NATIONAL RADIO NEWS

Best Wishes for a Merry Christmas
and a Happy New Year

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Peace on Earth, Good Will Toward Men

The universal joy of Christmas is profoundly wonderful. Nations have their red-letter days, their carnivals and festivals—and their wars. Popular idols are acclaimed when they are raised to leadership, or a mournful dirge is tolled when they pass away, but once in the year the whole world stands still to celebrate the advent of a life—to join in the spirit of Christmas.

While we are enjoying the double pleasure of giving and receiving gifts, the cheery family reunions in the warmth and comfort of our homes, many of us with those near and dear to us returned from the war, in these happy hours let us not forget to pray for the millions who are still homeless and very sad at this Christmas season. Let us do more than pray for them—let us do what we can to bring relief to them. Let us also do what we can to bring comfort to the great many American homes where, this year, there will be a vacant chair.

May the spirit of Christmas abide and be with you. And may the New Year bring you good health and genuine happiness. Much has been written, but no words better convey our wishes to you at this season than the simple expression, with all sincerity—Merry Christmas and a Happy New Year.

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

Essential Principles of RADAR

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J. A. Dowie

Editor's Note: Radar is one of the many marvelous war-time scientific developments, and, as such, is now receiving widespread publicity in newspapers and magazines. Unfortunately, however, much of the publicity has been prepared by writers with much imagination and not too much actual knowledge of the subject, so there is considerable confusion as to the real purpose and meaning of radar. We are presenting this article with the hope that it will help clarify some of the questions you may have in your own mind, or questions you may be asked by your customers.

There are many kinds and varieties of radar equipment—some of them are among the most complex pieces of electrical apparatus ever developed by man. In this article, we are giving only a brief explanation of some of the highlights of the more simple systems. (We cannot yet divulge full details on radar as many of the details are still under military restrictions.) Even so, we do not expect any but the more advanced students to understand many of the technical details. However, we hope even beginners will gain a more definite understanding of the meaning and purpose of radar. Therefore, this article answers the following questions: What is radar? What can radar do? How does radar accomplish the steps of radio detection and ranging?

THE word Radar was coined from the initial letters of the phrase "*RA*dio *D*etection *A*nd *R*anging." Hence, radar is used first of all to *detect* the presence of some object, and secondly, to establish the *position or location* of that object. Broadly, radar may be defined as a powerful radio "eye" that uses high-frequency radio echoes to determine the presence and location of unseen objects.

Thus far, the applications of radar have been primarily military ones. The military uses include the detection and location of enemy ships and airplanes; the identification of planes and ships; the direction of anti-aircraft and battleship guns; and finally, as an aid to navigation.

Some forms of radar equipment will undoubtedly find useful application in marine and aircraft navigation during peacetime. For example, ships could well use radar equipment to avoid icebergs and feel their way around in fog-bound harbors. Aircraft may use some form of radar to determine their height above ground, and perhaps to determine the positions of planes flying in their locality to avoid collision. Thus, radar may supplement some of the present direction-finding equipment used by ships and airplanes.

Radar types are broadly classified in two categories: First, "The search type which sweeps wide areas to detect the presence of a target," and second, "the fire-control type which uses a narrow beam to determine precisely the position of the target." To perform either function, the radar system must do the following:

1. It generates high-frequency, high-power electrical waves in very short pulses.

2. It projects these waves from an antenna of a directional type.

3. It picks up the waves that reflect from objects in its range.

4. It converts these echoes into a pattern on the fluorescent screen of an oscilloscope.

5. It times the intervals between the radiation of the pulse and its return.

To determine the position of an object, we must know its *distance* (the range), its *elevation* above the horizon, and its *azimuth*. (The azimuth is the angle the bearing makes with respect to some predetermined line such as the direction "north.") All three factors are indicated in Fig. *1*.

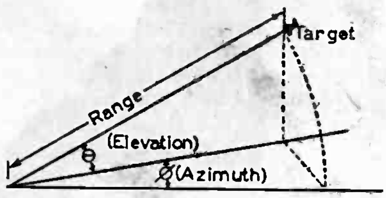

Fig. 1

As you know, the velocity of a radio wave in space is approximately 186,000 miles per second. Therefore, the time taken by a pulse in traveling any given distance represents an accurate measure of that distance. From this, the range of the target is determined by the timing mechanism, which determines the difference in time between the radiation of a pulse of energy and the return of its echo.

In a sense, we may think of a messenger being sent out into space, traveling at a definite and known rate of speed and therefore requiring a given time to reach a given point and return. The radar messenger is a pulse of r.f. energy. Its speed is approximately the same as the velocity of light (that of a radio wave) and the time required to make the round trip over typical distances and back is shown in Fig. *2*. The time is given in microseconds at the left of the graph and at the base of the graph distances in yards and miles are listed.

The other factors, the elevation and azimuth, are determined by radiating a highly directional wave from an antenna system of known characteristics. The angles of radiation (or reception) with respect to the horizon and the fixed direction line determine the other two factors.

How Radar Works

A block diagram of a simple radar installation is shown in Fig. *3*. It consists of a pulse generator, pulse modulator, high-frequency transmitter, high-frequency radiating antenna, high-frequency receiving antenna, receiver and oscilloscope.

Modulated by the pulse generator, the radar transmitter radiates short pulses of r.f. energy. The interval or time between individual pulses is made somewhat greater than the total time required for the radio wave to travel to a reflecting target at a maximum range and back to the receiver. The transmitting antenna emits radiation beams in the approximate direction to be explored. Whenever this radiation strikes a reflecting surface, it will be reflected back toward the receiver.

While the power radiated from the transmitting antenna is concentrated primarily in the beam, there is a small radiation directly to the receiver antenna along the dotted path shown in Fig. *3*. Since the distance between the transmitter and the receiver is small, transmission of this direct wave is practically instantaneous. The direct radiation from the transmitter therefore establishes the starting time of the exploring pulse.

Both direct and reflected pulses are picked up by the receiving antenna and generate corresponding pulses of signal voltage in the receiver input circuit. After being amplified and rectified, both signals are applied to the vertical deflecting plates of the cathode-ray tube indicator. There, the pulses register on the screen as vertical deflections of the horizontal timing trace. The general appearance of the screen is illustrated in Fig. *4*. The direct pulse produces the vertical deflection at the left of the screen, in line with the zero calibration mark. The target pulse produces the vertical deflection farther along to the right on the screen, near the 100 mark on the dial scale calibration.

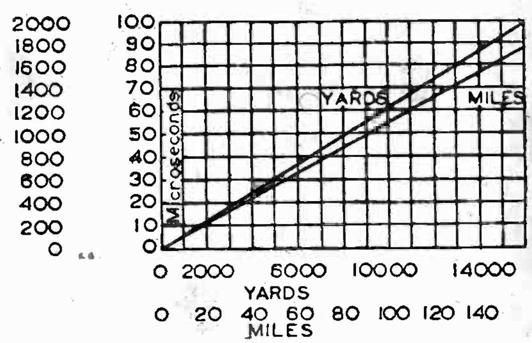

Fig. 2

By comparing the distance between the direct and reflected pulse indications on the screen, using a known time base, the distance traveled by the reflected wave can be read on a calibrated scale. The horizontal (X axis) deflection is synchronized with the transmitted pulses, giving a known horizontal time base which is adjusted so that the direct pulse indication coincides with zero on the scale. The amplitude or size of the pulse deflection (called a "pip") is, of course, proportional to the relative amplitude of the received signal. The height of the trace tends to vary with distance and it also may serve to indicate, to some extent, the size or composition of the target. Moreover, if the target under observation is moving, a change in its relative position will be indicated by a movement of the pip along the base line.

It is evident that the accuracy of such measurements are greatly dependent upon the accuracy of the scale calibration—which, in turn, is dependent upon the accuracy of the timing base. The key to the entire system is the pulse generator which times each and every step in the operating sequence. For this reason, the pulse source must be capable of delivering a continuous series of precisely identical pulses at an exact and unvarying repetition rate.

These control pulses synchronize both the transmitter - modulator and the receiver - indicator functions. Each pulse going to the transmitter direction is applied to the modulator input and serves to release r.f. power from the transmitter for a period precisely equal to the duration of the pulse. Similarly, in the receiver, each pulse triggers a saw-tooth sweep-voltage generator which supplies the horizontal time base for the cathode-ray tube indicator. Since the resulting sweep frequency is identical to the pulse repetition rate, the cathode-ray beam makes exactly one traverse or movement of the screen along the horizontal (X) axis in the interval between each transmitted pulse.

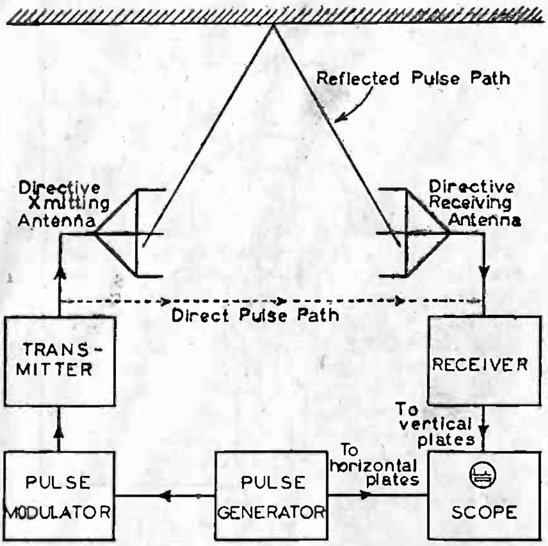

Fig. 3

The cathode-ray tube is comparable to a split-second stop watch in which the "sweep hand" makes a complete revolution in terms of thousandths of a second and reads time in microseconds (millionths of a second). Because of this fast time requirement, only an electronic device could meet the requirements of the service. An ordinary coil or meter would be too sluggish and slow in its operation, but a cathode-ray tube can easily follow and react to the signal voltages.

Cathode-Ray Tube Action

In effect, the cathode-ray tube is a two-dimensional voltmeter with an essentially weightless pointer which may be readily moved by the application of a pulse or signal voltage on the vertical plates. This pointer is a sharply focused electron beam which strikes the fluorescent material of the screen, creating a luminous or visible spot wherever it strikes. Normally centered on the screen, the spot of the cathode-ray beam may be deflected up or down, left or right, instantaneously, in response to the signal and controlling voltages. In its movement, it traces a visible line. Thus, using the cathode-ray oscilloscope, we can obtain a visual image of the signal and control voltages on the screen. In the radar installation, time, distance, and bearing are translated into corresponding voltages which result in the development of characteristic patterns on the cathode-ray screen.

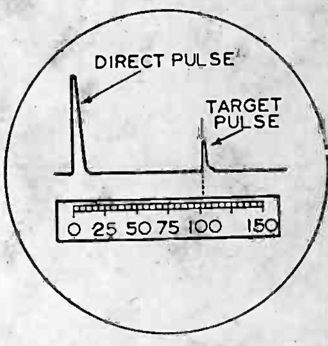

Fig. 4

In the system just described, the spot is swept horizontally by the sweep or timing voltage to form a line, and then this spot is vertically moved by the signals to form the "pips." There are other radar systems in which a "shadow map" is formed; that is, a semi-television image is produced. Exact details are not seen, but the formation of light and dark "blobs" can be interpreted as cities, rivers, ships, etc.

Pulse Development

The development of a pulse signal is important in radar work. Further, this pulse must be of the correct time duration. Actually, we may measure it in microseconds. A microsecond is only .000001 second, so you can see it's extremely short. We may make use of pulses which last only a few microseconds. If we feed a sine-wave signal into a class A amplifier, we get a sine-wave output. But feeding the same signal into a tube which is biased to cut-off, we get a series of half-wave output pulses. If we increase the bias still further and go to class C operation, we reduce the plate current angle and get a series of pulses which are of very short time duration. Fig. 5 shows how the pulses are shaped.

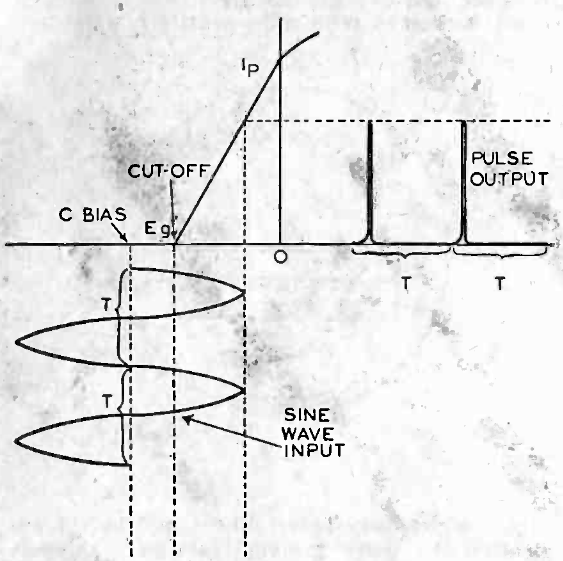

Fig. 5

Why and How Microwaves are Generated

To direct r.f. pulses in a very narrow beam, elaborate, highly directive types of antennas are necessary. The use of low r.f. frequencies would make these antennas large and cumbersome. In fact, early radar antennas were of tremendous size. The use of VHF (Very High Frequency) waves—microwaves—suitably reduces the radiating structure to a size which makes it more practical.

A pulse of a microsecond in duration may contain signal components above 100 megacycles. This signal pulses an r.f. oscillator into action, and we want each pulse of the radiated wave to consist of from 10 to 100 r.f. cycles. Hence, the r.f. value should be at least from 1000 to 10,000 megacycles. Further, in the r.f. and i.f. circuits, broad-band circuit operation may only be achieved by operating the circuits at frequencies 10 to 100 times the band width. Thus we see why VHF and microwave signals are essential.

The equipment used at VHF frequencies is unusual and new to men accustomed to dealing with broadcast and ordinary frequencies, so it is interesting to see how the magnetron and klystron microwave generators function. These special generators are used because ordinary tubes will not work at these frequencies.

The Magnetron

The magnetron is a special VHF oscillator, illustrated in Fig. *6*. It uses a plate (anode) which is split into two parts and connected to the L-C circuit. The cathode (source of electrons) is a directly heated filament. With no current in the large field coil surrounding the tube, electrons move directly from the cathode

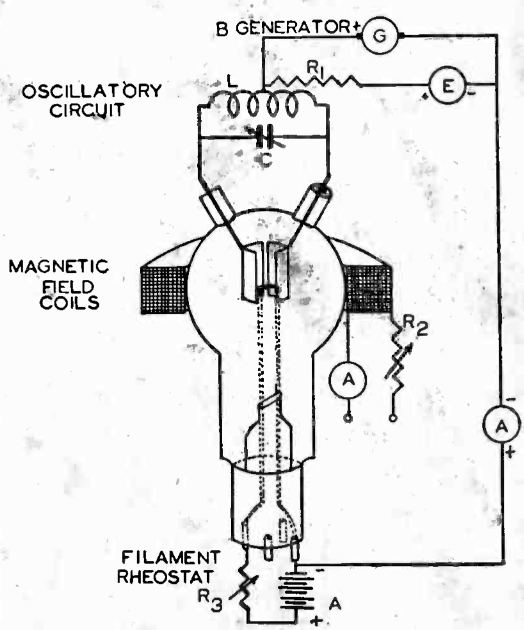

Fig. 6

to the anode, as shown in Fig. 7*A*. Each electron is a negative charge and is attracted to the positive anode which receives its potential from the B voltage generator.

In Fig. 6, the field current in the coil surrounding the tube may be varied by adjusting R_2. With R_2 at maximum resistance, the magnetic field is weak and exerts small influence on the electrons. As the field strength is increased by decreasing R_2 (the field current rises), the action of the magnetic field on the electrons forces them to follow curved paths as shown in Fig. 7*B*. With a weak field, the electrons still reach the plates. However, further increasing the field strength causes the path curvature to increase so that the electrons are attracted toward the plates but never reach them. Instead, as shown in Fig. 7*C*, they turn tail and shoot back to the cathode. The normal field setting is one slightly less than that needed for the condition at *C*.

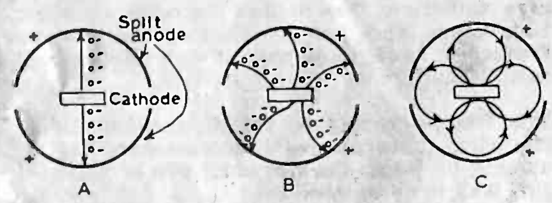

Fig. 7

Now that we understand the mechanics of the tube itself, let's see how we can get an oscillatory signal out of it. To do this, we must examine the circuit. In Fig. 8 a simplified drawing is shown.

With a weak field, we have electron currents I_1 and I_2 flowing in the plate circuit. These currents will not be exactly equal because of a slight difference in the resistance of each half of L_2 and slight differences in the plate and cathode areas of the tube which affect the electrons' distribution. When the B supply is suddenly switched on, therefore, the L_2-C_1 circuit may be shock-excited and a resonant voltage of small amplitude may build up across it.

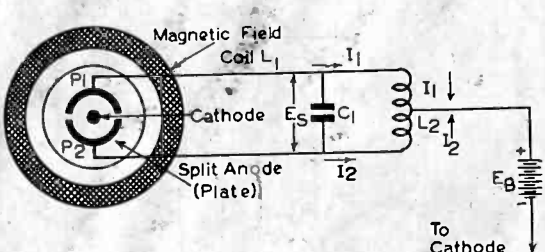

Fig. 8

Let us assume that the oscillatory voltage makes P_1 more positive than P_2 for an instant. The electrons attracted by the more positive plate travel over such a curved path that they strike the less positive plate. Hence, I_2 increases, which excites the resonant circuit L_2-C_1 in such a way as to drive P_1 more positive and make P_2 less positive. Energy is delivered to the resonant circuit because of the tube negative resistance characteristic—that is, as the P_2 *voltage* drops, its *current* increases. There is an energy gain which can only go to the resonant circuit. This action is reversed on succeeding half-cycles of the L_2-C_1 alternating voltage.

Using the magnetron, considerable amounts of VHF power can be generated. Greater efficiency, however, can be realized with a new tube—the klystron.

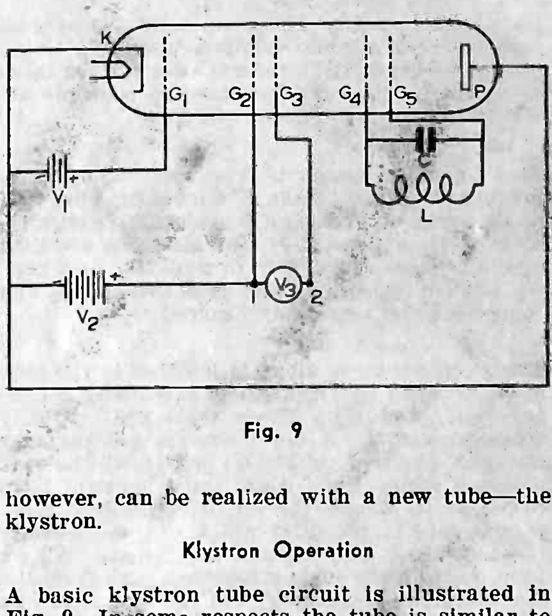

Fig. 9

Klystron Operation

A basic klystron tube circuit is illustrated in Fig. 9. In some respects the tube is similar to others of our acquaintance, in other respects it is radically new. The electron source is the cathode, K, which is an indirectly heated type. Electrons are attracted from the cathode by a positive charge on grid G_1, which is so constructed that it also serves as a focusing electrode, getting the electrons into a beam. The electrons are speeded up in flight by G_1 and further accelerated by the action of G_2, due to the high voltage of V_2. Therefore, the electrons are traveling at a very rapid rate when they reach G_2. Between G_2 and G_3 a signal voltage V_3, provided by a special high-frequency oscillator, is applied.

First, let us assume that we are going through the positive half of the signal cycle. Then, point *2* is positive and *1* is negative, so that G_3 is positive with respect to G_2. The electrons in the space between G_1 and G_2 are coming along with equal velocities and equal separations. But, as the electrons pass through G_2 and approach the positive charge on G_3, they begin to feel, more and more, the accelerating influence of G_3 and

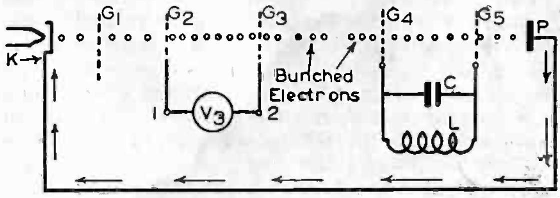

Fig. 10

they rush ahead to bunch up into groups, just as a bunch of people may jam up trying to get into a bus entrance in the rush hour. Once these electrons get past G_3 they tend to continue onward in bunches as shown in Fig. *10*.

This bunching action is also assisted by a retarding field effect. That is, during the next half of the cycle, G_3 and point 2 are negative with respect to G_2 and point *1*. The electrons are then accelerated as they pass through G_1 and near G_2, but are opposed as they pass through G_2 and come near the negatively charged G_3.

The electrons move along in bunches in the tube space between G_3 and G_4, and eventually get between G_4 and G_5. These grids are critically spaced, so that, if the electrons are properly bunched, one grid (either G_4 or G_5) will be near a bunch of electrons while the other will have few near it. Hence, there will be between them a difference in potential which can shock-excite the L-C circuit and produce oscillations. All we need do is now provide a feedback path from the L-C circuit to replace V_3, and the circuit can be made to properly bunch the electrons for continuous oscillation.

In Fig. *9* and Fig. *10*, the L-C circuit is shown in diagram fashion. In the klystron, however, cavity resonators, unusual L-C devices, are employed.

Cavity Resonators

The cavity resonator is used at frequencies above 300 megacycles to secure high efficiency. The development of the cavity resonator from an ordinary coil and condenser arrangement is shown by Fig. *11*. A single-turn coil as at *A* will have a certain amount of capacity between the leads (*C*), and the L-C circuit may tune quite high in frequency. By putting several single-turn coils in parallel (*B*) we may arrive at a rectangular (*C*), or cylindrical (*D*) cavity resonator. Hence, the resulting box or cylinder can be considered as a number of single-turn coils in parallel.

The frequency of the cavity resonator is determined by its dimensions. The electric and magnetic fields are confined to the inside of the resonator, thus preventing a loss caused by energy radiation. Due to this desirable shielding, body capacitance has no effect on the resonant frequency, as it would have in an ordinary resonant circuit.

The frequency may be varied mechanically by changing the shape of the resonator, but the amount by which the frequency can be varied in this way is quite small.

To excite the resonator, an electron stream, which always has associated with it a magnetic and electric field, is sent through holes provided at the center of the unit. The center is usually constricted to provide a very short path for the electrons inside the resonator. To remove energy from the resonator, a tiny loop of wire may be placed inside the resonator, at a point where the field intensity is greatest. For this purpose, a small opening is made on one side of the reson-

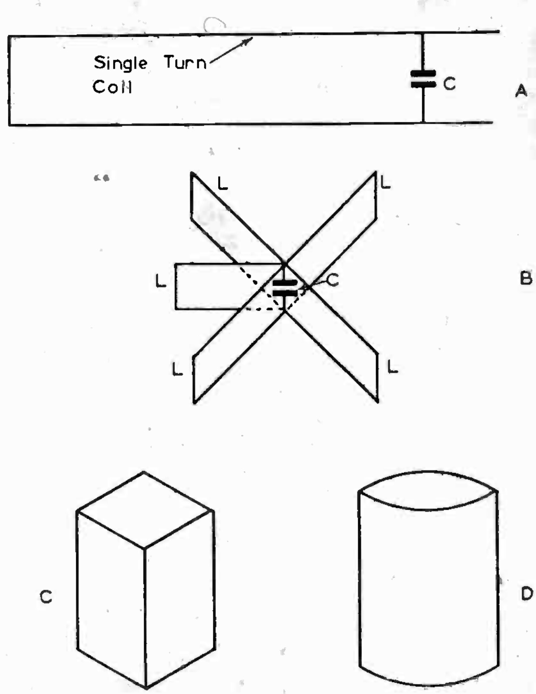

Fig. 11

ator which permits insertion of the loop and coupling to it. In the klystron, these cavity resonators are made a part of the tube itself, one way by which good efficiency can be obtained.

High-Frequency Antennas

After the high-frequency wave is generated, it must be radiated in space. The antenna of the

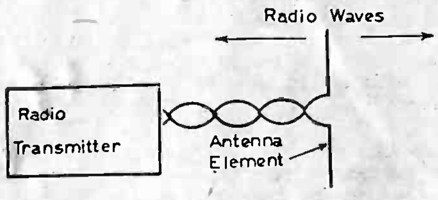

Fig. 12

radar installation may be one of several forms, the choice being dependent on the operating frequency and location, whether on ship, ground or aircraft. But all have one common feature—directionality. At the lower frequencies, dipoles and wire reflectors may be used. At the higher frequencies, parabolic reflectors and electromagnetic horns may be used for shooting out the microwaves.

One of the simplest types of antennas is the half-wave dipole indicated in Fig. *12*. Each element may be ¼ wave long, making ½ wave in all. This antenna radiates in the directions

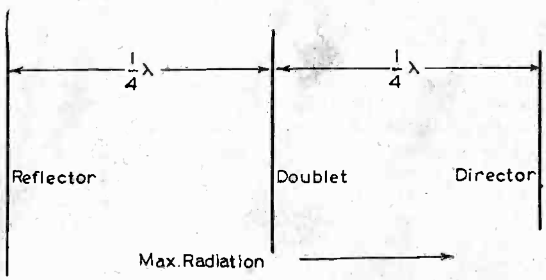

Fig. 13

shown, so that maximum radiation occurs at right angles to the antenna—minimum from the ends. At ultra and very high frequencies, this directivity is most marked. However, we can increase it still further by using a reflector as shown in Fig. *13*. Now, we find that we have a one-way type of radiation system in that the reflector forces radiation in the direction away from itself.

In specialized types of radar equipment, we may not only have dipoles with *reflectors* but also may use *directors* to increase the power gain in the desired direction This is illustrated also in Fig. *13*. (Directors increase the radiation in a direction toward themselves.) Quite often, additional reflectors and directors are used to beam the radio waves sharply in a desired direction. (The study of directional antenna systems is somewhat involved and cannot be covered completely here.)

When the operating frequency is made very high, the size of the radiating element shrinks and we may use a parabolic reflector, as shown in Fig. *14*, to obtain the beam effect. A small, dipole antenna is placed inside the reflector at the proper point and is connected to the transmitter by means of a transmission line.

This is not the limit of high-frequency ingenuity in radar, however, and we may use an electro-

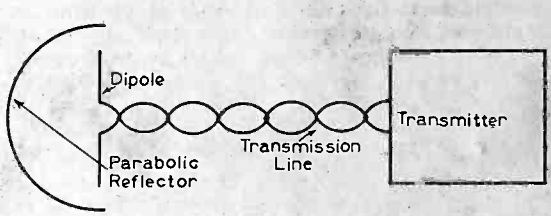

Fig. 14

magnetic horn, as illustrated in Fig. *15*, for directing the high-frequency energy into a concentrated beam. From a simplified viewpoint, the horn is somewhat similar to a megaphone. If you speak into a megaphone, the voice would carry best in the direction the megaphone pointed, and radiation from the horn in Fig. *15* is best in the direction the horn is pointed. Of course, this is electromagnetic radiation, not sound.

By arranging an antenna so that it can be rotated or made movable, we can swing the beam over a wide arc. Using suitable electro-mechanical systems, the beam can be rotated until it strikes an object in its path. Then, we may focus it and concentrate the directional properties of the system so as to obtain an indication of range and distance.

This directional effect is not limited to vertical or nearly vertical angles but may be used in a horizontal plane. In Fig. *16* a typical marine application is indicated. The radar installation is comparatively simple because of the fact that the ship moves at a slow rate of speed, much slower than that of an airplane, and in addition higher power may be used conveniently—because a reasonable amount of weight is not an important disadvantage on board ship.

In Fig. *16*, a top view is shown. The antenna on board the ship may be rotated in a 360 degree circle and may sweep a wide area. When the radio beam strikes an object, such as another ship, a definite indication of the position of the ship is given on the cathode-ray tube. The pip, previously described, varies in height and distance from the reference pulse to permit determination of the distance of the ship and its relative position. In the lower part of the drawing, a side view is indicated.

In addition to showing the presence of ships in a crowded harbor, the radar equipment will permit the efficient navigation of ships in fog and bad weather when the visibility is extremely poor.

Probably, simplified forms of radar will be used to a certain extent in commercial or civilian aviation and will also find wide application in marine service. *However, radar will not do all the jobs wildly predicted for it by untrained, non-technical persons in the press and even in some radio magazines.* It should be borne in mind that the apparatus is relatively complicated and expensive. Furthermore, it requires,

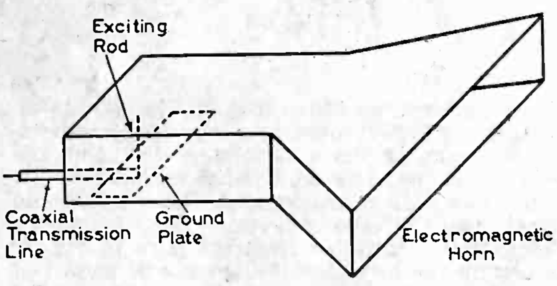

Fig. 15

for its maintenance and installation, highly skilled, well-trained technical personnel. In many respects, the principles which underlie the fundamental operation of television receivers and television transmitters are the same principles that are used in radar work. Therefore, those men who have studied television will find less difficulty in understanding the working principles of radar.

As a matter of fact, much of the war research involving millions of dollars in connection with radar will ultimately result in benefit to the general public in the development and production of highly efficient television receivers. In the radar equipment, as in television systems, wide-range amplifiers covering extremely wide-frequency bands are a necessity and the problems which were overcome in developing the radar equipment are essentially the same problems that, earlier, television engineers struggled

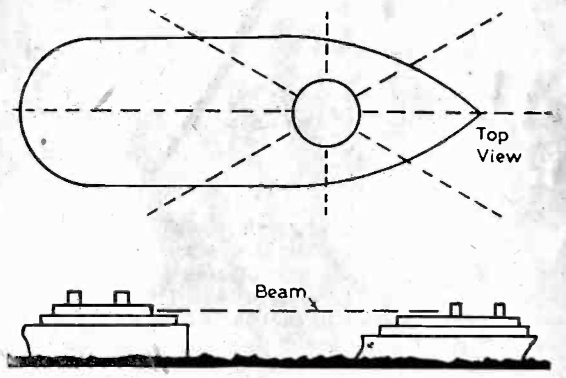

Fig. 16

with not too successfully. Also, numerous refinements in pulse generators and control circuits, as a result of radar developmental work, will find their way into modern television receivers and transmitters. The real benefits of radar, therefore, will be felt in numerous other ways, and the far-reaching effect of radar research will be observed in post-war years.

The teacher was testing the knowledge of the kindergarten class. Slapping a half dollar on the desk, she said sharply, "What is this?" Instantly a voice from the back row said "Tails."

Fundamentals of Magnetic Recording

Basic Operating Principles of Wire and Tape Transcribers

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We are very grateful to the Editor of QST, the magazine devoted to Amateur Radio, for permission to reprint this interesting article which originally appeared in QST.

THE principle of magnetic recording was first invented by Valdemar Poulson, a Danish scientist, in 1898. The public was first introduced to this new art in 1900, when Poulson demonstrated his "Telegraphone" at the Paris Exposition of that year.

As its name implies, magnetic recording consists of impressing on a suitable medium a magnetic force which will leave a record on that medium. If the amplitude of this magnetic force varies in unison with speech or music, then the record left on the medium will vary likewise. Both Poulson and the numerous investigators since him have generally used one or the other of two fundamental types of mediums for magnetic recording—steel tape or steel wire. Both have their advantages and disadvantages, some of which will be discussed later.

When using a tape, any of three methods may be used for magnetic recording — perpendicular, transverse, or longitudinal. Simple diagrams illustrating each of these three methods are shown in Fig. 1. In Fig. 1-A the perpendicular method of magnetization is shown. It may be seen that the two magnetic poles are so placed in relation to the tape

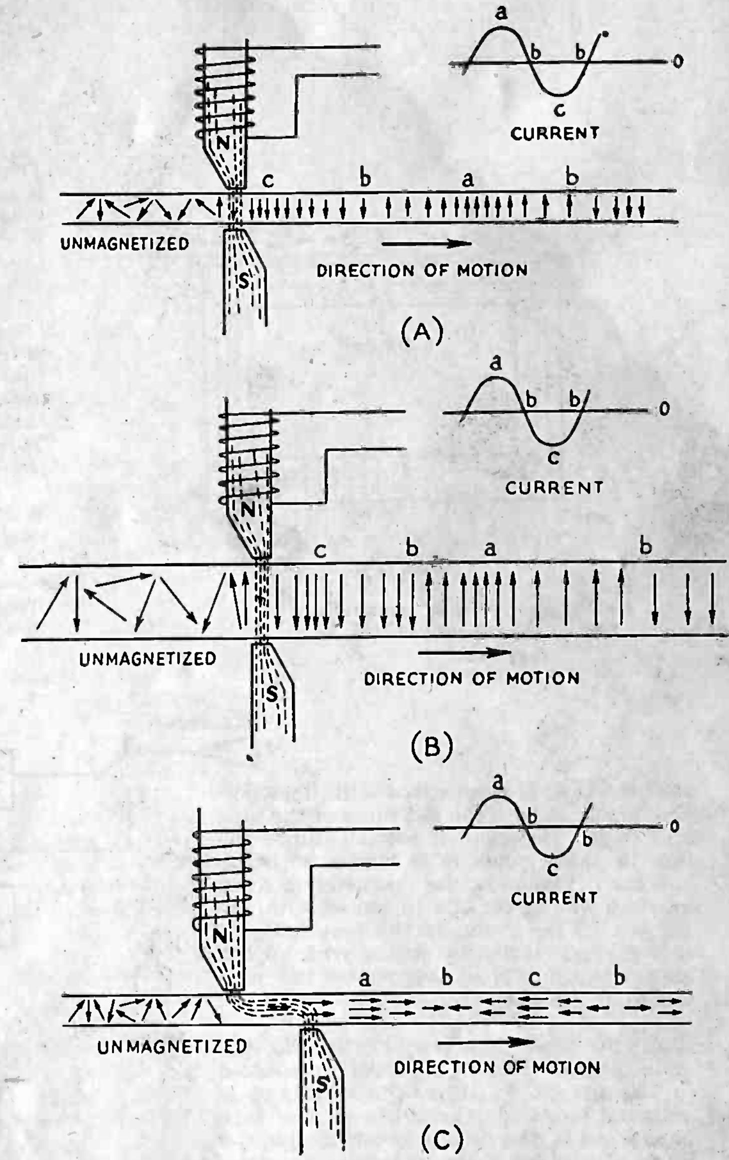


Fig. 1—Sketch illustrating three methods of magnetizing tape or wire. (A) perpendicular, (B) transverse and (C) longitudinal. In (A) the edge view of the tape (shown viewed from the top) is greatly exaggerated.

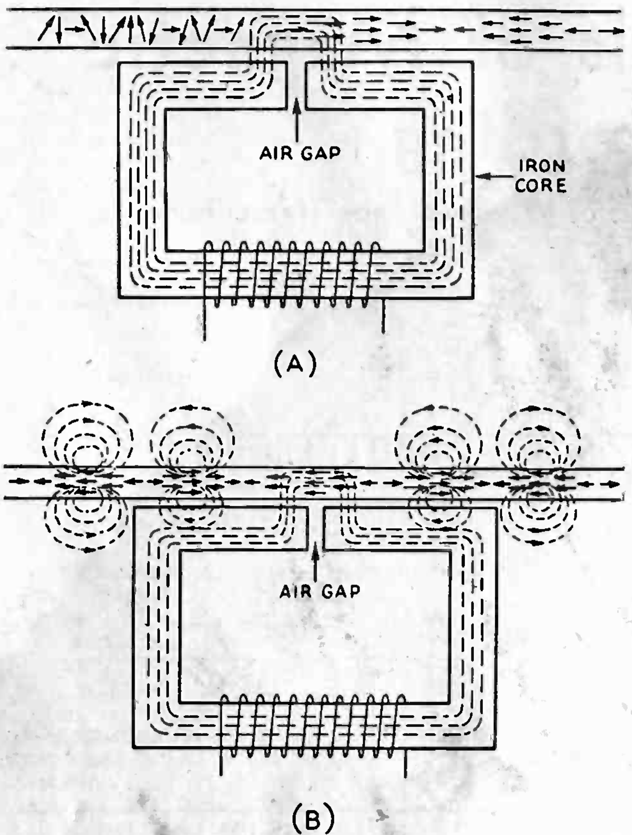


Fig. 2—Diagram showing magnetic paths, (A) in recording and (B) in play-back.

that the tape is magnetized with lines perpendicular to both the flat faces of the tape and to its direction of motion. Since the flux in these poles is in phase with the current in the coils, the magnetizing force exerted on the tape is in phase with the current in the coils. If the amplitude of this current varies in unison with speech or music, the force exerted on the tape will vary likewise.

Since the steel tape is magnetic, the tiny molecular particles in the tape, represented by the arrows, will line up with this magnetizing force. Furthermore, as the tape passes out of the field between the poles a large number of these molecular particles will remain lined up. It is this property of a magnetic material of retaining some of its magnetism after removal of the magnetizing force that makes magnetic recording possible. The bunching of the arrows is used to indicate the relative strength of the magnetism left in the tape. The arrows are bunched close together at a spot which was passing the poles at the instant that the flux in the poles, and therefore the current in the coils, was passing through a maximum either above or below the zero axis. The arrows will be pointing downward at points along the tape where the current was below the zero axis, and in an upward direction at points where the current was above the zero axis. The letters a, b, and c represent corresponding conditions for the current and the magnetism in the tape.

Transverse recording, shown in Fig. 1-B, is exactly the same as perpendicular recording except that the magnetizing force is exerted parallel to the flat face of the tape, although still perpendicular to the direction of motion.

Longitudinal recording, shown in Fig. 1-C, differs from the previous two methods in that the magnetizing force is directed parallel to the direction of motion. Thus the magnetic pattern is left as indicated. This is accomplished by displacing the poles slightly, as shown in the same sketch.

When using wire as a recording medium, longitudinal recording is the only successful method that can be used, since otherwise the wire would have to be prevented from turning on its axis to prevent distortion when the record is being played back.

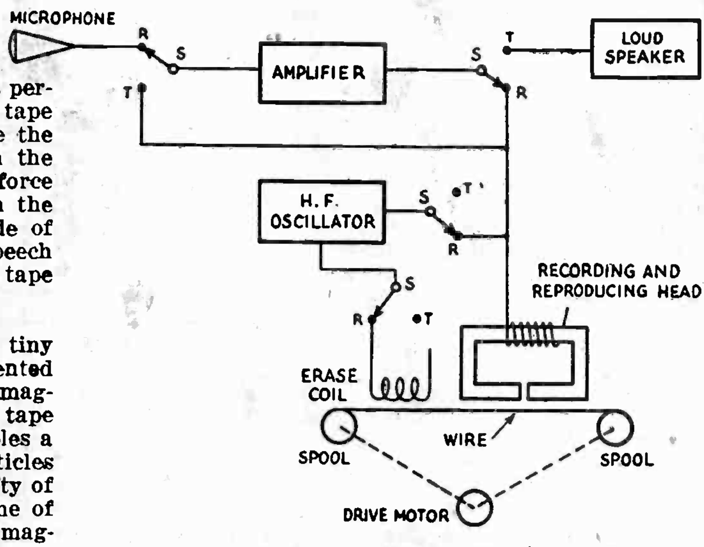
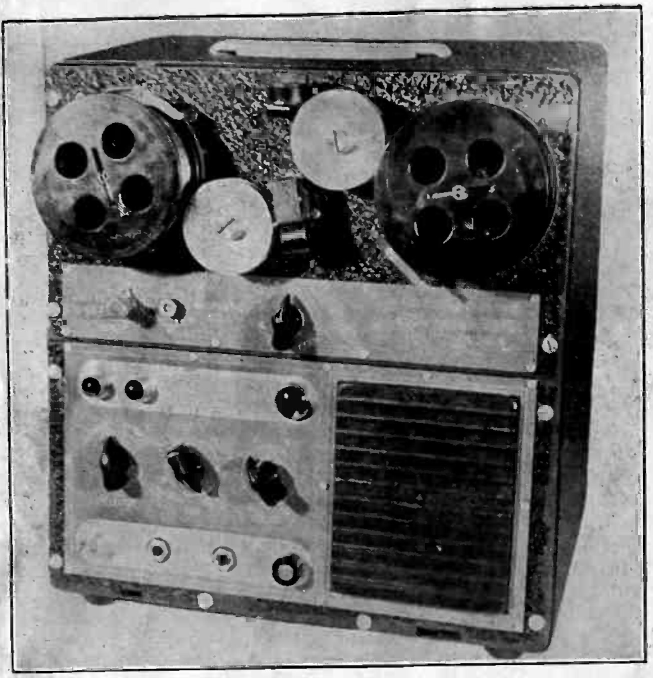


Fig. 3—Block diagram of a wire-recorder system.



The General Electric magnetic recorder. The puller mechanism and the recording and erasing heads are at the top, while the controls and play-back speaker occupy the lower portion of the panel.

For instance, if the wire turned through 180 degrees, arrows which should be pointing upward would be pointing downward. It is practically impossible to prevent wire from turning, although this is relatively simple with a flat tape.

Play-Back

After a record has been impressed upon the wire or tape, the process must be reversed to reproduce the record. That is, the magnetic impressions left on it must be used to produce electric impulses which can be amplified and eventually used to excite a loudspeaker. Fortunately, in some cases, the same magnetic structure used for recording may also be used for play-back. In the new General Electric wire recorder, a type of recording head is used which may also be used for play-back purposes. A diagram illustrating the principles of both recording and play-back with this type of head is shown in Fig. 2. As may be seen from Fig. 2-A, during recording the current in the coil sets up a flux in the iron core which follows the core until it comes to the air gap. Magnetic flux likes to follow the path of least resistance, and since it is much easier for it to travel in iron or steel than in air, it travels around the air gap, through the steel wire, and back into the core. Thus the wire is magnetized longitudinally.

During play-back, the previously magnetized wire has flux lines (which are magnetic force lines) surrounding it as shown in Fig. 2-B. When the molecular magnets of the tape are passing in the air gap, the flux lines find it much easier to travel over the longer path around through the iron core than through the air gap, which offers greater reluctance to the passage of magnetic lines. Consequently, they pass through the core, as shown. These lines must necessarily "link" the coil, and thus an electrical voltage is induced in the coil. The resulting voltage may then be amplified by means of an ordinary audio amplifier and used to excite a loudspeaker.

The G E Recorder

Having explained the basic principle involved in magnetic recording, a complete system such as used in the General Electric wire recorder may now be shown. Fig. 3 shows a block diagram of such a system. During recording the switch is turned to the "record" position, marked R. The following sequence of events takes place. Sound impulses are picked up by the microphone, converted into electrical impulses, fed into the amplifier, amplified, fed into the recording head, converted into magnetic impulses, and then impressed on the wire.

During play-back, the switch is turned to the transcribe position, marked T. The magnetized wire passing through the head now sets up magnetic impulses in the cores. These are amplified by the same amplifier used for recording, and then fed to the loudspeaker which converts them to sound impulses.

During both the recording and play-back processes the drive motor is used to turn the reels, which unwind the wire from one reel, pass it through the head, and wind it up on the other reel. Before the recording can be played back, it is necessary to rewind it on the first reel. Otherwise the speech or music would come out backwards, which would sound very weird. This is the only processing necessary after recording.

The high-frequency oscillator shown in Fig. 3 is connected to the recording head during recording. The purpose of this oscillator is to reduce distortion which would otherwise be present. The actual functioning of this oscillator is beyond the scope of this paper; suffice it to say that, by using this oscillator, a much more faithful recording is obtained.

In Fig. 3 there is also shown an "erase" coil. This coil is used to remove any previous record which may be on the wire just before recording. Thus a "double exposure" is impossible. Erasing is accomplished by subjecting the wire to a relatively high-frequency field, about 30,000 cycles per second. This completely disarranges the molecular magnetic particles, destroying any regular pattern and leaving the molecules disarranged, as shown ahead of the recording head in Fig. 1-A.

A machine incorporating all of these functions is shown in the photograph. This unit is approximately 12¾ inches by 13½ inches by 10½ inches, and weighs about 45 pounds.

The wire used is only 4/1000 of an inch in diameter, comparable to a human hair. Because of its small size, approximately two miles (11,500 feet) can be wound on a spool only 3¾ inches in diameter and 1¼ inches thick. This length of wire is satisfactory for a recording of speech lasting a little over an hour. This illustrates one advantage of wire over tape, in that a given length of recording will occupy less volume than tape. Another advantage is that the wire may be easily cut and sections spliced in for "dubbing in" if desired. The splicing is accomplished simply by annealing the ends to be spliced with a match or lighted cigarette and tying a simple knot.

Now that methods of overcoming its shortcomings have been largely worked out, this system of recording may soon be a strong competitor of more conventional methods in a variety of applications.

RADIO CENTER

Sale and Service of Electronic Equipment
Radio Center Bldg., 200 Cullom Street
CLINTON, TENNESSEE

Sept. 18, 1945

National Radio Institute
Washington, D. C.

Dear Sirs:

We have with us, Mr. L. Howard, 159 YG 45, and Mr. Arva Lee Luallen, 185 YD 54, and are highly pleased with the abilities both men are displaying at their work.

We are aware that you have a good number of students in this locality, and will be glad to have you refer some of your men to us for employment, as they display justifiable aptitude and abilities towards Radio repairing, and the things that go with it.

The two men mentioned above are proving to our entire satisfaction that they are going to make the kind of Radio men we need in our business, and both men attribute their success to your training.

Very respectfully yours,
RAYMOND BLANCHE.

Success

If I can thrill the multitude
  Yet try not to uplift the needy one,
If I can praises sing to Christ
  And spurn the hungry beggar at my door,
Can ask of others to have charity
  While I neglect the cheerless crippled lad;
Can laud the ones Fame crowned with victory
  But have no crumbs of praise for starving souls,
Can beauty see in crimson roses
  But trample on the small and common flower,
Can love the pure and lovely
  Still scorn life's common clay;
Then I'm a failure—and all mankind plus
  All the hosts of Saints
Cannot avert His stern and sad reproof
"Depart from me, I know ye not!"

Urania Rauter—class poem, 1924.

Written by Mrs. Rauter of Milwaukee, Wis., for the Senior Annual when she was in high school in 1924. It is as timely as if it were written today.

"Let's Finish The Job

The boys have done it, and Victory is ours!

The hardships they have endured, the dangers they have faced, the sacrifices they have made for the cause of liberty, call for everlasting gratitude from us at home and all freedom-loving people throughout the world. They have finished their job, and theirs is the honor and the glory.

But the job is not yet finished. Though men no longer face death in battle, the cost of the war, in dollars, will continue for some time to come. There is still an urgent call for huge expenditures to bring the men and women in uniform back home, to rehabilitate the wounded, for mustering-out pay, for veterans' benefits, for reconversion, and for lots of other war bills still to be paid.

That's why all of us have a share in the Victory Loan. Buy Victory Bonds regularly—Hold them.

NEWS OF THE RADIO WORLD

BY *Willard R. Moody*

A new type of vibrator, soon to be available for civilian use, is hermetically sealed and is immune to moisture, corrosive fumes and low atmospheric pressure This is a war-time development.

Doctors may now use an electronic stethoscope instead of the older-style acoustic stethoscope. More accurate and easier diagnoses are now possible. A small microphone or vibration pickup works into an audio amplifier which in turn supplies signal energy to tiny audio reproducers which fit into the ears of the doctor.

The FCC has announced that the 42-50 megacycle channel will be closed to FM operation as soon as FM receivers covering the 88-106 megacycle band are generally available in territories now receiving FM coverage.

Sentinel intends to manufacture a new vest-pocket Radio with a case not much larger than a package of cigarettes and an earphone cord which also serves as its antenna.

Authorities estimate there is a backlog demand for 60,000,000,000 radio tubes needed as renewals for civilian radio sets. Post-war sales should be enormous.

A new handy-talkie for civilian use in the FCC assigned band of 460-470 megacycles is being put into production by one radio manufacturer. Equipment of this kind should serve many useful civilian communication purposes.

John F. Royal, NBC Vice President in charge of television, thinks that "Television, as a medium for the interchange of ideas and customs, will permit better understanding of the thinking of other peoples, thereby enhancing the cause of international peace and solidarity."

At the close of 1943, there were about 57,000,000 radio receivers in use in the United States. Of these, about 30,000,000 were home radios, 16,000,000 table receivers, 3,000,000 battery portables and 8,000,000 auto sets.

Approximately 1,200 radio manufacturers were in business on January 1, 1944. A total of 947 stations were devoted to Radio broadcasting at that time.

The frequencies between 42 and 108 megacycles have been assigned as follows, according to a recent Federal Communications Commission report:

42 to 44 megacycles	Non-Government fixed and mobile
44 to 50 megacycles	Television—Channel No. 1
50 to 54 megacycles	Amateur
54 to 60 megacycles	Television—Channel No. 2
60 to 66 megacycles	Television—Channel No. 3
66 to 72 megacycles	Television—Channel No. 4
72 to 76 megacycles	Non-Government fixed and mobile
76 to 82 megacycles	Television—Channel No. 5
82 to 88 megacycles	Television—Channel No. 6
88 to 92 megacycles	Non - Commercial, educational, f.m.
92 to 106 megacycles	F.M. broadcasting
106to108 megacycles	Facsimile

Television is still in an experimental stage, to a considerable extent. However, some commercial television stations are in operation.

They are: WBKB, Balaban and Katz Corp., Chicago, Ill., 60,000-66,000 kc.; WABD, Allen B .DuMont Labs, Inc., New York, N. Y., 78,000-84,000 kc.; WCBW, Columbia Broadcasting System, Inc., New York, N. Y., 60,000-66,000 kc.; WNBT, National Broadcasting Co., Inc., New York, N. Y., 50,000-56,000 kc.; WPTZ, Philco Radio and Television Corp., Philadelphia, Penna., 60,000-72,000 kc.; WRGB, General Electric Co., Schenectady, N. Y., 66,000-72,000 kc.

On the basis of data set forth in a Federal Communications report of May 25, 1945, recent FCC allocations for television are: Television—Channel No. 1, 44-50 mc.; Television—Channel No. 2, 54-60 mc.; Television—Channel No. 3, 60-66 mc.; Television—Channel No. 4, 66-72 mc.; Television—Channel No. 5, 76-82 mc.; Television—Channel No. 6, 82-88 mc.

The use of very high frequencies for the operation of relay stations used to link together the stations of a television network will become general practice, in all probability.

The General Electric Laboratories have been working on an electronic robot which prepares a hot dog in fifteen seconds, drops it into a toasted roll and then delivers it to the customer. A dime in a slot does the trick and the machine will even return the right change if necessary.

THE RADIO PROXIMITY FUZE

By HARRY DIAMOND, Chief

Ordnance Development Division
National Bureau of Standards

Mr. Harry Diamond, the author of this article, has a B.S. degree in E.E. from M.I.T. and M.S. degree from Lehigh. He is inventor or co-inventor of; several aircraft Radio beacon systems; a system for blind landing aircraft; the Radiosonde system of weather information gathering; a method of shielding plane engines to allow Radio reception, etc. He is a member of the Washington Academy of Sciences, and a fellow of the Institute of Radio Engineers. Awarded National Academy of Science Medal for outstanding engineering work.

Mr. Diamond is an NRI Advisor. It may now be told that all during the war, Mr. J. E. Smith loaned our Director of Education, Mr. Joseph Kaufman to the Bureau of Standards, where Mr. Kaufman spent one half of his time working with Mr. Diamond and his associates in the development of the Radio Proximity Fuze and other very secret developments which did so much to shorten the war and bring victory to the Allies.

LEADING Army and Navy officials include the radio proximity fuze with radar and the atomic bomb in the trinity of outstanding secret weapons of the war. The reader need only cast back to the latter months of 1940, when the German Luftwaffe constituted a terrible threat to civilisation, to appreciate the purpose of the proximity fuze. Every Allied city and every ship within range of the Luftwaffe was considered vulnerable to German bombs.

Need for the Proximity Fuze

When the National Defense Research Committee was formed in August 1940 one of the first weapons sought was a solution to the threat of enemy aviation. British scientists urged the development of the proximity fuze as an ideal answer, and collaborated in the program. The advantages offered by the proximity fuze were obvious. If a fuze could be made to explode projectiles anywhere in the vicinity of an airplane target, the effective size of the target would be greatly increased, and much fewer shots would be missed. Time fuzes, preset according to radar information of range-to-target, were being used on anti-aircraft shells and rockets, in an attempt to cause the projectiles to explode within lethal range of the enemy bombers. Computations showed, however, that the automatic ranging af-

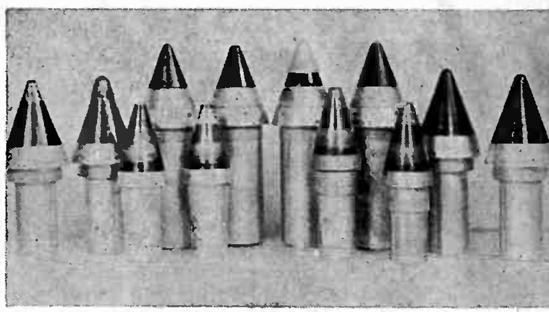


Fig. 1—A group of JHU designed radio-proximity fuzes for Army and Navy anti-aircraft and artillery projectiles.

forded by the proximity fuze would increase the number of "kills" by at least five-fold.

One vital need for the proximity fuze was on anti-aircraft shells for shipboard or land use (in the early days of the war rockets were too inaccurate for anti-aircraft usage). A second, equally urgent, need was a proximity fuze for

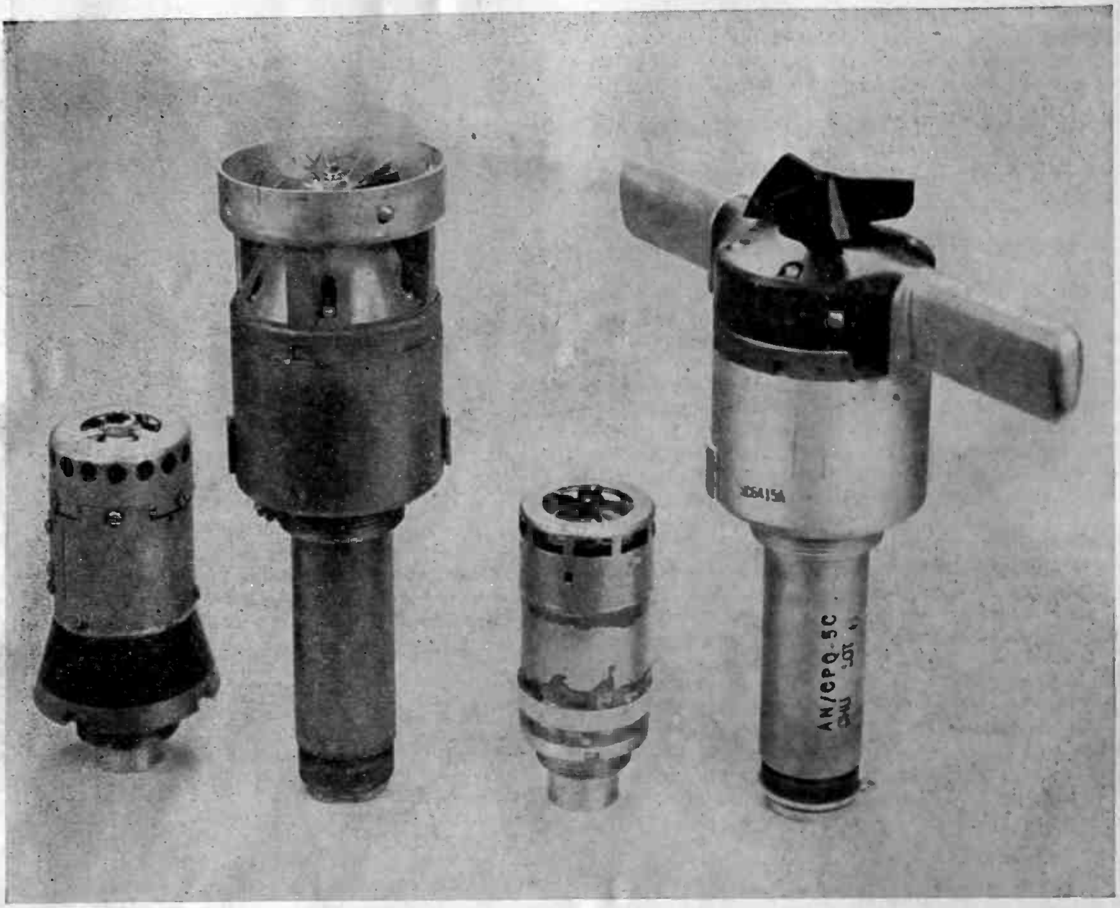


Fig. 2—Group of NBS designed generator-powered radio proximity fuzes for bombs, rockets and trench mortar shells. Arranged left to right: rocket fuze, ring-type bomb fuze, mortar fuze, and bar-type bomb fuze.

use on airborne rockets and bombs. The idea of firing rockets from fighter airplanes was receiving considerable attention in military circles. The British fighter pilots were showing that the best defense against enemy bombers was attack in the air. Army Ordnance Department officers were advocating increase of fire power of the fighter airplanes through use of rockets fired from wing mountings. Absence of recoil with rockets rendered practicable the use of heavy rocket shells exceeding greatly the range and lethal damage of aircraft machine guns and cannon. The proximity fuze was considered essential to make up for the dispersion of the rockets, so that practically all misses passing within lethal range of the enemy bombers would create as much havoc as if they were hits.

There were, also, some advocates of the use of air-to-air bombing against enemy formations. Bombs could be dropped by fighters flying above the formation in the same direction or released head-on into the formations. Here, again, the proximity fuze would convert many "misses" into "kills."

Soon after development work was initiated, it became evident that the proximity fuze could also be used with five to twenty-fold increase in lethal damage on projectiles launched against ground targets. Enemy anti-aircraft gun emplacements could be silenced more effectively by showers of high-velocity fragments from bombs, rockets, or shells bursting up to 100 feet above ground than by explosions on contact with the ground surface as obtained from "contact" fuzes. For contact bursts, the lethal effect of the fragments was usually neutralized by the revetments surrounding the guns and gun crews. Similarly, men in fox-holes, airplanes and truck transports parked within revetments, and other partially shielded targets, although relatively safe from contact bursts, except for direct hits, would become extremely vulnerable to air bursts. Full-scale experiments at Army proving grounds, conducted under Army Ordnance Department auspices, demonstrated the vastly greater lethal effect of the air burst against partially shielded targets.

Organizations Involved in Development Program

In the original N.D.R.C. organization, Division A, Armor and Ordnance, under Dr. R. C. Tolman had the responsibility for the development of the proximity fuze. Development work was started in the Department of Terrestial Magnetism, Carnegie Institution of Washington, in August 1940 and was later expanded to include the facilities of the National Bureau of Standards in December 1940. Section T of this N.D.R.C. Division, with Navy Department sponsorship, handled the work at D.T.M. and later set up the Johns Hopkins Applied Physics Laboratory in Silver Spring, Md. Section E of the same N.D.R.C. Division, with

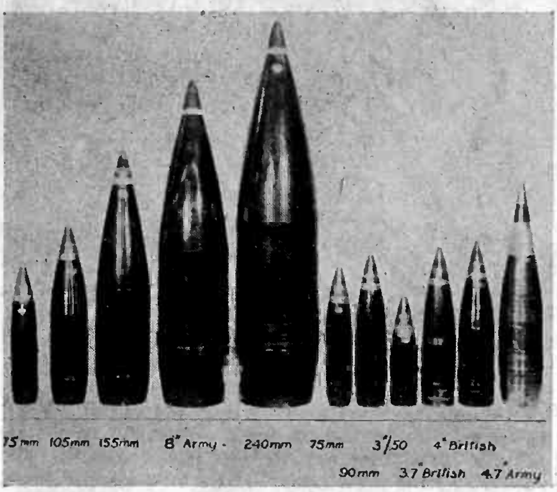


Fig. 3-A—A group of artillery and anti-aircraft projectiles fitted with VT fuzes designed by the Johns Hopkins Applied Physics Laboratory. Some of these types of shells with their radio proximity fuzes were used with telling effect in repelling the German advances in the Ardennes offensive in the winter of 1944-1945.

Army sponsorship, guided the work at the Bureau of Standards. Section T was assigned the job of developing proximity fuzes for rotating, rifled, projectiles (such as the anti-aircraft and artillery shells). Section E (later Division 4,

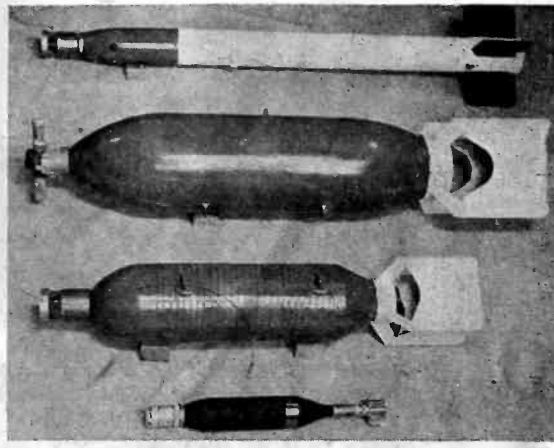


Fig. 3-B—Several weapons are displayed, each with a characteristic proximity fuze. Below is the 81-millimeter mortar shell with appropriate fuze. Next, is a 260-lb. fragmentation bomb with a ring-type bomb fuze. Next, above, is a 500-lb. general purpose bomb with a bar-type bomb fuze. At the top is a 5-inch high velocity aircraft fired rocket with a ring-type rocket fuze.

N.D.R.C.) was assigned the job of developing proximity fuzes for non-rotating, smooth-bore, projectiles (such as the rocket, bomb and mortar shell). By inter-Service agreement, the Navy was to procure all shell fuzes needed by both Services, and the Army was to procure all fuzes for bombs, rockets and mortar shells needed by both Services. In the Army program, the Signal Corps collaborated with the Ordnance Department in the development and procurement program.

War Usage

By now, the press has carried complete statements of the part the proximity fuze played in winning the war. Air-to-air usage of rockets and bombs was practically non-existent. By the time these fuzes were available in large quantities (mid 1943), air superiority was in Allied hands and was being used in strategic bombing of enemy industry and economy. There was therefore no need to call forth this defensive weapon. The extreme danger to our bomber formations, if this weapon were in the hands of the enemy, necessitated withholding its use unless the enemy should regain control of the air. Fortunately, this did not occur.

To insure complete security, the combined Chiefs of Staff did not release full use of the proximity fuze until the Battle of the Bulge in December 1944. Prior to that, usage was possible in protection of our warships against Japanese aircraft attack and in defense of London and Antwerp against the threat of the German Vengeance weapon V-1. In such usage, there was no danger of capture of the fuze by the enemy. The effectiveness of the proximity fuze on shells in hastening the westward push of our fleet against Japan and in overpowering the V-1 buzz bomb is now in the realms of scientific history. First used on land in the Battle of the Bulge, it was credited by responsible Army Generals with providing the extra punch which turned the Nazi tide. In later offensives, its continued use on artillery shells was no less effective. By far the greatest use of the proximity fuze in this war was on artillery shells.

The proximity fuze for bombs was first used in pre-D-Day saturation bombing of Iwo Jima, in February 1945. Jap radar, anti-aircraft batteries and airport installations were knocked out by these operations, resulting in a very weak enemy anti-aircraft defense in the subsequent invasion actions. In strikes by Army and Navy planes against Luzon, Okinawa, Kyushu, Wake Island and Japan proper, similar demoralizing effects on

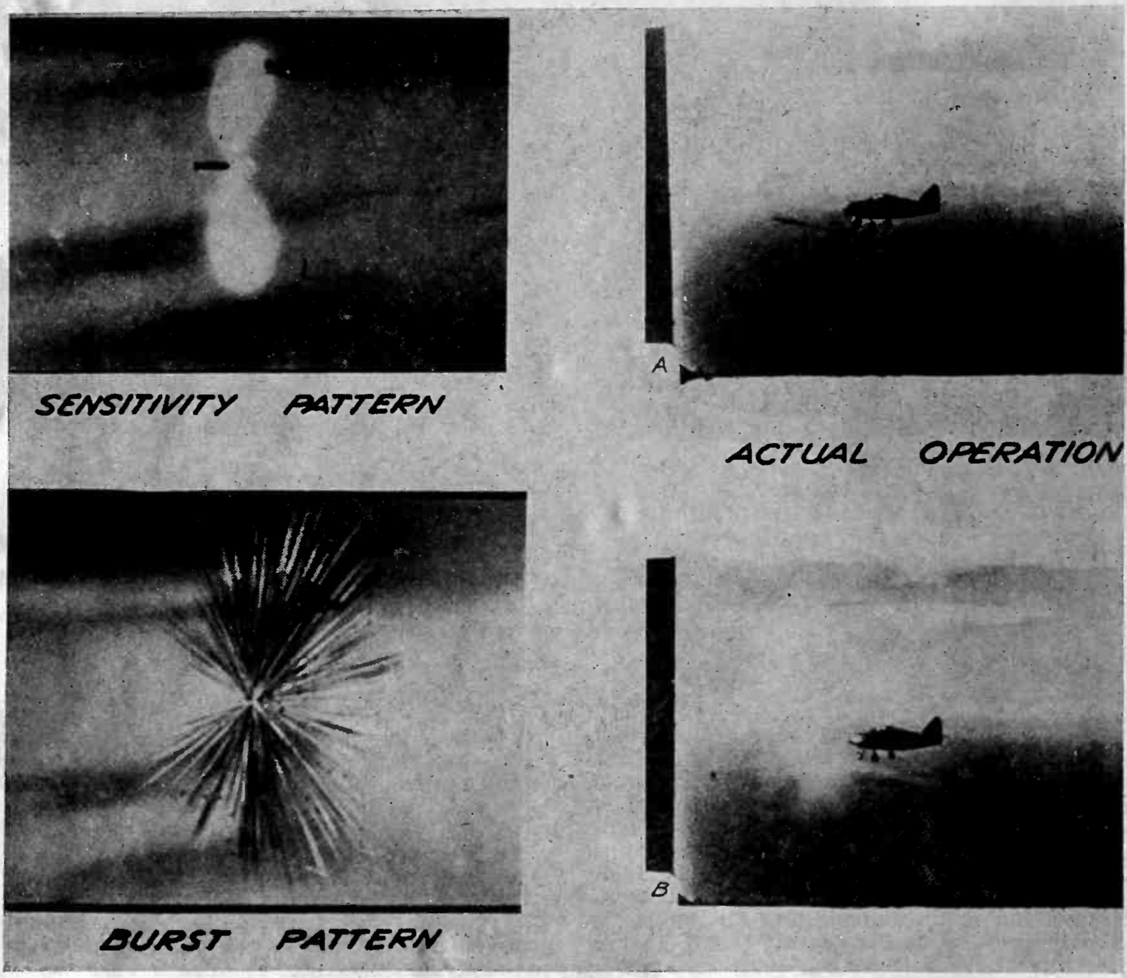


Fig. 4—Diagrammatic and action pictures showing a proximity-fuzed rocket functioning on a radio-controlled target airplane. In the action pictures at the right, the rocket was inert filled with a small smoke-puff indicator substituted for the high explosives so that action of the fuze could be tested under service conditions without destroying the target airplane. Note the puff at the front landing wheel.

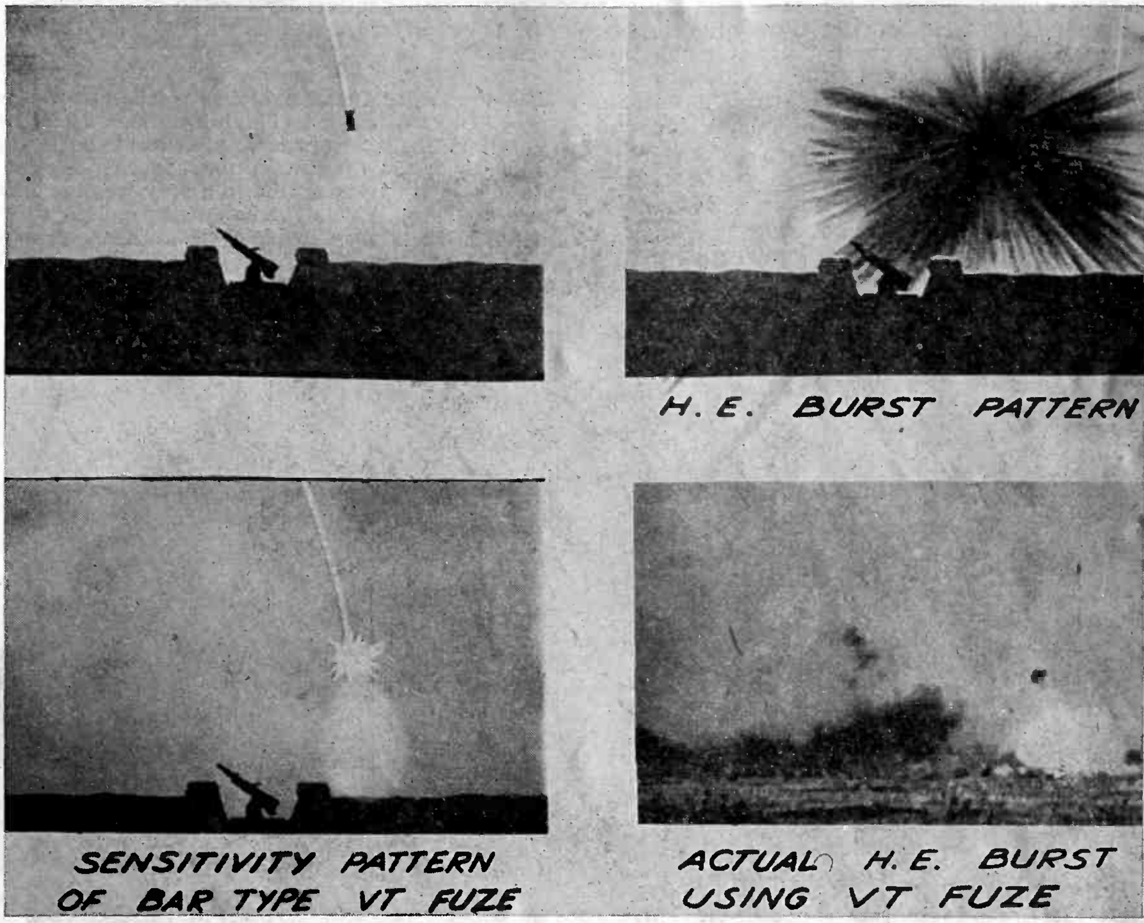


Fig. 5—Diagrammatic and action pictures showing use of proximity-fuzed bombs against a gun emplacement. The fuze first receives an activating signal at upper left, detonates its booster-charge at lower left and fragments the bomb at upper right. An actual HE air burst is shown at lower right. Note how the fragments completely blanket the target.

enemy personnel and vital targets from proximity-fuzed bombs were obtained. Airplanes based on major carriers of our fleet used proximity-fuzed bombs and rockets against ground targets in rapidly expanding amounts during the latter months of the war when our fleet was participating in the final knockout punches against Japan. In the European and Mediterranean Theatres of Operation the 9th, 12th and 15th Air Forces used proximity-fuzed bombs against enemy anti-aircraft positions defending avenues of approach into Austria and Germany. The 12th Air Force also used proximity fuzes on fragmentation bombs and on the new "gas-gel" incendiary bombs to support ground force offensives in Italy.

In all theatres of operation, the proximity fuze on rockets was used to more limited extent on Army and Navy aircraft-fired rockets to destroy similar ground targets.

Description of Proximity Fuze

The proximity fuze is an extremely rugged, miniature radio sending and receiving station with auxiliary safety features which fit into the nose of the projectile. It operates by continuously sending out radio waves which act as feelers, reaching out to detect any nearby objects. When any object of reasonable size is approached, the radio waves which reach that object are reflected back to the projectile. The fuze receiver picks up these reflected waves, and when they reach a sufficient intensity (that is, when the projectile

Fig. 6—Official Army Air Force picture showing proximity-fuzed bombs bursting over revetments and anti-aircraft gun installations near landing strip at Iwo Jima. The bomb fragments hitting the targets have a crescent shape, characteristic of air bursts. The bombs were dropped in trains by formations of airplanes and provided saturation coverage of the targets attacked.

is close enough to the object), they operate an electronic switch which detonates the fuze and the projectile. The detailed operation of the fuze is, of course, more complicated than this simple description implies. Fuze design is shaped to the final use—that is, it must fit and operate according to the particular requirements of the projectile with which it is to be used. A great many factors control fuze design, among them, size and velocity of the projectile, the type of target against which it is to be used, and the height or position of the desired explosion.

The problems of development of such fuzes for shells and for bombs and rockets differ essentially. In the shell fuze, it is necessary for the components, particularly the tiny radio tubes, to withstand the terrific stress of being fired in a gun. The fuze for bombs and rockets has to perform properly at the very low temperatures encountered at the high altitudes where bombs and air-borne rockets are usually released and must withstand the unbelievable vibrations encountered during the flight of smooth-bore projectiles. In the shell fuze, the energy is obtained from a small storage battery. A glass vial, filled with electrolyte, keeps the battery from being activated until the shell is fired. Set-back then breaks this vial and the spin of the shell distributes the electrolyte to the plates of the battery. In the bomb and rocket fuzes, the energy is supplied by a tiny electrical generator driven by a small propeller in the air stream. A miniature Alnico rotor provides the large amount of flux needed to generate the necessary voltage in the space available. Nailhead sized selenium rectifiers are used for converting the a-c voltage generated to suitable d-c plate and grid voltages. Filter condensers are of special miniature design; paper condensers are used—electrolytic condensers are not practicable because power may be needed within a fraction of a second after the projectile is launched.

Safety mechanisms to afford virtually fool-proof handling are required in fuze design by both Army and Navy Ordnance officials. The primary safety feature used in the interrupted powder train which interposes a thick metal plate between the detonator (similar to a blasting cap) and the high explosive of the projectile. In the shell fuze, this plate is removed by the combined action of set-back and spin when the shell is fired; the fuze is then in the "armed" position and ready to explode the projectile upon approach to its target. In bomb fuzes, the propeller driving the generator rotor also operates a gear train to complete the powder train after the bomb has traveled through a prescribed distance. In fuzes for rockets and mortar shells, the set-back operates a mechanical device which, with a propeller-driven gear train, removes the barrier plate and completes the powder train for action.

Typical models of shell fuzes are shown in Fig. 1 and those typical of bomb, rocket and mortar shell fuzes in Fig. 2. Fuzes of the shell type mounted on artillery projectiles are shown in Fig. 3A. In Fig. 3B bomb, rocket and mortar shell fuzes are shown mounted on typical projectiles. In all but the bar-type bomb fuze, the projectile is used as a common transmitting and receiving antenna. Excitation of this antenna arrangement is between a portion of the fuze serving as an antenna cap and the rest of the fuze together with the projectile serving as the remainder of the antenna. In the presence of a target, the radiation resistance of the antenna is altered producing a cyclic variation in the plate or grid current of the transmitter. This variation, amplified, operates the electronic relay to fire the detonator. The sensitivity pattern afforded by this form of antenna is particularly suitable for fuze operation against aerial targets. See Fig. 4 at upper left. Functioning is assured while the projectile is leading the target, so that a maximum of fragments may hit vital areas of the target.

For bombardment of ground targets, the use of an antenna perpendicular to the bomb structure is most suitable. When released from high altitudes, the bomb approaches the ground at nearly vertical incidence so that maximum responsiveness in a forward direction is required. The sensitivity pattern for the bar-type bomb fuze is shown in Fig. 5 at the left.

Peace-Time Industrial Applications

Aside from possible applications of the proximity fuze principles in civil aviation and other usages, the principal contribution of the fuze program to peace-time industry will stem from the myriad new processes and components developed during the course of the program. Here, manufacturers throughout the electronics industry contributed in generous measure. The emphasis was on very much improved performance from smaller and smaller components. A striking illustration of the achievement attained in this respect is had from Fig. 7. The fuze for the 8-lb. mortar shell was the last great fuze of the war. Here, a truly miniature model was essential. Note that its total size was little greater than that of a single tube used in the first VT bomb fuze successfully tested in February 1941.

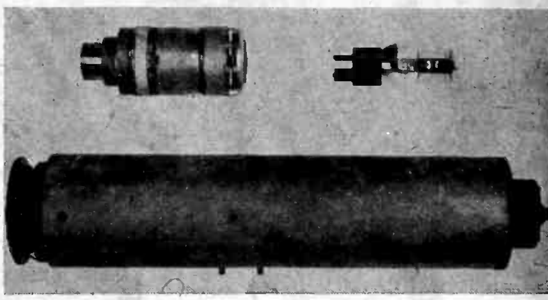


Fig. 7—This is an illustration of the first successful radio proximity fuze in the world, tested at the Navy Dahlgren Proving Grounds by National Bureau of Standards scientists on February 12, 1941, less than two months after initiation of the development. It was attached to the tail of a bomb and trailed a whip-like antenna. Above it is shown the miniature mortar fuze and for size comparison, a conventional radio receiver tube.

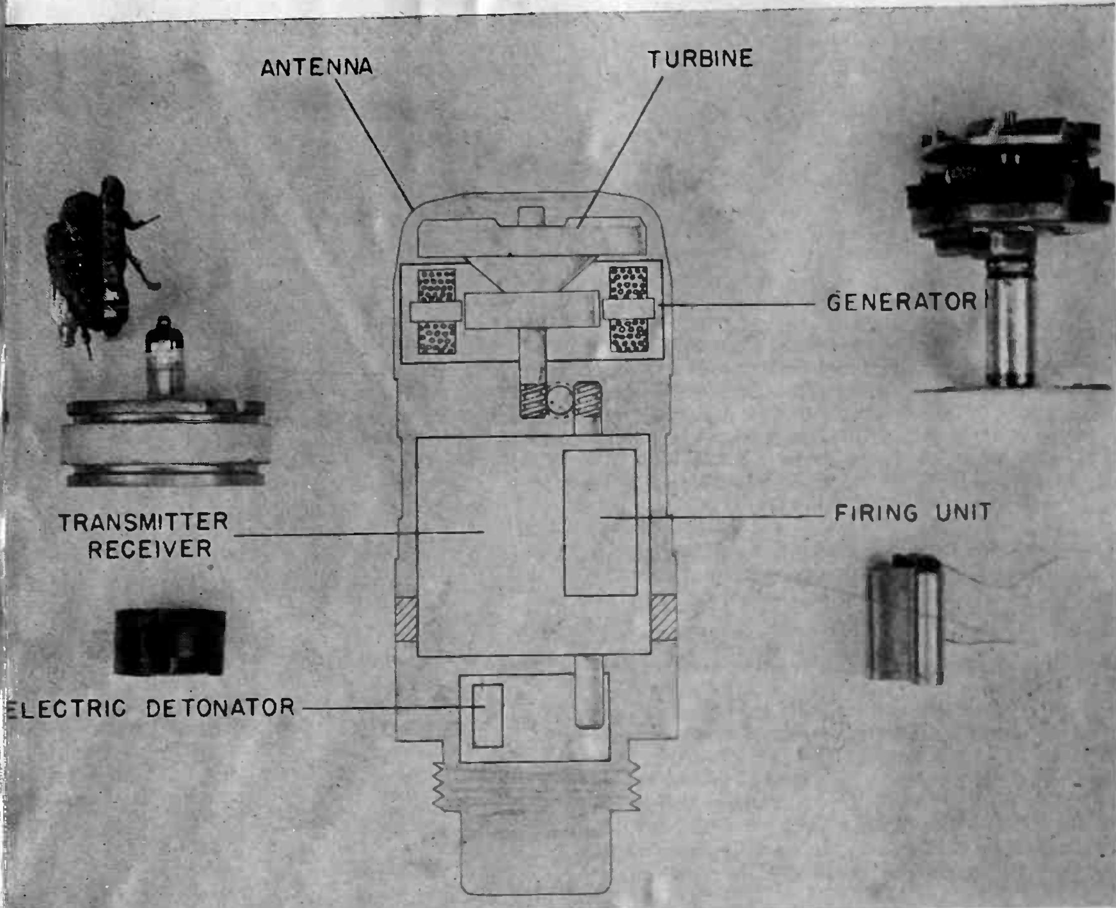


Fig. 8—Diagrammatic composite of the proximity fuze developed for use on the "G.I. fox-hole cannon"—the 81-millimeter trench mortar shell. Details of construction are shown only insofar as security considerations permit.

Reduction in size was obtained by reducing tube dimensions, resistors, condensers, switch gear and other components. New methods of molding and potting of components in compact units were evolved. Microphony of tubes was reduced at least one hundred fold. Power capacity of components and freedom from temperature and humidity effects were radically advanced. Battery construction was improved and size markedly reduced. Material for generator power supply was revolutionized. A novel and highly significant departure in processing which will probably replace other methods in many applications was introduced by Globe Union, Inc., in one of the skirmishes in the overall battle for space reduction. In this process, circuit components such as resistors and condensers and the connections between them were manufactured as a single ceramic plate; the mortar fuze utilized this adaptation with great success. Figure 8 shows some of these components placed on a section drawing of the mortar shell fuze.

The impact of the performance improvements and space reductions effected along the several lines indicated will undoubtedly be felt in the near future in smaller hearing aid devices, in miniature radio receivers, in walkie-talkie sets, and in many industrial electronic controls. A "match-box" radio set may not appeal to the music lover but it will have other practical utility. Many are the electronic control applications where size of the equipments required has hitherto hindered their adoption.

How to Get Along With Others

Dr. James F. Bender, Director

The National Institute for Human Relations

Daily Let us Resolve to Say Kind Words to One Another

People who get along well with others know the power of kind words. They never underestimate them but strive daily to repay acts of service and fellowship with kind words as well as kind deeds. What is equally important, they are aware of the most prevalent of life's minor tragedies: WE FIND IT HARD TO SAY KIND WORDS TO THOSE DESERVING THEM MOST.

Why don't we form a society for cultivating the habit of saying nice things to people while they are still with us? Why defer them until they are gone forever?

And isn't it strange that a passing courtesy extended by a total stranger—whom we may never see again—will bring forth profuse thanks? Even more constant and helpful courtesies showered upon us at home and on the job often go unrewarded with spoken recognition. Perhaps the fault lies in our attitude of "taking things for granted." But the kindly acts of everyday life must never be taken for granted; they are far too precious in building a good human relation.

It isn't that we are ungrateful. We just allow a habit of awkward silence to develop, and this acts like a barrier between our appreciation and the expression of it. Words are the wires between hearts and minds, and unless they are expressed our messages of good will are lost forever, making the world a poorer place in which to live and work.

Philips Brooks hit the nail on the head when he said, "You are letting your friend's heart ache for a word of appreciation or sympathy which you mean to give him some day. If only you could know and see and feel, all of a sudden, that the time is short, how it would break the spell! How you would go instantly and do the thing which you may never have another chance to do." In the better world each of us must help build, the greatest value is placed on the habit of repaying the common, "unremembered" acts of everyday existence with kind words.

How much brighter the day for the wife who receives a word of recognition for cooking a good breakfast! What an uplift for a little child when he is encouraged with a kind word! How we like to work beside those who let us know they are grateful for the helping hand! So, the cue is easy enough to take: if we get a thrill from giving others encouragement by using kind words more often.

Once the ice is broken, the rest is easy. We develop good will toward our associates by speaking words of good will. We strengthen our personalities each time we express the sincerity of our gratitude. Have you ever noticed that the really strong and respected people you know are those who make a practice of saying kind things? They cannot afford to do otherwise. It would be compromising the value they place on their fellowman. So, why not make it a practice to be on the lookout for the nice things people do for us and repay them with like deeds, never forgetting the kind words of recognition.

Coming to Washington?

When passing through Washington take advantage of the opportunity to visit the Institute. Students and graduates are always welcome. Street cars marked with route numbers 90 or 92 and buses bearing route numbers S1 and S2 pass our door. But to avoid disappointment bear in mind that our hours are 8:15 a. m. to 5:00 p. m. We are not open after 5:00 p. m. and the Institute is closed all day Saturday, Sunday and legal holidays.

He does this every year to check on his employees. Thinks no one recognizes him.

RADIO-TRICIAN
REG. U.S. PAT. OFF.

Service Sheet

Compiled Solely for Students and Graduates

NATIONAL RADIO INSTITUTE, WASHINGTON, D. C.

RCA VICTOR MODEL 9TX-50

(Chassis No. RC-435)

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 top edge of pointer just touches rivet in dial plate.

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.

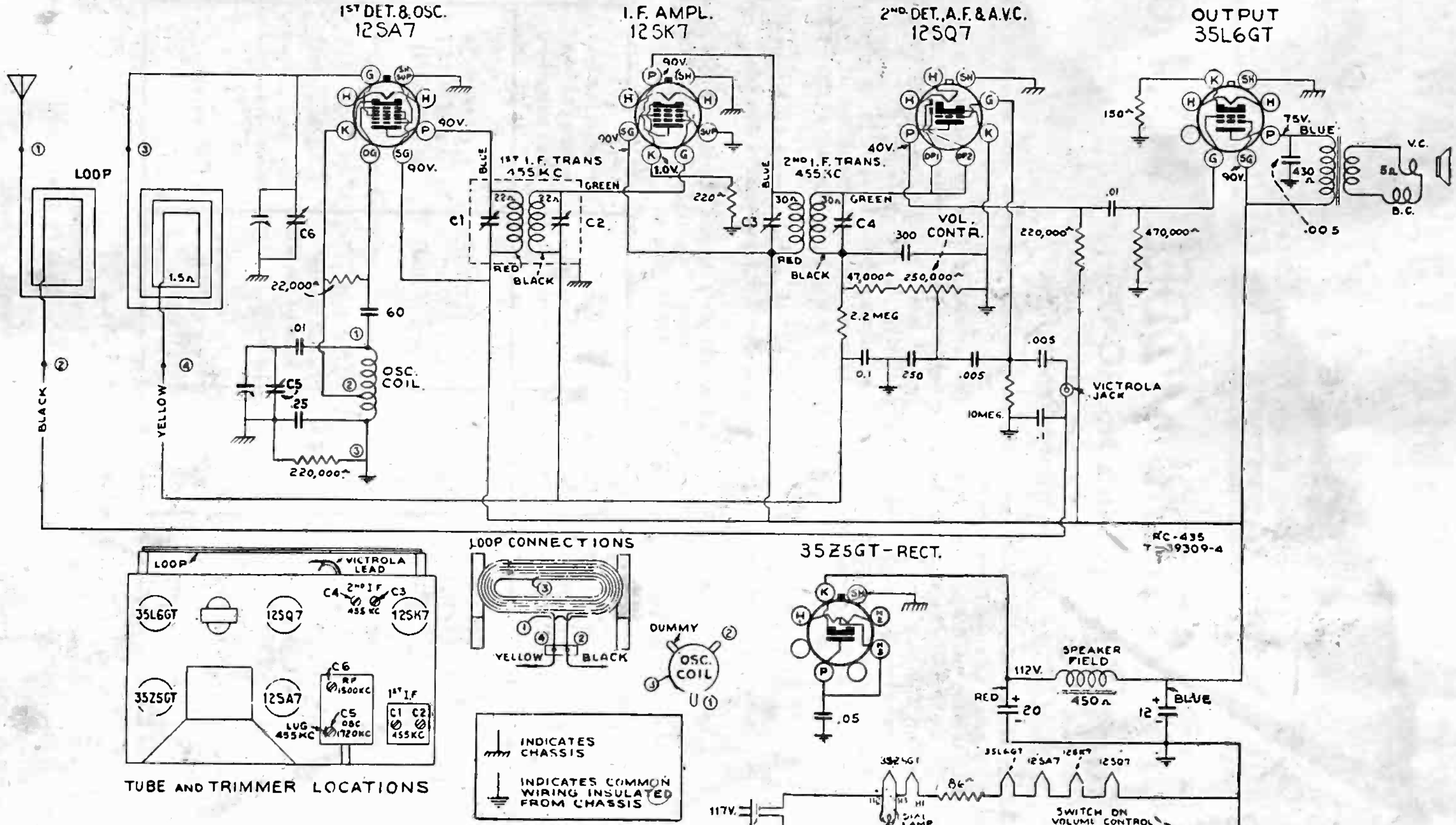
Victrola Attachment.—A jack is provided on the rear of cabinet for connecting a Victrola Attachment into the audio-amplifying circuit. The cable from the Victrola Attachment should be terminated in a Stock No. 31048 plug to fit the jack.

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	Tuning condenser stator (osc.) in series with .01 mfd.	455 kc	Quiet-point at 1,600 kc end of dial	C1, C2, C3, C4 (1st and 2nd I-F transformers)
2	Antenna term. of ant. loop in series with 100 mmfd.	1,720 kc	Full clockwise (out of mesh)	C5 (oscillator)
3		1,500 kc	Resonance on 1,500 kc signal	C6 (antenna)

Precautionary Lead Dress

1. Dress 2nd I-F green lead close to chassis and under other parts.
2. Dress lead from gang condenser to grid of 12SA7 close to chassis and away from 12SQ7 socket.
3. Dress blue 1st I-F lead under volume control close to chassis.
4. Dress blue 2nd I-F lead close to chassis and behind 12SK7 socket.

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



Schematic Circuit Diagram

N.R.I. ALUMNI NEWS

Charles J. Fehn .... President
Peter J. Dunn .... Vice-Pres.
Earl R. Bennett .... Vice-Pres.
F. Earl Oliver .... Vice-Pres.
Oliver B. Hill .... Vice-Pres.
Earl Merryman .... Secretary
Louis L. Menne .... Executive Secretary

NOMINEES FOR OFFICE DURING 1946

THE results of the primary for President, Vice Presidents, Secretary and Executive Secretary show that, for the most part, our members have voted for tried and true old-timers in our Alumni Association. However it is pleasing to say that a number of new or near-new candidates are also offered to our membership. This is a healthy condition. New blood in any organization is desirable if for no reason other than to keep the old-timers on their toes.

For President the tally sheet shows Peter J. Dunn, formerly of Baltimore but now on the West Coast, and Harry R. Stephens of Detroit. Pete Dunn has held office in our National organization as long as we can remember. He was President for four consecutive years. As we mentioned in previous issues, we had to amend the by-laws of our Constitution to give someone else a chance at the Presidency. The amendment, which was passed in 1939, limits the office of President to one term of one year but leaves the way open for the candidate to again qualify for President after one or more years have elapsed. In other words, the President may not serve two consecutive terms but he is eligible for any other national office. So Pete Dunn is back as a candidate for President.

Harry R. Stephens, the other candidate for President, has never held a National office but he is not entirely a new-comer. In fact, last year he was a candidate for President. It was his first recognition as a candidate for a National office and he ran very well, although short of election. For several years he has served as Secretary of Detroit Chapter and has done a grand job in that capacity. Harry Stephens is very businesslike in his work, dependable, enthusiastic. For a man who was little known outside of his own chapter up to a few years ago, Harry Stephens has indeed come along fast. He is a grand fellow.

There you have it, fellow Alumni members—for President choose between Peter J. Dunn and Harry R. Stephens.

Charley Fehn, of course, will take his place on the honor roll with other past presidents. Fehn is a grand organization worker—a fine man in every respect.

For Vice Presidents we have eight candidates, four of whom will be elected. Again we have some well known names and several new ones. Earl R. Bennett and F. Earl Oliver are ever reliable. Harry Andresen, Ernest W. Gosnell and Harold Bailey have been candidates in previous elections and are gaining strength right along. Oliver B. Hill is a popular hold-over. Frank Zimmer and Claude W. Longstreet are strictly first-timers and constitute some of the "new blood" we mentioned previously. Eight good men —all—and take your choice of four.

Earl A. Merryman, like old man river, keeps running along. On the ticket for Secretary is our good friend John Gough, of Baltimore, who is known to many of us as the personification of a true gentleman.

Louis L. Menne and Robert Many of Washington, D. C., make up the ticket for Executive Secretary. Both admit they are good men so you cannot go wrong no matter which one you vote for—but please do vote.

It will be interesting to our members to know that a considerable number of men were recognized in the balloting. The following received votes, although not enough to be nominated.

For President

R. Wallace, Ben Hill, Ga.
Robert Many, Washington, D. C.
Oliver B. Hill, Burbank, Calif.
Earl R. Bennett, Evanston, Ill.
H. Nichols, Lowell, Ariz.
F. Zimmer, New York, N. Y.
Bert Wappler, New York, N. Y.
R. Sawyer, Vancouver, Wash.
Wm. Peterson, New York, N. Y.
F. Earl Oliver, Detroit, Mich.
J. Jenkins, Washington, D. C.

E. W. Gosnell, Baltimore, Md.
Max Silvers, Raleigh, N. C.
L. Kunert, Middle Village, N. Y.
Orlando Irmin, Vicksburg, Miss.
Omer LaPointe, Salem, Mass.
Louis Cõrestin, Boston, Mass.
Chas. Shipman, Cleveland, Ohio.
Earl Merryman, Washington, D. C.
H. Andresen, Chicago, Ill.
G. DeRamus, Selma, Ala.
John Stanish, Detroit, Mich.
Wm. Martin, Kansas City, Kans.

For Vice President

L. Crestin, Boston, Mass.
R. Many, Washington, D. C.
P. Abelt, Denver, Colo.
L. Harrison, Ellis, Kans.
J. Layman, Hector, Minn.
D. Smelley, Cottondale, Ala.
R. Sawyer, Vancouver, Wash.
L. Kunert, Middle Village, N. Y.
J. Williams, Bellingham, Wash.
E. Lisenbee, Wells, Nev.
C. Parker, Lovelock, Nev.
R. A. Heise, Wheeling, W. Va.
C. H. Shipman, Cleveland, Ohio.
R. Drake, Cedar Falls, Iowa.
A. H. Wilson, Canon City, Colo.
B. Hiller, Detroit, Mich.
E. Smith, Winnipeg, Man., Canada.
R. Harrison, West Point, Miss.
E. Bergeron, Sherbrouke, P. Q., Canada.
J. Jerry, Exeter, Calif.
C. Garrett, Washington, D. C.
J. Stegmaier, Arlington, N. J.
L. McAlister, Mt. Berry, Ga.
H. Leepers, Canton, Ala.
A. Miller, Cicero, Ill.
D. Swann, Springhill, N. S., Canada.
A. Stanley, Spokane, Wash.
John Bills, Boise, Idaho.
Wm. Martin, Kansas City, Kans.
Wm. Nichols, Cynthiana, Ky.
Wm. Fox, New York, N. Y.
Orville Cook, Springfield, Mo.
Pete Peterson, New York, N. Y.
C. S. Burkhart, Kansas City, Mo.
Archie Burt, New York, N. Y.
Carl Darner, Sweet Grass, Mont.
V. S. Capes, Fairmont, Nebr.
John Kreitner, Buffalo, N. Y.
Charles Dussing, Syracuse, N. Y.
Joseph Snyder, Sunbury, Pa.
Clyde Kiebach, Washington, D. C.
Wm. Spathelf, Washington, D. C.
W. P. Collins, Pensacola, Fla.
Lowell Long, Geneva, Ind.
O. L. Kirkpatrick, Augusta, Kans.
K. M. King, Wichita, Kans.
S. E. Banta, Gonzales, La.
J. B. Gough, Baltimore, Md.
Samuel Robinson, Hagerstown, Md.
Austin Vachone, Bath, Maine.
Harold Davis, Auburn, Maine.
Ralph Locke, Calais, Maine.
Laurence E. Grant, Belmont, Mass.
A. Singleton, Chicopee, Mass.
Frederick Gaull, Freeland, Mich.
A. Campbell, St. Louis, Mo.
Ewell Wilkinson, Carlsbad, N. Mex.
Alfred Guiles, Corinth, N. Y.
Jesse Starr, Dobbs Ferry, N. Y.
Jacob Knaak, Cleveland, Ohio.
George Newton, Eugene, Oreg.
Elmer Hartzell, Allentown, Pa.
Argil Barnes, Jonesboro, Tenn.
Richard Mallard, Dallas, Texas.
Walter Leland, Orleans, Vt.
A. P. Caldwell, Buchanan, Va.
Wm. Wiesmann, Ft. Atkinson, Wis.
Robert Kirkman, Calgary, Alta., Canada.
Donald Swan, Springhill, N. S., Canada.
G. C. Gunning, Smith's Falls, Ont., Canada.

For Secretary

M. Perkins, Bristol, Conn.
W. Collins, Pensacola, Fla.
F. E. Oliver, Detroit, Mich.
H. Stephens, Detroit, Mich.
J. Collins, Paris, Tenn.
E. Fonseca, Union City, N. J.
A. Stanley, Spokane, Wash.
P. Dunn, Baltimore, Md.
C. Fehn, Philadelphia, Pa.
J. Jenkins, Washington, D. C.
Wm. Wiesmann, Ft. Atkinson, Wis.
A. Burt, New York, N. Y.
J. Dixon, St. Joseph, N. B., Canada.
Oliver Hill, Burbank, Calif.

For Executive Secretary

Austin Vachone, Bath, Maine.
C. Fehn, Philadelphia, Pa.
H. Andresen, Chicago, Ill.
A. Campbell, St. Louis, Mo.
E. Merryman, Washington, D. C.
I. Gardner, Saratoga, N. C.
E. Gosnell, Baltimore, Md.
R. Mallard, Dallas, Texas.
J. Stanish, Detroit, Mich.
J. Duncan, Duncan, Wyo.
A. Guiles, Corinth, N. Y.
T. Ellis, Richmond, Va.
E. R. Bennett, Evanston, Ill.
Wm. Wiesmann, Ft. Atkinson, Wis.
R. Harrison, West Point, Miss.

All Alumni members are urged to vote. Please use ballot on Page 29. Mail it as early as possible.

The polls close December 30, 1945. All elected officers will serve for a term of one year. The results of this election will be announced in the next issue of the News. Mr. C. Alexander, bookkeeper at NRI, has again been appointed Teller to count the votes. Please mail your ballot to Mr. C. Alexander, Bookkeeper, National Radio Institute, 16th and U Sts., N.W., Washington 9, D. C.

Philadelphia-Camden Chapter

The first chapt meeting of the month is our business meetir The fellows really turn out. The meeting is llowed by lectures, talks, demonstrations an quizzes on the blackboard or the ROA Demo rator. These sessions are conducted by Char J. Fehn, Harvey Morris, John McCaffery, Norr Kraft, Verne Kulp and others. These fellows ow their stuff and we are sure to learn a thing r two at each session.

Our second m thly meeting is all servicing. re are som of us who are only part-time ice men an are still just students who do t know it al but will when we finish our course. These the ones who bring into the chapter the se or problems that they cannot repair themselv, and our good men go to work on them. This ervice costs the member fifty cents for each et or problem solved, and the ney is turne into our treasury for the good the chapter. his source of income has fallen off lately, due the fact that the fellows are becoming darn ood service men. Many thanks to Morris, M affery, Sunday, Kraft, Rood, Kulp, Fehn, an others for their cooperation.

l students ar graduates in this area are in- d to attend ny and all meetings. The ad- ss is Post ice Building, 4706 Comly St., Philadelphia 2 Pa., and the time, the first and third Thursday f each month at 8:00 P. M.

RRY J. SCHNEIDER, *Secretary.*

Alum resident Fehn Visits Washington

rles J. Feh National President of the NRI mni Associ on, made the trip from Phila- phia to Was gton to spend a day conferring on Alumni matt s and visiting with J. E. Smith, E. R. Haas, J. Dowie and others. Then L. L. Menne, Charle ehn and his brother John, who accompanied C rles to Washington, drove to rlington Cem ery to visit the tomb of the Un- wn Soldier also the Washington Airport. Fehns spe a busy day in Washington. We hope they enj ed themselves as much as we enjoyed having em with us.

an who ha ust returned from a world tour telling w he had seen in various parts of the world. " ave seen the Apaches of Montmartre, the W rling Dervishes of the desert, the Pyramids of gypt." "Ever had the 'D.T.'s?' " interrupted the nebriated one. "No, certainly not!" said the aveler. "Well, then, shut up," said the sot, " ain't seen nawthin."

Tear or cut carefully along this line.

Election Ballot

Fill in this ballot carefully, and mail it to National Headquarters immediately.

FOR PRESIDENT (Vote for one man)

- ☐ Harry R. Stephens, Detroit, Mich.
- ☐ Peter J. Dunn, Baltimore, Md.

FOR VICE PRESIDENT (Vote for four men)

- ☐ Frank Zimmer, New York.
- ☐ Ernest W. Gosnell, Baltimore.
- ☐ F. Earl Oliver, Detroit.
- ☐ Earl R. Bennett, Wilmette, Ill.
- ☐ Oliver B. Hill, Burbank, Calif.
- ☐ Harry Andresen, Chicago.
- ☐ Harold Bailey, Peoria, Ill.
- ☐ Claude W. Longstreet, Westfield, N. J.

FOR SECRETARY (Vote for one man)

- ☐ Earl A. Merryman, Washington, D. C.
- ☐ John B. Gough, Baltimore, Md.

FOR EXECUTIVE SECRETARY (Vote for one man)

- ☐ L. L. Menne, Washington, D. C.
- ☐ Robert Many, Washington, D. C.

SIGN HERE:

Your Name ....

Your Address ....

City .... State.........

Polls close December 30, 1945

Mail Your Completed Ballot to:

C. ALEXANDER, BOOKKEEPER
NATIONAL RADIO INSTITUTE
16th and U STREETS, N. W.
WASHINGTON 9, D. C.

Chicago Chapter

We are going along nicely with only one problem to solve. That is a serious one. We still do not have suitable permanent quarters for our meetings. We have tried several places. They either are too small or do not permit us to set up a work bench. We have equipment with which to make all desired tests in connection with Radio servicing but we have not been able to find just the right place to set it up.

We have been meeting in the shops of some of our members. We are considering Garfield Park Field House. Again—plenty of room and all facilities except the most important one—no place for a bench. Any of our Chicago members and friends who may have a suggestion for a meeting place will do us a real favor if they will write or phone Harry Andresen, 3317 N. Albany Ave., Chicago, or phone, Juniper 2857.

At our last meeting Mr. Johnston and Mr. Clock of Burgess Battery Co. spoke to us. They gave us much interesting information on post-war radio products. Each person present was given a fine looseleaf Battery Service Manual.

This meeting was held at the Radolek Co. store, 601 W. Randolph St., through arrangement by our good friend Milton Coleman. As a door prize we raffled off a fine soldering iron and a pound of solder.

Tony Kapischke, our member, has offered his Radio shop as a temporary meeting place and we are taking full advantage of that.

This Chapter is backing our past Chairman, Harry Andresen, for a National Vice President.

We are glad to see some new faces at our meetings. We would like to see more of our older members at our meetings, now that the war is over. Come on, ye good and faithful old-timers, it is time to get together again.

Get your name on the mailing list. Send a postcard to the undersigned at 2306 W. 51st St., Chicago, Ill.

L. C. IMMEL, *Secretary.*

New York Chapter

We have a number of very capable speakers in our Chapter. They know Radio and can deliver interesting and instructive talks. Those who spoke to us in recent meetings are: Alexander Remer on Everyday Radio Servicing, Morris Friedman on Radio Diagnosing, James Newbeck on Circuit Diagram of our own P. A. System, J. E. Williams on Mathematics for Radiomen, Pete Peterson on Trouble Shooting by Signal Tracing, James Newbeck on Frequency Modulation. George Hirsch and other members at various times filled in to relate some of their experiences.

At each meeting Pete Peterson answers the questions which are dropped into the Question Box by our members. Pete, by the way, spent over sixty hours getting together the parts and installing our P. A. System. Several other members of our Executive Committee made sizable contributions in time and parts toward this long desired P. A. System and our members are very grateful.

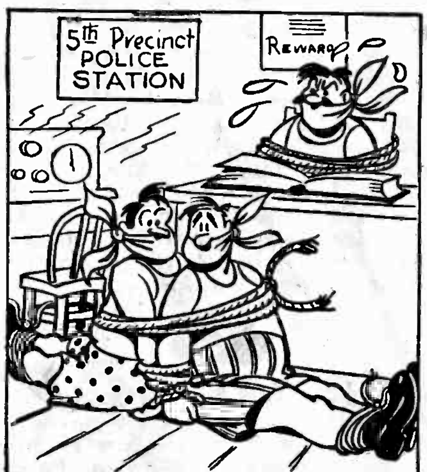
In addition to our Executive Committee which meets regularly to plan the regular meetings and arrange the program we have a number of subcommittees functioning with a leader for each group. It is the team spirit of our Chapter which accounts for the enthusiasm of our members. Our attendance at recent meetings has ranged from 40 to 59.

Within the next few weeks but too late to report in this issue, we will hold our annual social meeting. That will be quite an affair with entertainment, food and refreshments. More on this meeting in the next issue.

Our candidate for National Vice President is Frank Zimmer. He is a hard organization worker and will get our full support.

We took in a number of new members recently. Always glad to have a NRI student or graduate drop in on us to look us over. We meet every first and third Thursday of the month at St. Marks Community Center, 12 St. Marks Place, between 2nd and 3rd Aves., New York City.

LOUIS J. KUNERT, *Secretary.*



Attention precinct five! Robbers attired as police held up roadhouse! Get these men or think up a funny story for the commissioner!

Here And There Among Alumni Members

Mr. Ulpiano M. Muniz of Hanava, Cuba, was a recent visitor in Washington. He graduated from NRI in 1922. Is an employe of the P. A. A. and was honored by the Cuban Government by appointment as Radio Consultant of the newly organized Civil Aviation Advisory Committee for Cuba. Too rushed to come in to see us he nevertheless did speak with J. E. Smith on the telephone. A busy man and loves it.

J. W. Willoughby of Gainesville, Texas, has a full-time Radio business and is prospering. Nice photo from him.

Jerry J. McCarthy is connected with the U. S. Navy School of Music in Anacostia, near Washington, D. C. Jerry is in charge of the Recording Laboratory where he proudly displays his NRI diploma. Incidentally, Jerry and his associates got a nice write-up in *Broadcasting* Magazine.

Joseph Gulya of Fords, N. J., is doing a nice spare-time Radio business. Intends to open a full-time shop soon. Sent us a nice photo—thanks.

If you read Chicago Chapter report on the opposite page you will see that two gentlemen from Burgess Battery made the trip from Freeport, Ill., to address the Chapter. We got two reports from the usually dependable Chicago officers—one gave the names of the Burgess men as Johnston and Clock, the other as Johnson and Coke. So if we seem to be careless about names—this is the explanation.

Bert Wappler, Chairman of New York Chapter, has not been feeling as well as he should. We think he works too hard. There is a fellow who doesn't think anything of working until 2 a. m. That's a case of the boss driving the boss too hard.

Glen Woody of Mountain View, Ark., advertises his Radio business in his local paper with this "all work guaranteed—no play, no pay."

Man and boy, are those New York Chapter members enthusiastic. What spirit! And are they beating the tom toms for Frank Zimmer for Vice President. They are backing Zimmer to a man.

John H. Bailey is still in the army near Marseille, France, where he is hoping daily to receive orders to return to his job as Chief Engineer, Radio Station WJZM, Clarksville, Tenn. Bailey has seen service in England, France, Holland, Belgium and Germany.

H. F. Wilson of Tucumcari, New Mexico, has been appointed Chief Dispatcher, Santa Rosa subdivision of the Southern Pacific Railway. He is keeping his hand in Radio in his spare time.

As we are running out of space for this issue and for this year, right here is a good spot to thank you, and you and you and all for your friendship, your good wishes, your compliments and criticisms during 1945. And now let's give the old year a good kick in the pantaloons and good riddance. Scram! Amscray! Boy, a new year is coming up, new opportunities for all of us. Let's not live in the past. Let's forget water over the dam. This is a new year of great promise—this is 1946. Start now to make the most of it.

Clifford Cranmore of Borger, Texas, is another NRI graduate who is going strong in full time Radio. We saw some of the advertisements he runs in his local newspaper. Nice!

Last issue the Alumni News was high-lighted with some good pictures. This issue we were crowded for space. But please do send photos to us. They are very welcome and we will try to use them as soon as space permits.

B. B. Hinkle and D. W. Robbins have a marvelous Radio service and appliance business in Lockhart, Texas, known as Standard Radio and Refrigeration Service. The opening of their new headquarters at 112 No. Main St. was announced with a full half-page advertisement in the local newspaper. In addition the newspaper carried numerous 4x4 advertisements sponsored by local merchants such as furniture, automobile and gift stores—even the competing Radio shop offered best wishes. "Congratulations," "Best Wishes," "Can mean much to the citizens of Lockhart," "Success to you," "A Credit to our Town" were some of the expressions. There is something sound in community spirit.

E. L. Chambers of the Chambers Radio Supply Co., Cincinnati, Ohio, is planning a modernistic building with 10,000 sq. ft. of warehouse and general display room facilities with a large parking lot for the convenience of customers.

Clemence Ripperger of Adrian, Minn., suggests a local Chapter in the middle west—he mentions St. Paul. There is a lot of interest in Chapters in various parts of the United States and Canada but we are not going to organize any new Chapters until our soldiers, sailors and marines are back home. It's too hard to travel right now and personal contact is necessary. So, until things get back to normal—Ixnay! Don't ask.

Detroit Chapter member Thomas M. Paterson on Suicide Cliffs at Saipan. He will be seeing us at Chapter meetings soon.

Detroit Chapter

Our first meetings this fall were fully up to standard—average attendance of 32. Seven new members admitted. Considering that almost everyone was out of gasoline and had to ride buses and street cars, the attendance was quite satisfactory. Even the ever reliable Earl Oliver ran out of gas (during strike) and arrived a half hour late to receive a loud razzing from the members.

Effective in December our meetings will be held on the first and third Friday of each month.

Mr. Henry Rissi spoke at our first fall meeting. His fine, easy-to-understand talks on Radio Servicing are always well received.

Our second fall meeting was a dandy. We had an attendance of 43 of whom 12 were visitors. Three of the twelve joined the chapter.

Mr. James W. Head of Industrial Electronics, Inc., was our speaker. He gave an exceptionally fine talk on Television and explained in detail the workings of the Television tube. This with the aid of the blackboard.

Harold Chase and I set a goal for ourselves. We wanted to build the chapter membership to forty before our term of office expires. We have attained that goal, having now 43 *active* members. So Harold Chase and your humble Secretary feel they can retire to the ranks, when new officers are elected, with a sense of satisfaction knowing that we are turning over a live, vibrant organization. Harold Chase, by the way, has been a fine Chairman. He has put a lot of effort into his work and it has been a pleasure to work with him.

Next scheduled meeting at 2500 Jos. Campau (Chapter headquarters). Get on the mailing list. Send name and address to the undersigned at 5910 Grayton Rd., Detroit 24, Mich.

HARRY R. STEPHENS, *Secretary*.

NATIONAL RADIO NEWS

FROM N.R.I. TRAINING HEADQUARTERS

Vol. 11 December, 1945-January 1946 No. 12

Published every other month in the interest of the students and Alumni Association of the

NATIONAL RADIO INSTITUTE
Washington, D. C.

The Official Organ of the N. R. I. Alumni Association
Editorial and Business Office, 16th & You Sts., N. W., Washington, D. C.

L. L. MENNE, EDITOR
J. B. STRAUGHN, TECHNICAL EDITOR

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