7	$5.	6J6	$2.	6Y6	$2.	12AT6	$2.	14F7	$3.	37	$3.	117L7	$4.	5879	$2.
1A1	$5	1Q5	$4.	6A8	$3.	6J7	$3.	6Y7	$2.	12AT7	$2.	14F8	$3.	38	$3.	117M7	$4.	5881	$2.
1A3	$3.	1R5	$2.	6AB4	$3.	6J8	$3.	6Z4	$3.	12AU6	$2.	14H7	$3.	39	$3.	117N7	$7.	5992	$2.
1A4	$3.	1S4	$2.	6AB7	$3.	6K5	$3.	6Z5	$2.	12AU7	$2.	14J7	$3.	40	$6.	117P7	$7.	6080	$3.
1A5	$3.	1S5	$2.	6AC5	$3.	6K6	$3.	6Z7	$2.	12AV6	$2.	14N7	$3.	40Z5	$2.	117Z3	$4.	6146	$4.
1A6	$3.	1T4	$3.	6AC7	$3.	6K7	$3.	6ZY5	$3.	12AX7	$2.	14Q7	$3.	41	$3.	117Z4	$4.	6188	$3.
1A7	$3.	1T5	$3.	6AG7	$3.	6K8	$3.	7A4	$3.	12B7	$3.	14R7	$3.	42	$3.	117Z6	$4.	6842	$2.
1B4	$3.	1U4	$3.	6AK5	$2.	6L5	$4.	7A5	$3.	12B8	$4.	14W7	$3.	43	$3.	485	$4.	6973	$2.
1B5	$3.	1U5	$3.	6AK6	$2.	6L6	$3.	7A6	$3.	12BA6	$2.	14X7	$3.	44	$3.	807	$4.	7025	$2.
1B7	$3.	1V	$4.	6AL5	$3.	6L7	$3.	7A7	$3.	12BE6	$2.	15	$5.	45	$5.	809	$6.	7193	$2.
1B8	$3.	2A3	$6.	6AL7	$4.	6N5	$4.	7A8	$4.	12C5	$3.	19	$4.	45Z3	$2.	837	$4.	9002	$3.
1C1	$4.	2A4	$5.	6AQ5	$2.	6N6	$3.	7AE7	$4.	12C8	$3.	19T8	$2.	45Z5	$2.	843	$3.	9003	$3.
1C5	$3.	2A5	$4.	6AQ7	$4.	6N7	$3.	7AF7	$4.	12F5	$3.	22	$5.	46	$6.	879	$2.	9004	$4.
1C6	$3.	2A6	$3.	6AS7	$3.	6P5	$3.	7AG7	$4.	12H6	$3.	24A	$3.	47	$5.	884	$7.	VR-	
1C7	$5.	2A7	$5.	6AT6	$2.	6Q7	$3.	7B4	$3.	12J5	$3.	25A6	$3.	48	$4.	923	$3.	90	$2.
1D5	$5.	2B7	$3.	6AU6	$2.	6R7	$4.	7B5	$3.	12J7	$3.	25A7	$3.	49	$4.	930	$3.	VR-	
1D7	$5.	2C26	$2.	6AV5	$2.	6S4	$4.	7B6	$3.	12K7	$3.	25AC5	$3.	50	$6.	950	$3.	105	$2.
1D8	$4.	2E5	$4.	6AV6	$2.	6S8	$3.	7B7	$3.	12K8	$3.	25B6	$3.	50A5	$3.	951	$3.	VR-	
1D21	$3.	2E30	$2.	6AX5	$2.	6SA7	$2.	7B8	$3.	12L6	$2.	25C6	$2.	50B5	$2.	955	$4.	150	$2.
1E5	$5.	2V3	$4.	6B4	$5.	6SB7	$3.	7C5	$3.	12Q7	$3.	25L6	$3.	50C5	$2.	958	$4.	VT-	
1E7	$4.	2W3	$4.	6B5	$5.	6SC7	$3.	7C6	$3.	12S8	$3.	25S	$3.	50C6	$3.	1005	$3.	52	$4.
1F4	$4.	2X2	$2.	6B6	$5.	6SD7	$3.	7C7	$3.	12SA7	$3.	25Z5	$3.	50L6	$3.	E1148	$2.	XXB	$3.
1F5	$4.	3A4	$3.	6B7	$5.	6SF5	$3.	7E6	$3.	12SC7	$3.	25Z6	$3.	50X6	$3.	1201	$3.	XXFM	$3.
1F6	$4.	3A5	$3.	6B8	$3.	6SF7	$3.	7E7	$3.	12SF5	$3.	26	$4.	50Y7	$3.	1203	$3.	XXL	$3.
1F7	$5.	3A8	$3.	6BA6	$2.	6SG7	$3.	7F7	$4.	12SF7	$3.	26A6	$4.	51	$3.	1232	$3.		
1G4	$4.	3C6	$3.	6BE6	$3.	6SH7	$3.	7F8	$4.	12SG7	$3.	26A7	$4.	53	$5.	1273	$3.		
1G5	$4.	3LF4	$5.	6BJ6	$2.	6SJ7	$3.	7G7	$3.	12SH7	$3.	27	$3.	55	$4.	1612	$3.		
1G6	$4.	3Q4	$3.	6C4	$2.	6SK7	$3.	7H7	$3.	12SJ7	$3.	28D7	$3.	56	$3.	1620	$3.		
1H4	$5.	3Q5	$3.	6C5	$3.	6SL7	$3.	7J7	$3.	12SK7	$3.	30	$3.	57	$3.	1625	$4.		
1H5	$3.	3S4	$2.	6C6	$3.	6SN7	$2.	7K7	$3.	12SL7	$3.	31	$3.	58	$3.	1626	$3.		
1H6	$3.	3V4	$2.	6C7	$4.	6SQ7	$3.	7L7	$3.	12SN7	$3.	32	$3.	59	$4.	1629	$4.		
1J6	$4.	5AZ4	$4.	6C8	$4.	6SR7	$3.	7N7	$4.	12SQ7	$3.	32L6	$3.	70A7	$3.	1633	$3.		
1L4	$4.	5R4	$2.	6CB6	$2.	6SS7	$3.	7Q7	$3.	12SR7	$3.	32L7	$2.	70L7	$3.	1634	$3.		
1L5	$6	5T4	$2.	6D6	$4.	6ST7	$3.	7R7	$3.	12V6	$3.	33	$3.	71A	$6.	1635	$3.		
1LA4	$4.	5U4	$2.	6D7	$4.	6SU7	$3.	7S7	$3.	12W6	$3.	34	$3.	75	$3.	1656	$3.		
1LA6	$4.	5V4	$2.	6D8	$4.	6SV7	$3.	7V7	$3.	12X4	$2.	35	$3.	76	$3.	1852	$3.		
1LB4	$4.	5V6	$2.	6E5	$4.	6T7	$4.	7W7	$3.	12Z3	$2.	35A5	$4.	77	$3.	1853	$3.		
1LC5	$5.	5W4	$2.	6E6	$4.	6T8	$2.	7X6	$3.	14A4	$3.	35B5	$2.	78	$3.	2050	$3.		
1LC6	$4.	5X4	$3.	6E7	$4.	6U5	$4.	7X7	$3.	14A5	$3.	35C5	$2.	79	$3.	2051	$3.		
1LD5	$4.	5Y3	$3.	6F5	$3.	6U6	$3.	7Y4	$3.	14A7	$3.	35L6	$3.	80	$3.	CK108	$3.		

<u>COMPLETE CATALOG</u>

SEND 50¢ IN STAMPS PLUS A SELF-ADDRESSED STAMPED ENVELOPE FOR OUR COMPLETE CATALOG. IN ADDITION TO TUBES AND SCHEMATIC DIAGRAMS, WE CAN ALSO SUPPLY KNOBS, DIAL ESCUTCHEONS, TUNING DRIVE BELTS, ANTIQUE TUBE CARTONS, OLD-STYLE GLASS ENVELOPE TUBES, SPECIAL TUBES FOR TUBE COLLECTORS, ANTIQUE WIRE, MORE RECENT TYPE-NUMBER AND TV TUBES, SPECIAL MAINTENANCE AND SERVICE NOTES ON SPECIFIC RADIO SETS, ANTIQUE RECORD CHANGER DATA, ANTIQUE PA SYSTEM DATA AND SCHEMATICS, OLD STYLE TUBE SHIELDS, AND SOME ORIGINAL PARTS FOR SETS.

IF YOU DO NOT SEE A TUBE WHICH YOU SEEK LISTED, SEND A SELF-ADDRESSED STAMPED ENVELOPE. WE MAY BE ABLE TO RECOMMEND A SOURCE OF SUPPLY.

MILITARY TYPE (VT) AND EQUIVALENT COMMERCIAL-TYPE TUBE CROSS-REFERENCE LIST Send $1.00 plus a self-addressed stamped envelope.

We offer free technical advice for a self-addressed stamped envelope or you may call J.W.F. Puett at 214 - 279-8309 NO LATER THAN 10:00 PM CENTRAL STANDARD TIME OR CENTRAL STANDARD DAYLIGHT TIME (when applicable) <u>PLEASE</u>.

TABLE 2 - OLD STYLE TUBES
All are new many in original cartons:

<u>RADIOTRON</u>		<u>MAJESTIC</u>	
UY227	$5.	G4S	$5.
<u>CUNNINGHAM</u>		2A6	$4.
C327	$5.	2B7	$3.
CX345	$6.	G31	$4.
CX347	$6.	6C7	$4.
CX371A	$7.	6D7	$4.
<u>EVEREADY</u>		6E7	$4.
ER551	$4.	46B1	$5.
		G46A1S	$5.
		G6Z5	$3.

We have many others used such as W.E. 205D at $6. Send self-addressed stamped envelope for list.

SEPTEMBER

75c

THE HORN SPEAKER

1975

COLUMBIA
CHAMPION

Type BH
$30.00

COLUMBIA
STERLING

Type BI
$45.00

COLUMBIA
MAJESTIC

Type BD
$100.00

1906
Disc Graphophones

Mr. Gary B. Schneider
6848 Commonwealth Blvd.
Parma Hgts, Ohio 44130

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