

NATIONAL RADIO NEWS



BEST WISHES FOR A MERRY CHRISTMAS AND A HAPPY NEW YEAR

IN THIS ISSUE

Oscillators — How They Work

Your Radio Training and the Defense Program

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A circular frame containing a black and white illustration of the Virgin Mary holding the infant Jesus. The frame is ornate with scrollwork and floral patterns.

Christmas Greetings

The spirit of Christmas calls us to a better appreciation of old associations and the value of new friendships. May you have a very Merry Christmas and may the New Year be the Happiest and most Prosperous you have ever known.

J. E. SMITH, *President*
E. R. HAAS, *Vice-President*



Oscillators — How They Work

By J. A. DOWIE

N. R. I. Chief Instructor

IN every radio transmitter, in every super-heterodyne receiver and in radio servicing equipment, we find oscillators producing the signal. It is this oscillator that supplies the signal that is so essential in carrying out our work. Since it is so important in radio, let's study in greater detail how it works. That is, how does an oscillator operate in generating the signal and how does it continue to develop a signal after placed into operation?

Oscillator Circuits: There are a large number of different types of oscillators in operation. There are oscillators which maintain oscillation by the ionization of gas and by the projection of electrons through chambers where the rate of travel of the electron determines the frequency of oscillation. In this discussion I am going to cover only the operation of the better known oscillator circuits. The oscillators that are used most extensively in the radio field. For example, the tuned grid, the tuned plate, the Armstrong, the Meissner, the Hartley, the Colpitts, the ultraaudion, the push-push and the push-pull types with either the tuned grid or tuned plate or both. In my discussion I will cover these circuits and their operating characteristics. It will be pointed out, that when you understand the characteristics of oscillator circuits which depend upon capacitive or inductive feed-back that you will understand the operating characteristics of all of the conventional types of oscillator circuits mentioned above.

Phase Relationship Between The A.C. Grid And The A.C. Plate Voltages: It can be stated that the primary requirement in order to sustain oscillations in either an inductive or a capacity feed-back circuit is that the applied grid to cathode

voltage must be approximately 180 degrees out of phase with the plate to cathode voltage. This means that when the grid to cathode voltage is rising in a positive direction the plate to cathode voltage must be dropping in a negative direction. That is, the tube itself acts as an amplifier. Then, too, if the reversal is of a sine wave character the wave form of the signal generated will be a pure sine wave. Remember that the voltage applied to the grid of a tube which is not overloaded controls the plate circuit output wave form and that the triode tube is easily adopted to the inductive or capacitive feedback types of oscillating circuits. In an oscillatory circuit the tube does not become an oscillator—it continues to act as an amplifier—amplifying the voltage which is applied to its grid circuit and sending it through the circuit coupled to its plate. When the plate circuit is properly coupled to its respective grid circuit so that it continues to amplify the signal it excites itself, the circuit and the tube become an oscillator.



J. A. DOWIE

Since the tube continues to operate as an amplifier even though it is in an oscillatory circuit let us study some of the important characteristics of vacuum tube amplifiers. In Fig. 1A is shown a triode having electrode supply voltages. Its operating point being at *a* on the Eg-*I_p* characteristic curve shown at B. It can be shown that as the grid voltage of the tube is driven in a positive direction by some force that this will result in a decrease in plate voltage between P and K. This is due to the increase in plate current, the voltage drop being in the plate load and the polarity or phase of the voltage in this circuit being in a negative direction. Now when the grid is driven in a negative direction in the grid circuit the plate circuit voltage goes in a positive direction. This can be

proven by Fig. 1B. Point 1 on the grid voltage moves positive to point 2 and the plate current increases from point 3 to point 4. An increase in plate current means a drop in plate to cathode voltage and from a high positive value to a less positive value with respect to the cathode. It is

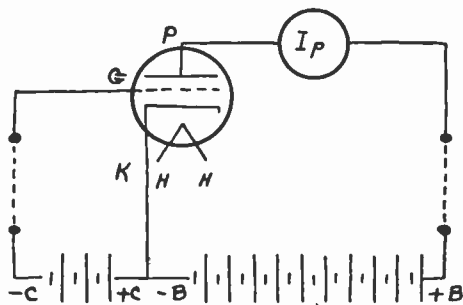


Figure 1A

therefore evident that the voltage applied to the grid-cathode circuit must always be 180 degrees out of phase with the change taking place in the plate circuit of the tube in order to have the tube excite itself and thus maintain oscillation.

So long as the signal voltage on the grid of the tube does not swing beyond points *b* and *c* on the *Eg-Ip* curve there will be no wave form distortion introduced and if the coupling between the grid and plate circuit permits uniform wave form changes, then a sine wave will be developed in the plate circuit and consequently at the output of the oscillator. This condition of operation is known as class A amplification.

Class Of Amplification: The efficiency of an oscillator is dependent to a large extent upon the class of operation. As in the case of the various classes of amplifiers used, the class A, B and C, the efficiency of the oscillator tube is the same as if it were an amplifier insofar as the tube is concerned. Figure 2 shows the relationship between the grid bias voltage, grid swing and plate current for the three fundamental types of amplifiers all of which may be used in the operation of an oscillator.

Outstanding Amplifier Characteristics: The outstanding operating characteristics of a properly operated class A amplifier is the fact that the variations in excitation do not produce a change in the average D.C. plate current. That is, the increases in plate current are equal to the decreases and for this reason the average current taken from the power supply does not change. The grid excitation signal never drives the grid positive with respect to the cathode of the tube.

In the class B amplifier increases in grid excitation produce proportional increases in the average D.C. plate current, that is, an increase in excitation raises the output of the oscillator. The grid excitation is sufficient to drive the grid positive but not off the straight portion of the *Eg-Ip* curve. The class C amplifier is operated so that further increases in grid excitation show no further increases in the average plate current. This condition of operation can only exist with the flow of grid current. The grid is driven positive and far enough to cause plate current saturation. It can also be stated that an oscillator employing a class C amplifier has very high harmonic content as the plate current exceeds the saturation point as can be seen at the upper right in Fig. 2.

How Phase Relation Is Obtained: As stated there must always exist a 180 degree phase shift in the voltages between the grid and plate circuits in order to use a triode as an amplifier tube in an oscillator circuit. This required phase shift can be obtained by means of a transformer or through the aid of a phase shifting network or phase inverter consisting of another tube. Most oscillatory circuits use a transformer consisting of either one winding having a tap on it or two separate windings. For example, Fig. 3A shows a tapped transformer, often referred to as an auto-transformer. The position of the tap being selected to give the required excitation voltage for the class of amplification desired. The transformer winding gives us the desired phase shift because one end of the winding will always be of opposite polarity with respect to the other. No

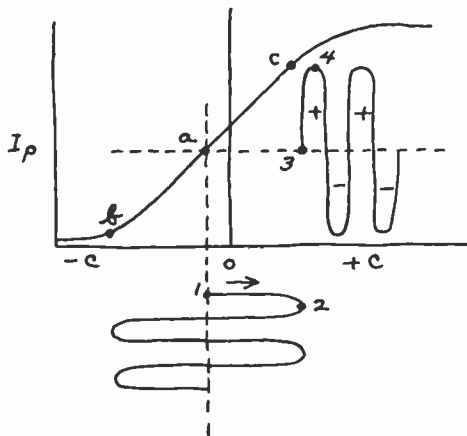


Figure 1B

coil or winding on a transformer can have the same polarity when the winding is wound in one direction. One end will always be positive while the other is negative. This is the condition when

all turns are linked together by the same electro-magnetic field.

If we use an oscillator coil having two windings then the windings must be connected so that the grid end of one winding will be of opposite polarity with respect to the plate end of the other, thus keeping the 180° phase shift. The connections will be as shown in Fig. 3B.

How To Determine Coil Polarity: Oftentimes the serviceman is required to make an oscillator coil replacement and he is confronted with the job of connecting the unmarked leads of an oscillator coil to produce oscillations. In order to connect the coils of an oscillator so the phase will be correct, refer to Fig. 3B. Note that *a* and

by what is known as the shunt or parallel feed method. The signal voltage generated is in parallel with the path taken by the power to the tube electrodes. In Fig. 3C the same circuit components are shown but connected to give us the series feed method of supplying power to the tube electrodes. Note that the coupling condensers are now by-pass condensers and are connected to the cathode of the tube. It is, of course, possible to use the series feed in the grid circuit and the parallel or shunt feed method in the plate circuit or shunt feed in the grid circuit and series feed in the plate circuit. The method of feed selected by the engineer in the construction of the device may be any one of these combinations. The series plate feed method being somewhat more efficient than the shunt feed method as this

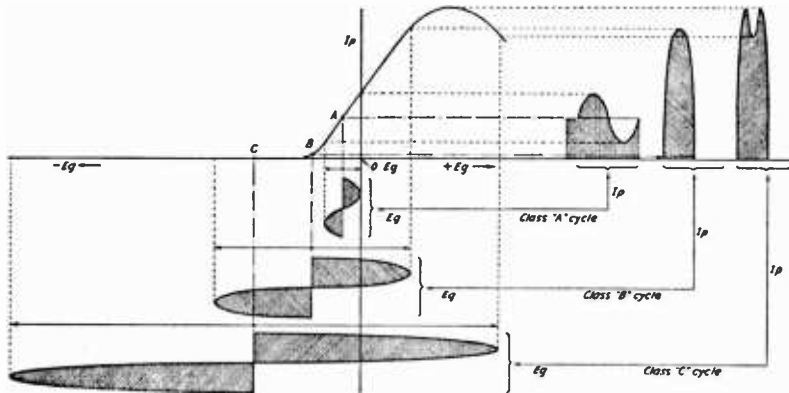


FIG. 2. Relationship between grid bias voltage, grid swing and plate current for class A, class B and class C amplifiers. In class A, the grid never swings positive; in class B the grid swings positive only over the linear region of the plate current characteristic; in class C the grid swings beyond the plate current saturation point.

d are at opposite ends of the oscillator coil. If lead *c* is connected to the plate coupling condenser C_p then to insure proper polarity lead *b* must be connected to the grid coupling condenser C_g . It isn't difficult to remember this requirement. I always say that when the grid is at one end of a coil form having two windings then the plate must be at the other end of the coil form when the two coils are wound in the same direction. That is, these two leads are always on the opposite ends of the two coils or at the two inside terminals. This rule holds good regardless of the placement of the tuning condenser or condensers or the method used in supplying power to the oscillator circuit. The tuning condenser or condensers do not shift the phase of the voltage across the coils sufficiently to stop oscillation.

Method Of Feeding Power To Oscillator Tubes: Figure 3B shows how the power or electrode voltages are supplied to the tube so it can amplify

method prevents R_p from shunting the plate circuit of the oscillator.

Automatic C Bias Supply: Although the circuit shown in Fig. 3A has a C battery to enable class A operation of the tube at a given point on its E_g - I_p curve, it is possible to obtain class B and C operation by omitting the battery. This latter is possible because the upper end of the resistor R_g will become negative when the grid is driven positive by the excitation signal. The grid serves as the anode and the cathode of the tube as the cathode of a rectifier tube. The positive end of the resistor R_g being connected to the cathode. R_g may be considered the load on the rectifier. The voltage across R_g is dependent upon its current and resistance.

How Oscillations Are Maintained: Now that we know how the proper polarity of the winding can be ascertained, how power may be fed to the tube

and how the grid bias can be obtained automatically, let's determine how oscillations are developed and maintained.

Assume that the cathode of the tube in Fig. 3B is at its operating temperature and that the B battery voltage is applied instantly. Upon application condenser C_{pc} will start to charge up to the value of the D.C. voltage dropped in the resistor R_p . Plate current will start to flow through winding L_2 . This causes a magnetic field to be present about coil L_2 . This field would appear to be of a steady value because the flow of the D.C. plate current is assumed to be constant. This is not, however, the case. The moment the plate voltage is applied the magnetic field about coil L_2 starts to expand, which, according to the electro-magnetic law would link the coil L_1 , due to its inductive relation and would consequently induce an e.m.f. or a difference of potential across it. If then, the coils L_1 and L_2 are wound as stated above where coil L_1 would produce a positive potential at the terminal a and a negative potential at b , the grid which is connected to a would receive a positive charge. This immediately partly neutralizes the space charge between the cathode and plate and allows more plate current to flow and at the same time causes the production of a negative grid bias. This causes a greater field to exist around coil L_2 and results in a greater positive charge on the grid. The plate current then increases and in turn applies a greater positive potential to the grid. Of course this action continues until the plate current is limited by the emission characteristics of the tube or by the automatic C bias voltage which is developed by the rectified grid current which is across the resistor R_g . The turns ratio and amplification factor of the tube will also affect the peak value of plate current.

When the peak plate current value has been reached, the magnetic field collapses and as a result the grid is driven negative. This causes a reduction in plate current which tends to aid in making the grid more negative. The grid may be driven so far negative that the plate current is completely cut off as shown in Fig. 4c. No further changes will then occur in the negative direction and again the magnetic field collapses. Then the complete cycle of operation will be reversed and as before the operation will start all over again. Thus it can be seen that the polarity of the coils L_1 and L_2 must be correct to cause the proper changes in plate current.

Transformer Turns Ratio: It should also be evident that the greater the turns ratio of L_1 to L_2 , the higher the voltage across terminals ab . That is, the voltage across winding L_1 should be high and naturally the greater the number of turns in coil L_1 , the higher the voltage developed. This will mean more excitation voltage and also a greater plate current as more power will be required to supply the extra excitation. These facts

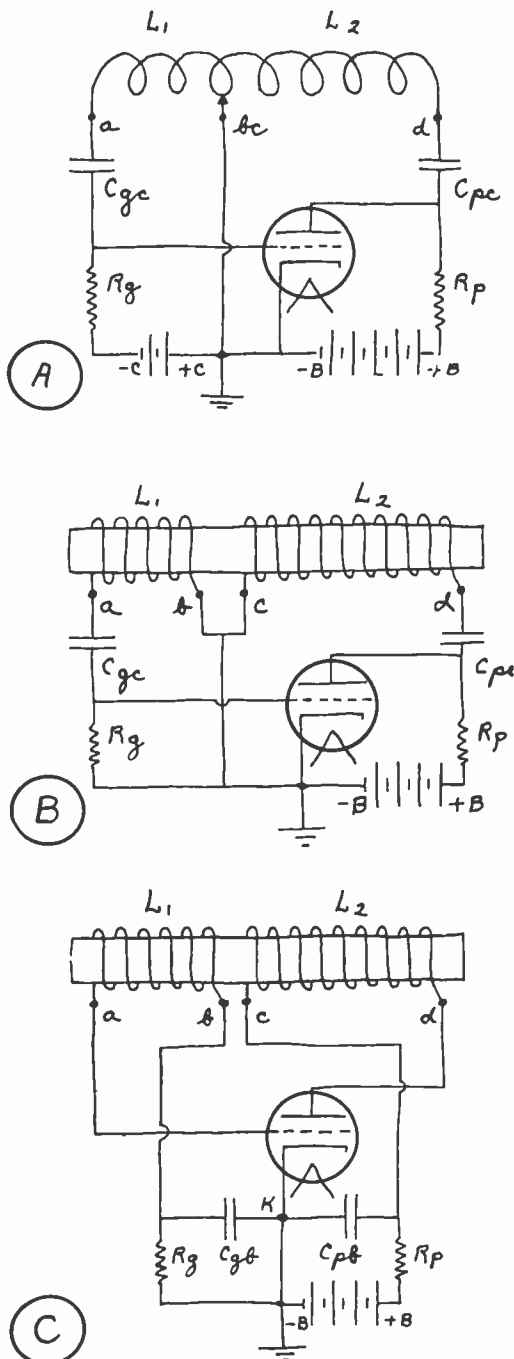


Figure 3

also apply to the operation of the circuit shown in Fig. 3A and Fig. 3B. The turns ratio factor is also present and holds true when the inter-electrode capacity of the tube is used in tuning the entire circuit and when the tuning condenser is connected between terminals *a* and *d* in Figures 3A, B and C. When the tuning condenser is connected across either coils L1 or L2 then the coil without the condenser across it has the least number of turns. This is due to the fact that the condenser tunes the circuit to resonance and allows a higher voltage to exist across the coil and naturally with a larger magnetic field.

Excitation Regulation: For a given plate supply voltage it is possible to find the correct excitation voltage by either selecting the proper number of turns or regulating the coupling or both in an oscillator circuit. The excitation voltage is also affected by the automatic bias voltage placed on the oscillator tube and the load coupled to the output circuit. For efficient operation of the oscillator circuit and for a given power output we must select the correct amount of excitation to give the class of operation consistent with the type of performance we desire. This value will usually be for the least amount of plate current that will give the most power output. There are other factors such as frequency stability and wave form that must be taken into consideration in the selection of the circuit values. It is the work of the radio engineer to select the proper operating characteristics of an oscillator circuit.

Oscillator Output: The output of the oscillator is affected by a change in the oscillator plate voltage for a given turns ratio or coupling between the grid and plate circuits. It is also a fact that an increase in the D.C. plate voltage causes an increase in the D.C. plate current, the generated R.F. tank voltage, the R.F. tank current, the R.F. grid and plate current as well as the self-adjusting grid biasing voltage. These factors are all related to the power supplied to the oscillator for a fixed amount of coupling. It can also be stated that for a given supply voltage it is impossible to change any of the other currents or voltages in the oscillator circuit without changing all other values. This means that an increase in the coupling of the load to the oscillator circuit will affect all of the values of currents and voltages, that is, their relationship to the other values.

General Discussion Of Oscillator Characteristics: In discussing how oscillations are maintained we stated that the plate current increased to a value established by the emission characteristics of the tube. An oscillator tube functioning in this manner will not operate very long as it will lose its emission and become defective. It is for this reason desirable to provide a self-biasing resistor having a value of resistance which causes the production of the automatic C bias voltage that

will give class B or C operation of the oscillator tube. Lower efficiency of operation is obtained when using either class B or A operation.

The self-biasing grid voltage developed should limit the peak plate current rather than the emission characteristics of a tube in a well designed oscillator circuit. The ability for the self-bias voltage developed to limit the plate current flow is often referred to as a "braking action" that limits the grid A.C. voltages for a fixed amount of excitation and prevents them from reaching unsafe values of operation. I will add that if we get a clear picture of what takes place in an oscillator, the effects of changing any factor in the circuit can be explained very easily. Let us see what is the basic action in an oscillator circuit.

When the oscillator reaches its final oscillating condition, we know that the grid is driven sufficiently positive to produce grid current which in turn develops across the grid resistor a definite negative C bias voltage. This voltage establishes a new operating point on the E_g - I_p characteristic curve. The A.C. grid voltage drives the grid positive and negative with respect to the operating C bias value as shown in Fig. 1B, always sufficiently positive so it creates this C bias voltage. The plate current flows only during that portion of the grid cycle when the grid voltage is less than the cut-off value. This is the point where the grid voltage stops the flow of plate current. The higher the excitation the smaller the operating angle for the plate current. For class B operation the operating angle for the plate current will be less than 180 degrees.

In Fig. 4A and B we find the plate and grid voltage curves respectively. Note that the A.C. grid voltage decreases to a maximum while the A.C. tank circuit or plate voltage increases to a maximum. This is the correct phase relationship between the input and output voltages of a tube used in an oscillator. The plate current as shown in Fig. 4C and as *ip* pulse represents the driving power to sustain oscillations for it is this change in current that is fed back into the tank circuit to set this resonant circuit into natural oscillation. The area of this pulse when we view it as a graph represents available oscillating power, the greater the area of the plate current pulse the more the power available. Technically speaking any increase in peak current, any increase in the operating angle, and any trend to make the size of this pulse steeper and more flattened on top indicates more operating power for all of these factors increase the area of the plate current pulse *ip*.

The amount of power consumed by the oscillator has a number of important functions to perform. It must overcome the losses in the tank circuit (resonant circuit), overcome the power lost in the grid resistor, the power lost in the grid-

cathode of the tube, overcome the power dissipated in the plate-cathode circuit of the tube supply power to the load and any other incidental circuit losses as well as to develop enough excitation to drive the grid circuit of the tube in order to produce the correct amount of plate current.

If we assume that there is a tendency for the A.C. grid voltage to increase then immediately the grid current increases and consequently the bias voltage becomes greater. This in turn reduces the operating angle of the plate current pulse, even though the current peak may tend to rise. Less power will then be available for oscillation and the braking action takes place preventing more power from reaching the circuit and consequently preventing the grid excitation to increase. If the grid A.C. voltage drops, the C biasing voltage is automatically reduced as the grid current is reduced and in turn the plate current flows over a greater portion of the cycle, resulting in the application of more power to overcome losses and again drive the grid up to a point where all losses are supplied and the grid excitation is sufficient to sustain the oscillating condition.

The basic braking action is the inability of the oscillator circuit to draw enough power to take care of all current demands, and as a result the circuit sets itself to a definite operating condition and balance. For example, if we increase the grid resistor value from a low value to a slightly higher value the initial action results in an increased C bias voltage. As this takes place the operating point on the E_g-I_p curve of the tube is further negative. The grid, however, must draw current to supply automatic C bias voltage and to do this the A.C. grid excitation increases. Because of this grid circuit action the peak plate current goes up slightly but at the same time the operating angle decreases. The power drawn by the circuit depends on both the operating angle and the peak plate current. If we increase one and decrease the other by a small amount the circuit will draw more power increasing both the grid excitation and C bias voltage. Again the peak plate current increases but it is perfectly possible for the operating angle to decrease so much that the amount of power drawn starts to decrease at the point where maximum power is drawn from the supply bal-

ance occurs and the circuit conditions are stabilized. Of course we can make the grid resistor so high in its ohmic value that this condition of maximum power is far below any condition which would exist for normal circuit values, and a large grid resistor may actually produce less power in the oscillator circuit than normal low grid resistor values. Increasing the grid excitation using a given grid resistor may also decrease the power developed because the operating angle is decreased more than the peak increase in plate current.

If we increase the D.C. plate voltage, the E_g-I_p characteristic instead of being held at the operat-

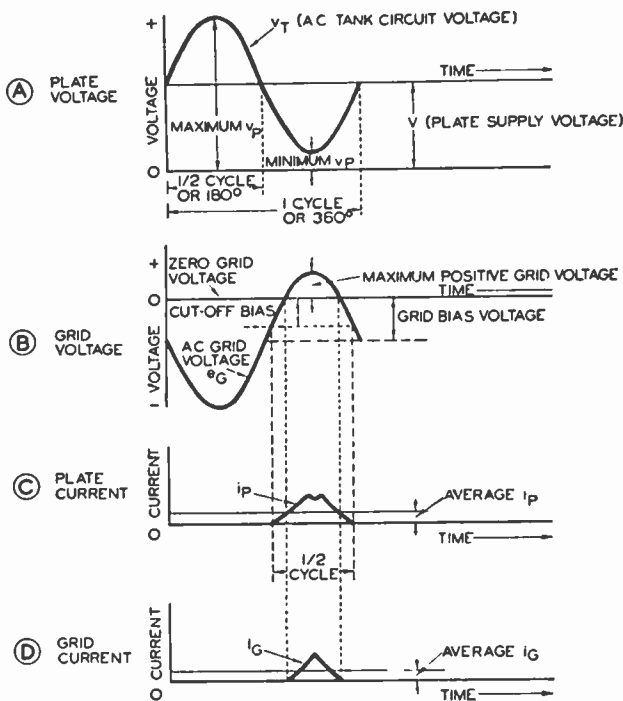


FIG. 4. These plate and grid currents and voltages represent operating conditions in the oscillator circuit of Fig. 3. Remember that graphs like these are always read from left to right. When comparing two voltages, that one which reaches a positive peak *closest* to the vertical reference line is said to *lead* the other; thus, v_T in A leads e_g in B.

ing point as shown in Fig. 1B will move toward the operating point b. Therefore for an increase in plate voltage the grid current will be greater as the grid voltage is increased and consequently a higher negative C bias will be produced as it will be required in order to cut off plate current. Since the grid A.C. voltage must always drive the grid positive to produce the automatic C bias voltage and as this C bias voltage is greater than

the cut-off bias, the result is a much stronger current pulse; the plate current increases, as explained above. Under this condition more oscillating power is available and greater power will be received from the oscillator.

With the usual testing instruments available to servicemen, only the D.C. plate voltage, the D.C. plate current and the self-biasing grid voltage can be measured with a voltmeter having a high resistance per volt rating. When there is any increase in the automatic D.C. grid voltage for a given value of grid resistance we have an indication of more A.C. tank voltage. This fact should be remembered and taken into consideration when servicing oscillators.



From the Chief Engineer, Radio Station WDOD, Chattanooga, Tennessee

Mr. J. E. Smith, President
National Radio Institute
Washington, D. C.

Dear Mr. Smith:

I am sitting here on the job this Armistice Day night with a few idle minutes thinking of the past, and it appears to me that all of us should be thankful. Also, I recall the days of 1926 when I graduated from the National Radio Institute. At that time I deeply appreciated the help and knowledge you had given me, but that in no way compares to the depth of that appreciation in 1940. I am married, have three lovely children and have recently received an increase in salary. I can say that you are responsible for my success and happiness.

I might inform you that this station has recently been granted authority to use 5 KW both day and night using a directional antenna system. We expect to have the new transmitter in operation by April 1st from the new site. Also, we are moving into new studios on January 15th. These will be one of the most modern in the south. With four studios and a complete new equipment installation, we should rank among the best for the size.

I trust that my help, however small it may be, will inspire some of your students to greater effort so that they may receive the same benefits as myself.

My best wishes and regards go to you and the entire staff.

Cordially yours,

JULIUS C. VESSELS,
Chief Engineer,
Radio Station WDOD.

Nov. 11, 1940.

Return Those Replaced Parts to Set-Owners

"There's a lot of good business psychology in returning all replaced parts to set-owners," states Vic Mucher, who is sales manager for the Clarostat Manufacturing Co., Inc., and knows more than a thing or two about the service business.

"Successful auto repairmen are doing just that, and since these auto boys have many years on us when it comes to service psychology, we surely can't go wrong following in their footsteps.

"Remember, your public is always suspicious of service bills. So if you include an item for replaced parts, there's that lurking suspicion that some fancy gypping is going on. But if you include the replaced parts when you return the set, the customer is promptly disarmed on that score and perhaps on all scores.

"Just think what this practice means to your customer. It's simply sales dynamite. The customer gets the idea you have no use for old parts and don't want them kicking around.

"Take it home, Mr. Set-Owner, and throw it in the ashcan,' you can say, as you hand said customer some old part taken out of his set. 'We don't want old parts kicking around our shop. Too much danger of having them sneak into some set or assembly, by accident. You know, we use only brand new, fresh, up-to-the-minute components in our work.' What a goodwill wallop you can pack in those few remarks!

"Then, too, this practice is mighty important from your side. It eliminates the temptation to use junk parts. Human nature being what it is, we all know that where there's a junk box around, there's going to be a lot of old stuff pressed into further service. And the breakdown of just one job, due to junk parts, can cost you many times the price of new parts. So why take needless chances! Why permit such temptation to be present?"



Left Without a Dame

The victim said that when he left the cafe with his two pretty companions he had \$60 on him besides several pockets full of loose change. But after being hit on the head he says he woke up without a dame.—Painter (Okla.) Recorder.



News Items from F. C. C.

This article was released to NATIONAL RADIO NEWS by the Federal Communications Commission, Washington, D. C.

A New Jersey amateur inquires if it is permissible to (1) listen in to short wave transmission from foreign stations and (2) if he can still exchange post cards with "ham" operators in Europe. The Federal Communications Commission advises that though amateurs in the United States are now prohibited from exchanging radio communications with such radio stations abroad, there is no regulation against listening to foreign broadcasts, or communicating with persons overseas by mail, telephone, telegraph or cable.

From Buffalo comes request for the "answers" to the questions contained in the Commission's "Study Guide and Reference Material for Commercial Radio Operators." Such answers are not furnished. The questions contained in this pamphlet, as well as in the Commission's "Study Guide and Reference Material for Amateur Radio Operator License Examination," are purposely paraphrased to cover the scope of examinations without giving actual examination questions. In either case, the operator should qualify himself to know the answers.

A North Carolina resident asks if he would have to get permission from the Federal Communications Commission to build a private telephone line to connect with a local telephone system. He is informed that such intrastate matters come within the jurisdiction of State public utility commissioners and, accordingly, is referred to the one for North Carolina.

The Commission informs several inquirers that there are some 270 pending applications for additional facilities in the present standard broadcast band, of which number 56 are for construction permits for new stations.

The Federal Communications Commission has had to censure, by mail, a Pacific Coast ship captain who, in radio discussion with another vessel about position and weather, could not refrain from cursing the latter. His unlawful superfluous language was heard by others and reported to the Commission.

A Long Islander is interested in the possibility of a three-way communication system between a vessel, a land station, and an automobile. Except for emergency service involving the safety of life and property, the Commission has not recognized the operation of any type of land station for the purpose of communicating with portable or movable equipment of organizations of individuals.

There is no specific amount of time which radio stations are required to devote to public and educational agencies, the Commission advises a Philadelphia body. Licenses are issued on general determination that the stations will serve the public interest, convenience and necessity. It is up to the broadcasters to include programs of an educational, religious and civic nature, but the amount of time devoted to these subjects rests between the stations and the groups concerned.

FM Gets "Go" Signal

The final "Go" signal for FM (frequency modulation) was given by the Federal Communications Commission in authorizing 15 applicants geographically scattered throughout the nation to engage in this new type of broadcast on a commercial basis as soon as they are able to do so.

The authorizations on October 31st embrace proposed FM service to millions of persons in widely scattered sections of the country, and are expected to expedite the rapid development of this new program art. The locations of these prospective pioneer stations follow:

DETROIT—The Evening News Association
LOS ANGELES—Don Lee Broadcasting System
BATON ROUGE—The Baton Rouge Broadcasting Co.
SALT LAKE CITY—Radio Service Corporation of Utah
CHICAGO—Zenith Radio Corporation
MT. WASHINGTON, N. H.—The Yankee Network
MILWAUKEE—The Journal Co.
NEW YORK CITY—National Broadcasting Co. William G. H. Finch
Marcus Loew Booking Agency
EVANSVILLE, IND.—Evansville On the Air, Inc.
BINGHAMPTON, N. Y.—Howitt-Wood Radio Co., Inc.
BROOKLYN, N. Y.—Frequency Broadcasting Corp.
COLUMBUS, OHIO—W B N S, Inc.
SCHENECTADY, N. Y.—Capitol Broadcasting Co., Inc.

Giving these stations the starting gun is the last formality in a series of actions by the Commission to make possible, for the first time in radio history, the use of the high frequencies for commercial broadcast.

Three particular advantages are claimed for FM, namely, that it gives more tone range, is static free, and more stations can use the same channel without interference. The last-mentioned asset opens up a new field for broadcasting, which has long clogged the present standard broadcast band.

The Laboratory Page

By GEORGE J. ROHRICH

The purpose of this department is to furnish supplemental experiments to students who have completed their Home Laboratory Course, but who wish additional laboratory experience. You are not required to perform these experiments, but you will gain increased knowledge by doing so.

Most of the material required will be that received as part of the Laboratory Course. Any other material necessary can be purchased very reasonably and will constitute an investment rather than an expense, as it will serve as replacements in service work or be useful in your shop later.



George J. Rohrich, Engineer
in Charge N. R. I. Laboratory

The Current-Carrying Ability of Resistors

A resistor can be constructed to have a given value of resistance by employing different sizes of wire. For instance, we can construct a 500 ohm resistance of very fine wire and it will be necessary to use only a few feet of such wire in order to obtain 500 ohms.

This particular wire can carry only a given amount of current without becoming excessively heated.

If we find that the 500 ohm resistor becomes excessively hot, then it will be necessary to obtain another resistor which is constructed of larger wire. In order to maintain the same value of resistance, it will be necessary to use a greater length of the larger sized wire. The same amount of heat will be produced in the larger wire but its larger surface will radiate the heat quickly, keeping it cool.

If we find that the resistor has to carry considerable current, then it may be necessary to use very large wire.

From the above explanation, we see that a resistor has to be constructed so as to carry a given amount of current. Of course, a resistor which is capable of carrying a large current can also safely carry a smaller current. The usual practice is to construct a resistor which can safely handle the maximum current which will be flowing through it at any time. There is no economy in constructing a larger resistance when a smaller one will do, unless the smallest allowable size is mechanically fragile and difficult to handle.

Instead of rating a resistor in its current carrying capacity, it is customary to rate the resistor as "capable of dissipating a given amount of heat." This rating is given in watts. This rating in watts is obtained by multiplying the value of current itself, and finally multiplying this result by the value of resistance. This is expressed in a formula; $Watts = I^2R$.

For example, let us say that we find a 500 ohm resistance carries 2 amperes. Multiplying 2 amperes by itself, we obtain 4. Multiplying 4 by 500 ohms we obtain 2000 watts. This is the rating of the resistor and we say that it is capable of carrying 2 amperes.

The rating in watts can be obtained by a second method. This requires you to multiply the voltage across the resistor by the current. This is expressed by the formula: $Watts = EI$.

A 500 ohm resistance which has a lower rating in watts is intended to carry a smaller current. This current carrying capacity can be obtained by dividing the value in watts by the value of resistance, and then taking the square root of the result. Thus, a $\frac{1}{2}$ -watt, 500-ohm resistor is intended to carry currents which are not greater than .031 ampere or only 31 milliamperes.

You will notice that the relation between watts, voltage and current is expressed by an equation which is similar to the equation of Ohm's Law which shows the relation between voltage, current and resistance. Remember these two equations:

(Page 12, please)

Voltage=current x resistance.
Power=voltage x current.

In order to help you remember them keep in mind these four numbers: 2, 3, 6 and 12 and associate the 2 with current, the 3 with resistance, the 6 with voltage and the 12 with power.

We know that $6=2 \times 3$.
Therefore voltage=current x resistance.

We also know that $2=6 \div 3$.
Therefore current=voltage \div resistance.

We know that $3=6 \div 2$.
Therefore, resistance=voltage \div current.

We know that $12=6 \times 2$.
Therefore, power=voltage x current.

We know that $12=2 \times 2 \times 3$.
Therefore, power=current x current x resistance. This represents the equation $W=I^2R$.

We know that $12=(6 \times 6) \div 3$. Thus, power=voltage x voltage, divided by the resistance. This represents the equation $W=E^2 \div R$.

We know that $3=(6 \times 6) \div 12$. Thus, resistance=voltage x voltage divided by the power. This represents the equation $R=E^2 \div W$.

We know that $2=\sqrt{12 \div 3}$. Thus, current=the square root of the result which is obtained when the power is divided by the resistance. This is represented by the equation: $I=\sqrt{W \div R}$.

We know that $6=\sqrt{12 \times 3}$. Therefore, voltage equals the square root of the result which is obtained when the power is multiplied by the resistance. This represents the equation $E=\sqrt{W \times R}$.

We know that $3=12 \div (2 \times 2)$. Therefore, resistance equals power divided by the square of the current. This is represented by the equation: $R=W \div I^2$.

We know that $6=12 \div 2$. Therefore voltage=power \div current. The symbol equation is represented by $E=W \div I$.

We know that $2=12 \div 6$. Therefore, current=power \div voltage. The symbol equation is $I=W \div E$.

With these twelve equations you can find the value of any one of the four quantities, provided you know the value of two other quantities. You can see how easy it will be for you to work out any one of the twelve if you will only re-

member the two equations to which I called your attention above.

The current carrying-capacity of a wire used in a circuit or electrical instrument is dependent on the size of the wire. It is customary to allow 1000 circular mills of cross-sectional area for each ampere where copper wire is exposed to good ventilation. Where the wire is used so that air cannot reach it freely for carrying off the generated heat, it is customary to allow 1500 circular mills for each ampere.

Gauge No.	Diameter in mils.	Cross-section		Resistance at 20°C. or 68°F. per 1000 feet	Turns per Linear Inch			
		Circular mils.	Square inches		S.C.C.	D.C.C.	S.S.C.	D.S.C.
12	80.81	6.530	0.005129	1.588	11.5			
14	64.08	4.107	0.003225	2.525	14.3			
15	57.07	3.257	0.002558	3.184	15.9	14.9		
16	50.82	2.583	0.002028	4.016	17.9	16.7	18.9	18.3
17	45.26	2.048	0.001609	5.064	20.0			
18	40.30	1.624	0.001276	6.385	22.2	20.4	23.4	22.7
19	35.89	1.288	0.001012	8.051	24.4			
20	31.96	1.022	0.0008023	10.15	27.0	24.4	29.4	28.0
21	28.46	810.1	0.0006363	12.80	29.9			
22	25.35	642.4	0.0005046	16.14	33.9	30.0	36.6	34.4
23	22.57	509.5	0.0004002	20.36	37.6			
24	20.10	404.0	0.0003173	25.67	41.5	35.8	45.3	41.8
25	17.90	320.4	0.0002517	32.37	45.7			
26	15.94	254.1	0.0001996	40.81	50.2	41.8	55.9	50.8
27	14.20	201.5	0.0001583	51.47	55.9			
28	12.64	153.8	0.0001255	64.90	60.2	48.8	68.5	61.0
29	11.26	122.7	0.00009853	81.83	65.4			
30	10.03	100.6	0.00007894	103.2	71.4	55.6	83.3	72.5
31	8.928	79.70	0.00006260	130.1	77.5			
32	7.950	63.20	0.00004964	164.0	83.4	62.9	101	84.8
33	7.080	50.13	0.00003937	205.9	90.0			
34	6.305	39.75	0.00003122	260.9	97.1	70.0	121	99.0
35	5.615	31.52	0.00002476	329.0	104			
36	5.000	25.00	0.00001964	414.8	111	77.0	143	114
38	3.965	15.72	0.00001235	659.6	125	83.3	167	123
40	3.145	9.888	0.00000766	1049	141	90.9	196	146

S.C.C.—Single Cotton Covered.
S.S.C.—Single Silk Covered.

D.C.C.—Double Cotton Covered.
D.S.C.—Double Silk Covered.

The cross-section area of various wires is shown in the accompanying table.

For instance a No. 30 wire has a cross section area of approximately 100 circular mills. This wire is used for carrying .1 ampere where the wire is exposed and it is used to carry a maximum of .066 ampere where the wire is confined to close places. A No. 30 wire will burn out when a current of 10 amperes flows through the wire.

A No. 38 wire has a cross sectional area of 15.72 circular mills and it is rated to carry 16 milliamperes and 10 ma. under the two conditions. This wire will burn out with 2.5 amperes.

The milliammeter furnished with the experimental parts uses No. 38 wire.

For ordinary purposes it may be remembered that a wire will not burn out until a current of 50 times to 150 times the allowable current-carrying capacity of the wire flows through the wire.



RADIO-TRICIAN

REG. U.S. PAT. OFF.

Service Sheet

Compiled Solely for Students and Graduates

NATIONAL RADIO INSTITUTE, WASHINGTON, D. C.

RCA VICTOR, MODEL VR-40

ANTENNA. The set is equipped with a built-in loop antenna. If an outdoor antenna is used, it may be connected to the "ANT" terminal on rear of cabinet. It should not be longer than 100 feet, including lead-in. If it is longer, connect a 100 to 200 mmf. capacitor in series with the lead-in.

POWER-SUPPLY POLARITY. For operation on d-c, the power plug must be inserted in the outlet for correct polarity. If the set does not function, reverse the plug. On a-c, reversal of the plug may reduce hum.

Alignment Procedure

OUTPUT METER ALIGNMENT. Connect the meter across the voice coil, and turn the receiver volume control to maximum.

TEST-OSCILLATOR. Connect the low side of the test-oscillator to the receiver chassis,

through a .01 mfd. capacitor, and keep the output as low as possible.

PRE-SETTING DIAL. With gang condenser in full mesh, the pointer should be adjusted so that pointer is vertical.

Steps	Connect the high side of test oscillator to:	Tune test osc. to:	Turn radio dial to:	Adjust the following for max. peak output
1	12SK7 (I-F) grid in series with .01 mfd.	455 kc	Quiet point at 600 kc end of dial	C13, C14 (2nd I-F trans.)
2	Tuning condenser stator (ant.) in series with .01 mfd.			C11, C12 (1st I-F trans.)
3	Radiation loop consisting of two turns of wire 18 inches in diameter.	1,600 kc	Full clockwise (out of mesh)	C8 (oscillator)
4		1,400 kc	Resonance on 1,400 kc signal	C3 (antenna)

SOCKET VOLTAGES

Type	Plate	Screen Grid	Cathode	Filament
12SA7 Det.	90V	90V		12V
12SK7	90V	90	1.1V	12V
12SQ7	40V			12V
35L6GT	84V	90V	5V	35V
35Z5GT	114V		112V	35V

NOTE: All voltages are measured to common wiring insulated from chassis with a line voltage of 117 volts.

Novel Radio Items

—BY L. J. MARKUS—

Television Increases Auditorium Size

Sixty television receivers served as electronic knotholes for the overflow audience at a recent political gathering. At least thirty persons could watch each of the RCA television receivers which were connected by cable to a battery of four television cameras mounted on a special balcony only thirty-five feet from the convention hall rostrum. This first demonstration of a new television application may be the solution to the limited seating problem of small auditoriums.

— n r i —

Machine Imitates Phone Noises

An elaborate sound-effects machine which reproduces all of the sounds made by or heard over a telephone has been developed by technicians of station WOR in Newark for use during radio dramas.

— n r i —

Radio Eye For Microbe Hunters

Scientists at RCA Laboratories have developed an electron microscope which magnifies tiny micro-organisms as much as 100,000 times. Electrons passing through the subject under study are focused upon photographic film by powerful

magnets, producing images of objects which have previously been invisible.

— n r i —

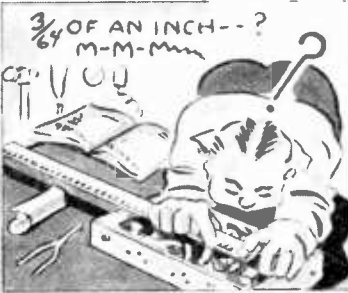
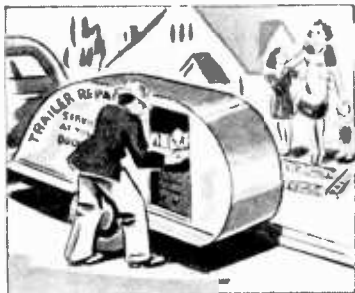
Engineers Build Talking Microphone

When visitors at a Philadelphia industrial show asked questions before a special WFIL microphone, the answers came from the microphone itself. The engineers of this station are credited with developing this unique talking microphone.

— n r i —

Colleges Use Wired Radio

Radio stations which have no assigned call letters are being used at Brown University in Providence, Rhode Island and at Williams College in Williamstown, Massachusetts to bring recorded popular music, interviews with visitors and campus gossip to students in dormitories and fraternity houses. Since the signals are distributed over a wired r.f. carrier system passing through underground conduit, there is no propagation of radio waves and the stations are exempt from control by the F.C.C. A national advertiser recently contracted for a series of daily news programs on these two stations, with students serving as the news reporters.



TRAILER RADIO SHOP. Charles Hurt of Elkhart, Indiana brings his radio service shop to the door of each customer, thus saving the customer the usual charges for pick-up and delivery service, providing immediate repairs, and keeping his own overhead expenses at a minimum. The test bench, along with all tools and equipment, are neatly arranged in a streamlined two-wheel trailer towed by his car. A dynamotor operating from a storage battery and delivering 115 volts at 60 cycles a.c. could be used to provide power for tests.

PIGEONS AND RADIO. Although carrier pigeons often stop at radio transmitters, they usually leave after a brief rest. One persistent pigeon refused to leave station WTAM in Cleveland, however, despite attempts to scare it away. A station engineer took the bird home, fed it, and released it. The bird showed up again at the WTAM transmitter. Finally, the engineer took the pigeon about seven miles out of town and released it. Again the bird returned to WTAM. Was it tuned to the wrong frequency?

F.M. PROBLEM. The instruction manual for the General Electric model HM-136A frequency modulation receiver specifies that a 15,000-ohm resistor and a 5 mmlf. compensating condenser in an oscillator drift correction circuit should be parallel and separated by exactly 3/64-inch. Does this mean that the serviceman of the future must include a feeler gauge, a micrometer, and a microscope with his radio tools, or will instructions like this be changed to read "the thickness of a worn-out nickel?"

Your Radio Train

By J. E. SMITH

President, National Radio Institute



J. E. SMITH

THE idea of mobilizing for defense in order to preserve peace is now gripping the attention of our nation. Each person will feel the many reactions from this momentous task. Each person is giving genuine support, thereby knitting our nation more closely together.

But preparations for National Defense are tending to affect our outlook toward the immediate future. Many of us fear that long-cherished plans may have to be laid aside temporarily. In many industries, conditions have changed radically within the last few months, so that new opportunities present themselves.

Radio plays an important part in our National Defense program. Since Radio is also your chosen field, I am taking this opportunity to analyze the manner in which our National Defense program may affect you as a Radio man.

First of all, we have the indisputable fact that the general public in the United States is more interested now than ever before in news broadcasts telling of the fast-moving

Young men look to the future wondering how our important task of creating a defense will affect their lives. Mr. Smith, in this message which he has prepared especially for you, makes it clear that you have a solemn duty to perform for our Nation and that this duty also presents greater opportunities to trained Radio men.

events in Europe and the Far East. The reactions of our own Government as reported by Radio commentators are likewise eagerly received by the Radio audience.

Another important observation we can make at the present time is that people are listening to Radio entertainment today more than ever before. Perhaps this is being done to counteract the many discouraging news broadcasts. Important speeches each attract additional listeners who might otherwise leave their receivers turned off.

Thus, Radio broadcasting has become a vital influence in our daily lives. More than 45,000,000 Radio receivers are now in American homes, with thousands more being purchased each day. Furthermore, each Radio receiver owner is insisting that his set be in good working condition so that he will not miss a single important broadcast.

Today it is no longer unusual to find a person owning two, three or even more Radio receivers. People like to be near a receiver regardless of where they may be—on a camping trip, at the office, in an up-stairs bedroom, or touring in an automobile. Increased receiver sales due to this desire for

ing and the Defense Program

extra sets means more work for every one connected with the Radio manufacturing industry. Furthermore, the increasing number of sets in use and the desire to have every set in working order is making Radio servicing a more vital and more important profession than ever before. We can therefore conclude that the events which have lead us into a National Defense program will multiply the opportunities in Radio servicing and in practically every other branch of Radio.

Modern Army, Navy and Air forces require reliable and fast communication between each active unit. Radio is the best medium for this communication, as experience in Europe this year has shown. In many cases, Radio is the only means of communicating between moving units.

To provide, maintain and operate a complete modern communication system for an armed force requires thousands of Radio operators and Radio service technicians. To meet this demand, many Radio service men and amateurs have already enlisted in the communication branches of our armed forces. But these will not be enough; many more young men with Radio training will be required.

Many of the men who are now being drafted for one year of military training will be assigned to the Army signal corps and to the other communication branches. Those who have had their Radio training will no doubt be given preference when these positions are assigned. Furthermore, we have been told that those who are now taking a course in Radio training will be encouraged to finish that course, and may be given additional training and practical experience after they have completed their course.

The absorption of trained Radio men by our National Defense program is reducing

the number of Radio servicemen available for ordinary servicing work. Added to this is the increased demand for Radio technicians created by the rapid increase in the number of receivers in active use. Never before in the rapid rise of Radio broadcasting has there been a greater demand for trained Radio technicians. Clearly, National Defense is creating greater opportunities in at least one field, that of Radio.

I honestly believe that the future of a Radio man is more promising now than ever before. The relatively new fields of frequency-modulation broadcasting, television and electronic control will develop along with the defense preparation. Trained men should have new avenues in which to find real opportunities for themselves in these busy and rapidly expanding branches of Radio.

There is no reason why a young man who is soon to reach his twenty-first birthday should be bewildered at all by the possibility of conscription in the near future. Likewise, men who are now within the draft age limit should not give up their desire to be trained Radio men, for in both cases this Radio training will be of great benefit to our Government, to the general public and to the individual himself.

Men who cannot qualify for participation in the National Defense program because they are outside the age limit or for other reasons, should not overlook the fact that this country urgently needs trained Radio men to take the place of those who are now serving their country or who will soon be called for service. By furnishing competent Radio service to the public, these men will be helping our nation to maintain its reputation for being the best informed of all nations, and will thereby be helping to bolster the bonds of freedom and justice.

Puzzling Radio Questions From Students

Filter Condenser Trouble

QUESTION: *Although I have now reached the point where I can recognize filter condenser troubles, I wonder if there is some simple rule to point out whether the trouble is the input or the output condenser, without having to test them individually.*

ANSWER: With any radio equipment, a test of the individual apparatus is always advisable. This is the only sure way, besides the substitution of another part, to determine definitely whether a particular piece of apparatus is defective or not.

In regard to filter condensers however, there are some indications as to whether the trouble is the input or the output condenser.

When the *input* filter condenser loses capacity, dries out, or becomes open, the d. c. output voltage will be much lower than normal, with perhaps a slight increase in the hum level.

If the *output* filter condenser opens, the d. c. output potential will be normal, but there will be a great increase in the hum level. Oscillations and loss of low frequency response will also occur in some instances. There may be a drop in receiver sensitivity and volume.

As you can see from the foregoing, the input filter condenser has more effect upon the operating potential than upon the hum level, while the output filter condenser has practically the opposite effect. This simple rule will provide a clue as to which of the filter condensers are defective. Of course, if low operating potentials together with considerable hum is observed, then both filter condensers are probably defective.

What Is Delaying Television

QUESTION: *Why is television not yet on a commercial basis?*

ANSWER: About one year ago, television was ready to go on a commercial schedule. However, the Federal Communications Commission held up the granting of the necessary licenses on the grounds that there was not enough proof that the present standards should be accepted. Some of this difficulty was due to the fact that several different standards were being used experimentally.

During the past few months, the radio industry has been studying this problem in detail and

has agreed to adopt a standard which will be acceptable to all broadcasters and to the Communications Commission, some time early in 1941.

Of course, television experimental stations have been broadcasting under their experimental licenses and developmental work has not stopped at all. It is just the commercialization of television that has been affected during the past year by this ruling. If the new standards are acceptable, it appears that television will become commercial within a short time.

It is impossible to make any definite statements as to what changes in the standards may be made. Investigations during the past few months by engineers of the Columbia Broadcasting System seem to point to the fact that even the present standards have not been made full use of. However, as mentioned above, the entire radio industry must agree on some standards before commercial licenses will be granted.

Noise In Receiver

QUESTION: *My radio receiver is quite noisy when it is first turned on. After operating for a few minutes, this noise seems to clear up. There is also considerable hum during this period. I have found that a sizzling sound comes from the filter condenser while these noises are present. What is the trouble?*

ANSWER: The condition you describe indicates the approach of the end of the useful life of the filter condenser in your receiver. This condenser is apparently one of the wet type electrolytic condensers.

After operation over a period of time, the formation of the electrolyte and the dielectric film on the plate becomes less perfect. While the condenser is not being used, the dielectric film breaks down. When it is started up again, the voltage applied forces the formation of a new film, but during this time, considerable arcing takes place within the condenser. An excessive current is passed through the condenser. The arcing causes a frying noise and furthermore due to the poor film formation, some of the capacity is lost and hum will result. When an electrolytic condenser acts in this manner, it is approaching the end of its useful life and should be replaced.

In a few instances, this trouble can also be caused in a set having high operating voltages if the bleeder resistor happens to open up. In

Are Answered By N. R. I. Experts

other words, electrolytic condensers are designed to operate only on certain specific voltages. In certain high power receivers, the operating potentials may be quite high, approaching the safe limit of the condensers. A bleeder resistor in this case would be used to keep the operating voltage down below this point. If this bleeder resistor happens to open up, the voltage may rise to too high a value, causing the condenser to break down intermittently. This is rather rare in modern sets, however.

Oil Burner Interference

QUESTION: *My oil burner creates considerable radio interference. What should I do to correct this difficulty?*

ANSWER: First of all, get in touch with the local distributor or the manufacturer of your oil burner. Practically all of the larger oil burner companies now have available various forms of suppressors, as well as information on reducing any radio interference caused by their equipment. You will find them glad to cooperate. Therefore, the first thing to do would be to obtain data for the specific make and model burner you have.

The installation of suppressors and other similar apparatus is not advisable with some types of burners except on recommendation of the manufacturer, as it may be possible for the ignition system to fail, permitting the furnace to flood with oil and then ignite, which could cause an explosion. Therefore, in case no recommendations can be obtained from the manufacturer or a reliable burner serviceman, it is advisable first of all to try shielding and the use of a ground on the frame of the motor of the burner. Shielding any high tension circuit is a critical procedure as the shield must be kept well away from the high tension wiring to prevent trouble with the ignition circuit. Obtain shielded ignition cable or try enclosing exposed wiring in a large cage, made of screen wire, then ground the cage.

Limited Output In Midget Receivers

QUESTION: *I live at a considerable distance from any broadcast station. I have a small set which does not give very good results. Is it possible to increase the output of this set?*

ANSWER: Most of the midget radio receivers are designed for use in and about the larger metropolitan areas, where powerful broadcasting stations are located. Many people purchase these receivers, however, that live beyond the

reasonable reception distance for such sets.

Most of the newer sets of this type have a built-in loop aerial. By removing the back, you will generally find that the manufacturer has provided a means for attaching a regular outdoor aerial to such a set. This may consist of antenna and ground terminals, while in other cases there may be short wires provided for this purpose. Therefore, I would suggest the use of a standard aerial wherever possible as the pick-up ability of the aerial will help considerably in raising the output from the set.

Where no such aerial connections are provided, you can make one by simply winding a turn or two of wire around the loop, in the same direction that the loop wire is run. In other words, place a turn or two of wire about the loop, just as if you were adding these turns to the loop, then connect the ground to one terminal and the aerial to the other terminal of this piece of wire. The coupling between the wire and the loop will generally prove sufficient to increase the output considerably.

Distortion In Receiver

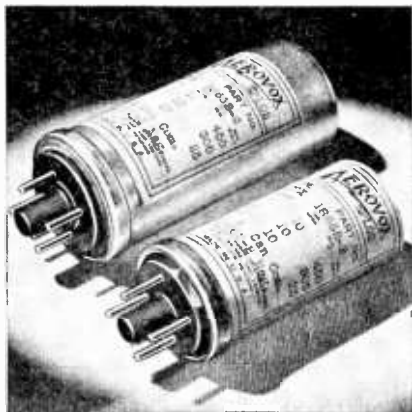
QUESTION: *I have a receiver which distorts on voice and sounds all right on musical programs. A man's voice seems to distort worse than a woman's. What would cause trouble of this sort?*

ANSWER: When first heard this type of distortion is indeed puzzling for it seems that the trouble occurs on only certain types of programs. It is not however the type of program which causes the trouble but the audio frequencies which are being reproduced by the loudspeaker. If a variable A.F. signal was to be sent through the speaker you would note the distortion on the lower frequencies while the higher frequencies would sound all right. As male voices are generally lower in frequency than most musical programs or female voices, the distortion is most noticeable when a man is talking on the program.

In most cases this particular type of distortion may be traced down to the voice coil rubbing either against the pole pieces or against metallic particles or filings which have worked themselves into the voice coil aperture. The greater movement of the voice coil at low frequencies causes the distortion to be apparent and at high frequencies the rubbing may not even take place. The remedy is to clean the voice coil aperture or recenter the voice coil.

Perfected Plug-In Electrolytics Offer Many New Possibilities

Of true significance to designer, manufacturer, serviceman and operator of radio and electronic equipment is the perfected plug-in electrolytic condenser now made generally available by Aerovox Corporation of New Bedford, Mass. Handling with the ease and speed of radio tube or vibrator changes, the plug-in feature permits an electrolytic condenser to be instantly removed



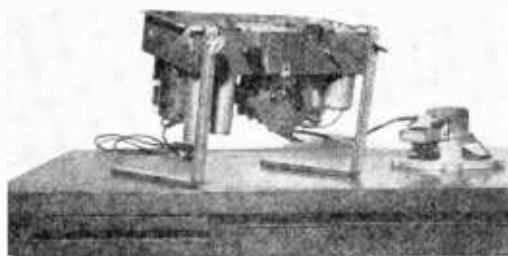
without tools or trouble, for testing and replacement. With the plug-in type, condenser tests and replacements can be made with minimum time out.

Developed primarily for the U. S. Signal Corps, the plug-in electrolytic has offered very obvious advantages to aircraft, police-radio and sound-system equipment where *continuity of service* is of paramount importance; and now with its transition from custom-built item to standard condenser, the plug-in type can provide many new possibilities in home and auto radios as well.

The electrolytic section is hermetically sealed in the aluminum can. The can top is spun over on the soft rubber gasket ring around the bakelite base. A vent in the cover allows slow escape of gas or immediate relief of abnormal pressures.

It is pointed out that the plug-in condensers cannot be incorrectly connected, for if the octal socket is properly connected, the condenser can go into circuit just that one way. Servicing operations are materially simplified with the plug-in electrolytic. Units can be instantly removed, tested and replaced where needed. Auto-radio receivers can be readily serviced in cars, with the usual 1-2-3 procedure of checking tubes, vibrators and condensers, thereby cutting service costs. The simplest of all tests—substitution—becomes feasible with these easily interchangeable electrolytics.

Chassis Supports



Nothing is perfect. Everything can be improved. The quest for perfection goes merrily on and, as a result, new devices are continually being developed by men of ingenuity.

Our student, Morton E. Phelps, 1002 Welch St., Little Rock, Ark., sent us the above pictures, illustrating his new chassis supports. No details were submitted with his letter and time was too short to get them for this issue of the NEWS, but the pictures tell the story quite completely.

Looks like Mr. Phelps has something of real utility which might prove very popular with Radio servicemen.



RADIO-TRICIAN

REG. U.S. PAT. OFF.

Service Sheet

Compiled Solely for Students and Graduates
NATIONAL RADIO INSTITUTE, WASHINGTON, D. C.

RCA VICTOR, MODEL VR-42

PUSH BUTTON ADJUSTMENTS

The push buttons should be adjusted for five favorite stations after the receiver has had a brief warm-up period.

Any standard broadcast stations may be chosen. The preferable arrangement is to adjust for stations in the order of frequency, from low to high.

Proceed as follows:

1. Set the Radio-Phono knob to "Radio" and turn the range selector to "A" band position.

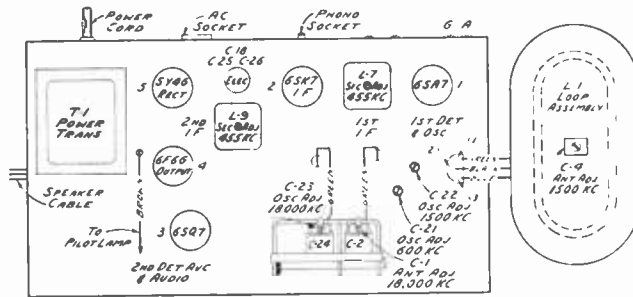
2. Loosen the five push buttons by turning in a counter clockwise direction one turn.

3. Accurately tune in the first station by means of the tuning knob.

4. With station accurately tuned in, press in the first push button and tighten.

5. Proceed in a similar manner to adjust the remainder of the push buttons.

6. Place call letter tabs in openings provided.



ALIGNMENT PROCEDURE

OUTPUT METER ALIGNMENT. If this method is used, connect the output meter across the voice coil, and turn the receiver volume control to maximum.

keep the oscillator output as low as possible to avoid a-v-c action.

DIAL INDICATOR ADJUSTMENT. With the gang condenser in full mesh, the indicator should point to the extreme left (low frequency) mark on the dial scale.

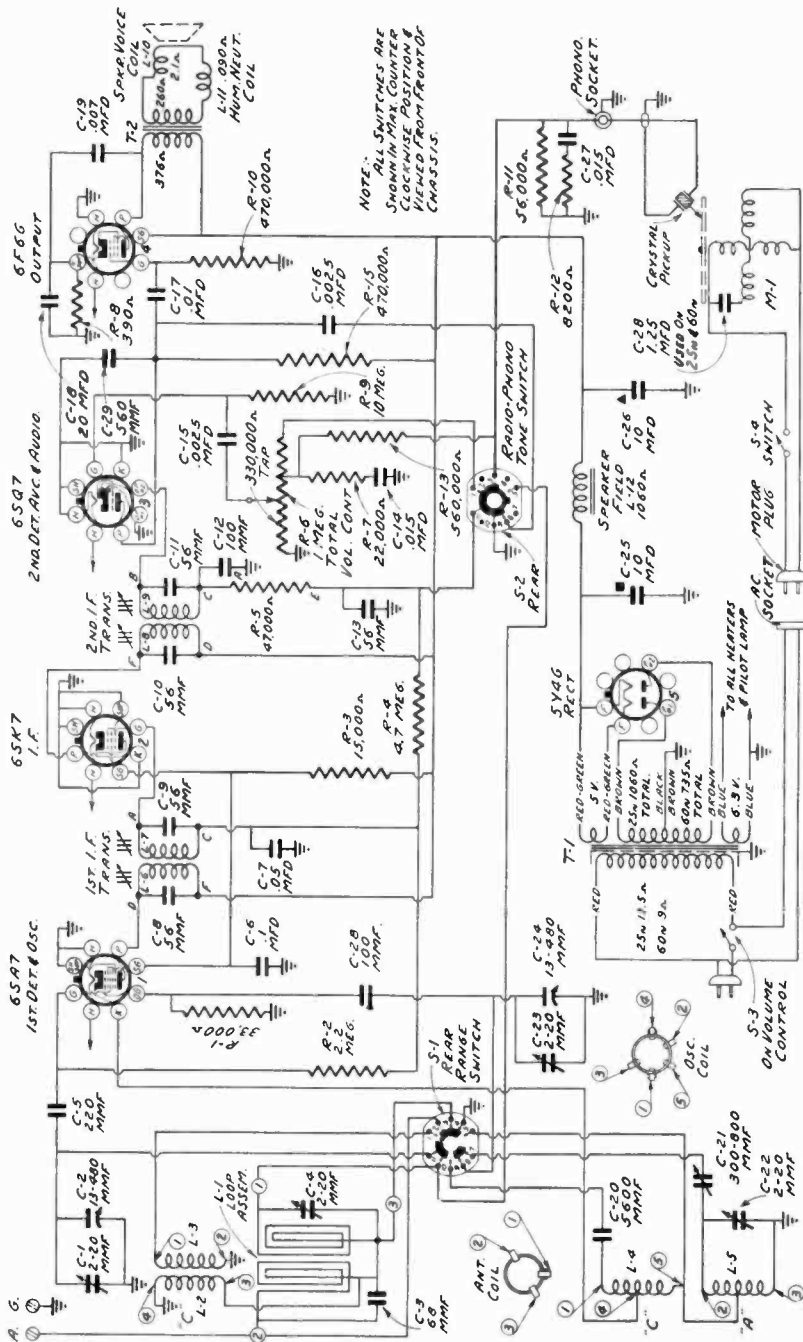
TEST OSCILLATOR. For all alignment operations,

Steps	Connect test osc. output to:	Tune test osc. to	Turn radio dial to	Adjust the following for maximum peak output
1	6SK7 1-F grid through 0.1 mfd capacitor and ground.	455 kc	Quiet point between 600-800 kc	L9 & L10 (2nd I-F trans.)
2	6SA7 1st det. grid through 0.1 mfd capacitor and ground			L7 & L8 (1st I-F trans.)
3	Ant. & Grd. Terminal Board	18 mc	Rock at 18 mc	C-1 antenna* C-23 oscillator
4	Radiation Loop consisting of two turns of wire located 4 to 6 feet from receiver	600 kc	Rock at 600 kc	C-21 oscillator
5		1,500 kc	1,500 kc	C-4 antenna C-22 oscillator

When making adjustments 4 and 5 the chassis must be in the cabinet, the loop connected, and all leads in their normal positions. When mounting chassis in cabinet if calibration does not line up with dial scale mounted on cabinet, move pointer to agree with dial scale on cabinet.

*If two peaks can be obtained, use low frequency (maximum capacity) peak.

Readers who file Service Data in separate binders remove page carefully; trim on dotted line for same size as data published heretofore.



RCA VICTOR, MODEL VR-42



The Service Forum

Conducted by

J. B. Straughn, N. R. I. Service Consultant

Send in your service notes. We will re-word them for publication. To qualify your note for the NEWS you must have observed the same trouble on two or more identical receivers.

FIRESTONE MODEL S-7125-3

INTERMITTENT

This is often caused by one of the I.F. terminal lugs intermittently shorting to the back of the loudspeaker. Either insulate the lugs or bend them so that the short cannot reoccur.

— n r i —

ATWATER KENT MODEL 206

OSCILLATION

Oscillation on the short wave band may be eliminated by moving the control grid lead of the 2A7 type tube toward the front of the receiver.

— n r i —

GRUNOW MODEL 1191

DEAD

Check the .05 mfd. condenser in the plate supply circuit of the second I.F. tube. If the condenser has shorted check the 2,000 ohm resistor associated with it as the resistor has probably burned out. In many instances both the condenser and resistor may be entirely eliminated. However if this causes oscillation other parts of the same size should be installed. The replacement condenser should be rated at 600 volts.

— n r i —

GRUNOW MODEL 5-B

WEAK AND DISTORTED

If the voltages are low and the filter condensers test correctly the difficulty is due to a high resistance short between the terminals of the 25Z5 socket caused by some of the sealing compound in the filter condenser can leaking in between the layers of the socket. Install a new socket.

— n r i —

PHILCO MODEL 45 SIDE BAND CUTTING AND OSCILLATION

To eliminate this condition increase the value of the cathode bias resistor for the first I.F. tube to 500 ohms then realign the I.F. amplifier.

PHILCO MODEL 38-2670

DEAD

If a circuit disturbance test shows all stages to be alive the difficulty is due to a poor contact in the wave band switch. Bend the contact so that a good connection is established.

— n r i —

PHILCO MODEL CT2

OSCILLATION

Check the connections between the rotor of the tuning condensers and the chassis. Clean and bend the spring to obtain a better contact. A little sandpaper may be used to clean the spring contact.

— n r i —

PHILCO MODELS TH-4, TH-5 AND TP-5

HUM

This is generally due to a cathode to heater short in either the detector, first audio or output tube. These tubes may best be checked by actual trial of others as the short may not always show up in a tube tester.

— n r i —

PHILCO MODEL 5 TRANSITONE

HOWL

An intermittent howl is sometimes due to the terminals of the output transformer making contact with the volume control terminals and shields. To eliminate the trouble, insulate the output transformer terminals either with paper or tape.

— n r i —

PHILCO MODEL 5

REPLACING LID

When replacing the lid of the receiver care must be taken so that no parts in the set are damaged. The speaker cable should be placed toward the vibrator end of the housing and the condenser plates should be fully in mesh so that they cannot be bent by the speaker field or cable.

PHILCO MODEL 5 IMPROVEMENT

On some of the early Model 5 receivers a frying or crackling noise may be heard. In some cases it is due to the vibrator and in others to the 6A7 type tube. To remedy the difficulty remove the grid clip from the grid cap of the 6A7 tube and remove the grid lead from the clip. Using a stranded wire of about the same size as the grid lead connect it to the grid clip and wind five turns of wire around the clip. Then splice this wire and solder to the grid lead. Reconnect the clip to the cap on the tube. This makes an R.F. choke of just the proper size which will eliminate practically all such complaints. In more obstinate cases, wind thirty turns of No. 16 cotton covered wire around a lead pencil. Withdraw the pencil which leaves an air core choke which must be installed in the A lead between the low voltage R.F. choke and the heater terminal of the 84 type tube. Keep the choke in the vibrator section of the base. Solder and tape the splices to prevent further trouble.

—————*n r i*—————

FADA MODEL F-55AT SQUEAL

A high pitched squeal at about the mid-point setting of the volume control can be eliminated by winding 25 turns of ordinary hook-up wire around the 12Q7GT control grid lead and grounding the wire to the chassis. The wire acts as a shield and prevents pick-up by the control grid lead.

—————*n r i*—————

RCA O-11 PHONO-MECHANICAL NOISE GRAPH MOTOR

Mechanical noise can be reduced by loosening the two screws which hold the governor shaft bearing and adjusting the eccentric bearings in order to obtain a desirable running clearance between the worm and the gear.

—————*n r i*—————

KADETTE MODEL 36 WEAK RECEPTION

Look for a leaky .02 mfd. 400 volt condenser between the plate of the 75 tube and the grid of the 41 tube. Use a 600 volt replacement.

D. A. TRICE, West Virginia.

—————*n r i*—————

GRUNOW MODEL 681 DEAD

Look for a shorted plate to chassis .006 mfd. condenser.

D. A. TRICE, West Virginia.

—————*n r i*—————

GRUNOW MODEL 12B INTERMITTENT RECEPTION

Defective volume control. replace.

D. A. TRICE, West Virginia.

—————*n r i*—————

RCA MODEL 210 DEAD

Check the output transformer secondary winding for an open circuit.

D. A. TRICE, West Virginia.

RCA MODEL T6-1 DEAD
I.F. coil lugs shorting to can shields. Remove shields and insulate.

D. A. TRICE, West Virginia.

—————*n r i*—————

RCA MODEL 9K2 WEAK AND INTERMITTENT

Look for a broken (or loose internal) .01 mfd. condenser connected from the plate of the 1st audio tube to the grid of the 61B output tube.

D. A. TRICE, West Virginia.

—————*n r i*—————

PHILCO MODEL 37-116 SCRATCHING NOISE

If a scratching noise which sounds like a leaky filter condenser is noted and the noise gradually increases in intensity, check the hum controls that shunt the filament windings of the two 6B4G output tubes. The contact arm on the potentiometers seems to arc between the arm and the resistance wire. A good cleaning with carbon tetra-chloride and the application of a lubricant will correct the trouble.

JOHN FOOTTIT, Montana.

—————*n r i*—————

DETROLA MODEL 102 WILL NOT LINE UP

If this receiver cannot be properly aligned using the recommended intermediate frequency of 456 kc. try an I.F. of 370 kc. Evidently a few of these receivers were released using an I.F. of 370 kc. instead of 456 kc. as stated in the service instructions. By aligning at the wrong I.F. blasting, fading, and insensitivity on the lower frequencies will be encountered.

RUFFNER THOMPSON, West Virginia.

—————*n r i*—————

STEWART WARNER INCREASING MODELS 5R4, 5R5, 5R6, SENSITIVITY OF AND 5R7 5R IN CHASSIS IN WOOD CABINETS

In those locations where extreme sensitivity is necessary in a radio set, the 5R wood cabinet models (5R4, 5R5, 5R6 and 5R7) can be stepped up by the introduction of a slight amount of regeneration. This change can easily be made as follows: Disconnect the .05 mfd. condenser #23 from the suppressor grid terminal of the 12SK7 socket. In the Underwriters approved sets (Model 03-5R, etc.) connect it instead to the B-terminal of the volume control. This is the terminal nearest the 12SQ7 socket. In non-approved models (07-5R, etc.) connect condenser #23 to ground. After the condenser change has been made, realign the receiver. It is especially important to re-adjust trimmer #9, the broadcast oscillator padder, exactly as explained in the service instructions. When aligning, keep the chassis away from the loop or oscillation may occur. This change cannot be made on any of the plastic cabinet 5R sets (5R1 and 5R3). The plastic cabinet sets of this series will oscillate if they are stepped up beyond the present limit of sensitivity by this means.



N.R.I. ALUMNI NEWS

Clarence Stokes President
Dr. Geo. B. Thompson, F. E. Oliver Vice-Pres.
Allen McCluskey, Alfred E. Stock Vice-Pres.
Earl Merryman Secretary
Louis L. Menne Executive-Secretary

Nominees for Office During 1941

The campaign for President of the United States is now a matter of history. But there is still an election of our own to be decided, for Officers of the N.R.I. Alumni Association for 1941. Every member of the Alumni Association is a qualified voter and we urge all of our members to submit their ballot.

The nominees for President, as determined by the votes submitted since the last issue of the NEWS, are Dr. George B. Thompson of Los Angeles, and John Stanish of Detroit. You are now requested to choose between these two men for President.

Dr. Thompson has long been a loyal member of the Alumni Association. He has several times served as one of our Vice Presidents. You may remember Dr. Thompson's inspiring article in the June-July, 1939 issue of NATIONAL RADIO NEWS on "The Home Study System." Among other things he said this:

"To my way of thinking the Home Study system of learning is the great modern democracy of self-education. It breathes the spirit of a new educational freedom. It is the way to get what you want in spite of obstacles. It is self-sustaining, economical, and well within even a small budget, without incurring any deficit, so that it falls easily within the financial reach of every ambitious student. The student is in a class by himself with unlimited time at his disposal in which to complete his lesson, and with unlimited help at his call. The lesson texts are,

comparatively, inexpensive and expertly prepared to cover exactly the desired field. They obviate the college system of depending upon notes taken at lectures. The texts are from point to point definite and clear, and are kept freshly revised and up-to-date—even up to tomorrow in anticipating what is to come. By carefully marking his texts at the most important points, and by making a personal reference index the student can quickly turn to any desired topic without loss of time.



"During the years since my graduation from college where I received my degrees (B.Sc., M. S., and M.D.) I have completed twenty-three Home Study or extension courses. My first was in 1904, three years after my M.D. degree. Following this I took Civil Service examination for Contract Surgeon at Honolulu. That was a long time ago, and Honolulu was many ocean

miles from civilization at that time, and I proceeded to forget all about it. Many of these courses were along the line of my chosen profession; others were not so closely allied, but were of a scientific nature, such as Radio.

"So I can speak of the value of Home Study work from the standpoint of experience. I graduated some seven years ago from N. R. I. and can say without reservation that any young man who is interested in electricity and any of its manifold applications to industry such as telegraphy, Radio, public address work, sound, television, or in any of the allied fields, can make no mistake by taking advantage of what the National Radio

Institute has to offer; this is with the assurance that he will not be disappointed.

"Of course, I need not say this to any N. R. I. man. But in a closing sentence I would like to say to every young man who feels the tingle in his blood to begin at the bottom in Radio, or to do advanced work, or become a better Radio-trician in the service field, or to keep in touch with the unlimited application of Radio principles in the rapidly moving industries of the country which are daily increasing with gathering momentum, set aside a definite part of your time for self-improvement, for each hour you give to study will pay you handsome rewards. Your destiny is in your own hands—make the most of it."

From the above you will quickly gather the impression that Dr. Thompson is a true friend of home study students and that he is a real leader of men.

A worthy opponent for Dr. Thompson is good and faithful John Stanish of Detroit. Stanish is Chairman of Detroit Chapter of the Alumni Association. He has done an exceedingly fine job for our Detroit members and, we understand, he has been drafted for another term. Stanish is one of these pep fellows who hits hard and straight from the shoulder. He is a successful business man in Detroit where he is highly regarded as a "go-getter."

Either Dr. Thompson or John Stanish will make a fine President for our Alumni Association. This is strictly an honorary office and it is too bad that both cannot be elected because both are fully entitled to this recognition.

In the contest for Vice Presidents we have eight nominees, four of whom are to be elected. McCluskey of Birmingham and Oliver of Detroit have been re-nominated. McCluskey has long been one of our most loyal members and Oliver has for years served as Secretary of Detroit Chapter. They have been faithful in their service to our organization.

Alfred Stock of New York is again a nominee this year. He is a past chairman of New York Chapter. Stock is very popular and he will again run a strong race this year.

Louis J. Kunert, Secretary of New York Chapter again has received deserved recognition. He is a conscientious worker, attends Chapter meetings regularly, keeps his records and reports in a business-like way and has demonstrated real executive ability. Kunert was a candidate for President of the N. R. I. A. A. in 1937 but ran second to Pete Dunn in a tight contest. His devotion to duties entrusted to him, his fine character, qualify him for the office of vice-president and he will have strong support.

Charles West of San Francisco is nominated by the strong vote he received from the West Coast. It would be mighty nice to have one of our Vice Presidents located in San Francisco.

Ed Sorg of Chicago has a large following. Sorg is a past chairman of Chicago Chapter and was a candidate for Vice President last year. Ed is the type of fellow who never hesitates to give his own time freely in any cause and his work is greatly appreciated by the Chicago fellows.

Pete Dunn pops up again as a nominee. Pete served our Association as President for four consecutive terms. We had to amend the by-laws to get him out of there. As a matter of fact it was Dunn who suggested the amendment because he felt that other men should have the honor of office and, by limiting the President to one term, there would be more interest in our elections. This was a noble, unselfish gesture on the part of Dunn. But his many friends still are loyal to him and again he is a candidate—this time for Vice President. Pete, by the way, is chairman of Baltimore Chapter.

Charley Fehn of Philadelphia is a nominee for Vice President, completing our slate of eight candidates, four to be elected. Fehn is past chairman of Philadelphia-Camden Chapter and this year is Treasurer for that Chapter. Charley is one of these fellows who is a glutton for work and who never falls down on any job he accepts.

Then there is the office of Secretary with our ever faithful friend, Earl Merryman, who like Niagara Falls, is still running. Competing for the office is J. J. Jenkins of Washington, D. C., a man who is thoroughly capable and who will poll plenty of votes.

The office of Executive Secretary completes the ticket. L. L. Memme is a candidate for re-election. His work in the interest of the Alumni Association is known to all our members through the reports which are given in these columns each issue. John W. Nally who competes for the office is a peach of a fellow. He is Radio operator for the Washington, D. C. Police Department and holds the degree of Bachelor of Electrical Engineering. He is a real credit to our organization.

Please turn to the ballot on page 30. Only a few minutes will be required to mark, sign and mail it. Remember that all elected officers will serve for a term of one year. Support your Alumni Association by casting your vote in this election. The Polls close December 30, 1940.

The results of the election will be announced in the next issue of the News. Kindly mark your ballot and mail it now. Every member of the National Radio Institute Alumni Association is urgently requested to vote.

New York Chapter

Chairman Gordy has been giving us some interesting talks accompanied with demonstrations. Gordy always comes to the meetings well prepared with radio parts which he fully explains for the enlightenment of our members who may have questions regarding them.

Our big fall meeting was held at our regular quarters at 12 St. Marks Place, New York City. The hall was filled to the last chair. The special attraction was a "Radio Information, Please" program conducted by Mr. Kaufman, Director of Education and J. B. Straughn, Consultant, both from N. R. I. Those present were requested to write out any Radio problems they desired discussed and Mr. Kaufman and Mr. Straughn analyzed the problems and gave the solution. It was an interesting meeting with never a dull moment because of the variety of practical questions and beneficial discussions.

Mr. Menne, Executive Secretary of the Alumni Association was also present and preceded the technical part of the program with a talk on "Information plus Inspiration."

A surprise visitor was Clarence Stokes, President of the Alumni Association who dropped in on us with a delegation of members of the Philadelphia-Camden Chapter. Stokes also made a fine contribution to the success of the meeting with an enthusiastic talk regarding the value of membership in the Alumni Association. Stokes has the happy faculty of injecting his jovial personality into everything he says and his talks are always well received. We hope all of those present from Philadelphia will visit us again soon and we promise to return the compliment by dropping in on them at their headquarters before long.

The fraternal spirit which is manifested by these exchanges of visits, by the inspiration brought to us by men from headquarters including Mr. Smith, Mr. Kaufman, Mr. Straughn, Mr. Menne and others is very much appreciated by our members and does much to encourage us in our own efforts to help one another.

In this connection it should be reported that a number of us will accept the invitation to be present at the Philadelphia-Camden Chapter social meeting, soon to be announced, at which time we also expect to again meet Pete Dunn, Chairman and a bunch of the fellows from Baltimore Chapter.

No report is complete without a reminder that visitors are always welcome at our meetings, held on the first and third Thursday of every month, at Damanzeks Manor, 12 St. Marks Place, New York City. The only requirement is that you be a student or a graduate of N. R. I.

L. J. KUNERT, Secretary.

Chicago Chapter

News from Chicago is vague owing to an unfortunate conflict in dates. A meeting was held at which it was decided to hold a business meeting to be followed by a social meeting, with an invitation to the Executive Secretary to be present. These meetings, however, were scheduled for the week during which Menne was to visit New York Chapter by previous commitment. Since no one has yet figured out a way for a fellow to be in New York and Chicago at one and the same time, it was necessary for Menne to extend his regrets to Chicago and ask whether the special meetings could not be postponed for two weeks. This will probably be done and a full report of these meetings will be given in the next issue of the News.



Chicago Chapter at one of its dances. The fellow in the immediate front is Ed Sorg who acts as Master of Ceremonies and sees that everyone has a good time.

Chicago Chapter is also considering changing both the dates of its meetings and its headquarters, but word has not been received regarding these proposed changes.



Drawn for National Radio News by Jennings Berge

"They say the music will keep my mind off the operation!"

Here and There Among Alumni Members

Carl E. Bohn of Bohn Radio & Sound Engineering, Fort Wayne, Ind., was in to see us recently. He is one of the top sound men in Northern Indiana and received wide publicity for the installation of the Tower Chimes in Grace Lutheran Church, Columbia City, Ind.

—n r i—

Herman Doberstein of Philadelphia was married recently. His wife waits outside the hall while he attends Chapter meetings. The boys kid him about that but when he walks down the street with his honey bunch Doberstein looks back over his shoulder and—does he have the last laugh.

—n r i—

Stokes Gresham, Jr., is now Chief Engineer at Station WBOW, Terre Haute, Ind.

—n r i—

Harold Durham recently was taken on by Station KOCY, Oklahoma City, Okla., as a member of the Engineering Staff. It's his first job since graduating and he is mighty happy about this promising connection.

—n r i—

Lou Kunert of New York reports that he recently lost his father-in-law. Lou had great admiration for his father-in-law and feels his loss keenly. We've met Mrs. Kunert, and to her as well as Lou we extend our sincere sympathy.

—n r i—

Frank Vetter of Paulding, Ohio, has been giving some lectures in Radio Theory to high school students.

—n r i—

Earl Bennett, former President of our Alumni Association, sends greetings to the members of Baltimore and Philadelphia Chapters, many of whom he met in person on his visit in 1939.

—n r i—

Congratulations to Mr. and Mrs. Joseph Dubanoski of Manchester, Conn., on the arrival of a baby boy. Mr. Dubanoski hopes his youngster will inherit his Radio ability so that he too may get the extra things in life that have come to his daddy.

—n r i—

One of the most adventuresome jobs in radio at the present time is Radio Operator on board ship. Edward T. Dillon writes an interesting letter from on board the S/S W. W. Bruce of the Continental Steamship Company out of Baltimore. Getting well over two thousand dollars a year, including board and room. Wonder what these Radio Operators do with all that dough with no place to spend it—until they reach port.

—n r i—

They tell a story about Norman Kraft of Philadelphia. Some one stuck his head in the door during a recent meeting and yelled, "McGuire, your house is on fire." Kraft ran out of the meeting and down the street for a block when

he suddenly came to a skidding halt and said, "Heck, my name isn't McGuire." Believe it or not!

—n r i—

Joseph Batranik of Milwaukee, Wis., is employed as Inspector for Zenith Radio Corporation. At the same time he is making all plans to start a Radio shop of his own.

—n r i—

George Payne is doing a fine job as Radio serviceman for Sterchi Bros., Inc., at Athens, Ga.

—n r i—

Clarence V. Rose, who was in the Army Air Corps when he completed his N. R. I. course has since been assigned to a bombardment squadron as Radio operator on a bomber.

—n r i—

John R. Munn is Chief Radio operator for the Bloomington, Ind., Police Department. His duties consist of maintenance of the Radio equipment, dispatching of cars and general work as a Desk Sergeant. He says his work is very interesting.

—n r i—

Ivan A. Divens is connected with the 2nd Communications Squadron, A.C. Langley Field, Va. His Radio training is serving him well in the service of Uncle Sam.

—n r i—

Jack Watt of Antonagon, Mich., lost most of his possessions in a fire. He is well on the way to a new start, however.

—n r i—

Eduardo H. Rivera of Puerto Rico on September 1 was assigned as Radio Operator of Master Station WWIX of the U. S. Forest Service, located at Caribbean National Forest.

—n r i—

Send your items for this page to the Editor, NATIONAL RADIO NEWS. And don't be so backward about it, please.

—n r i—

Putting one little word after another whatever happened to Charles McDormand who attended Baltimore Chapter meetings quite regularly and always brought his camera with him. We miss you, Mc.

—n r i—

From Philadelphia we hear that Norman Hafter is the proud daddy of a baby girl. And they tell us, too, that good looking Louis Michalski was married recently. No wonder he ducks right home after the meetings.



Philadelphia-Camden Chapter

We have been holding our meetings as usual, at the Longshore Radio Service, 4711 Longshore Street. We have been reviewing some of the N. R. I. textbooks. The fellows like these reviews because they are given an opportunity to ask questions to clear up points and this leads to an interesting and profitable informal discussion.

Our Chairman, Norman Kraft, acted as leader at one of our meetings at which time we discussed Signal Tracing. At another meeting Charley Fehn gave us a fine talk on Ohms and Watts.

At our most important recent meeting Mr. Kaufman and Mr. Menne of Headquarters were our guests. Mr. Kraft turned the meeting over to Mr. Menne who opened proceedings with an inspirational talk which got the fellows in just the right mood for what was to follow. Mr. Menne then



presented Mr. Kaufman, Director of Education, N.R.I., who gave us a fine talk on Frequency Modulation. Mr. Kaufman spoke for more than an hour and a half. Following this lecture a number of questions were asked from the floor which were answered by Mr. Kaufman in a thorough and understandable manner.

Following this Mr. Menne turned the meeting back to our permanent Chairman, Norman Kraft, who made some appropriate remarks and then presented our Alumni President, Clarence Stokes. He was enthusiastic in his praise of the benefits which are derived through our Alumni Association and, as a result of his talk, a number of new members were received including James Sunday, M. J. Hanlon, W. S. Angenly and Raymond Brown. Stokes then introduced all of the officers of our Local, some of whom made brief remarks. Door prizes were presented to a number of lucky fellows. Sixty-eight attended this meeting and most of them promised to be with us regularly.

A number of our members are planning a visit to New York Chapter under the leadership of Stokes and our ever enthusiastic Treasurer, Charley Fehn. Other fellows who have worked

hard to help build up our Chapter to its present prominent place among Locals are Bert Champ, Herman Doberstein and A. Wyoczansky, not to mention your humble secretary.

Before the expiration of the terms of our 1940 officers, our Chairman is planning to have a group photograph made as a keepsake in memory of one of our most active years.

As this issue goes to press we are planning a social meeting. The tentative program is a honey and we hope to have all of the members of our Chapter present as well as a large number of our guests. Notices will be mailed in due time.

We are also planning to move our meeting place to larger quarters. This is still in the hands of a committee and we may have some information on this for the next issue of the NEWS.

L. A. MICHALSKI, Secretary.



Baltimore Chapter

Mr. Straghn of Headquarters has talked to us on a number of occasions. Mr. Menne has also made the trip to Baltimore rather regularly.

In recent meetings we have been studying Code under the able direction of our member, Mr. Rathbun. The fellows have become so deeply interested in this study they have expressed a preference for it over other subjects, for the present, so it is our plan to continue this Code study with some other subjects interspersed to give us variation.

Pete Dunn, our Chairman, is getting behind the movement for our annual dance and that means action. So we may have some news on this very soon.

We like our present place of meeting because it is roomy, convenient to reach and has every facility desired. So you will always find us in session on the first and third Tuesday of the month at Fishpaw's Hall, 2nd floor, Baltimore and Gilmore Streets. Meetings are called to order at 8:15 P. M. Come up and see us sometime.

E. O. E. GRALLEY, Secretary.

Election Ballot

Fill in this ballot carefully, following instructions given on page 25. Mail your ballot to National Headquarters immediately.

FOR PRESIDENT (Vote for one man)

- John Stanish, Detroit, Mich.
- Dr. Geo. B. Thompson, Los Angeles, Calif.

FOR VICE PRESIDENT (Vote for four men)

- F. E. Oliver, Detroit, Mich.
- Allen McCluskey, Birmingham, Ala.
- Edward Sorg, Chicago, Ill.
- Charles West, San Francisco, Calif.
- Alfred E. Stock, New York, N. Y.
- Chas. J. Fehn, Philadelphia, Penna.
- Louis J. Kumert, Middle Village, N. Y.
- Peter J. Dunn, Baltimore, Md.

FOR SECRETARY (Vote for one man)

- Earl Merryman, Washington, D. C.
- J. J. Jenkins, Washington, D. C.

FOR EXECUTIVE SECRETARY (Vote for one man)

- L. L. Menne, Washington, D. C.
- John W. Nally, Washington, D. C.

SIGN HERE:

Your Name

Your Address

City State.....

Polls close December 30, 1940.

Mail Your Completed Ballot to:

C. ALEXANDER, BOOKKEEPER
NATIONAL RADIO INSTITUTE
16th and U STREETS, N. W.
WASHINGTON, D. C.

Detroit Chapter

Chairman Stanish gave us a talk on the installation of auto radios stressing important steps in the work. Stanish specializes in this work at his progressive service station and he is fully qualified to do justice to the subject.

Stanish recently made a business trip East and dropped in at Headquarters in Washington where he conferred with the Executive Secretary and others. Stanish was very favorably impressed with the building, equipment, and personnel at N.R.I.

Not much news this time, but plenty of spirit at Detroit Chapter. We expect a visit from Menne soon.

Some equipment has been added to our test bench. This equipment is for the benefit of our members and visitors, who are N.R.I. men, so come to see us on the second and fourth Thursday of the month, at Vernor Super Station, 2500 Jos. Campau. We meet at 8:15 P. M.

F. EARL OLIVER, Secretary.



Don't Quit!

When things go wrong—as they oft times will;
When the fight you're making is all "up hill";
When funds are low and debts are high
And you try to smile but are forced to sigh;
When cares sap your energy, every whit—
Rest, if you must, but don't you quit!

Life is strange, with its twists and turns—
As, sooner or later, each of us learns—
And many a beaten man turns about
When he might have won, had he stuck it out!
Never give up! Nor pause to fret!
You may arrive with one more step!

Success is failure turned inside out—
The "silver tint" of the "cloud" of doubt—
And you never can tell how close you are;
It's often near when it still seems far.
So, still fight on when you're hardest hit!
It's then, most of all, you shouldn't quit!

—Anonymous.

Cut or tear carefully along this line.



One of Many Similar Letters

"The N. R. I. Plan For Getting Practical Experience At Home," by Mr. Joseph Kaufman, N. R. I. Director of Education, was swell.

EMILIANO B. RUIZ,
Cebu City, Philippines.

----- n r i -----

Jay and Ozzie

Novel Radio Items and Electronics, Inc., are two of my favorites. I located an electric fence transformer by Jay and Ozzie's Hallowe'en story last year. Electronics, Inc. offers ideas to experimenters.

WILLIAM L. BOSWELL,
Wilson, N. C.

----- n r i -----

Laboratory Page and Service Forum

I think NATIONAL RADIO NEWS is one of the most interesting magazines ever published. I look forward to the Laboratory Page and the Service Forum.

HENRY GIROUD,
Sao Paulo, Brazil.

----- n r i -----

Is Proud of Our Magazine

NATIONAL RADIO NEWS is of more interest to me than any publication I read, for I feel that, being a member of the Alumni Association, it is partly mine, so naturally I take great pride in such a husky little magazine.

THOMAS B. LOVE,
San Jose, Calif.

----- n r i -----

From An Alumni Member

I want to tell you that I am proud of being a member of the N. R. I. Alumni Association and will help in every way possible to foster the well being of the Association.

ELROY SCHIZKOSKE,
Pembroke, Ont., Canada.

Booster for Puzzling Radio Questions

"Puzzling Radio Questions" are just the thing. I see Jay and Ozzie are back on the scene again, so don't let me miss any issue of the NEWS. I have been trying to follow the editorial by Mr. Haas on "Decision." I am getting results.

R. A. HERDER,
Irma, Alta., Canada.

----- n r i -----

Plan for Getting Practical Experience

I was very much interested in Mr. Kaufman's article on the plan for getting practical servicing experience at home. I believe, if he were to continue such an article as this, we students would be able to progress more rapidly.

HAROLD H. PARKER,
Oak Park, Illinois.

----- n r i -----

Business-Getting Ideas

Congratulations on the fine article, "Changing Push Button Radios to New Frequencies." I especially liked the introduction in Italian; its a great business-getting idea for service men. I am sure that the forthcoming frequency shift is creating a lot of interest in the Radio world. I, for one, would like to know how the frequency shift will cut down station interference. Perhaps in some future issue, another article will explain this.

STANLEY GLADYS,
Arborg, Man., Canada.

----- n r i -----

We Like This .

I enjoyed my first copy of NATIONAL RADIO NEWS. All the information I can get on servicing is like ice cream to me, and believe me, the NEWS is chuck full of just what I want. From start to finish there isn't one word goes by unappreciated. The Novel Radio Item page is of great interest, too.

WESSON F. DICKINSON,
Highland Park, Mich.

DeForest Day at the Golden Gate International Exposition

Lee DeForest was appropriately honored on September 7 at the Golden Gate International Exposition on Treasure Island. The day was designated as "DeForest Day."

The Veteran Wireless Operators Association bestowed upon Dr. DeForest the Medal of Honor, as well as an Engrossed Scroll entitled "Living Tribute," which was autographed by leading members of the Veterans Wireless Operators Association.



Dr. Lee De Forest

Dr. DeForest was tendered a Testimonial Luncheon by the City of San Francisco, on which occasion the mayor's representative presented Dr. DeForest with the Golden Key to the city.

In the evening there was a banquet. Both of these events were broadcast from coast-to-coast over the Mutual Broadcasting System. Many messages of greeting from prominent Radio officials were received and read, including a telegram from J. E. Smith, President of the National Radio Institute who said:

"Congratulations and best wishes from our entire staff on this DeForest Day. May our students and graduates continue to be inspired and encouraged by the example of your great work."

Dr. DeForest was similarly honored at the New York World's Fair. The National Radio Institute is extremely proud of the fact that Dr. DeForest, the "Father of Radio," is a member of its Advisors.

At present Dr. DeForest is busily engaged in working out a number of interesting inventions.

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