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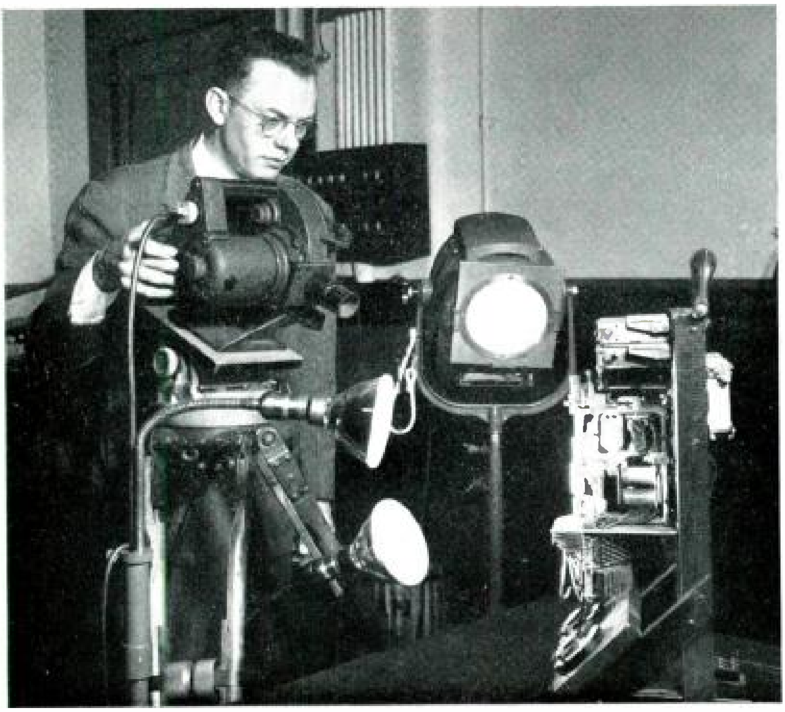


FASTAX

An Ultra-High-Speed Motion-Picture Camera

By H. J. SMITH
Switching Apparatus Development

HIGH-SPEED motion-picture photography is not a new subject at Bell Telephone Laboratories. As early as 1934 high-speed motion pictures were taken at 2,000 pictures per second in connection with studies of contact chatter in the U-type relay. This work greatly facilitated the elimination of chattering contacts. Since then, the use of high-speed motion-picture photography has been extended to studies of other telephone apparatus, such as switching mechanisms, clutches and cams, station ringers, and the impact testing of plastics.

Recognizing the utility of ultra-high-speed motion pictures, the Laboratories undertook to develop a camera* capable of taking 4,000 pictures per second on 16-mm film. This was built and put into operation in the early part of 1936, and has been used successfully in the design analysis of such varied equipment as fuses, arcing contacts, selectors, and relays, and machining operations including punch presses, lathes, shapers, and milling machines. High-speed motion-picture studies have also been found useful in connection with many laboratory tests including drop tests, impact tests and machines for the testing of various kinds of springs.

*W. Herriott, S.M.P.E. JOURNAL, *Jan.*, 1938, and J. R. Townsend, ELECTRICAL ENGINEERING, *Nov.*, 1940.

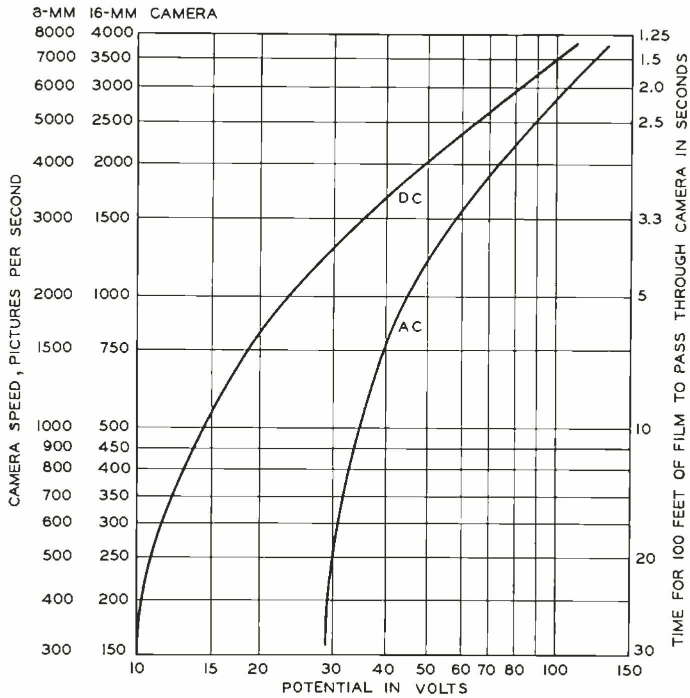


Fig. 1—Pictures per second and time required for 100 feet of film to pass through the high-speed camera plotted against voltage for both alternating and direct current

The latest Laboratories design of high-speed camera is capable of taking pictures at the rate of 8,000 per second. This camera is known as the Western Electric Fastax High-Speed Motion-Picture Camera. Pictures taken at this speed will give a time magnification of 500 to 1 when projected at the normal speed of 16 pictures per second.

Fastax cameras are made in both 8-mm and 16-mm models. The 8-mm model will take from 300 to 8,000 pictures per second, depending on the voltage applied to the motors as shown in Figure 1, while the 16-mm model will take from 150 to 4,000 pictures per second. Approximately full speed is obtained at nominal line voltages from 110 to 125 volts. To secure lower speeds a rheostat may be placed in series with the motor to reduce the voltage applied as shown.

These new cameras are of the continuous-motion type employing an optical compensator, or rotating prism, between the lens and the sprocket. The 8-mm camera has an eight-sided prism permitting eight pictures per prism revolution, and the 16-mm camera has a four-sided prism permitting four pictures per prism revolution; each revolves in synchronism with the film. The prism creates successive and properly spaced images traveling with the film. Figure 2 shows the schematic of this system. The image gathered by the lens is refracted by the prism upward to meet the incoming frame, and as the frame advances downward, the image follows, thereby permitting continued exposure throughout the period that the film travels past the aperture. The duration of the exposure is controlled by the speed of rotation of the prism.

Both of these cameras are arranged to use either 100-ft. or 50-ft. spools of film. At top speed the film travels through the camera at about 70 miles per hour. At this speed the exposure

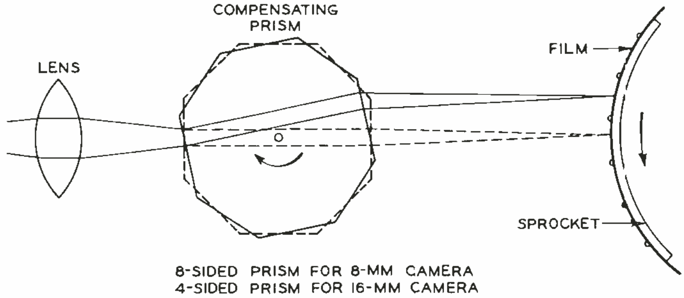


Fig. 2—Schematic diagram of the optical system of the Fastax camera. The prism shown is for the 8-mm model

time per frame is about 1/30,000 of a second for the 8-mm camera and 1/12,000 of a second for the 16-mm camera. At full voltage one hundred feet of film runs through the camera in approximately one and one-quarter seconds.

Figure 3 shows the inside of the camera and the relation of the compensating prism to the sprocket. The sprocket is driven directly by an electric motor and the prism is geared to its shaft.

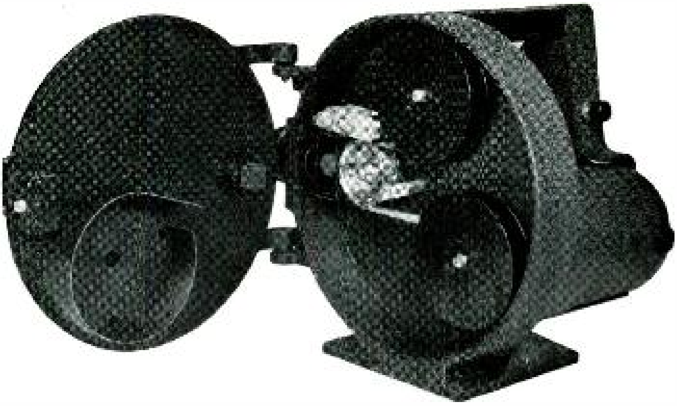


Fig. 4—The viewing prism is fastened to the inside of the door near the hinge edge

The path of the film is from the upper spindle, under the hold-down roller, around the sprocket, to the take-up reel.

In the 8-mm camera, after the film is run through on to the take-up reel, it can be put back on the supply spindle and rethreaded for another run, in the same manner as with the standard speed "Double 8" cameras.

The holes in the sprocket through which the image may be viewed on a ground glass screen are shown in Figure 4. The viewing prism shown on the door fits between the hub and rim of the sprocket when the door is closed, and looks at the object through one of the sprocket holes and the camera lens, thereby eliminating parallax. It projects the image on the ground glass viewing screen shown in Figure 5.

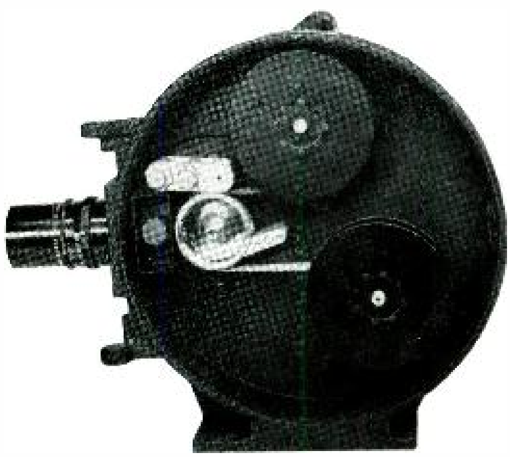


Fig. 3—Interior of Fastax camera showing octagonal prism and sprocket

The motor side of the camera is shown in Figure 6. There are two motors, one of which drives the sprocket while the other drives the take-up reel.

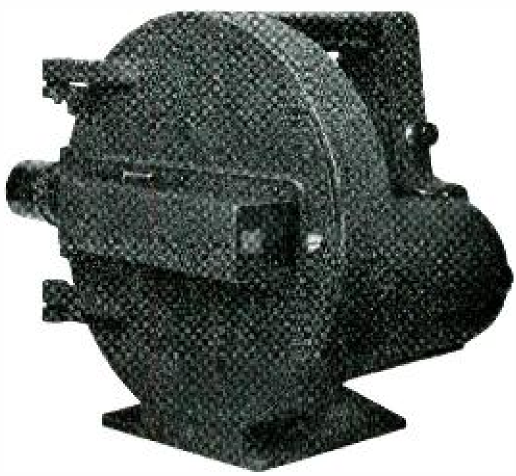


Fig. 5—The ground glass viewing screen is on the outside of the cover

These are identical motors except for the direction of rotation, and are not connected electrically or mechanically except by the film inside of the camera. These are universal motors, and can be operated on alternating or direct current. The starting button is a momentary contact switch, held down long enough

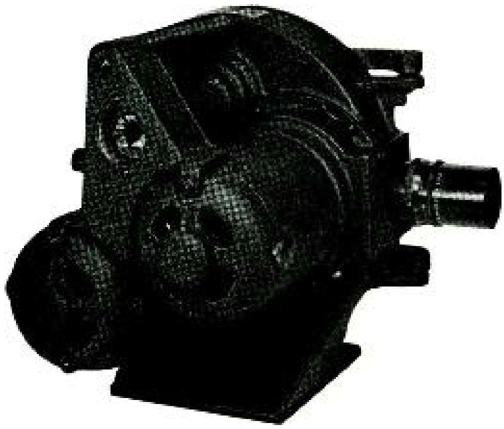


Fig. 6—Motor side of the Fastax camera

to carry the film through the camera.

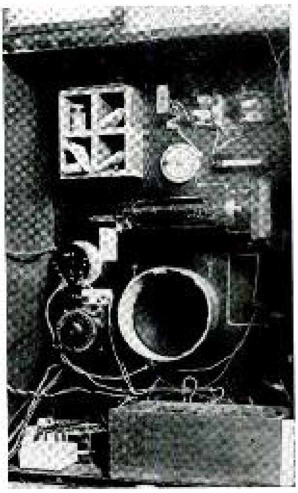
It is obvious that the higher the taking speed becomes, the greater becomes the intensity of illumination required. If pictures are taken 500 times faster than normal-speed pictures, the illumination will have to be 500 times greater than normal. To secure this high illumination, it has been necessary to use lighting units capable of providing intensities at the object of from 10,000 to 500,000 foot-candles. The efficiency of light production in an incandescent lamp increases with the temperature of the filament. Projection type tungsten filament lamps may be heated to within a few degrees of their melting point to secure maximum brightness. The maximum possible intensity is secured when the filament is projected so that the image is the same size as the filament itself. Since the focused images of the over-volted filaments are very hot, it is often necessary to place water cells or heat-absorbing glass between the lights and the object so as not to overheat the object. Since life is shortened considerably for lamps used in this manner, two lamps are usually wired in series during the setting-up period and then switched to a parallel circuit for the short period while the film is being exposed. Using elliptical mirrors or aspheric condensers of wide aperture, the lights are focused only on those parts of the object that are in motion. If one light does not cover the entire field, additional ones are added to supply sufficient illumination as shown in the photograph at the head of the article. Concentrated and properly arranged lights are the secret of success in high-speed photography; but each subject is a new problem and proper lighting is something of an art.

THE AUTHOR: H. J. SMITH, shown in the headpiece, joined the Engineering Department of the Western Electric Company in 1924. In the Laboratories he has been concerned with lighting and photographic problems since 1929, when he became associated with sound pictures. In later years he was responsible for the development and use of high-speed motion-picture photography as a laboratory tool. The present design of the Fastax camera is a natural outgrowth of this work. At the present time Mr. Smith is engaged in optical and photographic problems in connection with the War.

Historic Firsts

Long-Distance Radio Telephony

WHEN wire telephony passed city limits and began to interconnect cities it came to be described as long distance. By improvements and refinements the range was gradually extended to that between New York and Denver. That was about the limit; compared to that anything less might not be short but anything more was certainly too long. Then about 1915 the vacuum tube and other developments removed this limitation and telephony entered its present phase where no earthly distance is too long.



Vacuum-tube modulator in the 1915 experimental radio transmission from Arlington to Paris

Radio telephony also underwent a revolutionary change about the same time. For the new medium of ether transmission telephone transmitters were used to modulate antenna currents—to vary the radio frequency current just as they had been used to modulate the direct (zero frequency) currents of wire circuits. This new art, however, also came up against a limit; it could span only a few miles.

In wire telephony the limit was broken by using vacuum tubes as repeater elements, supplying new energy at appropriate points along the route so as to transmit further and without impairment the products of the transmitter's original modulation. In radio, on the other hand, because the initial energy has to be sufficient, it was not possible to span considerable distances since large antenna currents could be modulated only slightly.

The radically new method which was required came from a coördinated program of research in Bell Laboratories. At the proper radio frequency there was generated a current small enough to be adequately modulated by the telephone current; the products of this mixing were then raised to high power by vacuum-tube amplifiers and supplied to the antenna. By this technique long-distance radio telephony became practicable. No longer limited to a few score of miles, it jumped across the Atlantic in the Laboratories' 1915 experiments and also reached Honolulu. Two-way transatlantic radio telephony became a commercially available service in 1927.

Later, through other vacuum-tube techniques, it became possible to modulate efficiently even very large currents; and a wide engineering choice was opened to designers of radio transmitters. With these developments of Bell Laboratories, radio telephony like wire telephony became truly long distance—limitless in its range. Modifications and improvements from further researches have since made more effective and economical the radio coverage of the world by speech.

How Well Do I Hear?

By M. B. GARDNER
Acoustical Research

SOONER or later in the course of his life, probably everyone asks himself "How well do I hear?" At the New York and San Francisco World's Fairs in 1939, over half a million people visited the Bell System Exhibit to secure the answer. The nature of hearing and knowledge as to the extent and types of deafness are basic to the aims of the Bell System.

How well we hear cannot generally be answered by any simple statement because our acuity of hearing will vary with the nature of the sounds. Some understanding of the reaction of our hearing mechanism to various sounds is necessary for an intelligent appraisal. Acoustical pressures on the ear drum must pass through a mechanical system and then a nervous system before they can become sound; any defect in either will affect the hearing. The mechanical system consists of three small bones—called the hammer, anvil, and stirrup—that form a leverage system between the drum and another diaphragm—called the oval window—which seals the main entrance to the inner ear. This inner ear is filled with liquid, and it is the vibrations in the liquid—transmitted to it by way of the drum, the leverage system, and the oval window—that affect the auditory nerves and result in sounds being heard.

In an earlier article,* it was pointed out that the power in a sound wave depended not only on the pressure but on the impedance of the medium through which it was transmitted. Air is a tenuous fluid, and small pressures will produce comparatively large intensities, just as a small electrical resistance may result in relative large power consumption with only small voltages. The same pressure in a liquid would result in much lower intensities. The leverage system overcomes this difference by increasing the pressures on the drum some sixty fold before transmitting them to the liquid of the inner ear. One of the two major types of deafness is an affection of this leverage system that reduces its effectiveness in transmitting vibrations. The other is an affection of the nerves or their terminals that results in less response from the same stimulus.

The effect of any deterioration of the auditory system is to raise all or part of the threshold of hearing. As a result of this, pressures at some or all frequencies must be greater than normal to be heard at all. Hearing loss may thus be conveniently described in terms of the amount the threshold has been raised. Since the threshold is given in terms of db above reference level, the hearing loss is given in the number of db by which the threshold is raised above normal. A hearing loss of 30 db thus means that the intensity of the sound must be 30 db, or a thousand fold, greater than the normal threshold to be heard at all. A plot of the hearing loss against frequency is called an audiogram, since it is a graphic description of the nature of the hearing impairment.

Apparatus for measuring hearing loss, called audiometers, have long been manufactured by the Western Electric Company. These vary considerably in arrangement depending on how they are to be used, and on how extensive a test is to be made. One of the models which

*RECORD, *June*, 1943, *p.* 341

has been widely used is the 2A audiometer. It includes an adjustable oscillator as a source of single-frequency tones, and an attenuator by which the intensity level of the tone may be varied. The person whose hearing is being tested listens to the tone through a small receiver, and is given a push-button with which he lights or extinguishes a lamp in front of the operator. Normal procedure is to have the lamp lighted as long as the tone is heard, and the patient extinguishes the lamp by releasing the push-button when the tone disappears.

Eight frequencies are provided from 64 to 8,192 cycles, which covers the important range of hearing, and the frequencies are selected as desired by keys on the audiometer. The output circuits for the various frequencies are so arranged that with the attenuator dial set to the point marked zero loss, the output of the receiver is at an intensity corresponding to the threshold of the average ear for that frequency. At this position of the dial the attenuator is inserting nearly its maximum loss—a small amount of additional loss being provided to enable measurements to be made on those who hear somewhat better than the average. The dial is graduated in 5 db steps. Normal procedure is to set the dial at a level that the patient can certainly hear, and then to reduce it step by step until the tone is no longer audible. The reading of the dial at the last step the patient hears gives his hearing loss at that frequency.

The intensities corresponding to the zero settings of the 2A audiometer, which represent the threshold of hearing for audiometric purposes, were obtained from tests on a group of people of normal hearing between the ages of 20 and 30. They are on the average from 10 to 15 db higher than the M.A.P. (minimum audible pressure) values given in the earlier article. The latter were obtained under accurately controlled laboratory conditions using trained observers for the patients.

The objective of the M.A.P. values was to determine the minimum pressures that can be heard by the human ear, rather than the pressures heard under normal conditions by a more average group of people. That the values used by the 2A audiometer are well suited to their purpose is indicated by results obtained at the World's Fair in 1939. The threshold values of the 2A audiometer correspond very closely to those found during this survey.

Although the threshold curve is of fundamental importance in all acoustical work, there is another curve that is of interest, and that at times becomes of critical importance. As the level of a sound is increased above the threshold, the sound becomes louder and louder until the response becomes more that of the sense of feeling. The simulus is felt rather than heard, and at somewhat higher levels becomes painful. A curve drawn through these pressures at which the response is one of feeling as well as

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THE AUTHOR: M. B. GARDNER received the A.B. degree from Brigham Young University in 1930 and joined the Research Department of the Laboratories in June of that year. Since then he has devoted his time to problems in physiological acoustics, particularly as applied to the deafened individual. In the spring of 1936 he acted as a Technical Supervisor for the U. S. Public Health Service on a nationwide hearing survey project and was associated with the hearing test demonstrations at the New York and San Francisco World's Fairs. He is now concerned with the development of equipment for the Armed Forces.

M. B. GARDNER

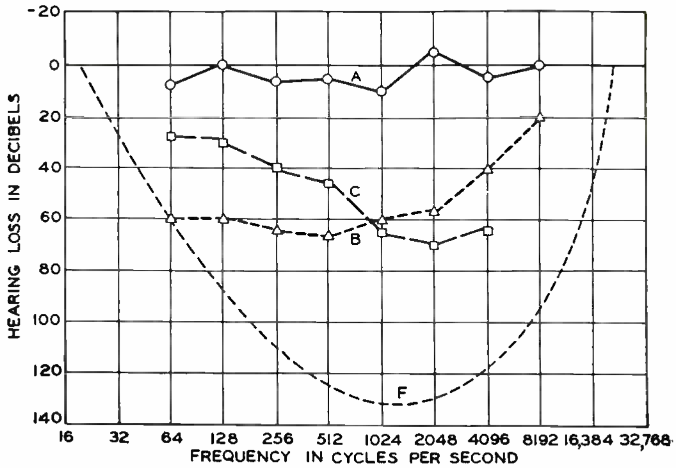


Fig. 1—Audiograms for: (A) a person with normal hearing; (B) one with conductive deafness; and (C) one with nerve deafness where this increases at the higher frequencies

hearing is called the threshold of feeling, and marks an upper limit to audible pressures. The area between these two thresholds represents the range of audible sound pressures, and by plotting the results of audiometer measurements on such a field, it is possible to gauge at a glance the relative seriousness of any particular pattern of hearing loss.

Charts indicating these two thresholds are usually employed when plotting hearing losses but, on them, the threshold of hearing is represented by a horizontal line near the top, and the threshold of feeling is plotted in db relative to the threshold of hearing. This gives a chart as shown in Figure 1, on which have also been plotted the results of audiometric measurements on three ears with different types of hearing loss.

The audiogram marked A is for a person of normal hearing, and needs no particular comment. At no frequency does it depart from the threshold by more than a very small amount. All hearing studies have shown that one is not conscious of any hearing impairment with a loss less than 20 or 25 db, and thus a deviation of only 5 or 10 db is insignificant for any practical purpose. In contrast with curve A, an audiogram following closely the threshold of feeling, curve F of Figure 1, would represent total loss of hearing.

As has already been remarked, deafness may be due either to a transmission loss in the three bones of the middle ear, by means of which vibrations are passed from the drum to the oval window, or to a reduced response of the auditory nerves. The former is called "conductive deafness," and the latter "nerve deafness." An audiogram typical of nerve deafness is shown at C. The loss usually increases at the higher frequencies. With conductive deafness, on the other hand, the loss is more constant with frequency, and may even be less at the higher frequencies as shown by audiogram B. In addition, of course,

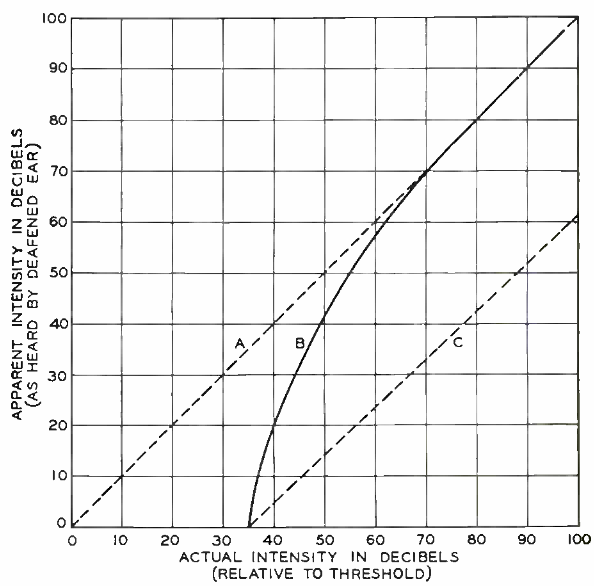


Fig. 2—Apparent intensity as sounds are raised above the threshold for nerve deafness, curve B, and conductive deafness, curve C

both forms of loss may be present, giving what is called mixed deafness.

Even when it is not clear from the audiogram which form of deafness is predominant, the two types of deafness may be distinguished by other criteria. As a result of the lack of sensitiveness of the responding system that results from nerve deafness, no response is obtained until the stimulus reaches a certain value. Beyond this value, however, the response increases rapidly with the stimulus. So rapidly, in fact, that at high-intensity levels individuals having one normal ear and one nerve-deafened ear judge the sound to be equally loud in either ear.

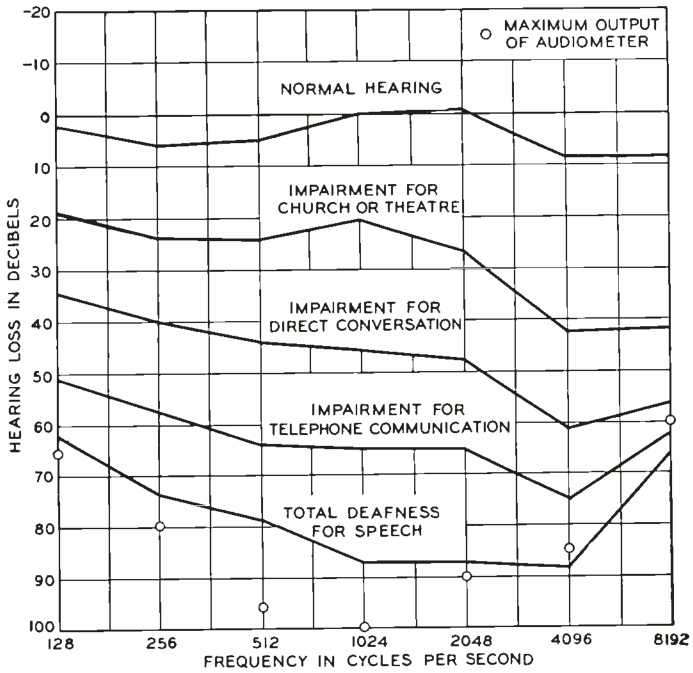


Fig. 3—Average audiograms for groups reporting different degrees of hearing in the Public Health survey

With conductive deafness, this is not true. With it all sounds, of whatever level, suffer the same loss. The deafened person therefore hears more nearly like the normal individual except that all sounds are reduced in intensity. Such an individual is not nearly so apt to complain of someone shouting too loudly in his ear as would the individual who has become affected by nerve deafness.

This situation is illustrated by the curves of Figure 2, where B represents a nerve deafness, and C, a conductive deafness, both having a threshold raised 35 db above normal. With conductive deafness, curve C, sounds are heard at an apparent intensity of 35 db below actual intensity regardless of their level. With nerve deafness, on the other hand, curve B, the apparent intensity rises rapidly at first and approaches nearer to the actual intensity as the level increases.

The curves of Figure 2 might lead one to the conclusion that in terms of ability to understand speech the conductive deafened case represented by curve C would be at a distinct disadvantage relative to the nerve-deafened case B. Actually the two are about equally handicapped compared to the normal individual. While the apparent intensity (as judged by loudness) increases much more rapidly in the nerve-deafened case, the loss in ability to understand speech is determined primarily by the threshold shift, which is the same for curve B as it is for curve C.

Because almost any audiogram is irregular—the losses for various frequencies not falling on a straight line or even on a smooth curve—the curves of Figure 2 would represent the true relationship for only one particular frequency. They serve, however, to make more graphic this particular difference between nerve and conductive deafness. The way in which a person hears, therefore, depends on more than the amount the threshold is raised at various frequencies. It depends also on the nature of the deafness of the individual.

Two extensive studies have contributed to our knowledge of the hearing ability of large groups. One was based on the results obtained from the Bell System exhibits at the World's Fairs of 1939-1940,* already referred to, and the other was a nation-wide survey undertaken by the United States Public Health Service a year or so previously. These studies sought to discover the extent and the degree of hearing loss of the country's overall population.

*Record, *Dec.*, 1939, *p.* 98.

Those tested in the Public Health Survey were asked to indicate their hearing ability according to five classes: 1, no noticeable difficulty in hearing; 2, unable to understand speech in public places such as churches or theaters; 3, unable to understand speech from a person two or three feet away; 4, unable to understand speech from a telephone; and 5, unable to understand speech under any condition. Their audiograms

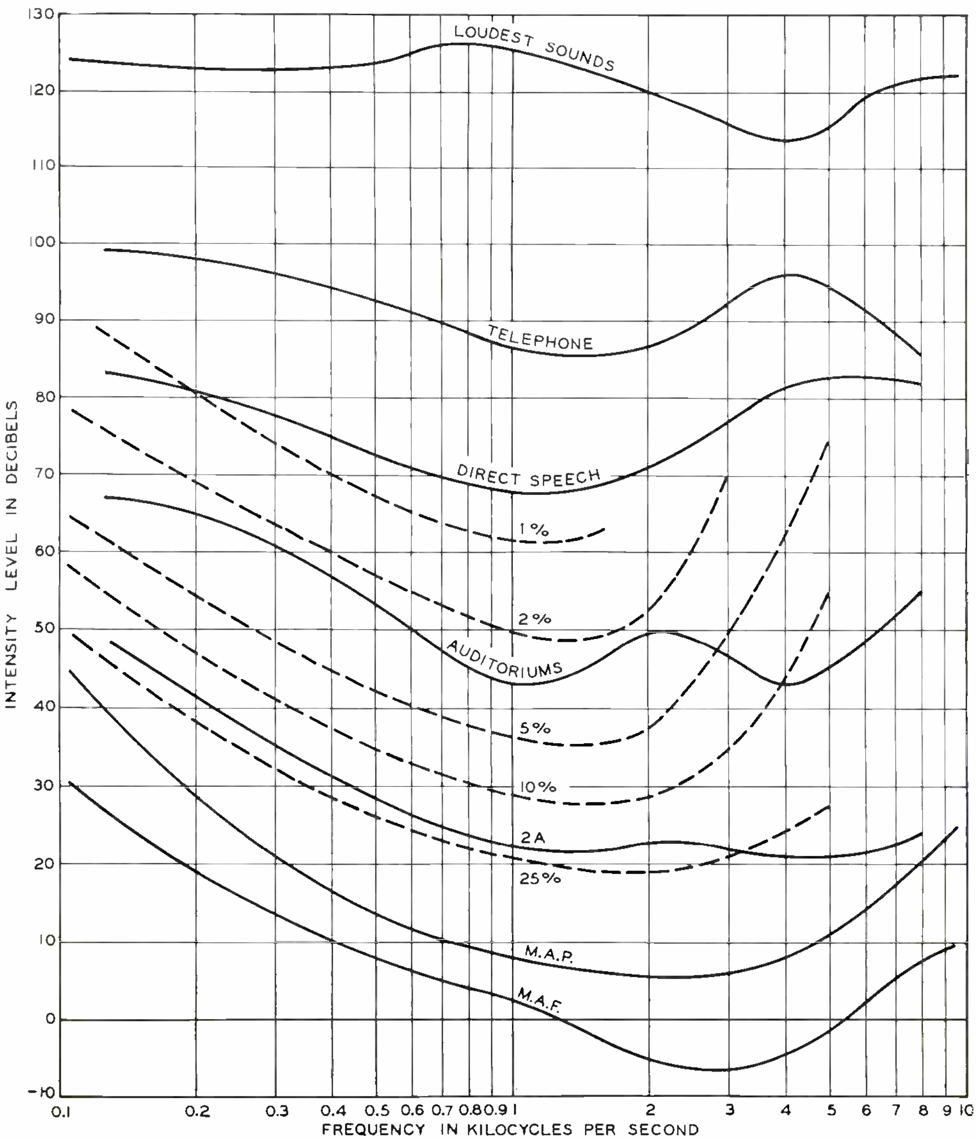


Fig. 4—Summary of thresholds of various types

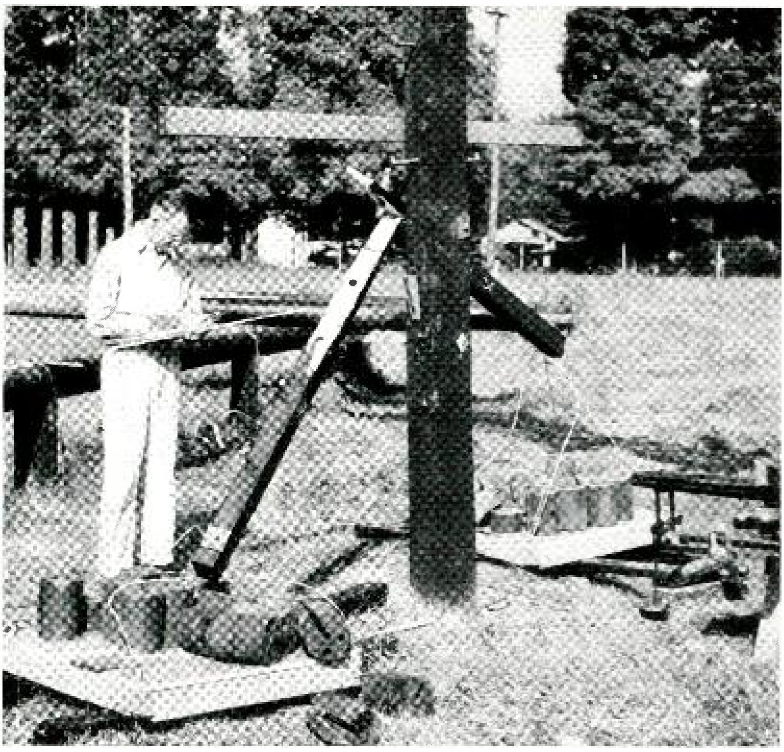
were then taken and recorded. Such tests were made on some 9,000 persons, and the audiograms of those of each of the five classes were then averaged to discover the amount and type of loss that was responsible for the various inabilities to hear. These results are shown in Figure 3. The five classes of loss are separated on the average by about 20 db. For those reporting normal hearing, the average loss was about 5 db, while for the other four classes it was 25, 45, 65, and 85 db, respectively, the latter figure corresponding to total deafness for speech.

How large a portion of the population suffers from various degrees of hearing loss was estimated from an analysis of the World's Fair hearing tests. These results are plotted in dotted lines on Figure 4 as a series of raised thresholds marked with the percentage of those who have a threshold higher than that shown. Thus only 25 per cent of the population will have a threshold higher than the one marked 25 per cent, and similarly for the other curves. On this same graph are plotted the threshold curve for the 2A audiometer, the M.A.P. and M.A.F. (minimum audible field) thresholds, and also the results of the Public Health Survey. This brings the various data regarding the ability to hear on one chart where they can be more readily compared.

It will be noticed, for example, that 75 per cent of the population have normal hearing or better, that is, they have a normal threshold as good as the 2A audiometer. Only about 2 per cent have loss enough to make it difficult for them to hear in auditoriums, and only 1 per cent have difficulty in direct speech. The thresholds plotted from the World's Fairs' hearing tests all show a decided rise above 2,000 cycles. This is probably due to the fact that the test included all ages up to 60, and, as already published,* these tests showed that with increasing age there is a sharp increase in hearing loss above 2,000 cycles.

As a result of these various studies there is thus available a large amount of information regarding the nature and extent of hearing loss in our population, and of the pressure ranges required for various abilities to hear. This information is of great value in the design of all acoustic apparatus and circuits, since it permits the design to meet specific requirements and conserves effort and material.

*Record, *Dec., 1939, p. 98.*



Crossarm Strength Tests

By R. C. EGGLESTON
Outside Plant Development

DEMANDS for lumber for defense purposes, especially for Douglas fir produced on the Pacific Coast, have limited temporarily the supply of this wood and also of southern pine for crossarms. Anticipating increasing difficulties from this situation, the Laboratories has been investigating for over a year the possibility of producing crossarms of red and jack pine from Minnesota and Douglas fir from the Rocky Mountain region.

To obtain first-hand information on the strength of crossarms of these species, breaking tests were made at the Chester Field Laboratory on a mixed lot of red pine, jack pine and Douglas fir arms. These arms were selected at random from an experimental lot of ten-pin arms, which had been treated by the supplier with a creosote-petroleum-pentachlorphenol preservative. All of the test arms were knotty but none could be classed as of minimum acceptable quality and only one of the lot contained noticeable slant grain. Their average weight was about thirty pounds, and their cross-sectional dimensions were slightly over the standard size, 3¼ by 4¼ inches. Soon after arrival the arms were stacked side by side out-of-doors with one end elevated and the other on the ground. In this slanting position they were exposed to full sunlight with air circulation to season them.

Each arm tested was mounted on a pole and loaded with weights laid on wooden platforms which were suspended from the end pin-holes. A straight joist was nailed to the pole above the test arm to serve as a datum rail from which the deflections of the ends of the arm could be determined. A sketch was also made to show the location and size of knots or other defects between pin-holes 4 and 7 as numbered consecutively from left to right. Defects located between the ends of the arm and pin-holes 4 and 7, respectively, were ignored as unlikely to have any measurable effect on breaking strength.

The weights used to load the arms were placed on the two platforms by hand in equal increments and as nearly simultaneously as practicable. Weighting was continued until the arm failed. Deflection measurements were made soon after an audible crackling of the wood fibers, or a minute visible rupture in the arm, denoted the beginning of failure. From these measurements and subsequent close observation of further motion of the arm ends reasonably accurate estimates of the maximum deflections were obtained.

When failure occurred the average maximum load on the end of each arm was 509 pounds for red pine, 636 for jack pine and 830 for Douglas fir. The loads that would have been required at each pin position, to have had the same effect as these maximum test loads at the end pin-holes, were calculated to be 178 pounds for the red pine, 223 for the jack pine, and 290 for the Douglas fir arms. The first evidence of failure occurred at loads which averaged about 68 per cent of the maximum loads.

Following the tests, estimates of the moisture and oil content and of the density of the test arms were made by weighing small samples cut from representative arms and then boiling them in toluene in a distillation apparatus to extract the water and preservative oil. These measurements indicated that the test arms were quite dry. Pine samples contained on the average about twelve per cent and fir samples about fifteen per cent of water. The average oil content of the fir samples was only six-tenths of a pound per cubic foot of wood, but this was not considered unduly low because Douglas fir is a difficult wood to impregnate. The red and jack pine samples contained 8.5 and 6.4 pounds, respectively, of preservative per cubic foot. Calculated average densities were 0.375 for red pine, 0.389 for jack pine and 0.455 for fir samples.

With few exceptions the breaks occurred near the pole at or between pin-holes 5 and 6. Breaks in the pine arms were generally short and sharp; whereas many of those in the fir were long and slivering. A large proportion of the

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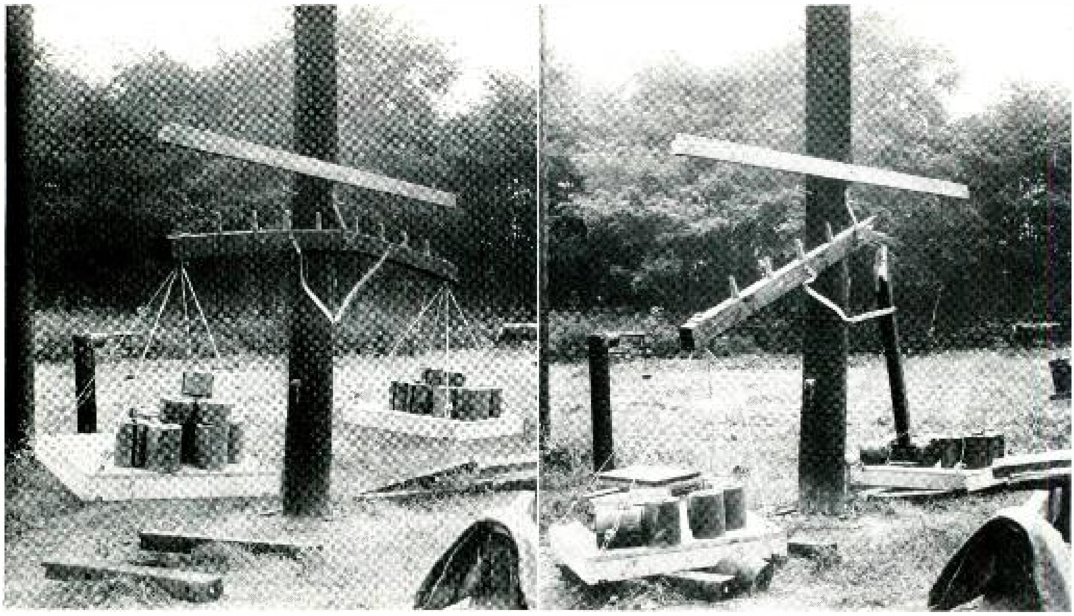
THE AUTHOR: RICHARD C. EGGLESTON graduated from the Sheffield Scientific School of Yale University in 1909 with the degree of Ph.B., and the following year from the Yale School of Forestry with the degree of Master of Forestry. He entered the United States Forest Service in which he was engaged, until 1917, chiefly in silvicultural problems and forest surveys in Idaho and Montana. From 1917 to 1918 Mr. Eggleston was employed in forest valuation work with the Pennsylvania Railroad. Then he served for a year in World War I as First Lieutenant in the Engineering Division of the Ordnance Department in forest products work. After the war he returned to forest valuation and timber survey work for the Pennsylvania Railroad. In 1920 Mr. Eggleston joined the D & R, from which he transferred to the Laboratories in 1927. As a member of the Outside Plant Development Department he has been engaged chiefly with problems relating to the strength of timber and with statistical investigations in the timber products field.

R. C. EGGLESTON



Breaking tests on crossarms at the Chesterfield laboratory. Test arms were loaded with weights suspended from their ends until they broke

The short break in the crossarm shown above is characteristic of jack pine. Long breaks, illustrated in the headpiece, occur in Douglas fir

breaks were definitely associated with knots. In several instances the beginning of rupture started at the junction between the rounded roof of the arm and the flat central section. Consideration is now being given to increasing the length of the flat section.

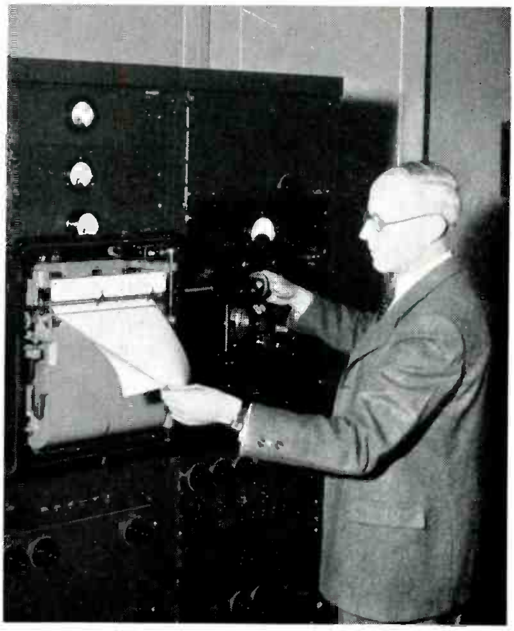
These tests indicate that crossarms of mountain type Douglas fir may be used interchangeably with the present standard southern pine or Douglas fir crossarms; and that red and jack pine crossarms are suitable for use in exchange lines and the less important toll lines.

How Would You Do It?

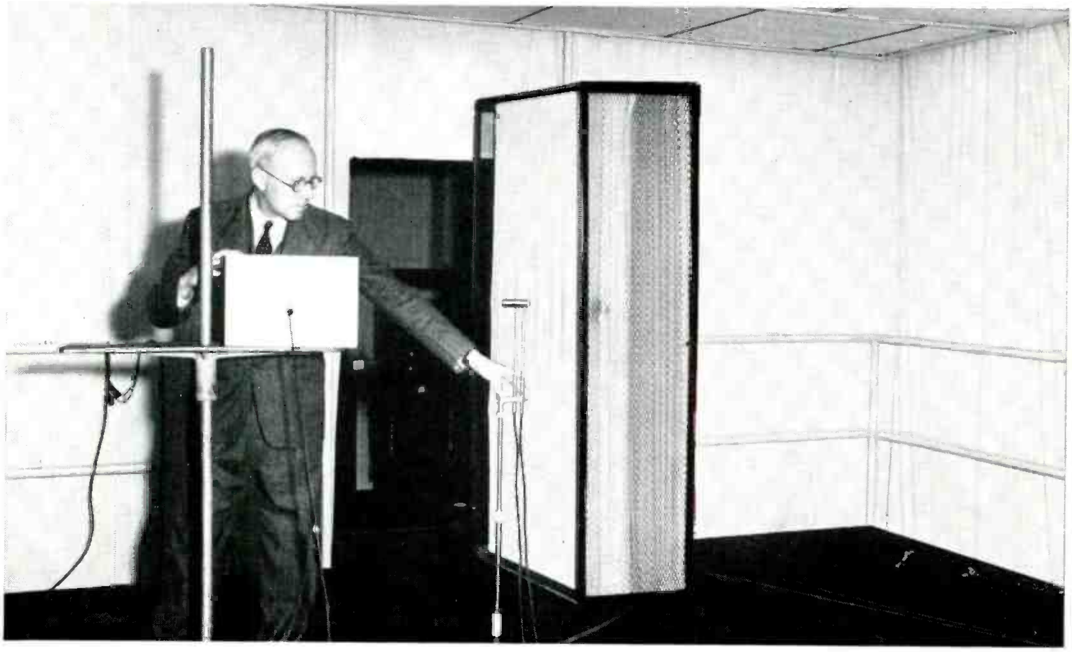
The Problem: To ensure that several lever-type keys on a switching panel be closed in a fixed order, and opened in the reverse order. The levers project from the panel and may be arranged as desired.

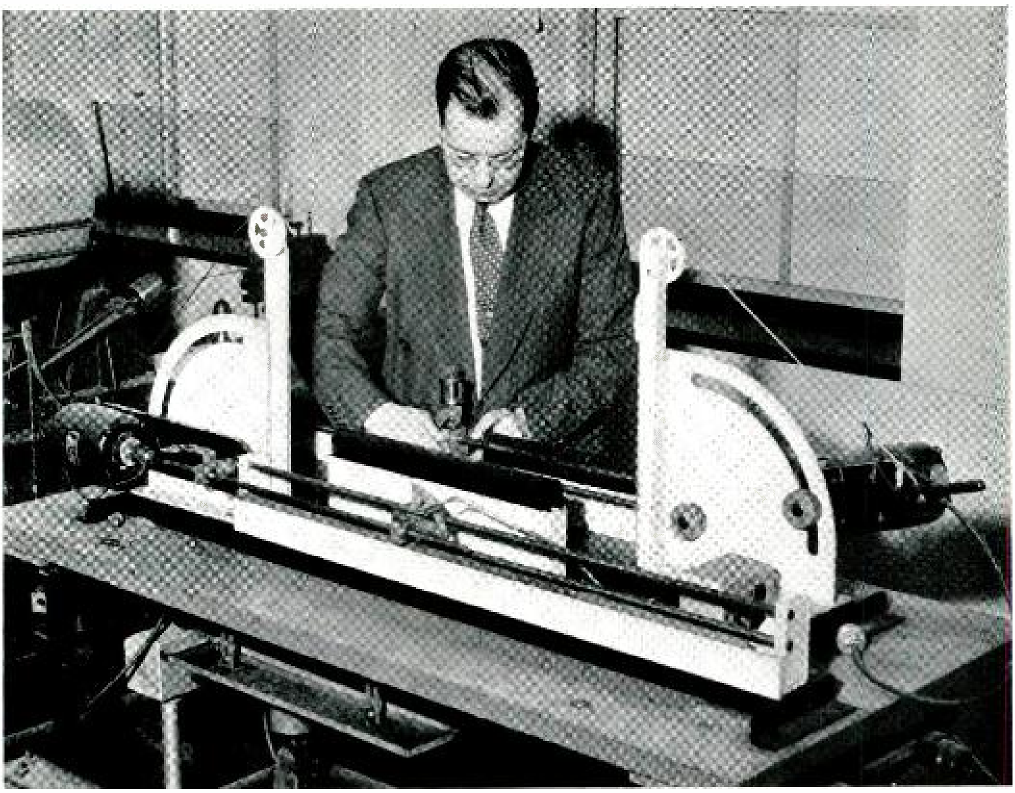
After you have decided how you would solve the problem, *turn to page 26 of this issue of the* RECORD.

Acoustic Room and Test Apparatus



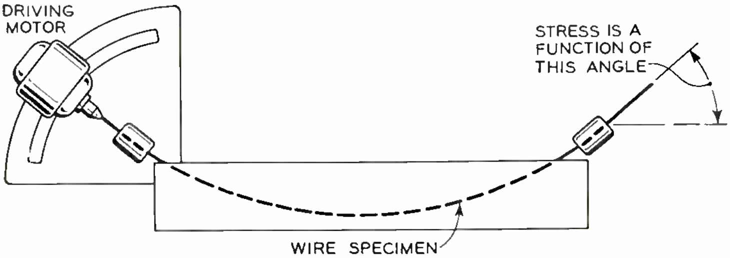
MICROPHONES and loud speakers are tested at the Murray Hill Laboratory with this apparatus, shown at the right, which records automatically their response frequency characteristics. Two records can be made simultaneously. The acoustic test room shown below is used in conjunction with these tests. The walls, ceiling and floor are covered with a number of layers of cloth separated from each other by different distances to absorb sound of a wide range of frequencies. This treatment is also applied to the door whose end-on position shows the construction. On the floor there is a grillwork to support the apparatus and the operators. Practically all of the sound which strikes the walls, ceiling and floor is absorbed. A much larger room of similar construction has been built in connection with the acoustics building, but it has not yet been equipped because of the pressure of war work. H. L. Lundberg is the engineer shown in the photographs.





Rotary Wire-Testing Machine

THE vibration of open-line wire due to wind sway and other causes often results in fatigue failure of the wire. Fatigue endurance of line wire material must therefore be taken into consideration in the installation of open-wire lines. This property is determined in the testing machine shown by bending the wire in an arc of known curvature and rotating it at constant speed until failure occurs. The rotation stresses the wire alternately in compression and tension simulating the vibratory stresses imposed in service. It was designed by I. V. Williams of Materials Engineering, to adapt an idea of Dr. John M. Kenyon of Columbia University to the practical needs of the Laboratories. Advantages of the machine are the considerable length of wire tested at one time, simplicity of design and stress calculation and the relatively close reproducibility of results. C. C. Kingsley is shown operating one of the machines in an Outside Plant laboratory at Murray Hill; several other machines are regularly used in the materials laboratory at West Street.



Multivibrators

By PHILIP CHAPIN JONES
Associate Editor

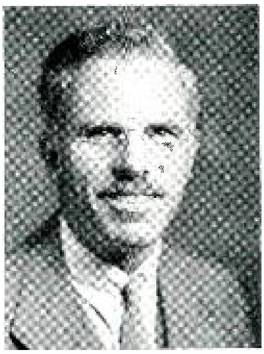
THERE are two words in the English language to describe a back-and-forth motion: vibration and oscillation. The former derives from the Latin *vibrare*, meaning to shake or brandish, and the latter from the Latin *oscillare*, which is a derivative of the noun *oscillium*, meaning a swing: the motion of a pendulum. Although to casual observation these two motions may appear to be the same, they are fundamentally different. A pendulum—if the arc of motion is short—always completes each full swing in the same time, and this time — or period — of swing is determined primarily by the length of the pendulum. Mathematically, this type of motion results because the accelerating force, which is due to gravity, is proportional, but of opposite sign, to the displacement from the vertical position of the pendulum.

In electrical circuits containing inductance and capacitance, there may be a relationship between voltage and time similar to that between distance and time with the pendulum. The voltage increases in one direction, returns to zero, and then increases and decreases in the other direction in a manner exactly analogous to the motion of the pendulum. For this reason such an electric circuit is called an oscillator.

When something is waved or brandished, the controlling law is different. The accelerating force is no longer inherently proportional to the distance from the position of rest but is independent of it, and may be made as great or small as desired within the limits of the force available. The time for one complete back-and-forth movement varies with the force and also with the mass, but since the force is variable at will, the period or frequency of the vibration is also variable. While with a given swing or oscillating circuit the frequency of the oscillation is inherently fixed, with something being shaken, the frequency is not at all inherently fixed, and may vary over a wide range.

When an oscillator is mentioned, one ordinarily thinks of an electrical circuit. A vibrator, on the other hand, is generally thought of as something at least partially mechanical, such as an electric bell. The feeling for this distinction is so strong that even when a mechanical system is truly oscillating, it is usually spoken of as vibrating. The word multivibrator thus suggests a mechanical device. This is unfortunate since in reality

THE AUTHOR: P. C. JONES received the B.S. degree from M.I.T. in 1912, and then spent two years in Brazil with San Paulo Light and Power Company. Returning to this country at the outbreak of World War I, he was with a consulting engineering firm for a year and then went with the Goodyear Tire and Rubber Company, where he later became Chief Electrical Engineer. In 1927 he joined the Technical Staff of the Laboratories. His work has been in the field of technical exposition as a member of the Bureau of Publication; and he is Associate Editor of the RECORD.



P. C. JONES

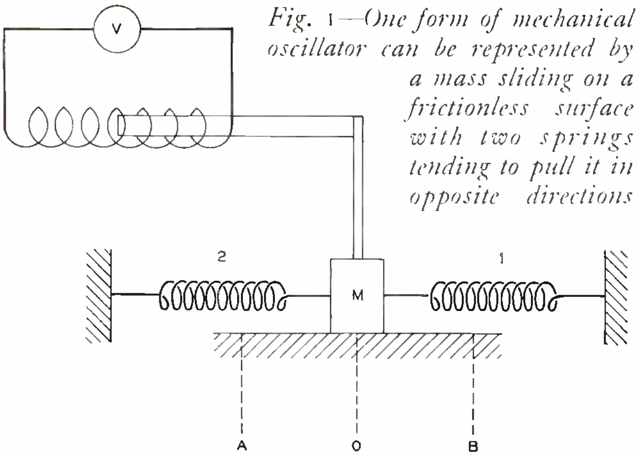


Fig. 1—One form of mechanical oscillator can be represented by a mass sliding on a frictionless surface with two springs tending to pull it in opposite directions

it is an electrical circuit used for the most part to secure a fixed frequency as is an electrical oscillator. Its name was applied, however, because the multivibrator circuit vibrates rather than oscillates—using these terms as they have been defined above.

The distinction between an oscillator circuit and a multivibrator circuit can be shown by a mechanical analogy. One form of oscillating circuit is shown in Figure 1. It consists of a mass sliding on a frictionless surface, and having two springs attached to it, one tending to pull it to the right and one to the left. In the inactive condition, with the mass stationary, the mass is at position zero, and the pull of one spring is just balanced by the pull of the other. If the mass is now pulled to position A and then released, spring No. 1 will pull it to position B—as far to the right of zero as A is to the left of it. The momentum imparted to the mass by spring No. 1 in pulling it from A to zero is just sufficient to carry the mass to B. At this point the momentum is overcome by the pull of spring No. 2, which accelerates the mass back to zero, and then the momentum of the mass carries it to A. With no friction this oscillation between A and B would continue indefinitely. The interaction of the pulls of the two springs, with momentum acting first in one direction and then in the other, maintains the oscillation at constant frequency. If an iron rod were attached to the mass in such a way that it moved in and out of a solenoid as the mass moved back-and-forth, an output voltage in the form of a sine wave would be obtained from the coil.

A mechanical analogy for the multivibrator is not so simple because the motion is not an automatic interaction of two inherent forces. In one form it could be represented as shown in Figure 2. Here the squares marked P represent two bodies assumed to be without mass. These move between guides G which retard their motion by friction as they are pulled one way by a motor, M, or the other way by a spring. There are two of these units, each consisting of a spring,

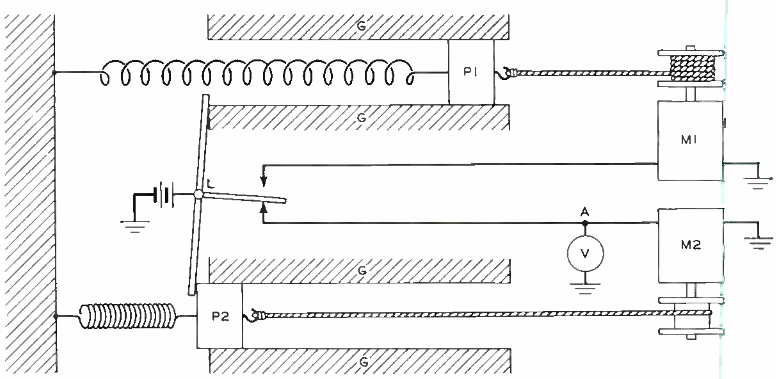


Fig. 2—A multivibrator when represented mechanically becomes more complicated than an oscillator because two moving elements are required, each drawn one way by a spring and the other by a motor, and the surfaces they slide on offer resistance to motion

a motor, and a body P, and, as shown in the illustration, the unit 2 has just been pulled to its extreme left position by the spring, and has opened a contact that opens the circuit of the motor that has been pulling the No. 1 unit to the right, and closed the circuit of motor 2. As a result P1 starts to the left and P2 to the right. When P1 reaches the extreme left position, it opens the circuit of motor 2, and applies power to motor 1, thus starting P1 to the right and P2 to the left. This back-and-forth vibration continues indefinitely. An output voltage could be secured by a connection at point A of Figure 2, but the wave would be rectangular instead of sinusoidal, consisting of a constant voltage for one-half cycle and no voltage for the other half.

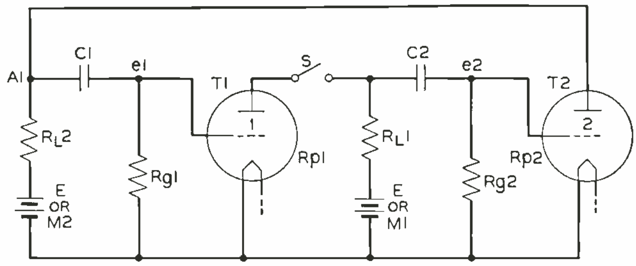


Fig. 3—Simplified schematic of a multivibrator

In the oscillator of Figure 1, assuming ideal conditions, there is no friction, and once the system is started it continues indefinitely at the same frequency, and this frequency cannot be changed without changing either the mass or the spring or both. The action is maintained by a momentum which acts first in one direction and then in the other. The timing results from the inherent relationship between the mass and the spring.

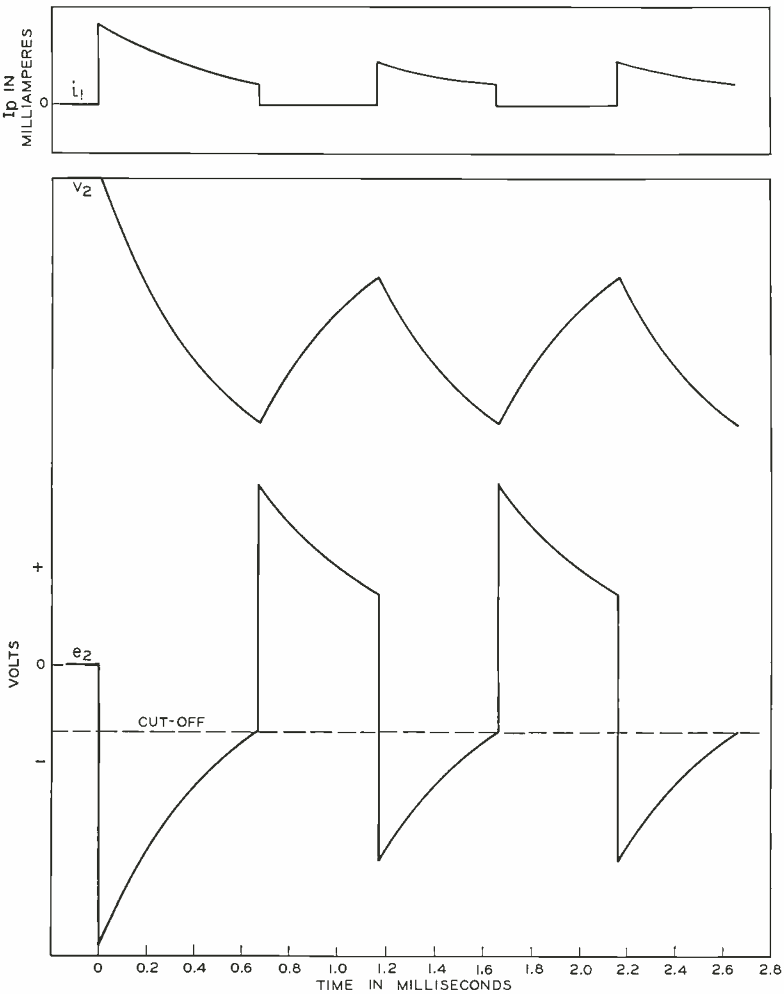


Fig. 4—The voltage V2 across C2 of Figure 3, and the corresponding voltage e2 across Rg2 as time progresses. The upper diagram shows the plate current of tube 1 over the same interval

With the multivibrator, on the other hand, there is no

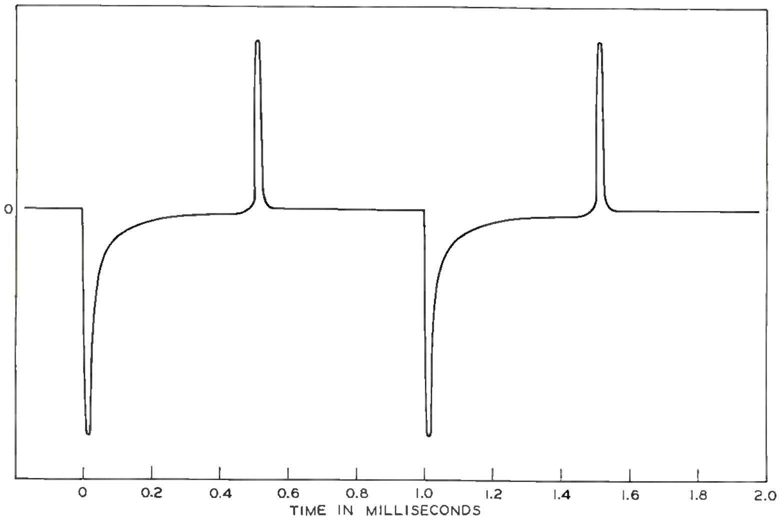


Fig. 5—When the plate current shown in the upper part of Figure 4 is passed through the primary winding of a transformer, the voltage across the secondary winding will be as shown above

equivalent of momentum. The friction between P and G is essential, and its value, in conjunction with the stiffness of the spring, sets the period of travel, and thus the frequency. Moreover, there are several things that can change the frequency without any change in the major elements. A change in the friction between G and P, for example, would do so, as would a change in motor speed. The frequency could also be changed, of course, by moving the control lever L to either the left or right. To provide the back-and-forth motion two units are provided—spring driven in one direction and power driven in the other. Timing is secured by allowing the spring-driven motion of one unit, which can be modified by adjusting the friction, to time the power-driven motion of the other. While with the oscillator of Figure 1 the change in motion is gradual, with the multivibrator of Figure 2 it is sudden—being caused by the making and breaking of contacts.

In its electrical form the multivibrator circuit is as shown in Figure 3. The various circuit elements have subscripts to indicate the two units of apparatus. With switch S open, tube 2 is passing current, condenser No. 2 is fully charged, and condenser No. 1 is discharged to the voltage of point A1; which depends on the relative values of the load resistance RL2 and the plate resistance Rp2. If the switch is now closed, tube No. 1 will at once pass current, since its grid is at zero potential, and condenser No. 2 will discharge through it. The surge of discharge current through Rg2 drives the grid of tube 2 below cut-off, and tube 2 at once ceases to pass current. The discharge current of the condenser 2 begins at a high value and decreases exponentially, and the voltage e2 follows a similar curve. When this negative potential e2 has decreased to the cut-off value, tube 2 will start to pass current again, allowing C1 to discharge and block tube 1 just as the discharge of C2 previously blocked tube 2. This cycle repeats itself, and after a few preliminary cycles the time of the complete cycle becomes fixed at some value, depending on the various constants of the circuit.

This action is shown in Figure 4 which is a plot of the voltages across condenser No. 2, marked V2, and across the grid leak resistance of tube 2, e2, as time progresses. While the condenser is discharging the voltage is negative, and when this negative voltage decreases to the cut-off voltage of the tube, the end of the half cycle is reached. When the condenser is charging, the voltage e is positive, as shown on the graph, but its value has no basic significance in the operation of the circuit since the tube is passing current at this time anyway.

The plate current of tube 1, which may be used as the output current, is shown at the top of the graph. If this output current is passed through the primary of a transformer, the voltage of the secondary terminals will be as indicated in Figure 5—consisting of very sharp peaks alternately negative and positive. Such a curve comprises all odd harmonics of the fundamental, and any desired harmonic may be selected by filters. It is this form of output characteristic that makes the multivibrator so useful.

The voltage across condenser 1 and that across the grid-leak resistance for tube 1 are the same as those shown in Figure 4 after stable conditions have been reached, but are offset from them by just one-half cycle. The two tubes and their associated circuits correspond to the two mechanical units of Figure 2. The discharge of the two condensers corresponds to the action of the two springs, and the charging of the two condensers by the battery corresponds to the winding-up action of the motors. The attainment of cut-off potential on the grids of the vacuum tubes corresponds to the operation of the lever switch L.

As pointed out in describing the me-

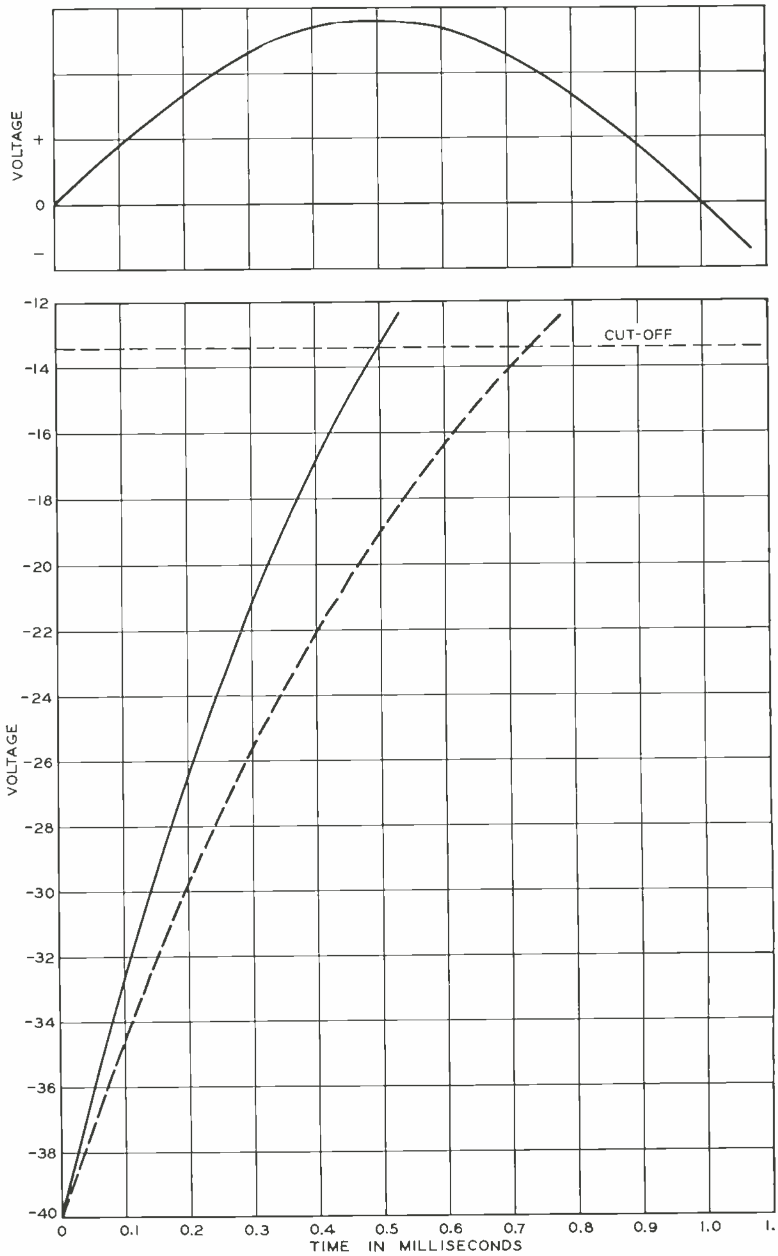


Fig. 6—By superimposing an oscillator voltage, shown on upper diagram, on the voltage e—dashed curve—the time required for e to reach the cut-off voltage is brought to the required period

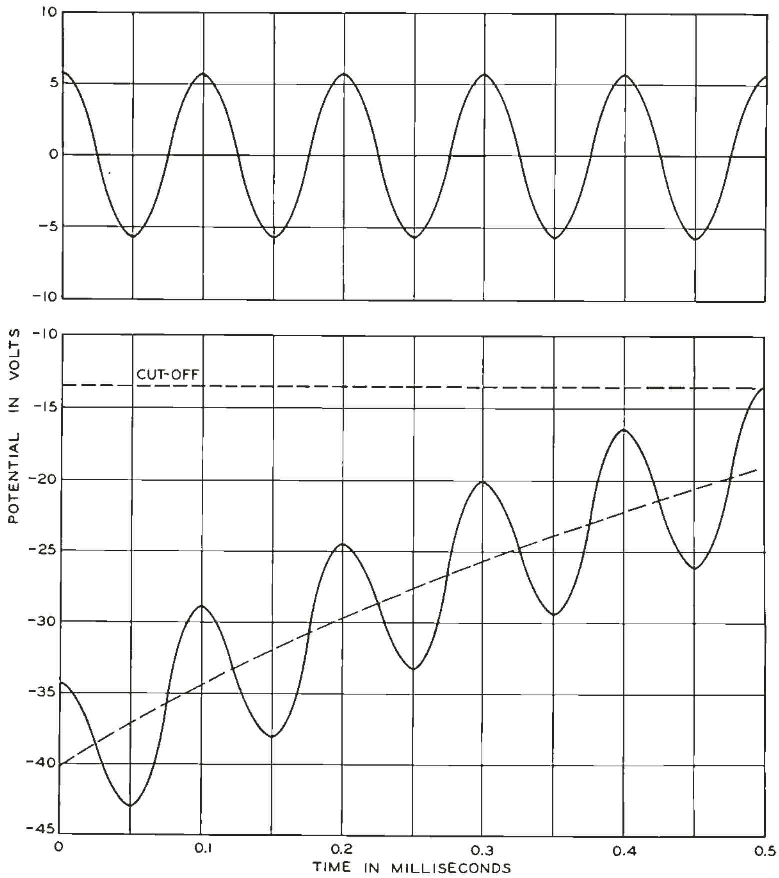


Fig. 7—An indication of how an oscillator voltage, upper diagram, superimposed on voltage e—dashed curve—results in a voltage, lower solid line, that reaches the cut-off value at a period that is a multiple of the oscillator period

chanical analogy of the multivibrator, the frequency is determined by a resistance. In the actual circuit this is the resistance through which the condenser discharges, and is given by a complicated expression including the grid leak resistance, the load resistance, and the plate resistance. The first two of these vary with temperature, and the plate resistance varies with the voltages impressed on the vacuum tube. The multivibrator thus lacks the inherent stability of an oscillator. In using it to generate a group of harmonics, however, this lack of frequency stability may be overcome by locking the vibrator at the desired frequency by an oscillator. The oscillator voltage, adjusted to the proper value, would be applied in the grid connection so as to modify the grid voltage e.

This voltage e, as the condenser discharges, is shown by the dashed line of Figure 6, which is plotted on the assumption that a change in conditions has increased the time required for e to reach the cut-off voltage, and will thus tend to decrease the frequency. By superimposing the oscillator voltage, shown in the upper part of Figure 6, the voltage on the grid is modified as shown by the solid lower curve, and cut-off voltage is reached at the desired intervals regardless of the variation in the constants of the multivibrator. This oscillator voltage would be applied to the grids of both tubes, and thus both tubes would begin to pass current at the correct instant. Since the duration of each half cycle is determined by the time required for the grid voltage of each tube to reach its cut-off value, the result is a wave of the frequency that is desired.

The greatest advantage of this locking-in procedure is its ability to make the multivibrator act as a submultiple generator. Suppose, for example, that we have a 5-kc oscillator and want a set of harmonics of 1 kc. It is necessary only to build a 1-kc multivibrator and to apply the oscillator voltage, properly adjusted in series with voltage e.

The action is indicated in Figure 7, where the lower dashed curve represents the voltage e without the oscillator, and the upper curve is that of the oscillator output. When these two are combined, voltage e becomes the lower wavy line, which reaches the cut-off voltage at the fifth cycle of the harmonic. The frequency of the multivibrator is thus made exactly one-fifth that of the oscillator, and the harmonics obtained from the output will be harmonics of the fifth sub-multiple of the oscillator frequency. In other words, they will be multiples of 1 kc rather than of 5 kc.

The various curves shown in the diagrams are approximate only, since they are plotted on the assumption that the plate resistance of the tube remains constant, which it does not. They serve, however, to illustrate the general action of the circuit and indicate the useful applications of the multivibrator.

"ELECTROMAGNETIC WAVES"

[*Quoted from a review of Dr. Schelkunoff's new book*]

This new addition to a well-known series has been awaited with much interest by all those acquainted with Dr. Schelkunoff's contributions to propagation theory, and it will be found that their expectations have been entirely fulfilled. This monumental piece of work is equally remarkable for the originality and consistency of its approach as for the wealth of information contained in its five hundred densely packed pages.

The specialist in wave propagation has no need to be told of the value of this book; but the reviewer would like to explain to his fellow non-specialists why it is particularly important that they should not miss it. When the results of much present-day research will suddenly be made available, it will be a hard task to catch up, not only with the new knowledge, but still more with the new modes of attack. The borderland between radio and optics is one of the fields from which great things can confidently be expected. Dr. Schelkunoff's book is a great opportunity for those not at present engaged in research to get familiar with methods which they will want to use tomorrow.

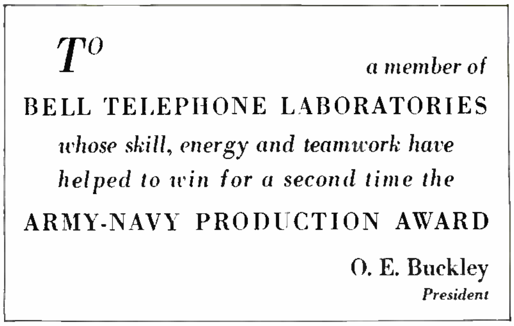
—P. Le Corbeiller, in "Quarterly of Applied Mathematics," July, 1943.

"E" Pin Distribution

With the second Army-Navy Production Award, new lapel pins became available for all those who were connected with the Laboratories on June 19, and who had not received a pin for the previous award, which was "as of" August 22, 1942. On the earlier occasion the procedure of giving out the pins was relatively simple: to everyone the Mailing Department addressed from its stencils an envelope in which a pin was enclosed. This year, however, stencils were distributed through the entire file, so recourse was had to the lists of changes prepared by Payroll showing the names added and dropped each week. The names were copied onto envelopes, the locations added from the address list, and the pins inserted. About 2,300 envelopes were addressed, but not all of these were sent out because many addressees were no longer in the Laboratories.

Our war effort has been furthered by nearly 500 people who work at our various locations but are employed not by the Laboratories but by other concerns who furnish services under contract. By permission of the Army-Navy "E" board, these people who contribute to the work of the Laboratories are eligible to wear "E" pins.

Many girls in Messenger and Mailing helped to distribute the "E" pins. Here Kathleen Davey addresses the envelopes; Sarah Serabian looks up the locations; and Effie Ross encloses and seals



Second award "E" pins were distributed in envelopes like this

To a member of
BELL TELEPHONE LABORATORIES
whose skill, energy and teamwork have helped to win for a second time the
ARMY-NAVY PRODUCTION AWARD
O. E. Buckley
President

Order Coal and Oil Now to Avoid Winter Crises

The Office of Price Administration has issued a reminder to occupants of oil-heated homes in the 33 states and the District of Columbia where there is fuel oil rationing to get their applications for next winter's oil allotments in early. The applications have been mailed out to all who had oil rations last winter, and although they are being returned to ration boards in fairly speedy order, many persons have failed to file the application for their coupons. Delay on the part of the home-maker in returning the filled-out form to OPA may mean a delay on the part of the ration board.

While last year's heating period system will be continued in a modified form, OPA arranged to make a large part of the coupons valid on July 1 so that those with storage facilities may stock up early, relieving strain on transportation later. All are advised, however, to use up any coupons remaining from last winter first. These are valid to October 1.

Coal users are also urged by the government to order early. The nation's 1943 requirements for soft coal are the largest in history. For anthracite, 1943 requirements are five million tons more than 1942 production.

British Officers Visit War Training School

Gathered around a new piece of equipment as Instructor William Keister explains it are R. K. Honaman, director of the School; Mr. Keister, Major H. J. MacLean, Lt. Col. A. J. S. Watson, and Brigadier F. R. Bloor, all of the British Ministry of Supply Mission; and E. J. Thielen, assistant director of the School

Whether you use oil or coal, your dealer may not be able to fill your order as soon as you place it. But one of the most vital factors in next winter's fuel supply picture—coal or oil—is consumer coöperation.

G. A. Anderegg, 1873-1943

Gustavus A. Anderegg, formerly Cable Development Engineer of the Outside Plant Development Department who retired in 1938 after thirty-one years of service, died on August 14. Upon the occasion of his retirement a biography and photograph of Mr. Anderegg appeared in the April 1938 issue of the Record.

Inflation: What All Can Do

One of the most explicit recommendations to relieve present-day problems of inflation was commented upon by the *New York Herald Tribune* on August 16. After reviewing the need of a prescribed course of action for the individual citizen, rather than further action by the Administration, the editorial says, "This gap in the anti-inflation education program is now being filled in. The life insurance companies of America, in the most comprehensive coöperative effort in their history, are inaugurating today a nation-wide campaign to hold down prices and the cost of living by encouraging thrift.

"Proceeding on the well-founded assumption that government action alone is not the answer—that the fight can be won 'only with the understanding coöperation of the American people as a whole'— the insurance companies have drawn up a list of 'seven practical things' that the citizen can do by way of making his own contribution to the effort. These are:

"1. Buy and hold war bonds—to lend our country the money it needs to fight the war to victory.

"2. Pay willingly your share of taxes—including increased taxes—that our country needs.

"3. Provide for your own and your family's future by adequate life insurance and savings.

"4. Reduce your debts as much as possible and avoid making needless new ones.

"5. Buy only what you need, and make what you have last longer.

"6. Live faithfully by the rationing rules to conserve those goods of which there are shortages.

"7. Coöperate with our government's price and wage stabilization program."

Don't Talk— The War Isn't Over!

Success of our arms on all fronts has made us all happy, and even more confident of an early victory. But that victory isn't here yet, and we are still at grips with two tough, wily adversaries. Both Germans and Japs have enormous respect for our inventive abilities. They would risk a lot to find out about some of America's future weapons.

We in the Laboratories are in a position of unique responsibility to our friends and former co-workers who are risking their lives in combat. We will never slacken our efforts to turn out designs for what they need. But do we remember that a leak about those designs might render them useless?

Most of us are fascinated by the ingenuity of the designs of which we know, and there's a lot of temptation to entertain a friend with the intriguing story of some new gadget. Don't forget that he or she expects you to set an example of reticence.

Just remember:

If you hear it from someone—particularly in the Laboratories—don't repeat it.

If you see it yourself—don't repeat it.

But if you read it in newspapers or magazines or hear it on the radio, then it's public property—and you may repeat it.

Building "R" at 70 Bethune Street, New York City, will now be known as Building "T." This change was necessitated by the confusion caused when mail meant, for instance, for Room 252 at West Street was addressed R-252 and delivered across the street to that room in the Electronics Laboratory.

Far-Flung Activities

A number of engineers in Apparatus Development have left the United States in connection with work on wartime projects. No details can be given concerning trips abroad by F. R. Dennis, H. C. Rubly, C. F. Wiebusch and A. F. Bennett. In August of last year R. C. Dehmel visited England in connection with the fire-director project. As noted elsewhere in this issue, F. J. Given has recently returned from a mission to England. A. H. Inglis has been traveling by submarine for a considerable distance.

Research men who have made similar trips are R. Bown, to England in connection with Radar, and to the Canal Zone; A. C. Peterson to Alaska, and T. C. Fry to England.

How They Did It

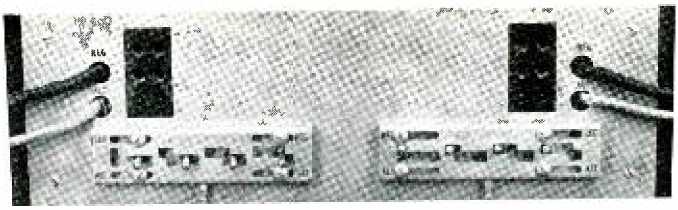
(A solution to the problem on page 14)

The keys (in this case, toggle switches) are lined up so that their motion is across the

Acme Photo

American ingenuity persists even in the heat of the South Pacific. The wire reel in the foreground was improvised from spikes, 2 x 4 lumber and a bicycle wheel; the second appears to be a British or French device and the one in front of the soldier is a commercial product made in the U. S. A.

line of assembly. Over the line-up is a channel through whose slots the levers project; this channel can be slid lengthwise, but only as each successive key is thrown. When all the levers are down, as at the left, the last key can be locked by sliding the channel to the left.



Arrangement to insure that keys in a line-pair switching panel are closed in a fixed order and opened in the reverse order

Designed by F. A. Bescherer and M. Fritts when they were working out designs for a piece of radio equipment, this idea is pictured in its present application to a line pair switching panel. When a new complement of carrier pairs is provided in a cable, it is necessary to balance the new pairs for crosstalk not only against one another but also against existing pairs. This means that the existing pairs must be removed from service and replaced by spare pairs, without disturbing telephone or telegraph transmission on the carrier panels.

Two of the line pair switching panels shown in the photograph, one placed at each end of a line section, make it possible to substitute two alternate pairs for two working carrier pairs. Each half of the switching panel serves for substitution of a single circuit at one end. The working pair is looped through the panel by a four-prong plug and cord and the spare pair brought in by the two-prong plug. With all keys "up" as at the right, transmission continues over the regular pair. By operating the first key, the alternate pair is then connected in parallel through a pad. Operation of successive keys 2, 3 and 4 removes the pad from the alternate pair, adds a pad in the regular pair, and finally transfers the regular pair from the equipment to the test jacks. In the reverse sequence the test jacks are disconnected from the regular pair before it is restored to service. These operations are coördinated, of course, with similar operations at the other end of the cable. This sequence of operation is necessary to prevent single large changes in transmission level which would result in telegraph hits.

* * * * *

Long Lines telephone calls increased more in 36 months ending April 30 than they did in the preceding 36 years, A T & T Statisticians reveal. The number of toll messages for the year ending April 30, 1943, reached the all-time high figure of 126,676,000, as compared to 61,848,000 messages for the year ending April 30, 1940. This represents an increase of 64,828,000 messages, a figure which exceeds the growth in Long Lines business during the 36 years prior to 1940. During April, 1942, Long Lines messages totaled 12,165,000, as against 5,274,000 in the same month of 1940.

At a conference on Quality Control sponsored by Princeton University and held at Newark Technical School on July 31, G. D. Edwards spoke on *Acceptance Quality Control and Its Relation to Process Quality Control*. A round-table discussion at the conclusion of the conference was under the guidance of W. A. Shewhart.

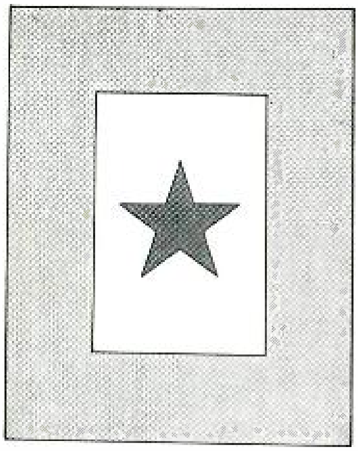
Sales and Swaps

For the convenience of members who have something they don't need, or need something they don't have, Bell Laboratories Club has set up bulletin boards at all Laboratories locations on which members may display their needs or haves. Notices must be typed on half-size sheets and carry the sponsor's name, department number and extension number.

In view of shortages in many lines of merchandise, Club members who have on hand cameras, radio sets, electrical appliances or similar articles which are serviceable are urged to make them available to others.

Each notice may be posted for two weeks, and may be reposted after a ninety-day interval. Notices should be sent to D. D. Haggerty, Executive Secretary of the Club.

Bell Laboratories Club



In the Nation's Service

As of July 31 there were 564 members of the Laboratories on military leaves of absence. These men and women are divided among the various services as follows:

Army 380 Waves 18 Wacs 8

Navy, Marines and Coast Guard 158

Sigmund Fronczak

"That picture of mine in the August RECORD was taken when I was on furlough in London. I have been promoted to Electrician's Mate 2/c which makes me proud and happy. My duties are to my liking—I work as an electrician maintaining the base. Although I would like some sea duty I have not been successful in getting it yet. I am anxious to be in the thick of it.

"My furlough in London was a pleasant one and I saw a lot of the town. We had a few alerts while I was there. Sort of gives one the creeps to see the shells bursting overhead. The people of Britain don't scare easily. They sure have a lot of guts to have gone through what they did and still come up smiling.

"The American Red Cross does wonders for the boys in service; it provides clean lodging and good meals for a small fee. Tell the boys to support it. They are really helping us when they do so. Give my regards to everyone, especially to JOHN HOULIHAN and JACK O'SHEA who are doing such a swell job in Malta and Sicily."

Lieut. Robert J. Koechlin

Word has been received from the War Department that LIEUT. ROBERT J. KOECHLIN was seriously wounded in action in the South Pacific on July 19. The June 1943 RECORD carried an account of his being moved up to the front lines of action as a Ranger leader. Bob is on a Mobile Naval Hospital and has sent word that he's all in one piece. He will be awarded the Order of the Purple Heart.

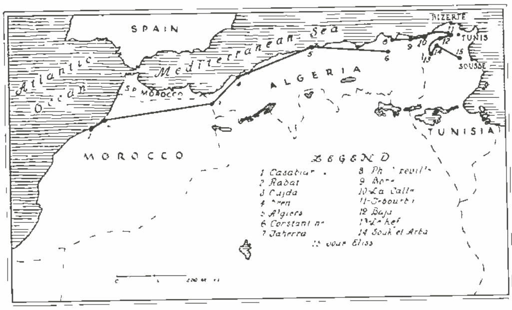
Major M. M. Bower, in North Africa, to His Nine-Year-Old Son

"Dearest Peter: I am in such a pleasant place it seems almost like a vacation even though I have work to do. It looks as though I will be busy up until the middle of June but then I am coming home and I feel very lucky. I can't tell you where I am now, but if you will get out a big map I will tell you where I have been traveling these last few months. I have visited Casablanca, Rabat, Oujda, Oren, Algiers, Constantine, Taherra, Phillipeville, Bone, La Calle, Tebourba, Baja, Le Kef, Souk-el Arba and Souk Eliss. And some other places too, but I think you will have a time finding those. I was at a place called Wardaa near Wessias when Sousse fell. I was at Baja in Tunisia when we took Medjez El Bab. I was at Djeebel Obird east of Tabarka when the fight ended on Cape Bon. I was sorry I didn't get to see Bizerte or Tunis, but I had too much work to do to go sight-seeing right then. It was on

U. S. Signal Corps

MAJOR M. M. BOWER   C. E. SMEDBERG

the road through Souk-el Arba and Souk Aben that I saw all the prisoners I told you about. I have been in places that were bombed just before I arrived and again just after I left, but no place has ever been bombed when I was there."



This map, drawn by H. M. Yates, shows the travels of Major M. M. Bower who has recently returned from North Africa

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Military Leaves of Absence

United States Army

Irving Bernstein
Walter J. Bittman
Richard G. Dolbear
Cornelius J. Keyser, Jr.
Henry A. Lamperty, Jr.
Robert P. McMahon
Harry C. Meier
Frances R. Merritt
Robert F. Rennick
John H. Rooney
Harry E. Seaman
Roland M. Scheller
John A. Schepp
John H. Simpson, Jr.
James M. Sullivan
William L. Willdigg
Wayne F. Wilson
John A. Zweig, Jr.

United States Navy

Marvin Bracken
Frank A. Chionchio
Julian D. Cohn
Patrick Connolly
Ensign Wm. L. French
John W. Hoell
Ernest M. Johnson
John J. McLarney
Francis R. Misiewicz
Donald J. Oakley
Nelson A. Popp
Marie T. Vincent
Vincent J. Wycheck

United States Marines

Lt. David E. Brenneman

Anthony Waraske

"We are at present on maneuvers, and our bivouac area lies almost at the foot of the Rockies with Pike's Peak in the background, offering us a splendid view of the surrounding area. The weather remains ideal throughout the day but our sleeping hours are spent under two good old Army blankets plus a comforter. We are going through a 'toughening-up' process stressing upon long hikes, drilling and rifle range practice. Our entertainment in the form of movies is supplied through our Photo Department and these are shown as soon as the stars make their appearance with the open sky as our theater." (*Sergeant Waraske is attached to a Photo Squad, Army Air Force, Peterson Field, Colorado Springs.*)

Major John H. Bogle, M.D.

"I am chief of a surgical team in this group (*Surgical Group, Lawson General Hospital, Atlanta*) which is composed entirely of surgeons. We are going through a toughening-up process which includes long marches, and in the Georgia heat that is something! We are also training the enlisted personnel on the teams."

Jack I. Picard

"Where I am stationed now the nights are very short and we find it hard going to sleep with the sun pouring down the hatch. Since I left you people I have been promoted twice. I am ship's cook second class. I hope that you let me prove my ability to you if I have the privilege of working with you

Major J. H. Bogle

W. P. Weiler

again. I have cooked for some high ranking officers lately and they always come back for more of my chow."

John J. O'Shea

"I am at present located in Sicily—what part a military secret. We had a rough time getting in here and I might mention I was rather lucky. What I did not know about dive bombers and land mines I learned fast. It's some experience. I hope that the next invasion will be Staten Island or South Ferry and that this mess will end soon so that we can get home and live natural again. War is hell.

"This country is somewhat similar to Africa, mountains to the right and left. Having to climb them is a hard day's work, especially with the terrific heat.

"I do hope I will be lucky enough to meet J. HOULIHAN again. I know he came to Italy. It makes a fellow a little braver to meet a pal on the front lines. I met JOHN MURRAY's son on the trip here. I hope he is well. As you know, when we hit this beach it was every man for himself.

"Here is a snapshot of me with a few natives. One is an Arab, the other a French Moroccan soldier—a ferocious tribe. The Jerries dread these soldiers as they specialize in using the knife a great deal. I am glad they are on our side now. We had to battle them for a while until they got wise to themselves. They are known as throat-slitting Goums. I would appreciate hearing from the gang in the Plant Operation Department. Ask them to write to me." (*The photograph is on page 35.*)

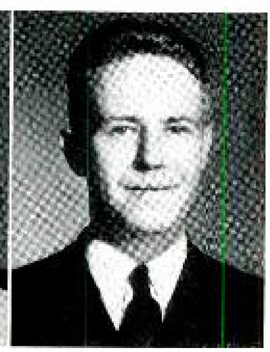
GRACE M. GOODALL

Andrew F. Bartinelli

"I am fine here on a very hot spot. I guess all the Restaurant gang would like to know where I am, but I can't tell you. As you know I'm an infantryman and my position now is a 'big secret.' The chow is getting better here all the time. Tell ANDREW, the West Street chef, that this is a cook's paradise. We have six ranges to cook on and twenty-five steamers, plus ten big cooking pots. And though they have plenty of room to move around in the kitchen they won't get me into the kitchen again to cook! Give my regards to all and maybe some day I will return and see the old gang again."

(*Andrew has since arrived in North Africa. The description of a cook's paradise seems to have been the ship's galley.*)

M. F. GRIFFIN THOMAS FOX



LIEUT. D. F. TUTTLE LIEUT. E. C. WALSMAN

Lieut. Comdr. Ralph H. Miller

"I am assigned to the Director of Naval Communications in Washington. My work has to do with plans and operations of the Navy Department teletypewriter service (TWX) and private line teletypewriter service (TWPL). At the present time I am closely associated with the A T & T 'Dull' Committee who are working with the Navy on a complete survey of these systems."

Arne O. Christiansen

"When I shipped over here to England I was surprised at the hospitality of the people. I had the impression that they were very cold and reserved, but they treated us nicely. The scenery is really beautiful. I had no idea England was so quaint. It was strange at first to drive on the opposite side of the road, but I'm used to it now. I've noticed how small everything is here, particularly the cars and trains, but that's in proportion to the rest of the country."


LT. COMDR. R. H. MILLER H. E. EARL, JR.

Frederick W. Schwartz

"I was surprised to receive the RECORD such a long way from home. (*Mr. Schwartz is with the fleet in the Pacific.*) It reminded me of the days I spent at the Labs. I am a Fire Controlman 3/c on a destroyer and am glad to say Western equipment developed at the Labs is playing a big part in winning this war."

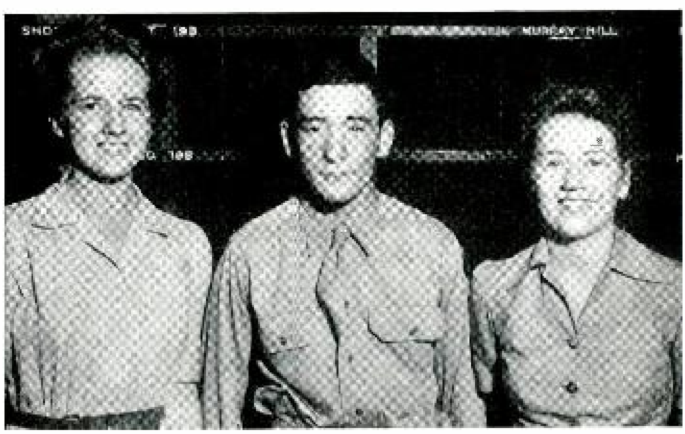

MICHAEL COLLINS J. S. DEVANNEY

Thomas Fox

"I have a reveille pass here at Fort Monmouth that permits me to stay out as late as I wish at night and be absent from bed check. Great Stuff Brother! Here's hoping it lasts. If I am still around at the end of the year, I may get a furlough. I just realized that I've been in the army over six months. It doesn't seem that long at all, does it? Please remember me to MR. BAARENS,

Joseph Rosato

"I have been going to a * * * maintenance and repair school out here in California. I am on my final lesson now (*July* 17) and after that it will be I.F.F., which means 'Identification of Aircraft, Friend or Foe'—another tough course. I sure wish I were back in Murray Hill with the rest of the boys working there."



Daniel J. Brady, on furlough from Camp McClain, with Catherine Sweeney, left, and Mildred Halsey, right, with whom he used to work in the Mail Room

Lieut. L. G. Rainhart

"Since returning to the good old U.S.A. I have received several issues of the RECORD with tell-tale re-addresses and postmarks showing they have traveled 10,000 miles on the high seas following the addressee around. Even though they are five months late, they are still very welcome. Now my time is occupied in training my company of recruits in this new battalion. The Rockies were beautiful to view but after training in them the view changes. Best of luck to the fellows of '2230' who are still holding the fort."

Capt. F. B. Blake   Capt. H. B. Guerci

Don, George, Harvie, Hill, Mrs. Grave and all the rest of the boys in the Apparatus Drafting Department."

Frank R. Hulley

"I guess the Battle of Waterville, Maine, is nearly finished as far as I am concerned, for I leave for a classification center in the deep South shortly. I have completed ten hours of flying here at Colby in a plane similar to the one shown in the picture. They crowd quite a bit of flying in the ten hours we have here. We learn to land, take off and perform spins, stalls, spirals and other simple maneuvers. It has all been fun though at times the instructor called me some awful things. Censorship prevents my being more specific here. I have been selected for pilot training at Montgomery, Ala. I have seen two boys from the Laboratories here, Jimmy Walls of the Accounting Department and Artie Palmer of the shop. They both have been classified pilots and are awaiting shipment."

F. R. Hulley

Robert B. Burns

"My humble abode is a barrack here at Scott Field, quite a letdown from the Miami Beach set-up. Up here you are treated like a soldier and not a robot. As training goes on you notice the officers become much more civil to the men because the time may come when both may be on the other side together. At the beach, we had to salute everything from empty staff cars to fire plugs and Coca-Cola bottles with caps on; up here I've saluted just twice in one week."

* * * * *

Capt. Orrin F. Crankshaw has returned from Guadalcanal where he had been on military duty.

From Camp Rucker, Alabama, J. W.

Fred Hediger   R. M. Eichhorn

Cunningham has written to say "hello" to everyone. "If the Labs needs a bridge built after the war, I'll be glad to oblige."

Capt. Harold B. Guerci has been assigned to duty in the Buffalo Area.

William J. Rosoff has been given a personal leave of absence to enter the United States Merchant Marine.

John Mallet has been given a personal leave of absence to work in a civilian capacity in the Office of Management Control of the A.A.F.

Arthur T. Olsson, having finished his basic training at Camp Edison, is stationed at Fort Monmouth for specialist's training in teletypewriter maintenance.

Joseph Daly, now overseas in the South Pacific, has been promoted to the rank of Warrant Officer.

Anthony Osinski has been assigned to an army air base at Ontario, California, as a radio operator.

H. THIEL has been transferred to March Field, California.

ELLIS GILLIAM, one of three Labs men at Camp Le Jeune, has just been transferred to Parris Island.

RICHARD COMER of the Army Air Corps has met two Labs men, he writes, from reading the RECORD. At present he's at Latrobe, Pennsylvania.

HERBERT E. EARL, JR., who has recently earned his aerial gunnery wings, has been transferred to Texas from Florida.

SEAMAN 2/c ELIZABETH A. FITZSIMMONS is at the Naval Air Station, Atlanta, Georgia.

EDWARD P. HULLAH is at Colorado Springs.

ROBERT F. MCLAUGHLIN, now at Camp Davis, North Carolina, hopes to change his rating from T/3 to Second Lieutenant upon completing the course he's taking.

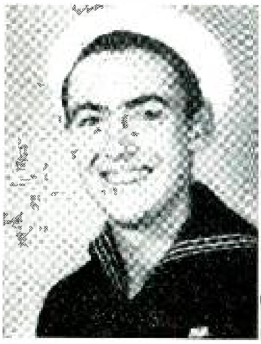
MICHAEL COLLINS has returned from Northern Ireland to attend Air Corps School in this country.

ALTHOUGH Navy life really agrees with Aviation Cadet JOHN F. MARTIN, he was glad to return to the Laboratories to visit his friends at West Street late in June. John finished his primary flight training at Albany Airport and he is now in intermediate training at Siena College, Loudonville, New York.

FROM THE SUBMARINE BASE at New London, where he is taking advanced training, JAMES V. CUNNINGHAM writes that he is intrigued with his studies.

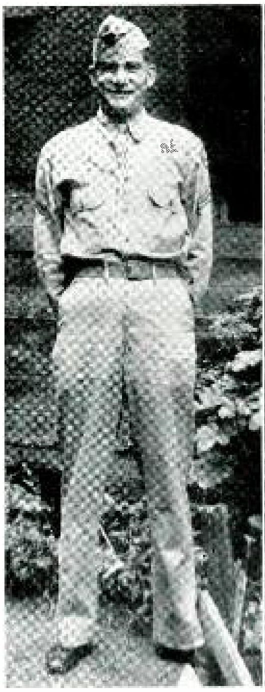
JAMES DEVANNEY of Building R, whose wife works in the Blueprint Department, has been assigned to active sea duty.

ANDREW KURUTZ, a third class petty officer, is a Soundman awaiting assignment on the West Coast. He hopes it will be on a fast boat, a destroyer, a destroyer escort or a PC boat.



A. M. KURUTZ

D. W. MACK



F. J. HOWE

A. T. STILLER

FROM HIS STATION at a Signal Service Battalion in Washington, WILLIAM GRANT sends word that the RECORD makes a big hit in the barracks.

R. C. LAMONT, who hopes that everything is running smoothly at West Street, sends his regards to the boys in Whippany.

RICHARD SHINE was in sick bay, somewhere in the Atlantic, when he wrote of his promotion to Seaman 1/c. Congratulations, Dick, and here's hoping you're well again.

ROBERT C. HENNEBERG is preparing to travel quite a bit as a special M.P. He is being trained at Fort Custer to escort prisoners of war to this country.

HOME on a furlough from Georgia Tech, GEORGE A. SCHIEHSER called on his friends at West Street during July. George has finished one term of a year's course in Electrical Engineering.

WILLIAM M. EHLER, now stationed at the Marine Training Center at New River, North Carolina, also visited the Laboratories recently when he was on furlough.

MAJOR S. H. LOVERING has been transferred to Fort Myer, Virginia.

Miss Anna K. Marshall takes time out as refreshment chairman to talk to service men of the United Nations at a party sponsored by Syracuse Alumnae at the Biltmore

ALFRED T. STILLER of the Plant Operation Department at Murray Hill is an M.P. at the Shenango Personnel Replacement Depot.

CARL E. SMEDBERG is now in Sicily.

F. C. WANITS is with the L.C.S. Amphibious Force and is stationed at San Diego.

DAVID WEBSTER is with the Medical Detachment, Sub Base Hospital, MacDill Field, St. Petersburg, Florida.

LOUISE PARIETTI writes that "Army life is the most wonderful thing that's ever happened to me. I'm not only enjoying myself—but also doing a job to bring this war to a quick end." (*Louise is now a Corporal in the Wac, Technical Supply, Great Falls, Montana, Army Air Base.*)

LIEUT. CHARLES J. McDONALD, from somewhere beyond San Francisco, says that he sees much Western Electric equipment in use where he is.

GRACE M. GOODALL of the Davis Building is now doing classification work at Harding Field, Baton Rouge, La. "The Wac mascot," Grace writes, "is 'Willy-willy-willy.' He was lost last night and I was given the job of finding him. You can imagine how much confusion was in the barracks when I went through them calling 'Willy-willy-willy'."

HAVING APPLIED for overseas duty, AUX. ETHEL McALEVLY hopes to sail upon completing her course at Fort Devens, Mass.

FROM Camp Endicott, Seaman 2/c JOHN E. SIENKO writes that after a ten-day leave he hopes to sail for "Island X," an advanced Seabee base.

AUXILIARY M. E. STONEBRIDGE, now at Fort Devens, Massachusetts, writes that Army life is the best in the world.

FROM SANTA ANA where he is recovering from an ankle injury, S. W. ERICKSON sends word that he has been classified as a pilot and will begin his training as soon as he's released from the base hospital.

ROBERT D. NOSTRAND has completed his course at the Naval School at Richmond and is now on active sea duty aboard a submarine chaser.

NICHOLAS SFOUGARAS is doing Military Police work and also Prisoner of War Escort Guard Duty at Burlington, N. J.

ENSIGN THOMAS M. BRAY studied radio theory at Harvard for four months and is now taking advance work at M.I.T.

R. M. EICHHORN, naval aviation cadet from Chapel Hill College, returned to 9C to see the draftsmen and women with whom he used to work.

FRANK J. HOWE, whose wife was an operator on our PBX board, has been home on furlough recently.

W. M. EHLER

G. A. SCHIEHSER

Transfer of R. G. McCurdy from Director of Transmission Engineering to Director of Electrical Apparatus Development was the occasion for a dinner in his honor given by his former associates on July 23. Among those pictured in their enjoyment of "Mac's" reminiscences of "D & R" days at 195 Broadway are Messrs. McCurdy, Trueblood, Ferris and Booth

A RECENT visitor to Murray Hill was DONALD MACK.

FRED HEDIGER, a former member of the Laboratories, visited MISS L. VAN BERGEN and his other friends in Messenger Service at West Street recently.

Corporal John J. O'Shea with two throat-slitting warriors who fight on the side of the Allies, and an unidentified sailor

LIEUT. EVERETT C. WALSMAN of the Naval Air Corps is at Quonsett Point, Rhode Island; while LIEUT. DAVID F. TUTTLE of the same branch of service is stationed at Breezy Point, Norfolk.

A VISITOR to Room 704 recently was CAPT. FOSTER B. BLAKE who is in charge of the Army Air Force signal services at Greensboro, North Carolina.

OTHERS FROM whom cards or letters have been received include:

H. C. DeValve, R. M. Eichhorn, W. F. Edwards, Lt. John Marrero, Jr., Capt. F. J. Skinner, Anne Kos, Alfred Bertin, J. P. Robinson, Ellis Gilliam, Major Walter F. Smith, Jr., R. F. Flinn, F. R. Hanlon, C. W. Muccio, W. T. Reck, R. D. Long.

Major Emil Alisch, Lieut. Nils H. Anderson, Lieut. E. C. Walsman, H. H. Sharpe, P. P. Melkonian, W. B. Schellerup, G. W. Wheeler, Edward Filipovits, G. E. Davis, J. V. Cunningham, Lt. J. C. Applegate, R. J. Drout, Lieut. W. A. Von Glahn, J. M. O'Neill, Lieut. R. C. Nance, A. W. Schmidt, C. H. Greenall, D. W. Fulton, H. C. Silent, R. R. Cordell, P. E. Watts, J. C. Ptacek, A. V. Frolic, G. N. Eltz and Arthur Jackson.

* * * * *

A NUMBER of stickers have been received from the War Production Board indicating that the Bell Telephone Laboratories has done its part in releasing vitally needed typewriters for the exclusive use of the armed forces. Approximately twelve and a half per cent of the total typewriter equipment has been released. The number that the Government could use was limited because of certain modifications in mechanical design which the manufacturers incorporated to meet Laboratories requirements.

Men of the Laboratories

(Chosen by Lot)

A "Dodger" fan of purest vintage is Charlie Hempel, whose feet lead him to Ebbets Field when his path of duty does not lead to West Street. After graduating from Public School 123 in Brooklyn, Charlie worked for a number of concerns, including some logging camps on the Coast, and entered the Laboratories in 1941 as a night cleaner at West Street. Next year he became a boiler room helper at Graybar and Davis. After serving for some months as a boiler room helper he was assigned to building service at Fourteenth Street.

The Hempels and their three-year-old daughter live in Ridgewood, Long Island. Charlie's personal sport is horseshoes, which he pitches every noontime on the Club's courts on Bethune Street.

Charles R. Hempel

An all-around handy man with lathe, shaper, pliers or soldering iron is Ray Desmond, one of the technical assistants at Holmdel. Ray joined the Laboratories in 1930, not long after graduation from Red Bank Catholic High School, and worked on short-wave directional antennas under E. Bruce. During the depression he was laid off, but was recalled in 1936 to work for a time for G. C. Southworth on wave guides,

Raymond A. Desmond

and then for H. T. Friis on antennas and receivers for ultra-short-wave circuits.

A loyal car-sharer, Ray drives four engineers between Holmdel and Rumson. He is married and has a six-year-old daughter, Judith Ann. He also has a 30 x 40 Victory Garden. Actively interested in his community, he is a member of the Civilian Defense Council and a former chief of the Fire Department. Sailing, fishing and softball are his hobbies, when war work permits.

* * * * *

To Charlie Haas, as to many others, the war has brought opportunity; and he was ready for it because he had been following a constructive hobby. At home he had been building miniature automobiles with gaso-

Charles A. Haas

line engines, and racing them. So when High Frequency Transmission, expanding under pressure of war work, needed a man who was handy with his hands, someone who knew of Charlie's hobby thought he would do. A transfer was arranged from Laboratory Service, and Charlie has done so well that he has been rerated from Laboratory Mechanic to Technical Assistant.

Born in Brooklyn, Charlie graduated from Far Rockaway High School in 1934. The next year he entered the Laboratories as a messenger, transferred to General Service as a clerk, and then became a service man. He and his wife live in Queens Village, where they have a 50-foot-square Victory Garden. They both enjoy active sports such as skiing, skating and swimming; and look forward to big-game fishing, when victory comes.

News Notes

F. J. Given, in charge of coil, condenser and resistance development, has recently returned from a month's visit to England as chairman of a mission to discuss production, grading and use of mica. Other members were F. E. Hanson, Western Electric; W. J. Spengler, Bendix Aviation; and J. J. Budelman, War Production Board. The group traveled both ways by air; they were aboard the next plane out of Lisbon after a ship in the same service had been shot down. In England, the mission conferred with officials of the British Ministry of Supply and engineers of the electronic and aircraft industries and was successful in securing agreement on a number of engineering matters concerned with quality grading, conservation and reduction to essential uses of mica. They were guests of the British Mica Trade Association at a luncheon—Mr. Given responded to a toast, "Our Guests"—and at a reception tendered in their honor by the British Government.

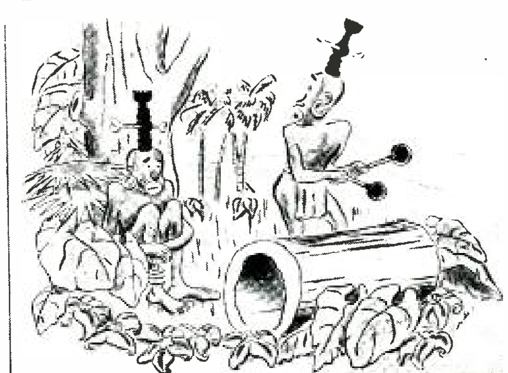
The Men's Bowling League of the Bell Laboratories Club will meet at the National Bowling Recreation Arena on Wednesday and Friday nights from 6 to 8:15 from September, 1943, to April, 1944. M. J. Wean has been elected to serve on the Executive Committee as General Chairman of the Bowling League. All men who wish to participate are asked to call A. B. Kvaal of Room 963, Extension 707, at West Street, General Secretary-Treasurer of the League.

R. R. Williams has received the citation of *Useful Citizen* from the University of Chicago Alumni Association for his service to the community, the nation and humanity.

C. H. Sample visited Hawthorne and Point Breeze to discuss corrosion problems.

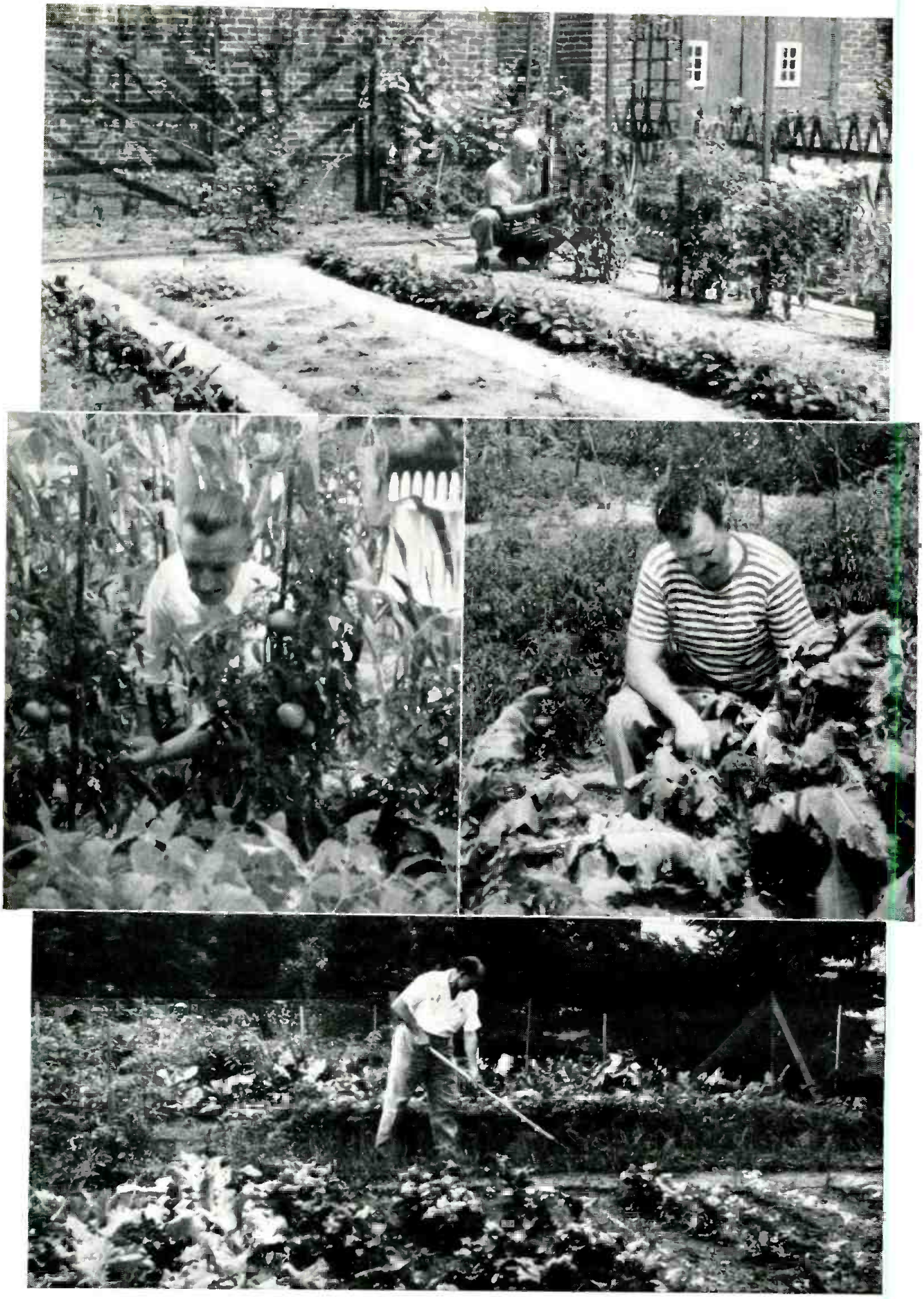
B. L. Clarke attended the meeting of the Advisory Board of *Industrial and Engineering Chemistry* (Analytic Edition) at Woods Hole, Massachusetts.

R. H. Erickson was in Philadelphia on July 6 to discuss with the representatives of the Resinous Products and Chemical Company methods of compounding Paracon.



Suydam in Collier's

"I forget Port Moresby's thump and I hate to bother Information"



Victory Gardens—Here are four out of several hundred gardens cultivated by Laboratories' members. Top—E. M. Mullin of Lynbrook has this garden in his yard and a plot in the community garden, where W. R. Stuart (center right) has one 20 x 50 feet. P. A. Doscher (center left) of Valley Stream is justly proud of his tomatoes. Bottom—A. H. Muller has a garden near the entrance to the Murray Hill grounds

J. W. Mullen went to Akron on July 22 and 23 in connection with war work.

W. O. Baker was also in Akron to attend committee meetings in connection with research and development for the Office of Rubber Director.

Work on the development of vitreous enamel resistors took M. D. Rigterink to Hawthorne during the week of July 19.

J. B. Howard, G. N. Vacca and V. T. Wallder visited Point Breeze to witness extrusion trials of insulated wire.

V. T. Wallder attended the Pittsburgh meeting of the A.S.T.M., June 29 and 30.

H. H. Staebner was at Point Breeze on cord development matters.

C. T. Miller discussed motor problems at the General Electric Company, Fort Wayne, Indiana.

War work took K. G. Compton to Dayton, Ohio, and to Hawthorne during the week of July 19. Mr. Compton examined captured enemy equipment at Washington. He also conferred with the Signal Corps at Fort Monmouth and at Camp Evans on moisture and fungus-proofing of land-based equipment on July 9 and again on July 30. Mr. Compton is chairman of, and J. M. Wilson, H. F. Marting and E. B. Wood members of, the Bell Laboratories Committee on Moisture and Fungus-Proofing.

R. E. Poole has been appointed Assistant Director of Commercial Products Development, reporting to B. W. Kendall, Acting Director in O. M. Glunt's absence. Mr. Poole will continue his present duties as Radio Development Engineer.

Special cable problems took C. A. Webber to Chicago during July.

E. B. Wood discussed apparatus problems with the Signal Corps at Fort Monmouth.

P. H. Richardson and W. C. Schmidt were in Chicago on networks problems.

J. A. Carr attended trial installations of communication lines in Florida by a field signal battalion during the latter part of June and early July. More recently Mr. Carr, with G. M. Bouton and Long Lines and O & E engineers, visited towns in Connecticut on aerial cable maintenance problems.

"The Telephone Hour"

(NBC, Monday Nights, 9:00 P.M., Eastern War Time)

SEPTEMBER 13, 1943

Floods of Spring — *Rachmaninoff*
Orchestra

Minuet — *Beethoven*
Redwoods at Bohemian Grove — *Templeton*
Impression — *Templeton*
Alec Templeton

Nocturne from "A Midsummer Night's Dream" — *Mendelssohn*
Orchestra

Concerto No. 2—First Movement — *Rachmaninoff*
Alec Templeton and Orchestra

SEPTEMBER 20, 1943

Tea for Two — *Youmans*
Orchestra

Après Un Rêve — *Fauré*
Lily Pons

In Deep Woods — *MacDowell*
Orchestra

Ay, Ay, Ay — *Freire*
Lily Pons

Overture to "La Pskovitianka" — *Rimsky-Korsakoff*
Orchestra

Variations — *Proch*
Lily Pons

SEPTEMBER 27, 1943

Song of Love — *La Forge*
Swing Low, Sweet Chariot — *Spiritual arr. Burleigh*
Helen Traubel

Waltz No. 15 in A Flat Major — *Brahms*
Orchestra

Beautiful Dreamer — *Foster*
Helen Traubel

A Night on Bald Mountain — *Moussorgsky*
Orchestra

Divinités du Styx from "Alceste" — *Gluck*
Helen Traubel

OCTOBER 4, 1943

Babes in the Wood from "Very Good Eddie" — *Kern*
Orchestra

Fireworks — *Debussy*
Pequeña — *Iturbi*
Prelude — *Shostakovitch*
José Iturbi

Dolores Waltz — *Waldteufel*
Orchestra

Concerto in A Minor—Last Movement — *Grieg*
José Iturbi and Orchestra

Women of the Laboratories

"Torch of Liberty"
Symbol of Women War Workers

Today's manpower problem is in great part a womanpower problem. As men steadily are inducted into military service, the jobs they leave behind must be filled by women. It is impossible to continue to wage offensive war without making use of more of the nation's unused womanpower. By the end of 1943, it is estimated that 17,400,000 women must be at work, not necessarily in the factories, but in stores, trains, schools, offices. Any job a woman takes which releases a man for military service or heavy industrial work is a *war* job. This includes the hard, the strenuous, the unglamorous work of women in agriculture, communications, education, medical care, restaurants, hotels, stores, transportation, office work.

This month's cover of the Record is a salute to the unsung heroines of the home front who have rolled up their sleeves and pitched into full-time war work. For the cover we picked Laura Chamberlin, lamp replacer, because as she goes about her work she swings gracefully into a pose which echoes the emblem of the womanpower program, shown on this page. Besides helping to win this war by releasing a man for active duty, Laura is also an air-raid warden in Valley Stream, her home town. She writes twice a week to her two favorite servicemen, her brother and her fiancé who is returning to this country after spending a year in the South Pacific. An all-round athlete, she enjoys all kinds of sports, but she likes swimming, skating and horseback riding best.

With her telephone headset plugged in, Irma J. Scott of Transcription types dictation for a vital military project

Specifications Distribution

For the first six months of 1943, 4,252 specifications were issued and distributed by the five girls who comprise the Specifications Distribution group of the Apparatus Development Department. When a specification is approved by the Specifications Department its issuance becomes the responsibility of these girls. Under the supervision of Shirley M. Lawton, the necessary copies of the specifications are requested from the Transcription Department and reproductions of the drawings are ordered from the Blueprint Department or from the National Process Company. When ready, the reproduced copies of specifications and the drawings are assembled and the completed specifications sent to the Western Electric Company and to the engineers concerned. The original and copies are filed in Section 4-A.

* * * * *

It's a far cry from life on a Vermont farm to operator of the fire alarm control board in the West Street power room. But Margaret B. Leddy, who operates the board, has bridged the gap, thereby releasing a man for fighting. Mrs. Leddy receives,

A — Members of the Specifications Distribution group are, left to right, Blanche H. Adams, Shirley M. Lawton, Marjorie M. Hayes, Mary R. O'Brien and Alice G. Sorensen

B—Josephine B. Hores keeps the utensils in the bake shop scrubbed and spotless. By helping to keep Laboratories members well fed, Mrs. Hores is doing war work

C—Office clerk in the Development Shop, Marion B. Miller took her place in war work when her husband joined the Navy. Amid the grinding and drilling of the lathes and milling machines or the shrill buzzing of a band saw, Marion does her clerical work. Like many other members of the Laboratories she has moved to Greenwich Village where the trees and birds in the garden of her apartment remind her of her home in Carmel, New York. For relaxation she likes bridge and the movies

A—Among jobs at the Laboratories essential to the war is the work of stenotypists such as Elizabeth V. Jackson who is taking dictation from F. T. Meyer. A graduate of John Adams High School, she learned stenotyping at night school after she first came to Transcription. Elizabeth is a tennis enthusiast

B—Margaret B. Leidy checks fire alarms coming into the control desk in the Engine Room

C—Gloria E. Schieler, graduate of a Defense Training course, applies her skill to mathematical problems of confidential signaling devices. She is equally at home in the laboratory of the Special Apparatus Development Department making electrical measurements on these signaling devices. Gloria lives with her parents on College Point, Long Island acknowledges and retransmits fire alarms and elevator alarms; answers the phones; makes records of complaints on lights, fuses, fans, plumbing and fixtures that go out of kilter; and distributes the complaints to maintenance men and women when they call in to her control board. Besides this, Mrs. Leddy reads engine room meters for logs that are kept 24 hours continuously, assists in monthly tests on all the alarm systems and operates the engine pumps when maintenance men want air in the pressure tanks on the roof.

Mrs. Leddy came to the Laboratories last March when her husband had expected to enter the service. She had been a housewife since her marriage, but previous to that had been a dental nurse, having graduated from a New York Dental Training School. Besides doing a man-sized job at the Laboratories, Mrs. Leddy does her own housework, and enjoys cooking the evening meal. She finds little time for her piano or for singing—she used to play in an orchestra—most of her evenings being taken up with sewing and with preparing her things for her next day's work. However, she does manage to read a few pages of a good book each evening.

* * * * *

Joy Piker measures and adjusts the resistance of deposited carbon resistors. These small units have the resistance of a much larger coil of fine wire and they are particularly useful in ultra-high-frequency radio apparatus. Joy became a Technical Assistant at Murray Hill last October after spending a year at Bergen Junior College. She graduated from the Summit High School the previous year. Joy plays the banjo and the piano. She likes tennis and skating and is enthusiastic about horseback riding.

* * * * *

"Floors please" is a call most of us hear hazily in the early morning. We call out the floor we want and leave the elevator mechanically. For us the day's work is just beginning, but for the elevator operator, Helen D. Hickey, the day is well along. Before reporting to work at West Street she has helped to get her three lively youngsters ready for school; she has sent her husband off to his job with the City of New York; and she has left plans for the day's menus, the children's routine and household chores in capable hands at home.

Joy Piker

When the need for women to replace men first became urgent Mrs. Hickey decided that with proper supervision the children, John, Billy and Anne, the youngest, who is seven, could be left alone while she did her part for the war. Her return to work for the Bell System was only natural since she had worked for the New York Telephone Company as a clerk prior to her marriage twelve years ago. Mrs. Hickey works for two weeks on an elevator and then changes to another car; she also runs the mail car occasionally and substitutes for the regular girl in the Package Room during the day.

At five-thirty she returns to her home in the Kingsbridge section of Manhattan to spend as much time as possible with her family. After dinner they all play games, or listen to a radio program until the children's

HELEN D. HICKEY

bedtime. Then Mrs. Hickey and her husband enjoy a long walk, a movie, or a visit to nearby friends.

* * * * *

EMMA MONACO is seen here pointing a piece of fine aluminum-alloy wire preparatory to threading it through a diamond die to reduce its diameter to the extremely small size of .0008 of an inch. It is then suitable for the vibrating elements of recording oscillographs. Before coming to Murray Hill last November, Emma was a messenger and mail girl at West Street. She graduated from the Summit High School in 1941 and was drum majorette of the school band for three years. Fond of music, she plays the piano and sings and like most people with musical talent enjoys dancing. Emma also likes the movies and the theater, particularly musical drama. In athletics she bowls and plays a good deal of tennis.

HOW RESTAURANT RATIONING WORKS

The housewife who manages ration points for an average family can appreciate the problem it is to balance ration points for the Laboratories family of five thousand three hundred who eat at Whippany, Murray Hill and West Street daily. As in almost every family today, the problem is that of serving nutritious meals to war workers while stretching the allotment over a given ration period.

Restaurant rationing, while basically the same as individual rationing, is carried on on such a large scale that it requires a regular banking procedure, with deposit slips, check books, balance sheets and a complicated budget. Points were originally allotted on a figure taken from the usage in a given month in 1942. The Restaurant deposits in a checking account all of its points and the bank sends out a statement showing the monthly ration balance. There is a separate account for sugar; another for processed foods; and a third for meats, fats, cheese and butter. Sugar allotments are banked by the pound as

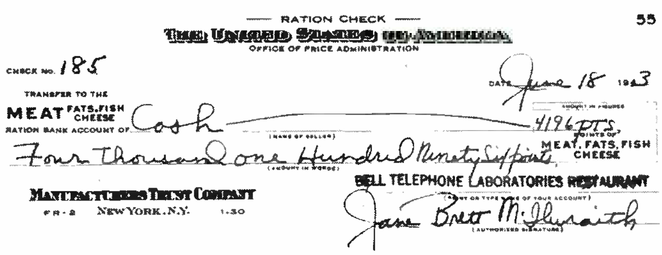
EMMA MONACO

was coffee; processed foods and meats by the point. The Restaurant pays the wholesaler by a ration-banking check which looks like any ordinary check, being numbered, dated and signed in the same way. From the wholesaler this check goes from the various clearing houses back to the bank on which it was drawn. After its cancellation it is returned to the Restaurant with the monthly statement.

Jane B. McIlwraith looks on while Theresa W. Grippa makes out a ration-banking check

Not only must the ration points in the bank be balanced out each month, but a budget of points must be kept. As an example, if there is too much cheese used there will not be enough meat. When too many points are used for meat no fats can be bought. This means customers get no pie, because pie calls for shortening. When too much canned fruit has been bought there will not be enough canned vegetables. When customers use too much sugar in their tea and coffee, no puddings will be on the menu; puddings require large amounts of sugar. However, even with a balanced point budget and ration points in the bank the Restaurants often cannot buy what they want—the market supply is limited.

To receive larger food allotments a Restaurant must show a twenty per cent increase in the number of customers as well as a twenty per cent increase in the amount of money taken in at meal time. It is during such a period when customers increase, say, fifteen per cent, and must still be fed on limited ration allotments, that preparing menus and satisfying all becomes trying.



— RATION CHECK — 55
THE UNITED STATES OF AMERICA
OFFICE OF PRICE ADMINISTRATION

CHECK NO. 185 DATE June 18 1943

TRANSFER TO THE MEAT FATS, FISH CHEESE RATION BANK ACCOUNT OF Cash (NAME OF SELLER) 4196 PTS. (AMOUNT IN FIGURES) POINTS OF MEAT, FATS, FISH CHEESE

Four Thousand one Hundred Ninety Six points (AMOUNT IN WORDS)

MANUFACTURERS TRUST COMPANY
FR-2 NEW YORK, N.Y. 1-30

BELL TELEPHONE LABORATORIES RESTAURANT (PRINT OR TYPE NAME OF YOUR ACCOUNT)
Jane Brett McIlwraith (AUTHORIZED SIGNATURE)

This is a ration-banking check

* * * * *

Alice G. Sorensen has been awarded an evening scholarship to the Washington Square College of New York University. The scholarship was offered on a competitive basis to young men and women employed by New York City firms and municipal agencies. A picture of Alice appears on page 41 of this issue of the Record with the girls of the Specifications Distribution group.

Girls' Bowling League

Bowling is good exercise and lots of fun. You will enjoy yourself and make new friends if you join the Girls' Bowling League which will meet Friday nights beginning Sept. 17 at the National Bowling Recreation Arena, Twenty-third St. and Eighth Ave., New York City, from 6:00 to 8:15 P.M. If you wish to bowl please advise Miss A. Richter, Room 971, Extension 613, at West Street immediately.

As a convenience for those who wish to eat at their desks, the Restaurant at West Street is now selling lunch boxes in Section 8-C. All boxes include a sandwich, salad, dessert and beverage. Mrs. Leda Girouard and Hansel Hodge sell about one hundred boxes a day

C. S. Knowlton visited the General Electric Company plants at Lynn, Massachusetts, and at Fort Wayne, and also the Aircraft Radio Laboratory, Wright Field, Ohio, on power problems.

R. E. King and Paul Winsor, Jr., made tests at a step-by-step central office in New Haven, Connecticut.

W. M. Hill appeared before the Primary Examiner at the Patent Office in Richmond relative to an application for a patent.

J. E. Cassidy and C. Baraff were also at the Patent Office in Richmond during July on patent matters.

J. W. Farrell has been appointed a member of the Advisory Board of the Manufacturers Trust Company's branch at Eighth Avenue and Fourteenth Street, New York City.

D. P. Barry has been transferred to the Electronics Research Department reporting to V. L. Ronci, Electronics Research Engineer. Mr. Barry will be responsible for experimental vacuum-tube construction work in Building T.

A. H. Sass has been appointed Superintendent of the New York Development Shop. He will report to H. C. Atkinson, Plant Shops Manager.

August Service Anniversaries of Members of the Laboratories*

Research Department

D. M. Black—15	A. M. Curtis—30	Mary Kelly—20	P. H. Smith—15
A. J. Bond—20	Harry Grutzner—15	C. G. Reinschmidt—15	E. W. Templin—15

Apparatus Development Department

N. V. Firth—15	Marion Leworthy—15	E. F. Smith—20	Fred West—15
W. G. Freeman—30	M. L. Martin—15	Catherine Tully—20	B. S. Woodmansee—20
J. O. Israel—15	R. H. Mills—25	V. J. Weber—15	

Systems Development Department

N. M. Anderson—30	Fred Broome—25	C. A. Grierson—15	R. C. Kraft—25
G. E. Bailey—30	J. L. Carter—15	J. M. Horne, Jr.—20	R. K. Potter—20
F. E. Blount—15	W. A. Drake—25	Henry Kahl—15	W. H. Spahn—35
H. N. Bowman—35	B. A. Fairweather—15	Arthur Kenner—30	W. J. Turney—30
M. E. Brandin—15			J. G. Walsh—20

Technical Consulting Staff

Marian A. Darville—25

Patent

R. J. Guenther—15
Frances Post—20

Commercial Relations

J. T. Keough—20

Bureau of Publication

C. D. Hanscom—20
Helen McLoughlin—15

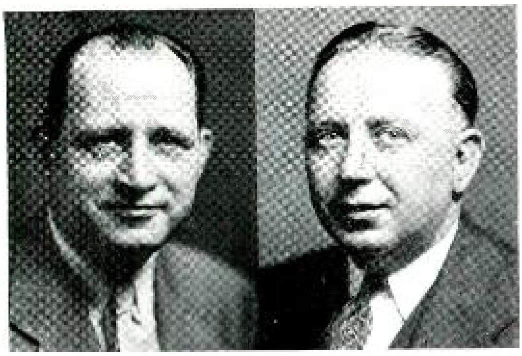
General Service Department

Herbert Oldham—25
G. F. Voehl—25

Plant Department

G. E. Banks—15	James McDonald—15
M. T. Diaz—20	Kieran Rohan—15
R. R. Hopkins—20	Lillian Roome—15
Hugh McCaffrey—15	W. F. Sill—15

*Biographies of 25-year service people that have not as yet appeared will be published in future Records.



W. L. Daly L. H. Keller

Twenty-Five-Year Service Anniversaries

Walter L. Daly, Staff Assistant. Fordham University, accounting and business law, 1925-27. New York Edison Company, 1914-18; Bell Laboratories, 1918. mem. Telephone Pioneers. m. Anna Lehan; ch. Mrs. Muriel Acker, Mrs. Claire MacDonald, Doris Anna; r. Bay Ridge, Brooklyn.

From 1918 to 1922 Mr. Daly was successively in the shop expense, engineering expense, plant accounting and classification groups. He then joined the departmental cost group of the Apparatus Development Department. In 1929 he transferred to what is now the Quality Assurance Department on complaint statistics work. He returned to the Apparatus Staff Department in 1935 and since then has been concerned with handling all service work in connection with costs of cases or projects, including the preparation and issuing of reports on these cases.

Lester H. Keller, Draftsman. Cooper Union, drafting course, 1918-21. A T & T, 1917-25; David Grimes, Inc., 1925-26; A T & T, 1926-42; Bell Laboratories, 1942. mem. Telephone Pioneers. m. Margaret Rector; r. Westwood, N. J.

Mr. Keller is one of the draftsmen who have been transferred to the Laboratories from the A T & T to work on war projects. This he does in the Research Drafting Department. His first work in the Bell System was with the Engineering Department of the A T & T and then, in its 1919 reorganization, he transferred to the General Service Bureau at 195 Broadway on drafting work for the D & R and later for the Patent Department preparing court exhibits for the Kellogg and Gray Pay Station Patent Litigation Cases.

Thomas Solan, Building Shop Supervisor. Charles Murphy, 1905-11, and Martin Kelly, 1911-18, paint contractors; Bell Laboratories, 1918. mem. Telephone Pioneers. m. Catherine Fennelly; ch. Thomas, Jr., Mrs. Mary Casey; r. Mineola, L. I.

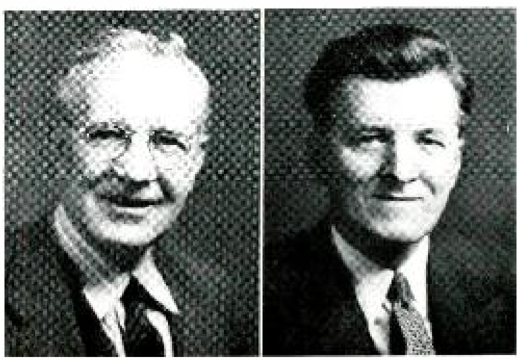
Coming to West Street in 1918 as a painter, Mr. Solan advanced to an assistant foreman in 1927 and, two years later, to a foreman, a classification later changed to supervisor. He is now in charge of a group of painters doing outside as well as inside maintenance painting on Laboratories' premises. Some of the larger jobs he recalls are the change from kalsomine to paint on all walls and ceilings from the basement to and including the ninth floor, the complete refinishing of Sections K, J, I and T when these were taken over and the initial painting of Sections L and H when these were built.

Charles D. Davidson, Sheetmetal Worker. Bell Laboratories, 1918. mem. American Legion. m. May Anderson; ch. Edith Lillian; r. Elmhurst, L. I.

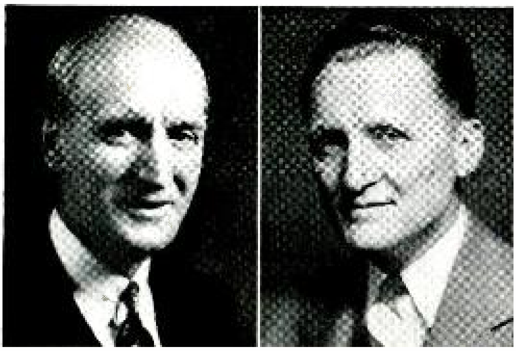
Shortly after Mr. Davidson joined the Laboratories he enlisted in the U. S. Navy and spent nearly a year at the Naval base in Queenstown, Ireland, as a coppersmith. He then returned to the sheetmetal group of the old Model Shop. When this group was later divided he went with that section now in the Building Shops.

William Spangenberg, Draftsman. Bell Laboratories, 1918. mem. Telephone Pioneers. m. Catherine Gleason; ch. Mrs. Dorothy Blanchard, Rita Eveline; r. Queens Village, L. I.

In 1918 Mr. Spangenberg was assigned to the apparatus drafting group where he was concerned with the design of apparatus for telephone systems, radio receivers and transmitters. During this time he was also associated with the design of submarine detection apparatus and with aircraft receivers. Later, when the Commercial Prod-



Thomas Solan C. D. Davidson



C. A. FRANK   WM. SPANGENBERG

ucts Development Department moved to the Graybar-Varick building, he went there with the drafting group. Since that time he has been concerned with the design of aircraft and police radio transmitters, receivers and speech input equipment. More recently he has been on war projects, particularly battle announcing systems for the U. S. Navy.

Charles A. Frank, Sheetmetal Worker. John J. O'Mara, 1908-17; Dayton and Montgomery, Inc., 1917-18; Bell Laboratories, 1918. mem. Telephone Pioneers. m. Mary Cross; ch. Charles Peter and William Joseph, both with Western Electric, and Mrs. Virginia Frank Westphal; r. Greenwich Village.

Mr. Frank joined the sheetmetal group of the Model Shop in 1918. When this group was later divided he went with the section that became part of the Building Shop. His work as a sheetmetal worker has been principally on the maintenance of the West Street building.

W. Lindsay Black, Member of the Technical Staff. Pace Institute, courses in accounting and business administration, 1932-36. Bell Laboratories, 1918. mem. A.I.E.E., I.R.E., Acoustical Soc. of Am. m. Alice Burger; ch. Ruth Alice; r. Mountain Lakes, N. J.

Entering the Laboratories as a technical assistant in 1918, Mr. Black took part in the testing of carrier telephone equipment and a number of special systems, notably the terminal equipment for the Key West-Havana cable and the first public address system for commercial installation. In 1922 he went to Rio de Janeiro to install a public address system at the Centennial Exhibition and then a carrier telephone system between Rio de Janeiro and Sao Paulo.

Since 1925 Mr. Black has been in what is now the Commercial Products Development Department where he is now a supervisor. He has been engaged in the development and installation of audio amplifiers, public address systems, power line carrier systems, radio transmitters, and, since 1927, speech input equipment for radio broadcasting and audio-frequency equipment for other apparatus. He is now concerned with the design and development of apparatus for the Armed Forces.

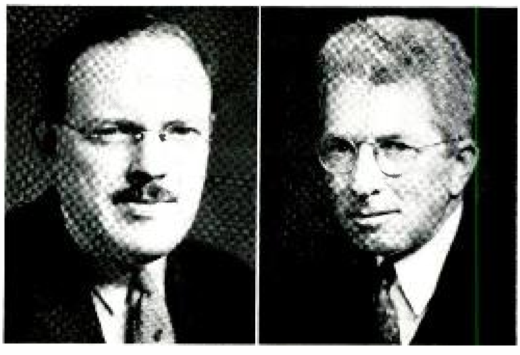
Frank E. Ward, Member of the Patent Staff. New York Law School, LL.B., 1923. Bell Laboratories, 1918. mem. Telephone Pioneers. m. Martha Strutt; ch. Mrs. Dorothy Curry, Harvey Robert; r. Williston Park, L. I.

During Mr. Ward's twenty-five years of service he has been continuously concerned with patent investigations and the prosecution of patents relating to equipment for the telephone plant. In recent years he has devoted practically all of his time to vacuum-tube structures and methods for their manufacture.

Joseph F. D. Hoge, Member of the Technical Staff. Cornell, M.E., 1909. Westinghouse Church Kerr & Co., 1906-07; American District Telegraph Co., 1907-16; The Maintenance Co., 1916-18; Bell Laboratories, 1918. Life mem. A.I.E.E.; mem. Am. Electrochemical Soc., Cornell University Club. m. Cele Mendel; r. Manhattan.

Mr. Hoge's first work was in the Apparatus Development Department where he was engaged in the design of telephone repeaters and mounting structures for telephone apparatus. Later, in what is now the Commercial Products Development Department, he became occupied with the design of amplifiers and accessory apparatus for public address systems, sound picture systems and equipment for the U. S. Navy.

More recently Mr. Hoge has specialized on mechanical design problems in connection



W. L. BLACK   F. E. WARD

with the development of battle announcing systems for the U. S. Navy. This work has included racks for control equipment, loud speakers, mounts for high-power reproducers, transmitter control boxes, microphones and testing equipments.

Archie R. Kemp, Organic Research Chemist. California Institute of Technology, B.S., 1917, M.S., 1918. Teaching Fellow, California Institute of Technology, 1917-18; Bell Laboratories, 1918. mem. Am. Chem. Soc.; Am. Inst. Chem. Eng.; New York Acad. Sci.; fel. Inst. Rubber Industry, Gt. Britain. m. Ruby R. Stokesbary; ch. Vera Lucile, Marilyn Lenore, Warren Reed, Ernest Eugene; r. Westwood, N. J.

Organic research on rubber and other insulating materials has occupied Mr. Kemp's time since the first two years of his association with the Laboratories, when he was in charge of analytical work. In 1922 he was responsible for the development of the pressure equalizing material required for the successful operation of the first permalloy-loaded submarine telegraph cable. Paragutta is outstanding among Mr. Kemp's many contributions in the field of rubber insulation. He has also been active in the development of processes for the continuous vulcanization of wire and other rubber products. Much of his time is now devoted to problems relating to the development of synthetic rubber compounds. Mr. Kemp is the author of numerous publications on organic and analytical chemistry, rubber science and technology and electrical insulating materials. Over 40 patents have been issued in his name.

Philip Venneman, Member of Laboratories Staff. Paterson (N. J.) High School, 1918. Bell Laboratories, 1918. m. Mary F. Daily; ch. Walter F., Phyllis F.; r. Chatham, N. J.

A. R. Kemp J. F. D. Hoge

C. E. Sunderland Philip Venneman

After serving several years as draftsman, Mr. Venneman took charge of telephone installations and lock systems at West Street and other New York locations. He became Building Foreman in 1932 and was placed in charge of the Building Service Department in 1934. In June, 1941, he transferred to Murray Hill to organize building service there in preparation for occupying the new buildings and he is now in charge of building and telephone service.

Charles E. Sunderland, Design Draftsman. Pratt Institute, 1917-18. Bell Laboratories, 1918. mem. Telephone Pioneers. m. Corinne Carson; ch. Charles Robert; r. Baldwin, L. I.

A member of Systems Drafting, Mr. Sunderland has worked on circuits, equipment and assembly drawings of every kind. One of his skills is in making up synthetic pictures by means of combining and retouching photographs.

We See by the Papers, that

There has been argument whether "Quality Control" was first born here or in America. We are informed, however, that it was first put forward in 1922 by Dr. W. A. Shewhart, of the Bell Telephone Laboratories, in New York. It has been used in this country in electric lamp manufacture and some branches of the Textile and Chemical industries. In production engineering it is, however, quite a recent development. Since 1940 its development has been rapid, and many improvements in the original technique, appropriate to machine shop applications, have been made.—*Electrical Times, London, July* 15, 1943.

Some capitalist firms allow their scientists great freedom. Thus R. R. Williams works for the American Bell Telephone Laboratories. His main job is to keep telephone poles from rotting and insect attack. I imagine he does this pretty efficiently, for the Bell Laboratories allows him so much time and equipment for his own work that he has isolated a vitamin and worked out its composition. Few British industrial chemists are so lucky.—*J. B. S. Haldane, Daily Worker, New York, July* 25, 1943.

The first commercial dust-core material was produced in America by the Western Electric Co. about 1915. . . . The next step forward was about 1928, when the Bell Laboratories in America perfected a method of producing cores composed of compressed powdered "permalloy." . . . —*Electronic Engineering, London, August*, 1943.

In a recent statement made by Sir Ernest Simon before the Parliamentary and Scientific Committee, some outstanding facts were given concerning research in the United States. The research unit of the Bell Telephone Company, for example, has some 5,000-6,000 research workers concentrated on the one problem of telephonic communication. In the United States there seemed to be little need to persuade the business man, hard-headed though he be, of the value of research. . . . The discussion which followed Sir Ernest's statement showed how the problem was appreciated by his listeners and gave indications of where research here should be encouraged and fostered.—*Nature, London, June* 19, 1943.

Mica and the War—An instance of one of the minor revolutions produced by the war is the recent arrival here of a little group of American business men who are mica specialists. These industrialists have come to see how we are using our supplies of this product. On their side they have been

Engagements

John J. McCarroll, U. S. Army—*Madelyn R. Flynn
*Edward A. Hake—*Marjorie G. McLinden
*Edward B. Kopetz—Elfrieda Neuman
*George J. Thiergartner—*Marian Spara
*H. J. Delchamps, Jr.—Margaret Ann Stewart
*R. Shiels Graham—Ruth C. Opie

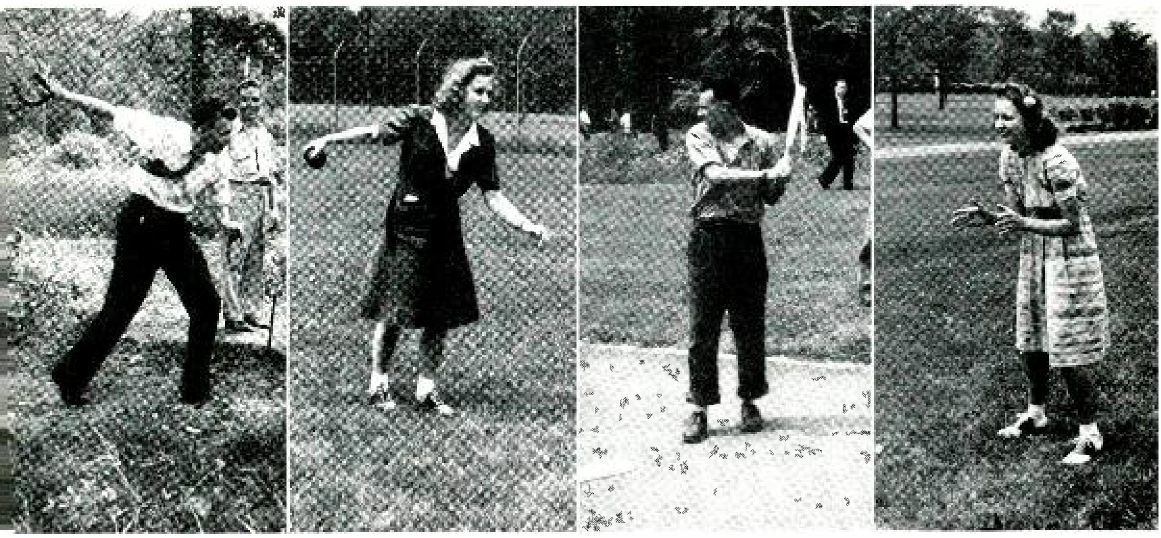
Weddings

Donald Coughlan, U. S. Navy—*Anna Backstedder
Mathew McMahon, U. S. Navy—*Mary Fassig
Walter A. Hutchison, U. S. Navy—*Betty Kent
Clifford R. Radus—*Martha R. Leigh
Joseph Blank, Jr.—*Theresa Malaspina
Richard D. Long, U. S. Army—*Hazel Norris
Douglas Shropshire—*Carol C. O'Malley
*James M. Labaugh—Pearl Schimpff
*William L. Mraz—Virginia M. Sherwood
J. M. Waldman, U. S. Army—*Frances L. Sikelianos

Members of the Laboratories are marked with an asterisk. Notices of engagements and weddings should be sent to Mrs. Helen McLoughlin, Room 1103, West Street.

During June and July the United States Patent Office Issued Patents on Applications Previously Filed by These Members of the Laboratories

L. E. Abbott	P. G. Edwards	B. J. Kinsburg	A. Rienstra
A. E. Anderson	R. A. Ehrhardt	L. E. Krebs	A. A. Roetken
J. A. Ashworth	G. J. V. Faley	W. Y. Lang (2)	E. E. Schumacher
W. M. Bacon	E. W. Gent (2)	M. A. Logan (2)	A. M. Skellett
A. B. Bailey	H. C. Harrison (2)	R. F. Mallina	A. A. Skene
J. R. Bardsley	C. A. Hedberg	E. D. Mead	H. M. Stoller
B. S. Biggs (2)	H. A. Henning	V. F. Miller	H. W. Ulrich
H. S. Black	A. Herckmans (2)	D. Mitchell	E. Vroom (2)
R. R. Blair	F. H. Hibbard	C. M. Morris	V. T. Wallder
G. M. Bouton	C. N. Hickman	R. Nordenswan	W. W. Werring
J. T. L. Brown (2)	W. H. T. Holden (2)	E. L. Norton	L. R. Wrathall
T. C. Campbell	J. B. Howard	B. M. Oliver	E. E. Wright
K. G. Compton	N. Insley	G. S. Phipps	M. K. Zinn
A. C. Dickieson	J. B. Johnson	J. R. Pierce	F. A. Zupa
E. Dickten, Jr.	R. M. Kalb	C. E. Pollard, Jr.	



'ports enthusiasts at Murray Hill snatch a few minutes during lunch hour for relaxation from exacting ›artime duties. Left to right: F. K. Harvey with M. O'Brien in background on the horseshoe courts and Jean Williams, F. W. Flood and Marion Smith in a softball game

putting all their information into the common pool. . . .

The Americans are a most likeable party. MR. FREDERICK J. GIVEN, the leader, is quiet and unassuming, of slow speech and dry humor. From him I learn that one of the things the members of the American mission are most looking forward to while in this country is a visit to the House of Commons to hear one of the war debates.—*The Daily Telegraph* (*London*), *June* 17, 1943.

Next door is the biggest noise in the world. Right across Rockefeller canyon and on top the terrific pile of the RCA building is the great air-raid warning siren which sounds alerts to Greater New York and jars the eagles' nests for fifty miles up the Hudson. At this desk, about three hundred feet away, it can be heard rather clearly, even with the blackout curtains down.

This hell-roaring device was designed, probably with great glee, by those same Bell Telephone Laboratories which had so much to do with that scientific conspiracy which brought sound to the pictures some years ago. It was built by the Chrysler Corporation, and runs with a 140-horsepower motor car engine and no gas rationing. This siren positively works.

This Victory Siren, according to the engineers, has a "cry" equal to the combined voices of "4,000 million ordinary men." It is so loud that it takes ten million people to listen to it.—*Motion Picture Herald*, *New York*, *July* 10, 1943.

HOLD THAT CALL!

Clear the lines for war calls
That Government requires;
Make less, instead of more, calls
For war is on the wires.

Let's cry a halt on fun calls,
That you don't have to make.
Give right of way to gun calls,
Give Uncle Sam a break.

And let's cut out the dumb calls
And keep the circuits free.
The "guess-who-this-is-from" calls
Are out, for you and me.

At least, let's make 'em short calls,
The long ones are the worst.
Abandon *pour le sport* calls,
The war calls must come first!

Carl H. Claudy, Jr., C. & P. Tel. Co.

Publication and Credit—an editorial by John Mills

"Cast thy bread upon the waters"—and if it is the bread of science it will return amplified and vitaminized by those it has sustained and stimulated. That is evidenced by the enormous advance of science which has been due to the completeness and promptness with which scientists through publication have informed their colleagues, as well as due to the cumulative productivity of the scientific method and the constantly increasing number of workers.

Through publication has been formed the common base of knowledge upon which rest all the special fields of science and all the engineering arts. Because on a broader and deeper foundation they can erect larger and higher structures, industrial laboratories can profit in the long run by contributing to the foundation by publication of their results and methods.

Bell Telephone Laboratories, for example, recognizes its dependence upon and its obligation to science; and through publication makes its material available to scientists and to academic institutions.

Another reason for the Laboratories' policy of publication is inherent in the attitude, conscious or unconscious, of scientific workers. A creative worker needs the stimulation and satisfaction of having his work recognized. Salary alone is not sufficient; he needs as well the acclaim of his peers.

Individualizing credit by publication has long been a policy of the Laboratories, and still is—within the present limitations of military secrecy. During the years from 1922 to Pearl Harbor about 1,400 papers, in technical society magazines, and an even larger number of shorter articles in the Record, reached a world-wide audience. This record, outstanding among industrial organizations, has encouraged other companies to liberal policies of publication.

The policy of publication must take account of the needs of the organization and of the individual. Disclosure must sometimes await the conclusion of coördinate investigations. Sometimes, on the other hand, the worker may prefer to plough ahead rather than stop to recount. He may even feel that someone else—an editor, for example—should do the exposition for him. He must, however, do that himself since an editor's job is merely to dress scientific facts for particular readers just as do patent lawyers or the draftsmen who reduce them to blueprints.

A more serious difficulty arises from the fact that in research, frequently, and in engineering developments, almost always, the final product is a coöperative result. Few of its contributors can be named in any report. As an illustration, note that in the development of Radar—joint effort of about two thousand scientists, engineers and mathematicians—there coöperated about seven hundred members of Bell Telephone Laboratories. Of sheer numerical necessity they, like their colleagues on other equally important work, must remain anonymous.