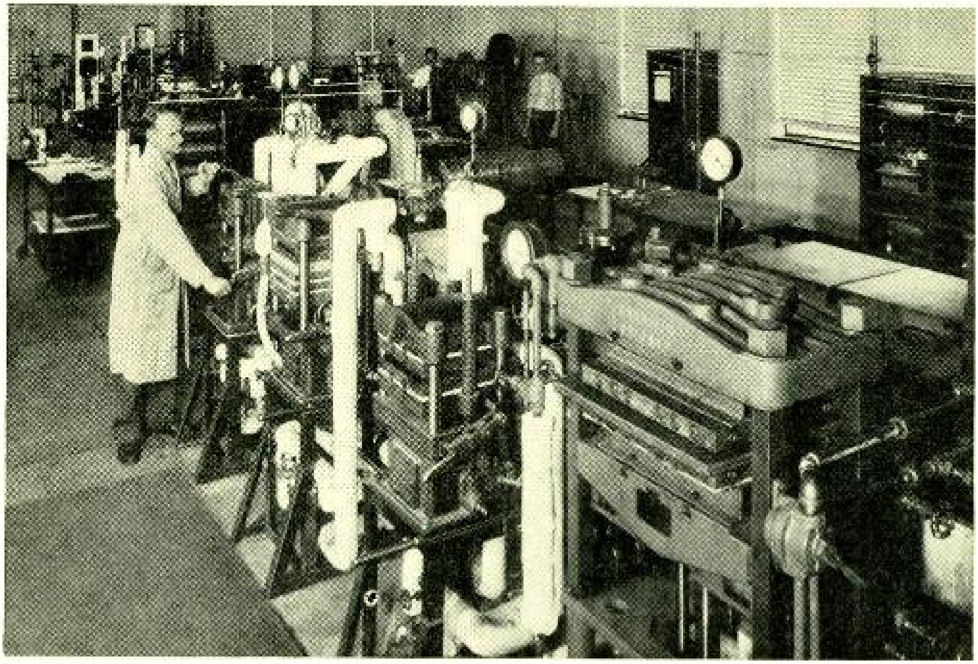


Rubber Research Laboratory at Murray Hill

By F. S. MALM
Chemical Laboratories

RUBBER is used by the Bell System to insulate wires which are installed in the telephone plant in normal times by the millions of feet annually. It is also used for many other purposes including various types of soft and hard rubber manufactured in molded form or cut from rods, tubes or sheets for telephone apparatus. Much of this rubber is subjected to severe weathering and has to give long life under constantly changing conditions of temperature, humidity and light exposure.

The Laboratories have for many years been actively engaged in research on the chemical and physical properties of rubber and its compounds, to determine the kind of materials required to withstand these severe conditions.* Most of the work has been directed to improving insulating materials made from plantation rubber but an increasing part has been directed, during recent years, to synthetics such as Buna S and neoprene. This research work is being directed by A. R. Kemp, assisted by J. H. Ingmanson and the writer.

Extensive studies have been carried out on insulation for submarine cables leading to the development of Paragutta† and pressure equalizing materials for loaded telegraph cables. Insulation has been developed for coaxial cables and more recently dielectric materials for ultra-high frequency and micro-wave cables. Rubber jackets were also devised to pro-

*RECORD, *Oct.*, 1936, *p.* 34. †*May*, 1931, *p.* 412.

tect against corrosion in the transcontinental cable being laid between Omaha and Sacramento.

Recent loss of Far Eastern sources of supply of natural rubber has now forced an urgent problem on the rubber chemists of the Laboratories and their time is at present almost exclusively devoted to studying the properties of synthetic rubbers and their compositions for immediate requirements.

About a year ago the rubber group moved to the new laboratories at Murray Hill where complete facilities have been provided for studying rubber and its synthetic substitutes and for improving them. In anticipation of a peak load in this work additional equipment was installed including mixers, vulcanizers and apparatus for physical and chemical tests. A view of some of the equipment for general use in the rubber laboratory is shown in the headpiece. In the closed type of mixer, Figure 1, there are blades instead of rolls to masticate the rubber until plastic, after which the compounding ingredients are fed into the mixer through a hopper and pressure is applied by a pneumatic ram during mixing. This completes the operation in considerably less time and with greater cleanliness than on open rolls and conforms closely to good factory practice. Various compositions are prepared on these machines for making insulated wire, rods, tubes, sheets or molded parts. A conventional open-type mill with two rolls in which rubber is milled until plastic, preparatory to gradual incorporation of compounding ingredients by hand, is shown in Figure 2.

All of this rubber working equipment is provided with auxiliary apparatus for controlling and recording temperatures, pressures and power consumption. The laboratory rooms are unique in that any of fifteen different services including electric power, air pressure, vacuum, hot and cold water, hydrogen, oxygen and nitrogen in addition to illuminating gas are available at any bench or can easily be made so.

The extruding equipment shown in Figures 3 and 4 is used for making rods, tubes and insulated wire. For these items the compound is plasticized on a mill and fed into the extrud-

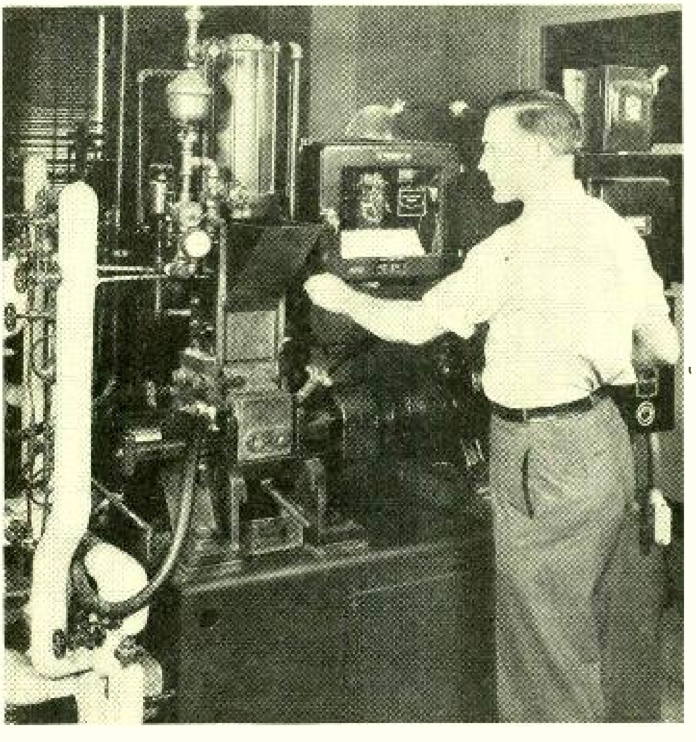


Fig. 1—Closed type of rubber mixer

ing machine, which is provided with a revolving screw for forcing the compound through sizing dies. These machines have water and steam connections so that materials can be run at

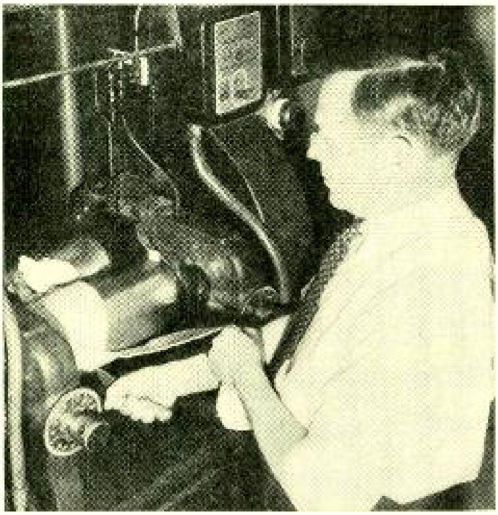


Fig. 2—Conventional two-roll rubber mixer

different temperatures. When insulation is put on wire, a capstan is used to pull the wire through the sizing die. Two separate coverings can be applied simultaneously by using two machines in tandem. The extruders and capstan are driven independently so that varying screw and wire speeds can be obtained for the wide range of experimental work encountered.

A battery of five vulcanizing presses is shown in Figure 5. The four units to the left are used for the compression molding of finished parts. They are closed by rams and take conventional two-part molds which are filled by hand with sheet material. The last one to the right differs from the others in that it has a ram on top so that it can force blanks of compound into closed molds and thus effect savings in mold cost and time of molding.

Insulated wire and many other products are packed in soapstone and vulcanized in steam-heated equipment similar to that shown in Figure 6 or in high-speed continuous vulcanizers as in factory practice. Hard rubber is plated with tinfoil and placed in a water bath during vulcanization.

Vulcanization changes the rubber compositions from a plastic dough-like mass to soft or hard rubber, depending primarily on the amount of sulfur present. This transformation occurs as the result of heating appro-

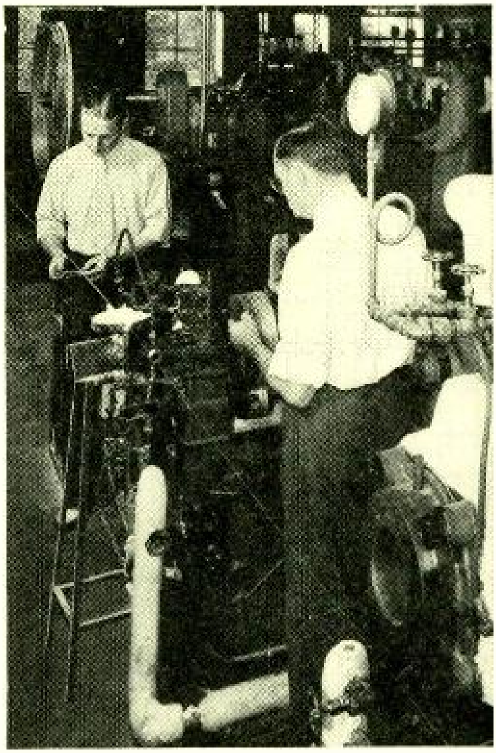
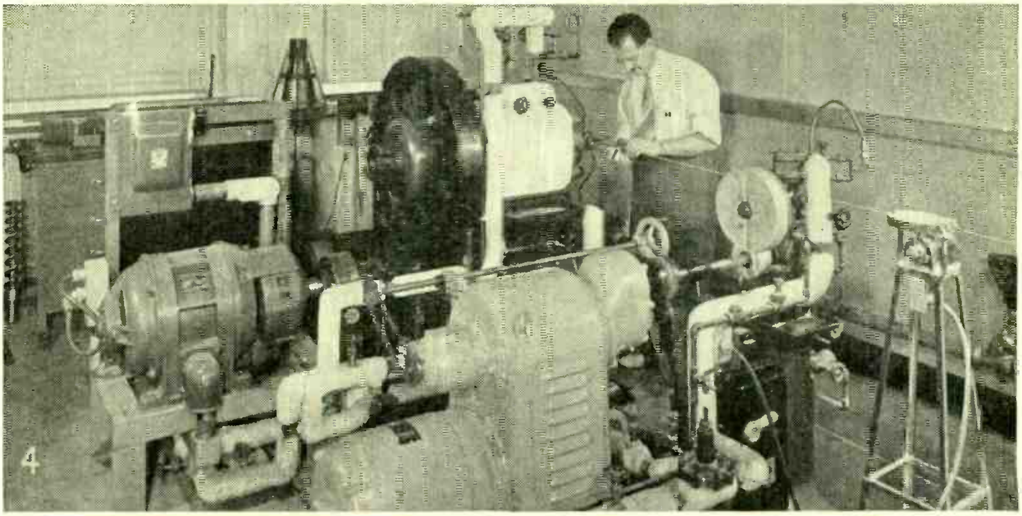
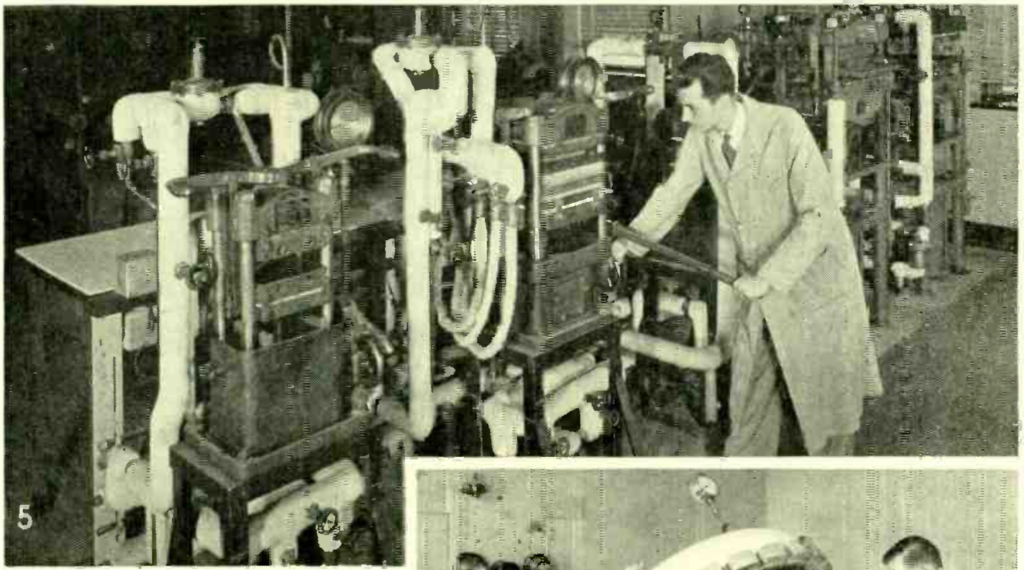


Fig. 3—Covering machines and take-up for applying insulation to wire

priate compositions for different periods of time, depending upon the kind of product desired.

Some of the synthetic rubbers are similar to the natural rubber in that they can be vulcanized by the addition of sulfur and accelerators and





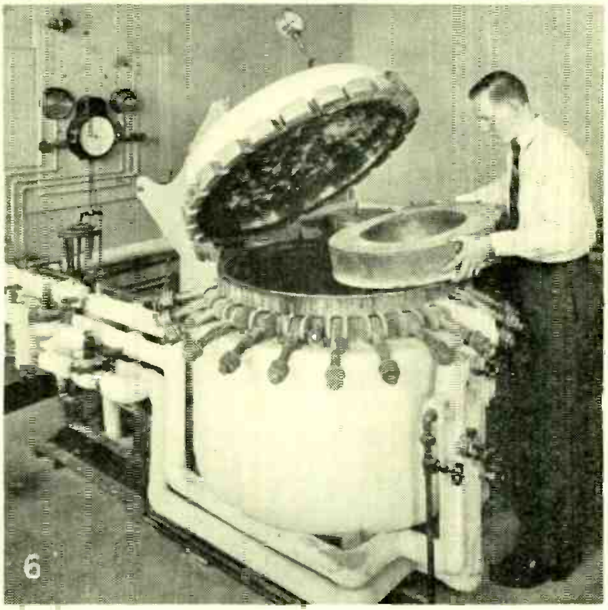
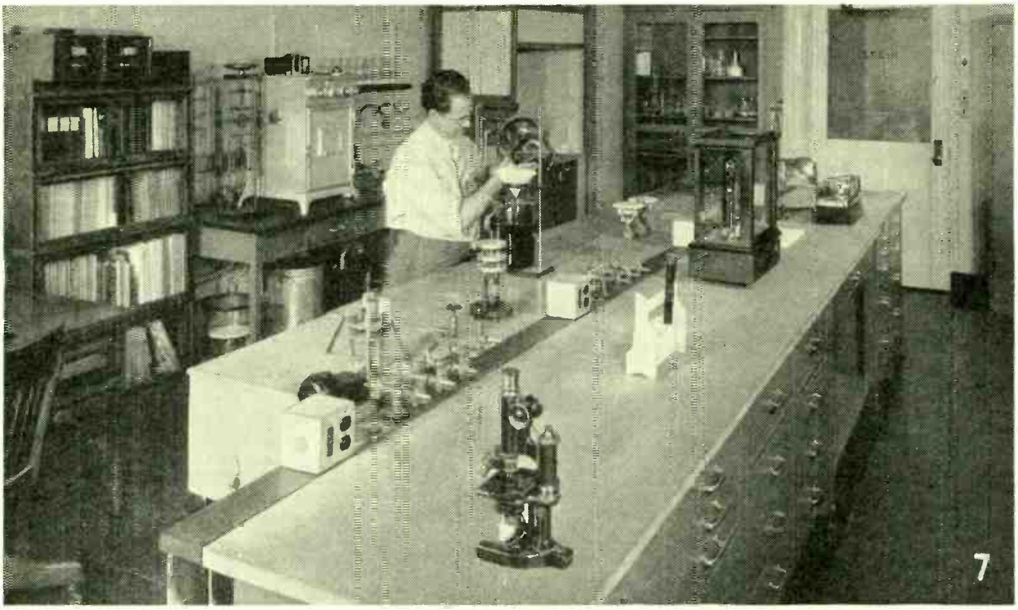
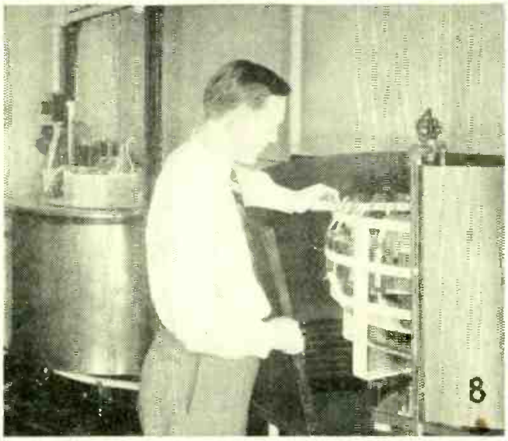


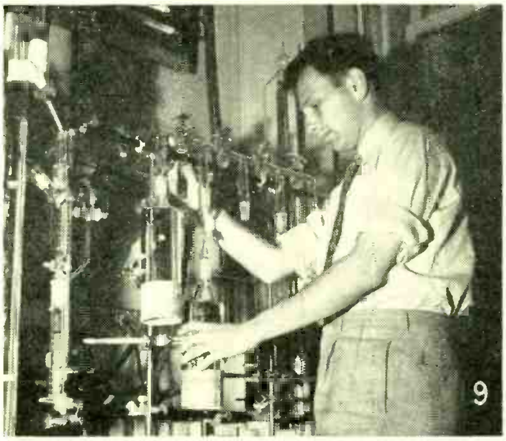
Fig. 4—Wire insulation is carefully gauged during the covering operation

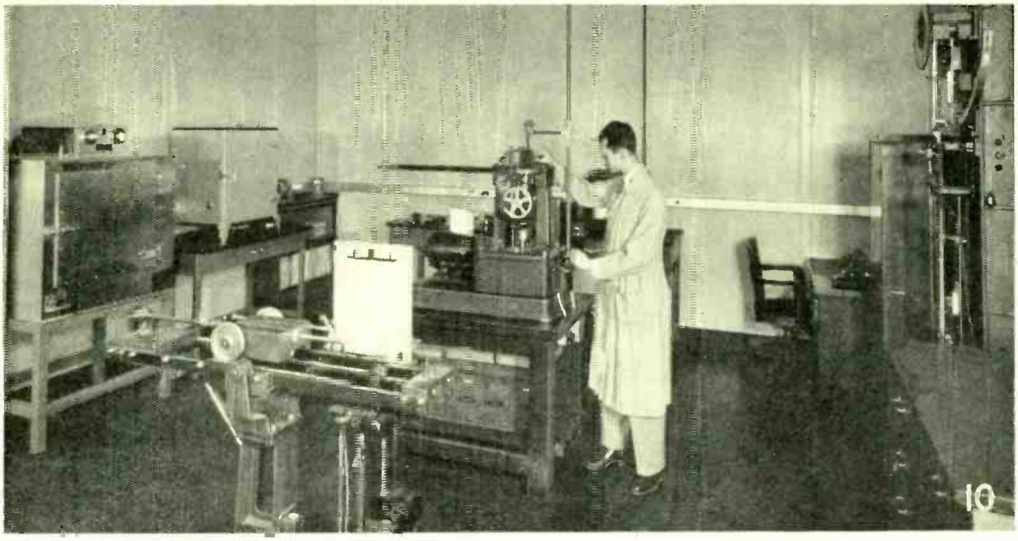
Fig. 5—Hydraulic presses used for molding rubber parts

Fig. 6—Steam-heated container used for vulcanizing rubber


7


8


9


10

their physical properties improved by adding reinforcing pigments. Synthetics in general are not so workable as natural rubber, and for this reason, modifying ingredients are necessary to obtain satisfactory processing properties. Views of the laboratories where research pertinent to these problems is done are shown in Figures 7 and 9.

To improve the desirable characteristics of a rubber material and suppress the undesirable ones the rubber research organization endeavors to relate the physical characteristics of elastic materials to their molecular structure. Special apparatus is used in studying what happens to the rubber molecules when they are compounded, vulcanized, and destroyed through use. These studies on the mechanism of vulcanization, viscosity, molecular weight and brittleness of rubber and allied substances are associated with current synthetic rubber problems.

Equipment used for the general physical testing of rubber compounds is shown in Figure 10. These tests are made in an air-conditioned room at 75 degrees F. and 45 per cent relative humidity to insure uniform testing conditions throughout the year. On the right wall there is mounted a conventional 150-pound tensile machine with a compensating dynamometer head for testing dumb-bell specimens stamped out from sheets. An inclined-plane tensile tester of ten-pound capacity which stands in the foreground is used for specimens of very small cross-section. Behind this apparatus there is a compression machine, designed by the Laboratories for determining resistance of insulated wire to crushing loads and the shear resistance of sheet stocks. Along the left wall are two ovens. The nearer one is used for accelerated aging of rubber specimens and the other for plasticity and scorch determinations of various compositions.

Fig. 7—One of the laboratories where investigations of the properties of rubber compounding ingredients are carried out

Fig. 8—Equipment used for artificial weathering of rubber and other insulating materials

Fig. 9—Laboratory equipped for special research on rubber

Fig. 10—Rubber testing laboratory

F. S. Malm's long experience in rubber research began in 1908, two years after he joined the Western Electric Company, when he took charge of the chemical engineering and development work on soft and hard rubber at Hawthorne. In 1920 he assisted in the manufacture and laying of two rubber-insulated cables between San Pedro and Catalina Island. Mr. Malm transferred to the Laboratories in 1929 and went to Europe that year on telephone cable projects. On his return he joined the Chemical Laboratories to undertake the development of natural and synthetic rubber compounds for the insulation used in communication systems. He is on the Hard Rubber Consulting Technical Committee, Office of Rubber Director, and subcommittees on Hard Rubber and on Low Temperature Tests, A.S.T.M.

Considerable replacement of rubber insulated wire and other equipment is required annually by the Bell System on account of weathering. Studies of the weathering of rubber and rubber substitutes are therefore conducted in the laboratory to correlate outdoor observations with experiments where the weather can be artificially controlled. Figure 8 shows the interior of the photo-chemical laboratory where rubber and allied materials are subjected to artificial weathering. The machine in the rear encloses an arc light of high intensity which simulates sunlight. The samples tested are rotated around the light and subjected to a spray of water at intervals. The apparatus in the foreground comprises a cage-like structure and a sunlamp. The cage supports samples of insulating materials and rotates them around the lamp for exposure to the action of light only.

These new facilities for rubber research at Murray Hill come at a particularly fortunate time because the available supply of natural rubber is rapidly decreasing and many problems relating to the production of synthetics are not yet solved. They make available equipment required in this critical emergency to investigate and improve the rubber substitutes on which our military and civilian needs must now largely depend.

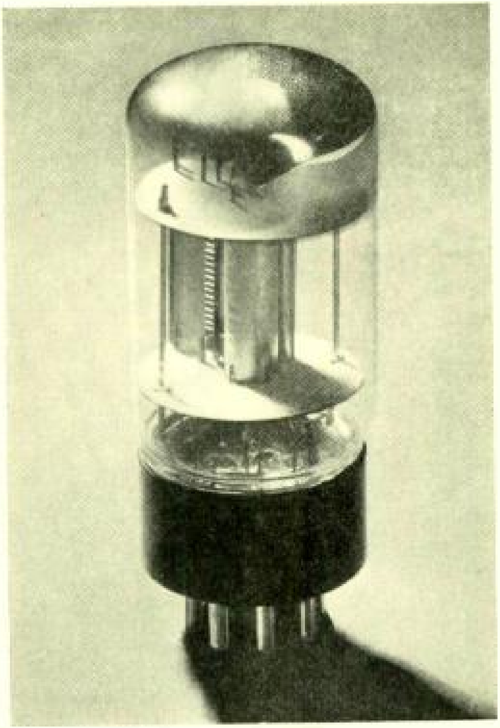
Electromagnetic Waves

A New Text in the Bell Telephone Laboratories Series

In recent years the range of useful frequencies of electric currents has been expanded so greatly that at the higher end of the scale the wavelengths are of the same order of magnitude as the dimensions of the terminal apparatus. New practical possibilities arise and the demands on theory are extended. Dr. S. A. Schelkunoff, in his book just published by Van Nostrand, presents the subject of electric oscillations and waves in a way free from frequency limitations and at the same time without sacrificing the ideas which have been found useful in the low-frequency theory. The book contains extensive chapters on transmission theory, wave guides, resonators, radiation and the author's theory of wave propagation in antennas.

Trigger Action from Secondary Electrons

By A. M. SKELLETT
Electronics Research



BY MEANS of sensitive instruments one may listen to the patter of electrons falling on a metal plate. It sounds very much like rain on a tin roof. If there were available a microscope of great enough sensitivity to make these electron impacts visible, one could observe a great amount of splashing at the surface of the plate; an electron as it strikes a surface sets up a splash of electrons that might be likened to the splash of a drop falling on a quiet body of water. This electron splashing is a great annoyance in many electronic devices. Since electrons are charged particles, however, those in the splash, which are called secondary electrons, may be attracted to another electrode and thus prevented from falling back into the surface from which they came; in this way the splashing may be put to use.

Although the dynatron—a vacuum tube oscillator making use of secondary electrons—has been known for over twenty-five years, its instability in operation made it impractical for engineering uses. Because of this instability, it was the generally accepted conclusion that the use of secondary emission in vacuum tubes was to be avoided. This situation held up to a few years ago when the electron multiplier appeared and focused attention once more on secondary emission. Comparatively recent investigations have indicated that the cause of the instability was to be found in the transfer of volatile matter from the hot cathode to the secondary emitting surface by evaporation. It was also ascertained that if the secondary emitting surface were shielded from the hot cathode the action would be stable and dependable. Thus, the restriction on the use of secondary electrons in tubes with hot cathodes was removed.

The recent investigations already mentioned sought to increase the amplifying power of vacuum tubes by the use of secondary emission. A tube recently developed in the Laboratories, however, makes use of secondary emission for an entirely different purpose: namely, to obtain trigger or relay action similar to that obtained in a gas-filled tube. Trigger tubes have many possible applications in telephone switching, but their use has been limited largely because gas-filled types are noisy and their ionizing and deionizing times introduce a delay in the trigger action. With vacuum tubes there are no ionizing or deionizing times and the delay in the trigger action is reduced from around a thousandth of a second to something less than a millionth of a second. This thousandfold reduction in the time element is of great advantage in many applications. The reduction in noise, which is also obtained with the vacuum tube, is also an obvious advantage in telephone work.

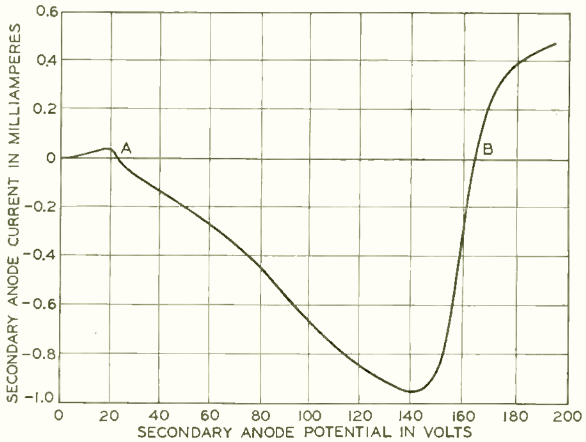


Fig. 2—Voltage-current characteristic of secondary anode of the vacuum tube

The layout of the elements in one of these trigger tubes is shown in Figure 1. The cathode, grid, and first anode are like those in a Western Electric 244A triode except that a slot in the plate, or first anode, allows about 10 per cent of the electrons to pass through. These electrons follow the dotted paths to the secondary anode which has a good secondary emitting surface. The secondaries are collected by the collector grid. The deflector shape was determined by rubber model studies.* Since there is no direct path for contamination between the hot cathode and the secondary anode the tube is stable over many thousands of hours of life.

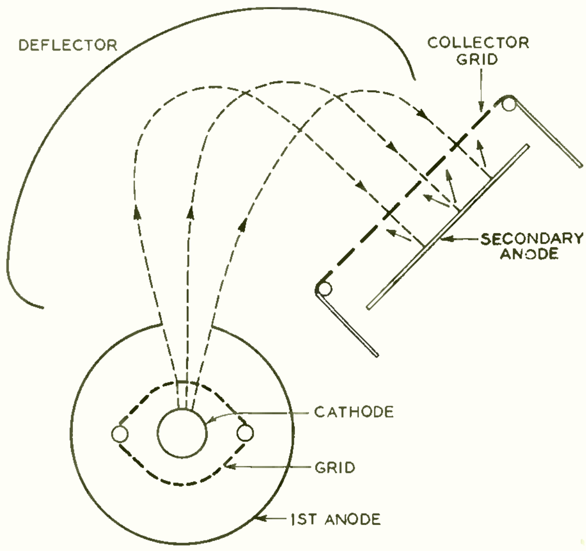


Fig. 1—Arrangement of elements of new secondary emission trigger tubes

The current-voltage characteristic of the secondary anode is shown in Figure 2. A positive current indicates that more electrons are being received by the anode than are given off as secondary electrons, while a negative current indicates that the secondary electrons leaving the anode exceed the electrons received. There are two potentials, A and B, at which the current to this element is zero. If the anode is at the upper zero marked B, the external circuit may be disconnected entirely and the element will float at this voltage so long as the electron stream continues to strike it. Should the voltage of the anode tend

*Record, *May*, 1938, *page* 305.

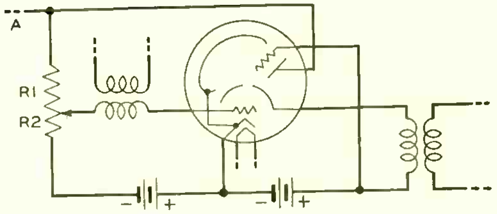


Fig. 3—One basic form of trigger circuit using secondary emission tube

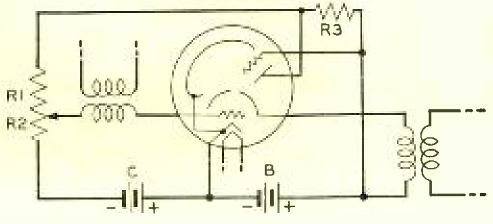


Fig. 4—The other basic form of trigger circuit; a change in grid potential of a fraction of a volt is sufficient to trigger the tube on

to drop slightly, more electrons would be drawn off as secondary emission than were received, and the resulting reduction in negative charge would increase the potential back to the value at B. Similarly, should the voltage tend to rise, the decrease in the number of secondary electrons drawn off would reduce the voltage. This point is thus one of stable equilibrium; any tendency to change is self-correcting. At the lower zero, marked A, however, the equilibrium is unstable, and if the circuit is disconnected, the potential of the element will at once either fall to zero or rise to the upper zero point, B. At this lower zero, a slight tendency for the voltage to increase results in an excess of secondary electrons, and this in turn results in a still higher potential. The building up of the voltage is so rapid that point B is reached almost instantaneously as far as most practical applications are concerned. It does not rise above B, however, because of the self-correcting action at that point. Similarly, should the voltage start to drop from the value at A, there would be a decrease of secondary electrons and the voltage would drop further. The jump from just above A to B is used to obtain the trigger action.

The action described above will occur even though a resistance is connected between the element and a negative voltage supply provided only that the resistance is high enough so that the electrons that flow along it to the element are not greater in number than the secondaries released at its

---

A. M. Skellett joined the Laboratories in 1929 after spending several years teaching, finally as assistant professor of physics at the University of Florida. Antenna design and radio transmission occupied Dr. Skellett's time when he first came to the Laboratories. Since 1934 he has been concerned with the application of atomic and electronic devices to telephony. At the present time he is engaged in special war work. Dr. Skellett received the A.B. degree from Washington University in 1924, the M.S. from the same institution in 1927 and the Ph.D. from Princeton in 1933.

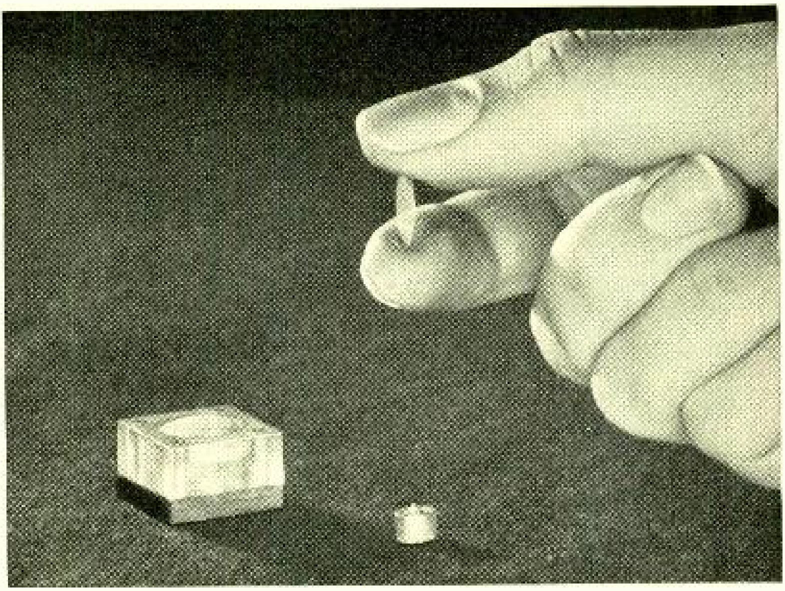
surface. Such a resistance is that labeled R1 and R2 in Figure 3, which shows one of two basic trigger circuits. When the tube is in the off condition, the potential of both the secondary anode and the control grid will be that of the C battery, which is sufficient to prevent electrons from leaving the vicinity of the cathode. Now if the potential of the secondary anode is raised to a value just above A on Figure 2, for example, by the application of a positive pulse at point A of Figure 3, the grid will be driven a volt or two in the positive direction by the potential so that a small electron current begins to flow in the tube. The potential of the secondary anode will jump suddenly to a value near B on Figure 2, and will carry the potential of the grid up to its operating potential. Thus the tube has "fired" and is now in the "on" condition and can be used as an amplifier through the transformers shown.

The amplifying characteristics of the triode section of the tube are not appreciably altered by the addition of the trigger mechanism that puts it into action. The tube may be extinguished or returned to the off condition either by momentarily establishing a potential condition on the secondary anode that is just a little less in magnitude than the potential A of Figure 2, or by swinging the grid sufficiently negative to cut off momentarily the electron stream. This is still another advantage of this new type of trigger tube. With gas-filled tubes, the grid loses control once the tube has fired, and the electron stream can be stopped only by reducing the plate voltage below a critical value.

With the secondary-emission tube, however, the grid does not lose control, and the tube action can be stopped by grid as well as plate control. While these secondary-emission tubes have several distinct advantages over gas-filled tubes, they are of higher impedance, and when lower impedances are required, larger cathodes would have to be used with the secondary-emission tubes than with the equivalent gas-filled tube.

The circuit shown on Figure 4 is the other basic trigger circuit. It is the circuit of Figure 3 with the addition of R3, the function of which is to maintain the potential of the secondary anode a little above the potential A in Figure 2 when the tube is off. This is accomplished by the bleeder action of R1, R2, and R3 across the batteries. With this type of circuit, it is necessary to apply only a fraction of a volt to the grid to trigger the tube on.

These secondary emission tubes may be used in many applications requiring trigger action. Their quiet operation, extremely rapid action, and flexible control features are expected to make them particularly useful in the telephone field.



Using High Crystal Harmonics for Oscillator Control

By I. E. FAIR
Radio Research

STABILITY, almost always a desirable characteristic, is one of the major requirements for oscillators controlling the frequency of radio transmitters. In ultra-high-frequency transmitters it assumes particular importance because a very small percentage change in the frequency of the controlling oscillator may shift the transmitted band many thousands of cycles. At 100 megacycles, for example, a 0.01 per cent change in frequency means a change of 10 kc, as much as the entire width of a broadcast band.

Stability in oscillators is secured by some form of tuned circuit. The reactance of such a circuit changes slowly with frequency except over a narrow band in the region of resonance. Here a small change in frequency is accompanied by a very large change in reactance. It is this large change in resistance resulting from a small change in frequency that enables the resonant circuit to act as a frequency stabilizing element. Quartz crystals are eminently suited to control in this way because of their very sharp resonance, which is due to their low values of coupling and dissipation. Their characteristics, moreover, change only slightly with variations in temperature and voltage, and thus high stability under all conditions is more easily obtained with them than with elements having higher dissipation or greater sensitiveness to changes in temperature and voltage.

The reactance-frequency characteristic for a one-megacycle crystal is shown in Figure 1. Over almost the entire range of frequencies except for an extremely narrow band in the vicinity of one megacycle, the reactance changes very slowly. In this narrow region, however, the reverse situation holds. This is shown in Figure 2, which is a plot to a larger scale of the reactance curve in the region of resonance. Between resonance and anti-resonance, a 0.01 per cent change in frequency may result in an impedance change of the order of fifty per cent or more. It is this delicate electrical leverage that gives quartz crystals one of their great advantages for oscillator control.

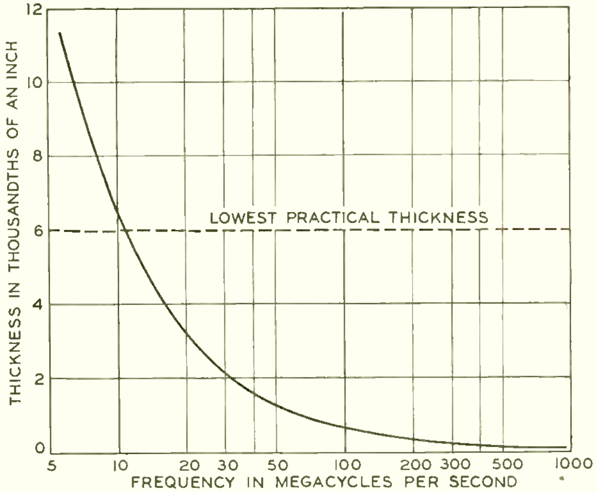


Fig. 3—Relationship between thickness of crystal and fundamental frequency

With the type of crystal most commonly used for oscillators, the frequency of resonance is inversely proportional to the thickness of the crystal. The relationship in the vicinity of 10 megacycles is shown in Figure 3. At ten megacycles, for example, the thickness of the crystal is only about six and a half thousandths of an inch. This is not much thicker than the paper of this page. Before being used in an oscillator, the crystal must be accurately ground to have parallel faces and to be of the desired thickness; and satisfactory grinding becomes impractical for crystals appreciably thinner than this. For transmitters requiring higher frequencies—and radio transmission at frequencies many times ten megacycles is becoming more important and more generally used every day—it has been almost universal practice to use a crystal with its fundamental resonance below ten megacycles, and to use

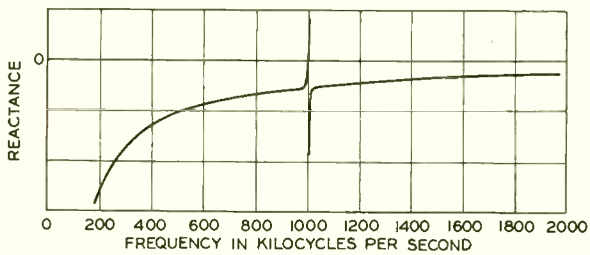


Fig. 1—Reactance-frequency characteristic for a one-megacycle crystal

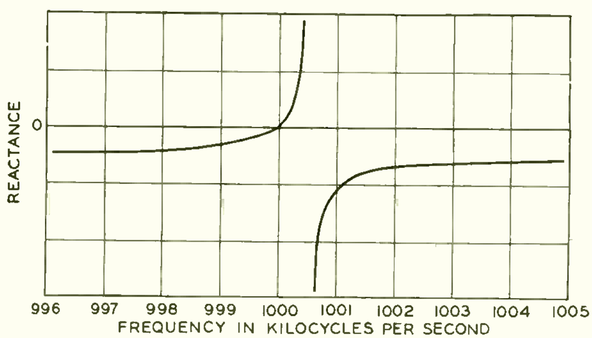


Fig. 2—Reactance of one-megacycle crystal plotted to a much larger frequency scale

a harmonic generator with it to secure the desired higher frequency. So far as stability is concerned, this method is satisfactory, but it requires a very appreciable amount of additional apparatus. Not only does the cost of the oscillator go up, but the size also increases, and for many of the high-frequency applications, space is at a premium.

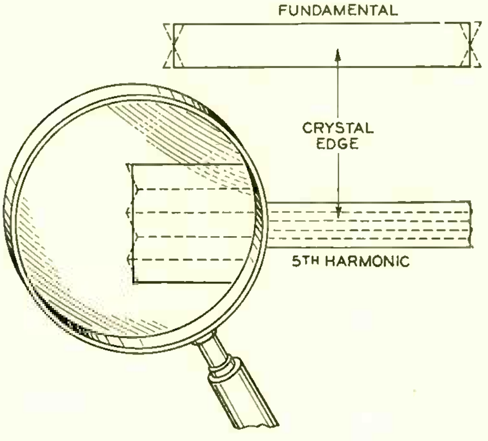


Fig. 4—Representation of nature of crystal vibration for the fundamental, above, and for the fifth harmonic, below

At their fundamental frequency, crystals of the type under discussion vibrate as indicated in the upper part of Figure 4. The two faces move in opposite directions, and hence are polarized 180 degrees out of phase. A crystal may also vibrate at a harmonic frequency, and the motion of one vibrating at the 5th harmonic is indicated in the lower part of Figure 4. Even harmonics are not possible because the two faces would then be in phase, and there would be no piezoelectric potentials between them. At harmonic frequencies, the general form of the frequency-reactance characteristic is the same as Figure 2, but the position of the curve with respect to zero reactance becomes lower, the higher the harmonic. In Figure 2, the reactance becomes positive at a frequency slightly above resonance; but for harmonics, the curve is lowered, and for harmonics much above the 5th, the reactance remains negative throughout its entire range.

Practically all the circuits used for quartz crystal oscillators require that the reactance of the crystal be positive at the operating point. While harmonics of the fundamental crystal frequency may be used with this type of circuit, therefore, only those giving a positive reactance are possible. Oscillators for a large part of the ultra-high-frequency range have thus been forced to employ harmonic generators, since the 5th harmonic of the thinnest usable crystal is only about fifty megacycles. This situation has now been changed by a circuit developed in these Laboratories which permits crystal harmonics at least as high as the 23rd to be used for direct control of an oscillator circuit.

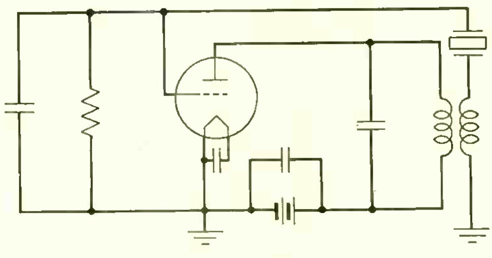


Fig. 5—Many forms of low-frequency crystal oscillator circuits are possible; that shown above, although not the form ordinarily used, will serve to indicate the transition to the new form of circuit

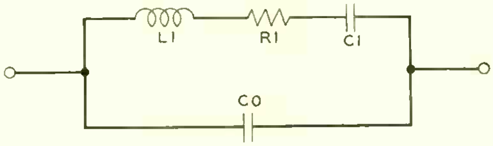


Fig. 6—Equivalent electrical circuit of quartz crystal

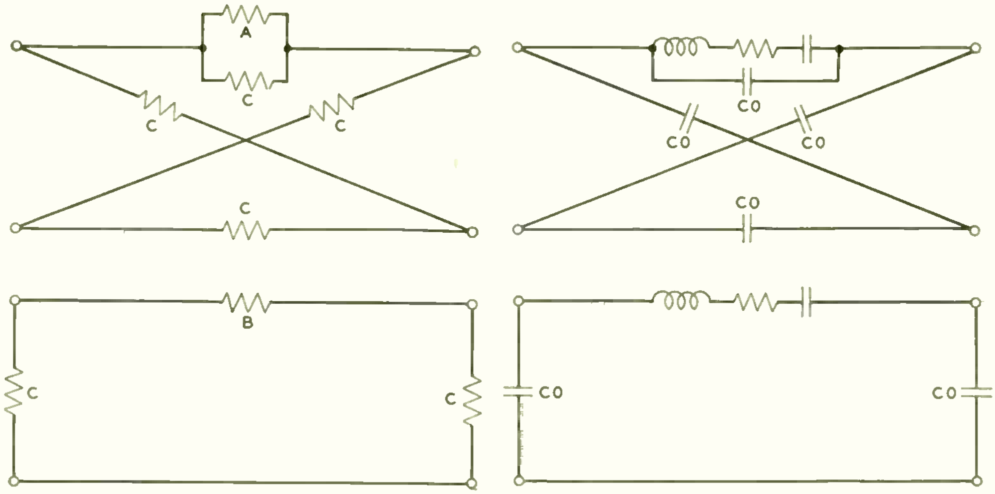


Fig. 7—Left: By network theory these two networks are equivalent to each other. Right: By using a crystal in a lattice network as shown in upper diagram, the effect of CO may be transferred to the ends of the lattice, lower diagram, by the theorem illustrated in the diagram at the left

Oscillators have been built for frequencies as high as 150 megacycles using crystals with fundamental frequencies below 10 megacycles.

One type of low-frequency crystal oscillator circuit is shown in Figure 5. Although this is not the form most commonly used, it will serve to indicate the change that has been made to enable high harmonics of the crystal to be used. A crystal may be represented electrically by the circuit shown in Figure 6. Here L1, R1, and C1 represent the characteristics of the crystal as a vibrator, while CO is the static capacitance—the sort of capacitance that would exist if the crystal were replaced by some other insulating material. It is this latter capacitance that tends to hold the reactance of the crystal negative at all frequencies, and that becomes large relative to C1 at the higher harmonics. If this capacitance could be sufficiently re-

---

I. E. Fair received the degree of B.S. in Electrical Engineering from Iowa State College in 1929, and the same year entered the Radio Research Department of the Laboratories. He assisted in the development of the first experimental ship-to-shore radio equipment after which he began the study of modes of vibration in piezoelectric crystals. At the present time Mr. Fair is concerned with crystal oscillator circuits, methods of specifying the quality of crystals for oscillators, and the development of crystals for war use.

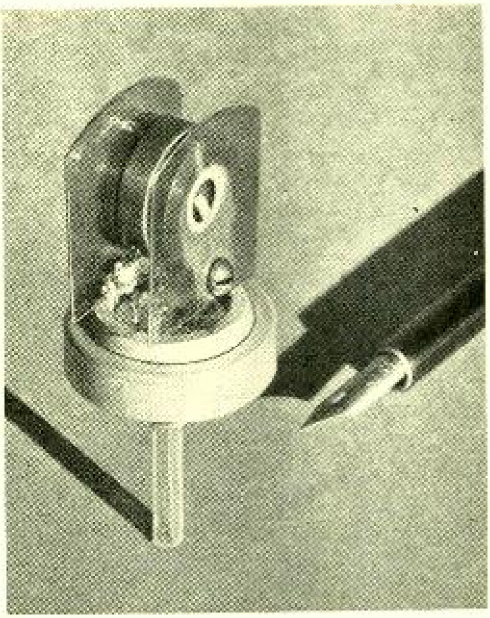


Fig. 8—Complete crystal and network used for ultra-high frequencies

duced without affecting the other characteristics, the crystal reactance would be positive when oscillating at its higher odd harmonics.

By theorems of circuit theory, it may be shown that a lattice network with equal elements in all branches and with an element in parallel as shown in the upper part of Figure 7, left, is the equivalent of the network shown in the lower diagram, in which impedance common to all branches is replaced by an impedance at each end of the network. Since a crystal may be represented electrically by two impedances in parallel, a lattice network including a crystal in one of the series arms could be represented as shown in the upper diagram of Figure 7, right. By the above-mentioned theorem, this network — in turn — would be equivalent to that shown in the lower diagram. In such a network, the shunting effect of co is brought to the ends of the lattice, where it may be combined with other elements of the circuit.

If the upper network of Figure 7, right, is put in place of the crystal of Figure 5, the circuit would become as shown in the upper part of Figure 9. The effective circuit, however, is as shown in the lower part of Figure 9, where co is not shown since it now forms part of CD and CE. With the effect of the shunting capacitance co removed from the crystal, positive reactance is obtained above the resonance frequency of the series arm, even at high harmonic frequencies, and thus the requirement for positive reactance is met.

The capacitances co and c1 comprising the crystal are very small, and those associated with it in the lattice are also very small. It is possible,

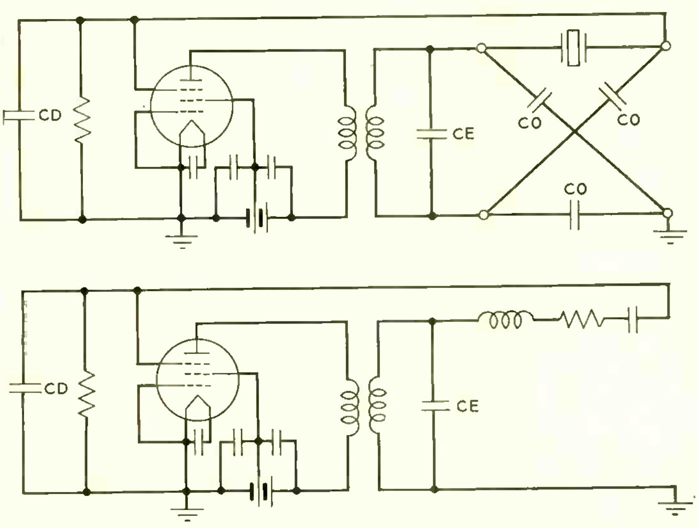


Fig. 9—An oscillator circuit in which the oscillator is placed in a network like that shown at the right of Figure 7. Actual circuit above, and equivalent circuit, below

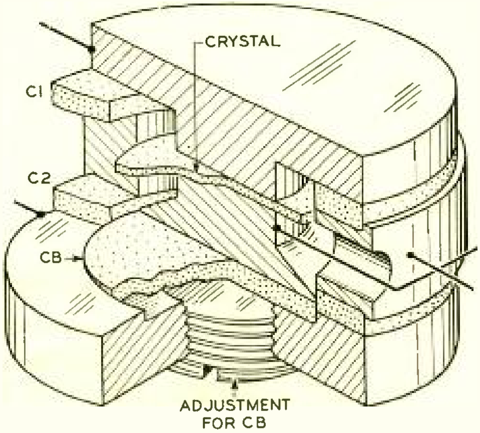
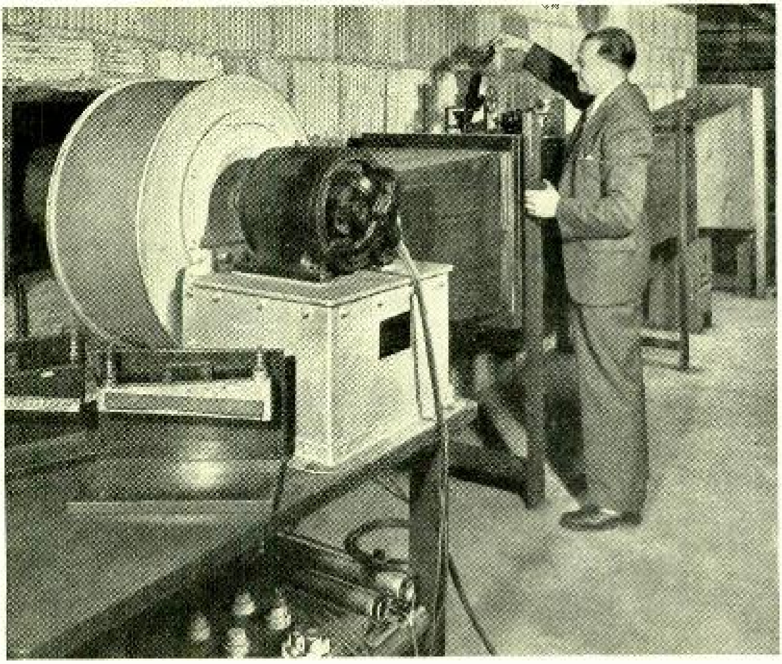


Fig. 10—*Arrangement used to include crystal and three condensers in network*

therefore, to assemble the crystal and the three condensers, one of which should be adjustable, in a very small space. With a view to commercial utilization, a unit has been constructed and arranged for mounting on a vacuum-tube base as shown in Figure 8. The unit consists of metal disks and annuluses and insulating pieces, also of annular shape, to form the condensers. The general arrangement of the assembly is indicated in Figure 10. This very small device can replace the relatively large and expensive harmonic generator previously required to produce ultra-high frequencies from a crystal having a fundamental frequency usually under ten megacycles. The crystal will vibrate at a high harmonic of its fundamental frequency, and yet, at the same time, all the desirable crystal characteristics will be retained.

Improved Elevator Telephone

For elevator and corridor service there has been developed an improved recessed telephone. It embodies a regular hand set of the latest design and can be equipped for manual or dial service. To minimize the size of the set a buzzer signal instead of a bell is employed. The metal base on which the hand set and other apparatus are mounted has been changed to cast iron to release aluminum for war.



Testing and Rating Air Filters

By O. C. ELIASON
Transmission Apparatus

THE trouble created by airborne dust in industrial interiors has been given much attention in recent years and as a result many types of air-cleaning devices are available for use in ventilating, heating and air-conditioning systems. These devices vary widely in cost, efficiency and space requirements. High efficiency is generally to be obtained only at considerable expense both in cost and maintenance. Accordingly, the selection of an air filter for a particular application involves not only a knowledge of dust conditions to be met and the capabilities of the various filters under those conditions but also the various economic factors involved so that the overall cost of a filter installation may ultimately be justified by the benefits that are derived from its use.

The problem of selection is complicated by the fact that dust, both as to type and amount, varies widely in different sections of the country and, in some industrial areas, even at different nearby locations. In some places where dust conditions are not severe or where the prevailing dust is fibrous or coarse, inexpensive filters are usually adequate. In others, where large amounts of fine dust and soot are present, a more expensive filter may prove to be most economical from the standpoints of overall cost and maintenance.

In response to the need for data regarding the efficiencies of filters, methods for measuring their capabilities and for determining the dust conditions in the field have been developed in the Laboratories. These methods, in general, follow well-known test procedures and are well adapted to meet the special requirements that are encountered with this problem.

The laboratory test for measuring the capability of a filter consists in passing air containing a known concentration of a standard dust through the filter and measuring the amount of dust remaining in the air. The equipment includes a wind tunnel, shown

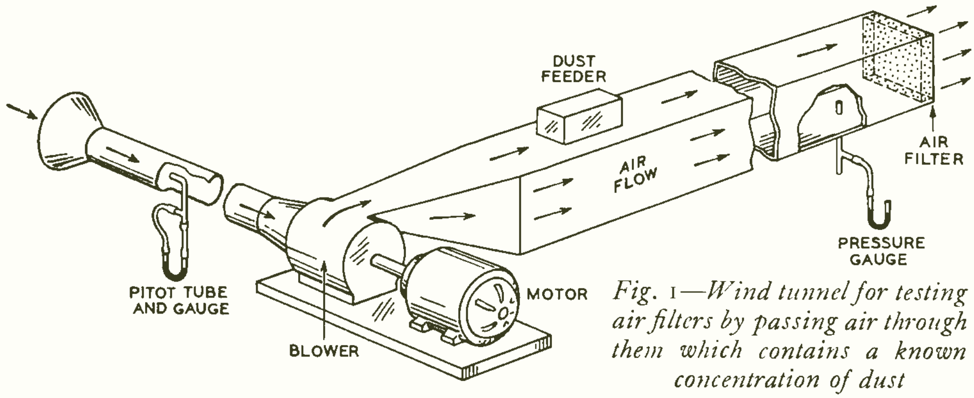


Fig. 1—*Wind tunnel for testing air filters by passing air through them which contains a known concentration of dust*

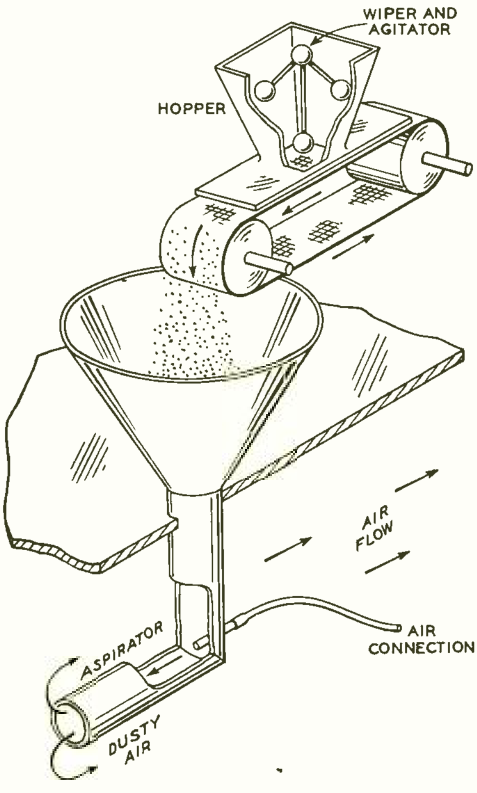


Fig. 2—*Machine for feeding dust into the air stream used to test air filters*

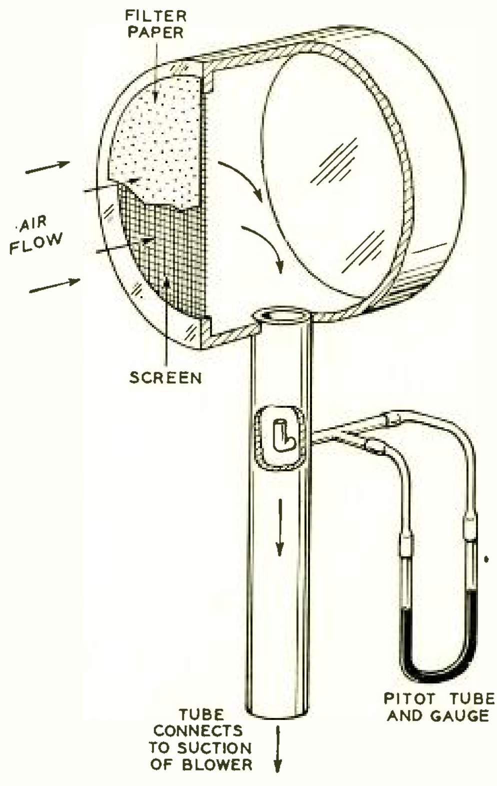


Fig. 3—*Air sampler with which the dust concentration of the air is determined*

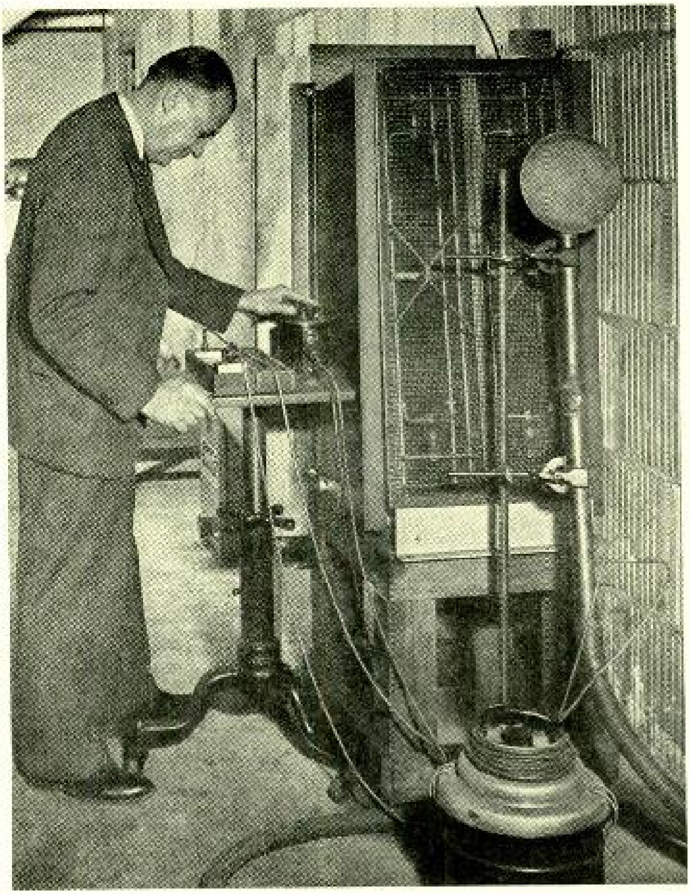


Fig. 4—W. A. Bunzel measures the volume of air passing through the air sampler

stream of the wind tunnel. A moving arm in the hopper stirs the dust and also wipes across the chain to insure that it carries a uniform load.

A standard dust, consisting of a mixture of lamp black, powdered charcoal, iron oxide and wood flour, was chosen after considerable experimentation. It contains those components of natural dust which are most likely to tax the ability of air filters where dust conditions are severe. Coarse, granular and fibrous dusts are not included since they are easily filtered out and tend to build up in a layer on the face of the filter which increases its air resistance and also its efficiency and therefore tend to mask the true ability of the filter to remove the finer nuisance dust.

in Figure 1, built in accordance with the standards of the American Society of Heating and Ventilating Engineers and of the National Association of Fan Manufacturers. There is a variable speed blower for controlling the volume of air and there are pitot tubes and gauges for measuring the flow and the static pressure of the air in the tunnel.

A schematic of a machine developed by the Laboratories for feeding dust into the air stream in the tunnel at a constant rate is shown in Figure 2. A chain carries the dust from the hopper and drops it into the aspirator tube from which it is blown into the air

An instrument for sampling the air, which is used in the field or in the laboratory, is shown schematically in Figure 3. It was developed in the Laboratories as a relatively accurate and easy means of determining, by weight, the amount of dust in the atmosphere and at the same time, by a discoloration test, affords a visual indication of the amount and character of the dust. It consists of a cylindrical chamber with one end screened. A pipe, equipped with a pitot tube for measuring air flow, connects the chamber with the suction side of a blower. To obtain a sample of the dust in the air, a white filter paper is placed over the screen and air is drawn through it at a constant rate. The dust in the air is deposited on the paper and its amount is quantitatively the difference in the weight of the paper before and after the test. The visual indication is given by the discoloration of the white filter paper.

The air filter on test is installed in the end of the wind tunnel and the volume of air through it is adjusted to its rated value. The dust feeder is then started. The volume of air and the rate of dust feed are held constant throughout the test. Samples for determining efficiency are taken during the first hour and at specified intervals thereafter.

As dust collects in the filter its resistance to the flow of air increases; and for most types of filters the air-cleaning efficiency increases as the resistance increases. In some filters the efficiency increases for a time and then decreases. The useful life of a filter, before it must be replaced or cleaned, is determined either by the point where the fan can no longer deliver the required amount of air through the filter or by the point where the air-cleaning efficiency is no longer satisfactory. The test is continued somewhat beyond this useful life. Efficiency of dust removal, or the "arrestance" of the air filter as it is called, is expressed as a ratio of the dust removed as compared with the dust in the air entering the filter.

From the weight of dust fed during the test and from the volume of air delivered by the blower, there may be calculated the amount of dust in grams per cubic foot of air entering the filter. The corresponding amount of dust in the air leaving the filter may be calculated from the weight of that collected on the filter paper and from the volume of air passed through the filter paper. The filter paper is weighed before and after the test on a balance sensitive to a tenth of a milligram, in a room in which temperature and relative humidity are constant.

Results of tests on two typical air filters are shown in Figure 5. From these curves it is possible to determine the relative life and efficiency of the filters and to determine which type of filter would be most satisfactory for a particular use.

When tests are to be made outside of the laboratory on air filters in-

---

O. C. Eliason was graduated from Iowa State College with the degree of B.S. in Electrical Engineering in 1921. He came to the Laboratories, then Eng. Dept., Western Electric, that summer. For two years he worked on electrolytic condensers. Then he transferred to the group concerned with development work on equipment manufactured for the Western Electric Company by outside suppliers. Since 1925 Mr. Eliason has been engaged in studies of wires and cables and the effects of air-conditioning on telephone equipment performance.

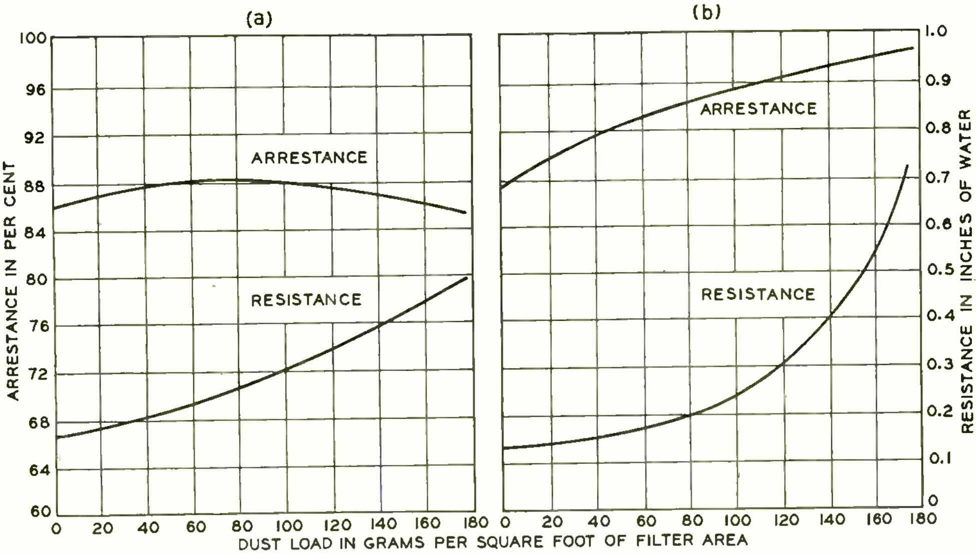


Fig. 5—Results of tests on two typical air filters

stalled in a ventilating system two samplers are used, one on the intake side of the filter and the other on the outlet side. The efficiency of the filter is calculated from the difference in the weight of dust collected on the two filter papers.

The sampler is also used to obtain the concentration of dust in a room directly from the weight of dust collected on the filter paper and the volume of air that is passed through the paper.

By the use of such apparatus and methods of test, the relative merits of various types of dust filters may be conveniently determined under conditions that are directly comparable.

Controlled Atmosphere Induction Furnace at Murray Hill

In metallurgical studies, when it is desirable to melt metals in vacuum or in atmospheres of different gases, the electric induction furnace shown on page 225 is employed. The heating coil of the furnace, the crucible, the mold and a small hopper for adding ingredients to the molten metal are all enclosed in an air-tight vessel. The mold is so located that the metal may be cast without exposure to the outside atmosphere by tilting. A hopper, which is operated from the outside by a shaft through a gas-tight joint, may be used to add extra ingredients to the melt. O. J. Barton is checking the connections.

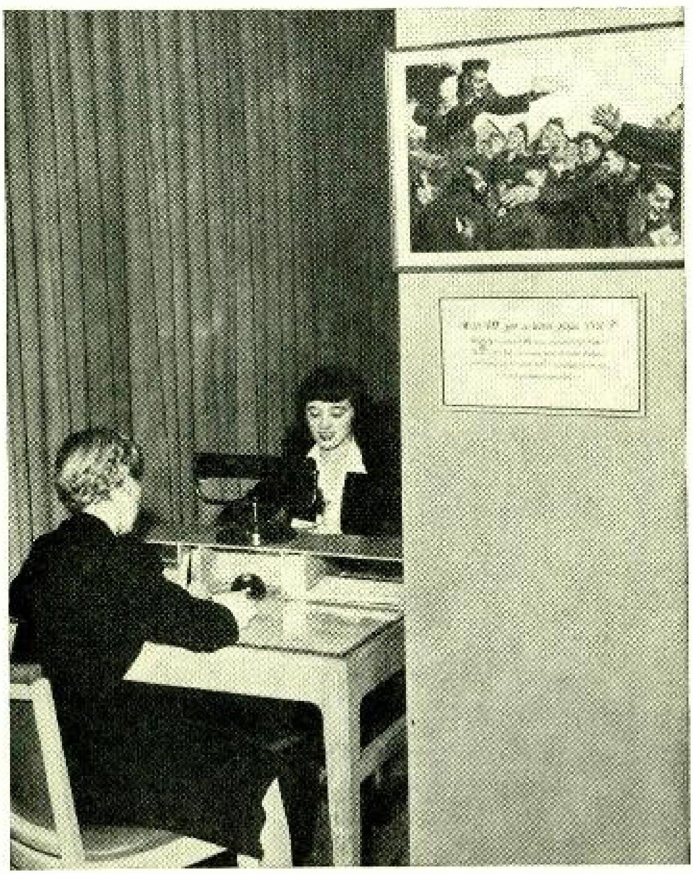
to suit the thickness of the pile-up. Shift, spacing, carriage-return, and paper advance are likewise done by power, so that only the lightest touch is necessary. What this change means to the typist in lessened fatigue can readily be imagined.

As used in the Laboratories, the electric typewriter is equipped with a horizontal tray attached to the carriage, over which the forms feed directly to the platen. Forms, accordion-folded, are received from the printer in a cardboard box containing from 150 to 250 sets. As they pass over the tray, they are separated by metal strips to each of which is attached a long sheet of carbon paper. Both the forms and the carbon paper pass into the grip between platen and rollers and are drawn forward as the work proceeds. When one form has been typed, the operator releases the platen's grip on the work, draws the paper forward with one hand, and pushes the carbon sheets back with the other. She then tears the paper off at its perforations and relatches the grip on the new set of forms with the carbon paper between them. She is then ready to start typing the next order.

Eventually the carbon paper wears out, although we have actually obtained as many as 144 legible writings from one set. To bring in a new carbon area, the operator has only to pull both carbon and forms and tear them off together.

Advantages of this method are many. Foremost are the greater output and lessened fatigue of the typist; saving in carbon paper principally due to less handling of it; more legible copies; and elimination of collating and of hektographing where more copies were wanted than could be typed by hand.

The electric typewriter in combination with continuous forms was studied by the author at the time he was a member of Office Standards. It was first tried in Shipping, where five copies of each shipping ticket are typed for record. Following its



Mail Call is the biggest event of the day in camp or aboard ship. To encourage members of the Laboratories at West Street to write to men and women in the Services, there has been installed in the Lounge a writing table with pens, ink, V-mail forms and a list of Laboratories' people in the Armed Forces. When writing, do not worry about the address. Put the addressee's name on the envelope and stamp it. Drop the envelope into the box provided and the Personnel Department will fill in the latest address and mail the letter. Mrs. Carol Frew of the Store is shown writing to her husband, a Pharmacist, U.S.N.R., and Miss Eleanor Burns, the 3-I messenger, to her brother Edward who worked in the Library before joining the Navy. Thanks for the poster, and its duplicate for the Murray Hill Laboratory, go to the W. A. Sheaffer Pen Company success there, additional machines were secured and the method was adopted in Purchasing and at the same time in Plant Shops, where ten to fifteen copies of each order are written.

A typing section of the Purchasing Department is shown in the headpiece on page 248. Edna Glessmann (left) types orders which require a special set-up; Mrs. Augusta Welsh and Mrs. Lillian Curt operate the two Electromatic machines. In the back row are Mrs. Olga Ferko, acting as supervisor in the absence of Rose Kirk, and Frances Kohout, checker.

Four-Conductor Cable for U. S. Signal Corps

A carrier telephone system which employs a four-conductor cable has been developed by Bell Laboratories in coöperation with the Signal Corps of the U. S. Army. The cable can be buried, laid on the ground or suspended in the air. The system provides three telephone channels, including both voice and carrier frequencies, and four telegraph circuits. Voice frequencies are heard satisfactorily forty miles without amplification. All the channels can be amplified by a single compact repeater. These are spaced twenty-five miles apart and extend the range to 200 miles.

The cables are made in quarter-mile lengths with quick coupling connectors at each end to permit extending a circuit to any desired distance. In each connector one of the pairs of conductors is loaded with small coils developed by the Laboratories.

The conductors are made of stranded copper, individually insulated, and formed in a "spiral four." Strength is provided by enclosing the cable in a braid of small high-strength steel wires. A tough rubber jacket completes the four-conductor cable.

This system extends the distance over which telephone communication can be quickly established by our field forces.

Red Cross War Fund

Total contributions of $14,502 from 2,845 members of the Laboratories was the report of the Red Cross War Fund Campaign on March 31 as the forms closed on this issue of the Record. Opening with letters to all from Dr. Buckley and E. C. Wente, president of the Bell Laboratories Club, the campaign was conducted without personal canvassing.

The Telephone Business

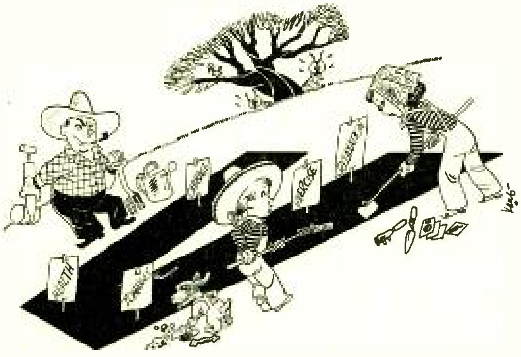
In order that telephones be available to as many subscribers as possible, the Michigan Bell Company, in some areas where new installations have been restricted, is offering service on a temporary basis. Applicants are given contracts which permit the company to withdraw service after 48 hours' notice if the facilities are required for the direct war effort or the "public health, welfare, or security."

War Production Board orders require the reserve of sufficient facilities to meet military, war production and essential public needs. Rather than holding to arbitrary estimates on the extent of such future needs in restricted areas, the company is releasing its narrowing plant margins for such use.

D. D. Haggerty, executive secretary of the Club, told patrons of the Cafeteria at West Street about the needs of the Red Cross. The public address system was operated by H. L. Bowman; it was assembled by members of the Moving Picture Camera Club from parts furnished by the Club

Victory Gardens

This year many suburban members of the Laboratories are thinking seriously of starting a vegetable garden. Worthwhile additions to the family food supply can certainly be made if the garden is intelligently planned and persistently cultivated.



A vegetable garden should be located on a well-drained soil that has grown vegetables, flowers, good grass or rank growth of weeds. Ground that has been filled in should not be used unless it has grown a heavy crop of weeds the previous year. Such filled-in soils may dry out too much for a good crop of vegetables. The location should receive at least six hours, preferably more, of direct sunlight. Shade from buildings and large trees must be avoided. Competition of vegetable plants with tree roots for soil moisture and nutrients causes many of the garden failures.

How big should the garden be? Not too big for the amount of time you are willing to spend on it. It is better for the novice gardener to start with a plot 20 by 20 feet and get good results than to waste seed and fertilizer on a garden that is too big for him. Plans for gardens of various sizes are given in a pamphlet, "Victory Gardens," which is available from the Library at West Street or Murray Hill.

A garden spade or spading fork to dig the soil, a rake to level and pulverize the soil, a line to make straight rows, a hoe to make furrows and to kill weeds and a trowel to transplant young plants are essential equipment. A wheel hoe and more elaborate equipment may be purchased for those having larger gardens.

Well-rotted manure, leaf mold, compost, grass clippings or other decomposed plant material form organic matter in the soil. These materials when well incorporated into the soil help it to hold moisture and will aid in the drainage of soils that are heavy in

PLANTING CALENDAR

Vegetables italicized may be planted after April 15; the others during all of April:

Asparagus, **Beets,** ***Sprouting Broccoli, Brussels Sprouts, Cabbage,*** **Carrots,** ***Cauliflower, Celery, Chicory, Chinese Cabbage,*** **Cress,** ***Dandelion,*** **Endive,** ***Horse Radish, Kale, Kohl-Rabi, Leek,*** **Lettuce, Mustard, Onions,** ***Parsley, Parsnips,*** **Peas,** ***Potatoes, Radish, Rhubarb Roots, Salsify, Sorrel,*** **Spinach, Swiss Chard, Turnips.**

Members of the Laboratories to Whom Patents Were Issued During the Months of January and February

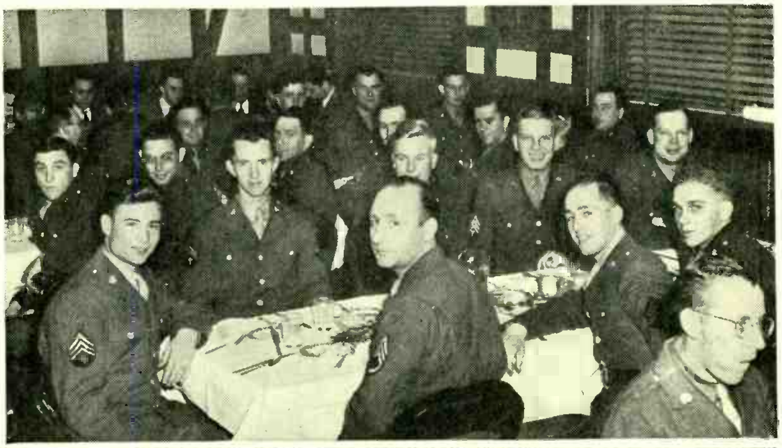
A. E. Anderson	A. B. Haines	R. F. Mallina (3)	W. T. Rea (2)
F. B. Anderson	J. A. Hall	W. P. Mason	R. E. Ressler
S. M. Babcock	H. C. Harrison	A. L. Matte	C. D. Richard
H. M. Bascom	R. B. Hearn	L. A. Meacham	A. R. Rienstra
K. E. Bower	W. H. C. Higgins	P. Mertz (2)	J. W. Schmied
E. T. Burton	W. H. T. Holden	A. H. Miller	A. M. Skellett (2)
C. J. Calbick	F. A. Hoyt (2)	R. L. Miller	G. R. Stibitz
C. A. Dahlbom	W. E. Ingerson	S. E. Miller	L. Vieth (2)
E. Dickten, Jr.	C. L. Krumreich	M. E. Mohr	J. Whytock
H. Eckardt	F. B. Llewellyn	C. V. Parker	J. R. Wilkerson
I. E. Fair	M. A. Logan	D. B. Parkinson	S. B. Williams
D. K. Gannett	C. A. Lovell (2)	R. L. Peek, Jr.	R. C. Winans
J. S. Garvin	G. R. Lum (2)	N. Y. Priessman	L. R. Wrathall
E. W. Gent			C. H. Young

texture. Organic matter helps to prevent a heavy soil from baking and cracking during dry weather and a sandy soil from drying out unduly. Organic matter does not take the place of either lime or commercial fertilizer. It is a supplement to them.

Most garden soils in the New York area are acid and need lime. You can have your soil's acidity tested by sending a quarter-pound sample to H. E. JOHNSON, West Street, or C. L. LUKE, Murray Hill. For liming material, pulverized limestone is preferred, at 5 pounds for each 100 square feet; or hydrated lime may be used, 3 to 4 pounds, not more, per 100 square feet.

Victory Gardeners should ask for the Victory Garden Special 3-8-7 fertilizer. This formula has been authorized by the government for Victory Gardeners for the sole purpose of growing food. On well established gardens, 3 pounds per 100 square feet is sufficient. On new garden soil, 4 pounds should be used. Commercial fertilizers supply nitrogen, phosphoric acid and potash for plant growth. Wood ashes supply some lime and a small amount of potash. Sifted coal ashes or cinders have no fertilizing value but temporarily help loosen heavy clay soils. If commercially dried manures are used, follow directions that are given.

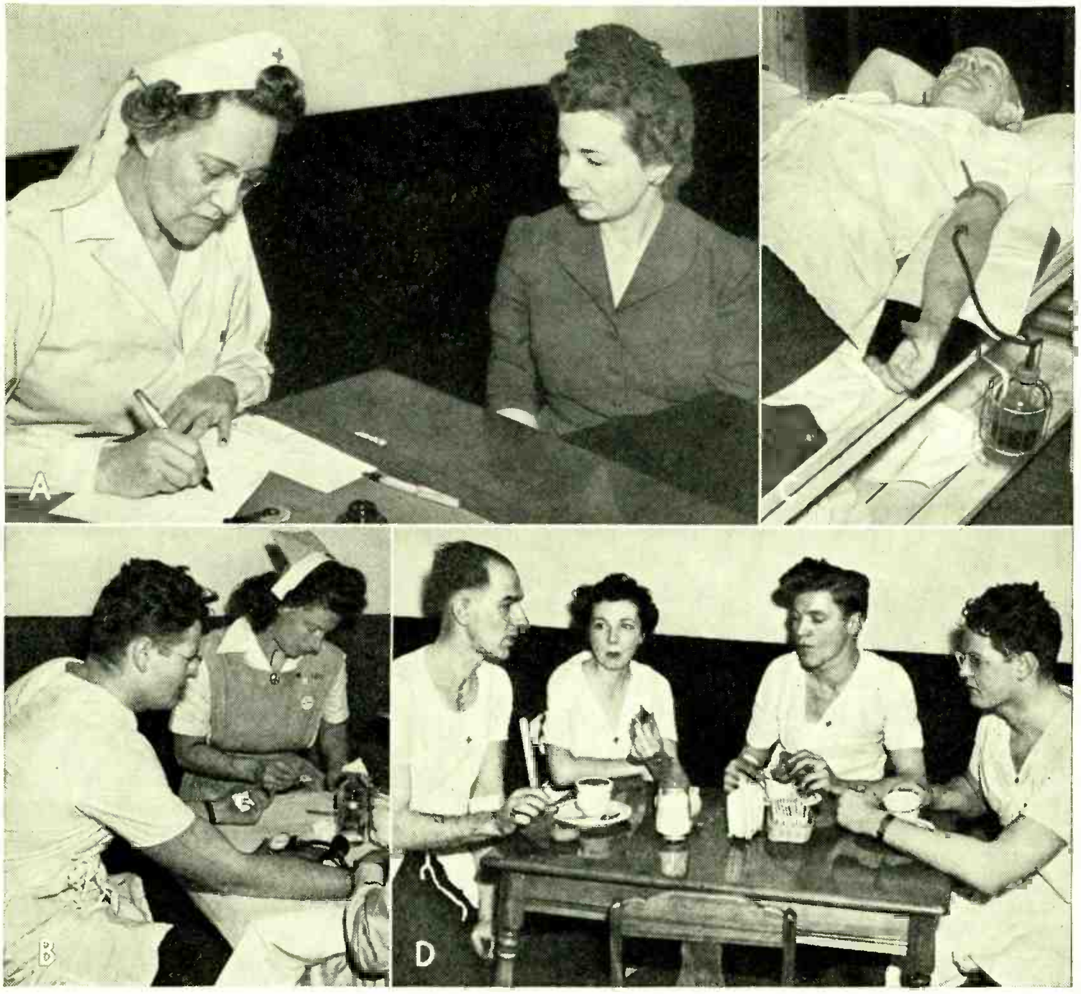
Dinner to Welcome Incoming Class for War Training



To welcome each incoming class, a dinner is tendered them by the School. About 175 students attended the dinner on February 25. At the guest table were (left to right): Major C. A. Wehnert, Second Service Command; J. S. Ward, Navy Radio Contract Service, W. E. Co.; Lt. Col. R. A. Visco, Ordnance Officer, Eastern Defense Command; C. G. Stoll, President, W. E. Co.; Col. L. B. Bender, Signal Officer, Second Service Command; R. K. Honaman, Director of the School; Lt. Col. R. E. Meeds, Office of the Chief Signal Officer, Washington; O. B. Blackwell, Vice-President, B. T. L.; Major H. J. C. Maclean, R. A. (British Army Staff, Washington); C. R. Smith, Manager, Government Radio Contract Service, W. E. Co.

The manure, lime and fertilizer are spread evenly over the garden and well-turned under with either spade or fork. The soil should be spaded to a depth of from 10 to 12 inches. Begin by digging a trench along one edge of the garden; it should follow the contour of the ground so as not to be a channel for rainwater. Throw the soil from the trench over the part yet to be spaded; then turn over spadefulls of the soil in such a way as always to leave a trench next to the unturned soil. Break up the soil while digging, then level and pulverize the surface by raking. Do not dig when the soil is too wet. If it falls apart readily when it is turned up it is then in a proper condition for spading.

Don't kill your interest by working too hard the first week-end. Until muscles are toughened, stop now and then, and quit when you're tired. Avoid overstrain doing garden work or handling tools and other materials. See that the footing is secure. Avoid awkward positions. Bend the knees and keep the back as straight and erect as possible, particularly in lifting. Do not lift heavy articles without help.



A GROUP FROM PURCHASING GIVE BLOOD FOR SOLDIERS

A—Catherine May gives her history to a Red Cross registrar. B—Leon Bodycott is examined by a physician for general health, pulse, temperature, blood pressure and hemoglobin. C—Kenneth Davies gives a pint of blood. D—After their donation the three are joined by Elliott Johnson at refreshments served by the Red Cross

Blood Donors

These members of the Laboratories, and no doubt many others of whom the Record has no present knowledge, have donated blood through the New York Chapter, American Red Cross—some of them more than once:

E. G. Johnson	Martha Keller
L. A. Bodycott	J. C. Berka
A. C. Asker	Edward Bulman
K. F. Davies	C. G. Arnold
Catherine May	A. E. Gerbore
Madeline Roché	R. E. Yaeger
K. B. Walker	G. S. Bishop
F. C. Keuntje	A. F. Schweizer
Joseph Hathaway	F. C. Neuls
D. L. Shelton	E. P. Dinsdorf
Richard Haard	J. F. Ferko
F. J. Hurley	D. Oakley
E. Van Horn	R. C. Carrigan

A. Gibby

Other donors should make themselves known to the editors of the Record or to the news correspondent in their department.

Appointments for blood donations may be made with the American Red Cross Blood Donor Service, 2 East 37th Street, New York City, Telephone, Murray Hill 5-6400. The offices are open for donations from 10:30 A.M. to 8:00 P.M., Mondays through Fridays, and from 10:30 A.M. to 4:00 P.M. on Saturdays.

One of a series of War Bond posters designed for the Laboratories by P. B. Findley

News Notes

For the second time, all three major Works of the Western Electric Company have received the Army-Navy Production Award for meritorious services on the production front. In notifying the workers of the honor, Under Secretary of War Robert P. Patterson said in part, "You have continued to maintain the high standard that you set for yourselves and which won you distinction more than six months ago. You may well be proud of your achievement. The White Star, which the renewal adds to your Army-Navy Production Award flag, is the symbol of appreciation from our Armed Forces for your continued and determined effort and patriotism."

The Bell Chorus will celebrate its tenth anniversary with the presentation of an annual spring concert at Town Hall on Tuesday evening, May 11. The program will include Mozart's *Gloria in Excelsis* and *Hallelujah*, di Lasso's *Sweet Maiden*, and folk songs of the United Nations. America will be represented by splendid arrangements of Stephen Foster's *Old Folks at Home* and the creole song *Ay, Ay, Ay* as well as some less well known Missouri folk tunes. England, Russia and Czecho-Slovakia will contribute their share to the program and China will be represented by choral settings of three ancient Chinese poems which are as delightful and interesting as Madame Chiang-Kai-shek. Tickets may be obtained from Miss Hilda Muller on Extension 1902.

J. M. Holahan appeared before the Board of Interference Examiners at the Patent Office in Richmond during February.

G. B. Thomas attended the American Management Association Conference on Manpower Utilization held in Chicago.

News from Service Men

Walter Bachmann

"I am now located at Dutch Harbor, Alaska. Of course I cannot explain my mission here, but I can say that we, the Naval Construction Battalion, commonly known as the CB's, are sure living up to our name. We have several kinds of amusement here and they are feeding us plenty."

John A. Stelljes

"Back to my first love at the Labs, I'm once more involved in supply. As always with supply there is never a dull moment, for which I am quite thankful. The hours pass so quickly that there is hardly time to enjoy all the natural beauties that surround me where I am in the great Northwest."

Leon Blackman

"Would you be interested to know that the RECORD I receive monthly is one of the main reasons I am so content here at Fort Lewis, Washington? It makes me very proud to feel that I am part of the Labs. . . . From all sides, in the classroom, on the field, and in the barracks I am being molded to the Army pattern. My job, as 'the eyes and ears' of the gun batteries, is to set up an observation post near enemy installations and to see to it that all radio and telephone circuits are kept open to Brigade Headquarters. It's a grand feeling to see what you have set up work in perfect harmony. Soon I will have the thrill of seeing my work put into actual use."

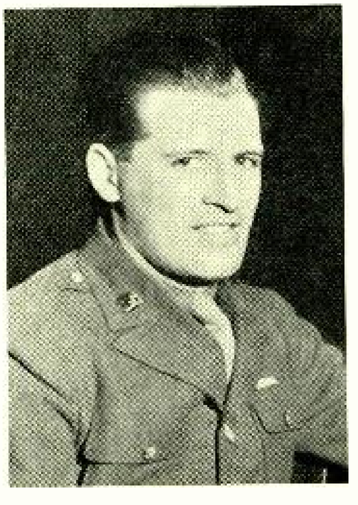
Gerard E. Campbell

Home on furlough from the bitter cold of the great Northwest, Gerard E. Campbell found our February sub-zero weather very comfortable. When he left his Army outpost in the woods the temperature was 70 degrees below zero! It was Gerard's first leave of absence since he went to this wilderness fifteen months ago. He's been in service since June, 1941, and before entering he worked in the Power Plant battery room.

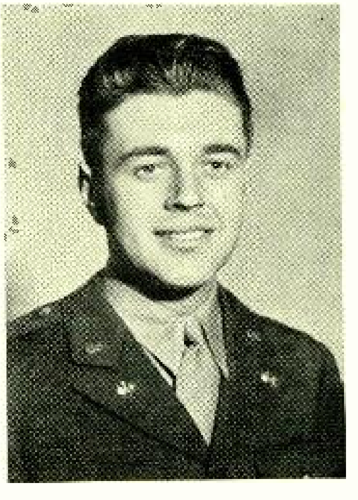
Lieut. George Bukur

"It is surprising how many people enjoy reading the RECORD! When I finish with it I always leave it in the Camp library and the men consider it an excellent magazine to have around. The Servicemen's News Section is a fine idea. It keeps men oriented on the doings of their former associates." Such were George Bukur's comments when he visited his friends in the Systems Drafting

LEON BLACKMAN



GERARD E. CAMPBELL



LIEUT. GEORGE BUKUR

Room recently. Bukur went into the Army with the National Guards of the 71st Infantry in September, 1940, and became a Topographical Draftsman in that outfit. He rose from the ranks and is now the Assistant Plans and Training Officer of a Signal Training Regiment at Camp Edison.

Ensign Arnleiv Jensen, recently graduated from the University of Minnesota with a B.E.E. degree, has been called to active duty with the Navy. He is shown greeting Mary Maglio and the girls in the Telegraph Department, Mrs. Martha Shields and Joan Pisano

Nicholas Brady

"I am on a destroyer and like it very much, although it is far different from civilian life. I am a fireman. My work consists of steam watches which are of a very high pressure on a destroyer. I go on 4 hours and have 8 hours off. I would like to tell you more about my daily routine, but as you know, most of it is secret."

Robert F. Healy

"I am staying at the Atlantic Towers, a neat little establishment, since my arrival in Miami. Palm trees swaying in the cool breezes and a calm blue ocean is the scene from our window. Below us are sergeants yelling their brains out, 'Pop to!' 'Double time!' 'Yar' bird!'. . . . Last night, when we were being led like a bunch of sheep by a sergeant, in the pitch blackness side soldiers

Members of the Laboratories Granted Leaves of Absence to Enter the Armed Forces Since the Last Issue of the Record

United States Army

Marian F. Adler
Gustav A. Backman
Andrew F. Bartinelli
Patrick S. Bennett
William F. Bodtmann
Daniel J. Brady
Richard J. Comer
James de G. Cuyler
John L. Farbo
William V. Flushing
George E. Fuchs
William R. Grant
William P. Harnack
Wallace C. Hickman
William V. Hoshowsky
Frank R. Hulley
Harold Jaffe
Thomas E. Jew
Edward M. Kennaugh
William P. Knox
Louis A. Kramer
Eugene F. Krautter
Ellsworth A. Lichtenberger
George K. McMillan
Robert J. Nielsen
Arthur J. Nolan
Robert L. Norton
Lawrence P. O'Donoghue
Kenneth C. Oestreicher
William R. O'Neill
Alfred O. Schmitz
Henry H. Sharpe
William R. Spenninger
William C. Sylvernal
James R. Walsh
Peter Wargo
Frederick W. Whiteside
David H. Wright
Edward J. Zillian

United States Navy

William A. Anderson
Walter Burkart
Robert M. Eichhorn
Eugene Fieldhammer
Marie L. A. Keough
Frank A. Koditek
Robert C. Kuenstner
Andrew M. Kurutz
Isabell D. Maddocks
Marilyn Pearson
Robert L. Pritchard
Elwood N. Riker
William Robertson
Eugene A. Steppuhn
Frank Zylla

were having fun calling out locations. Someone called out, 'Jackson Heights!' I stopped. I knew the fellow. Two soldiers with me also stopped and thirty struggling rookies piled up on us. The confusion was awful . . . the sergeant swearing, soldiers dropping their utensils . . . ! I quickly caught up and no one knew who started the new army on the road to ruin."

Major Eric Hill

"On the last day of November, the day I was winding up two years in the Army, I was informed I had been promoted. As soon as I can get the new company commander back from Hawaii I am supposed to take over the job of the Battalion Executive Officer. A year ago I was hoping to get out of the Army on the last day of November. Now, I wonder what November 30, 1943, will bring."

Thomas J. McDonough

"The crew of the blimps, such as I am on, is made up of specialists who have gone to a Lighter-Than-Air School to be trained in the duties of other crew members and to relieve the officers acting as pilots. This is done primarily so that in an emergency every man can be replaced. Then, also, interchanging the duties makes the long patrols less tiresome.

"There is a move on now to give the blimps 'pet names.' Already some of the ships have Walt Disney characters stenciled on the cabins. One in particular has a burro or donkey who has just kicked several submarines to pieces."

McDonough is at the Naval Air Station at South Weymouth, Mass.

Eugene Fieldhammer

From the Naval Training Station at Great Lakes, Eugene Fieldhammer wrote to his friends in the Patent Department: "All I have seen of the Navy so far are the decks! I have been cleaning them continuously and if it is not the decks it's the bulkheads or something else. . . . I am in a company with a group of Southern boys and what a riding

Photo by U. S. Army Signal Corps

BELL LABORATORIES MEN AT FORT MONMOUTH SIGNAL CORPS

Front row, left to right—Major William H. Edwards, Major Floyd A. Minks, Major Stanley H. Lovering and Lieutenant Charles L. Semmelman. Rear row, left to right—Robert A. Dryden, Frank J. Osolinik, Staff Sergeant Francis M. Hodge, Albert C. Reynell and Ambrose J. Vallely



George Langzettel — Jack Roback — Edwin Schnabel

I take about New York! The boys never call me by name; they say, 'Hey, New York!' and I call them 'Mississippi,' or 'Alabama,' real Navy-like."

Edwin Schnabel

"Well, 'Ed of the Wash Room' is now 'Pvt. Ed, anti-aircraft gunner.' The Army has issued me lots of fun and knowledge so far and it's only starting. . . . Never before did I realize how important to the war effort are the Bell Labs. We use some of the equipment pioneered by the Laboratories and it is very efficient. . . . Give my regards to Peggy, Blanche, Marge, Letitia and all the other members of the exquisite Wash Room personnel." ["The Wash Room" referred to is a chemical cleaning laboratory for vacuum tube parts in Building R.]

Gordon Taylor

"Well I dood it! Last Monday the whole company went over to the receiving unit and we were all examined for submarine duty. Out of 207, thirty-three of us passed. That doesn't mean I will get sub duty, but I have a good chance. There is a quota of 18 for each company to meet so I have a 50-50 chance!"—This news came from Taylor, Davis Building Drafting Room, now at the Naval Training Station at Newport.

* * * * *

Early in February, George Langzettel visited his former associates in General Service. He is now a Private First Class in the Coast Artillery, Anti-Aircraft, and has been recommended for transfer to an Officers' Training School.

Ensign Donald S. Duguid has been assigned to Fort Schuyler Naval School. After completing his course he expects to be sent to Bowdoin College for advanced studies.

Frank A. Braun, Willard A. Reenstra, Benjamin P. Ransom, all of the Labs, and Joseph R. Fay of Kearny are living in the same room at the Naval Research Laboratory, Washington.

Arthur Schmitt and Harold Raimert, both formerly of the General Messenger Service, are in the same battalion at the Naval Training Station at Sampson, N. Y.

Robert Tomb writes that he has finished his boot training and is now attending a torpedo school in Norfolk.

Jack Roback has been transferred to an Aircraft Warning Company at New River, N. C., for special training.

Major James McRae is engaged in the coördination of Signal Corps research and the development of secret radio appliances.

Ralph Horne has been transferred to the Flying School at Pecos, Texas.

William Wiegmann, now at Fort Knox, has been attending the Armored Force School, where he is taking a radio electrician course in an intensive ten-week training period. He writes that most of the equipment he works on is made by the Western Electric Company.

William Farmer, who is studying at an

HUGH GLYNN JAMES VIGGERS WILLIAM WEILER

Air Corps School in Lincoln, Neb., writes "I am specializing on fighter planes and there are all types of fighters here. The school is fine and the course should last about four months."

SERGEANT HUGH GLYNN writes: "I am fine in Australia; we had a very good trip over here. Australia is a pretty nice place. The girls are nice here and they seem to like the American boys."

SERGEANT JAMES J. VIGGERS is now a member of the permanent Ordnance Detachment at Camp Kilmer. He recently visited his friends in the Coil Winding Shop.

WILLIAM WEILER, who was a pipefitter in the 2-H Shop, has been transferred from Woods Hole, Mass., to active sea duty, as a ship fitter.

ALEXANDER HOWITT sent a few pictures to his friends in the Plant Department "to let them see what a soldier in action looks like." The accompanying picture shows him in front of his hutment when he first went to Camp Livingston. Among the other were snapshots of him learning hand-to-hand fighting and one of him fast asleep in his tent.

HENRY BOYLE is attending Officers' Candidate School, Fort Benning.

LAST MONTH JOHN ROBINSON wrote that his address was M.O.P.O.U.T.C., Jackson, Mississippi. A bewildered RECORD editor wrote back to him to find out what he was. His answer straightened things out. He's a Private First Class at the Mississippi Ordnance Plant, Ordnance Unit Training Center, down there!

ELLSWORTH LICHTENBERGER, on a card to his friends in the Patent Department, had this to say about the Air Corps: "So far this Army life has been O.K. because the sergeants are a bunch of regular fellows. Can't take time to write more now because I have to scrub the bathroom for inspection tomorrow." "Red" has been quartered in an Atlantic City hotel since his induction.

ENSIGN H. A. FREDERICK, JR., is at the Naval Aircraft Factory in Philadelphia.

"BEING A STUDENT and a soldier at the same time has advantages and disadvantages," ROBERT DAWSON writes from Fort Monmouth. "The new obstacle course we

ENSIGN FREDERICK

ALEX. HOWITT

War Bond Subscriptions Continue to Grow

Changes in subscriptions to War Bonds which took place in the two months ending March 11 paint an encouraging picture of the way members of the Laboratories are backing the war effort with their money. The figures:

New subscribers	422
Cancellations*	57
Net increase	365
Increases in allotments	549
Decreases in allotments	32
Net increase	$13,235

*Excluding those due to resignations or leaves of absence.

have to go through makes us appreciate the student part more."

H. J. Braun, of the Development Shop, is at Bradley Field learning the repair of all types of guns used by the Army Air Forces.

John Lordan, formerly a photocopy man, has been sent to Camp Edwards, Cape Cod.

R. A. Dryden, though still at Fort Monmouth, has changed companies twice within a short time. He expects to be stationed there for a while longer.

John C. Ptacek of the Marine Corps is now with the Sea School Detachment at the Norfolk Navy Yard.

Fred Alexander, Horace Camp and William Knott, on military leaves of absence, have returned to the Laboratories. Miss Helen Rose Franze, who was on a personal leave of absence for work in the N.D.R.C., came back to her work on February 22.

News Notes

Trials at Fort Monmouth on several hundred miles of field wire involving new developments of the Laboratories had to be suspended recently because the wire was requisitioned for immediate shipment to North Africa. The trials will be resumed as soon as replacements can be obtained from the Western Electric Company. Designs and proposals to the Signal Corps for this project were made by the Outside Plant Development and Transmission Engineering Departments.

L. C. Roberts spent four days in February in New Jersey testing special equipment being developed for the Army. Captain Tambling of the Signal Corps, formerly of the Laboratories, R. M. Sprague of the Priss Wireless Company and H. W. Reichel of Long Lines Engineering Department participated. Among the others present part time were M. E. Strieby, now with the War Department, A. Bailey and E. Bemis of the O & E Department and R. D. Parker, R. B. Shanck, F. J. Singer and J. R. Davey of the Laboratories.

"The Telephone Hour"

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

April 5, 1943

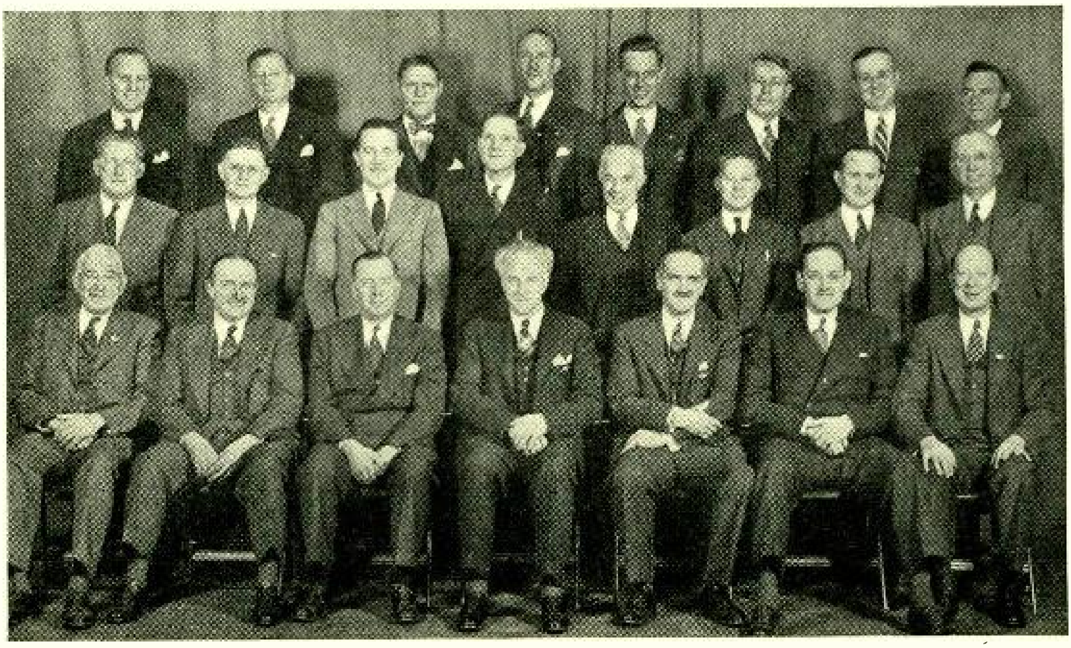
Give Me One Hour from "The White Eagle"	*Friml*
James Melton	
The Girl with the Flaxen Hair	*Debussy*
Orchestra	
Ouvre Ton Coeur	*Bizet*
Indian Love Call from "Rose Marie"	*Friml*
Francia White	
Since First I Met Thee	*Rubinstein*
James Melton	
Rosenkavalier Waltzes	*Strauss, R.*
Orchestra	
O Soave Fanciulla from "La Bohême"	*Puccini*
James Melton and Francia White	

April 12, 1943

A la Bien Aimée	*Schütt*
Orchestra	
Musette and Tambourin	*Rameau*
José Iturbi at the Harpsichord	
El Pelele from "Goyescas"	*Granados*
Minute Waltz	*Chopin*
José Iturbi at the Piano	
At an Old Trysting Place from "Woodland Sketches"	*MacDowell*
Orchestra	
Concerto in B Flat Minor—First Movement	*Tschaikowsky*
José Iturbi and Orchestra	

April 19, 1943

Valse from "Coppelia"	*Delibes*
Orchestra	
The Nightingale	*Alabieff-La Forge*
Lily Pons	
Put on Your Old Gray Bonnet	*Wenrich*
Orchestra	
My Moonlight Madonna	*Fibich*
Lily Pons	
Finale—Symphony No. 1, C Minor	*Brahms*
Orchestra	
Je Suis Titania from "Mignon"	*Thomas*
Lily Pons	



General Service Department Supervisors and Their Responsibilities

R. H. Wilson, (Row I, Seat 4), General Service Manager, is in charge of the groups which are headed by the men in this photograph. For many years the Service Department has had regular meetings of its supervisors and this picture was taken at one of these meetings.

E. J. Reilly, (I, 6), Local Service Manager in charge of all local services in the Laboratories except those at Murray Hill. Reporting to him:

L. B. Eames, (II, 5), is responsible for service to all of the engineering groups at West Street above the ninth floor; he is also in charge of groups in Building R, the chemical storeroom, West Street, and storerooms at Holmdel and Deal.

J. P. Greene, (II, 4), is responsible for service to all the engineering groups at West Street below the seventh floor.

C. A. Charity, (II, 6), is directly in charge of the three self-service storerooms and the groups rendering service to the engineering departments at the Graybar-Varick building.

G. J. Mihm, (III, 5), is responsible for the procurement of raw material used in the West Street Shops and private outside shops doing Laboratories work.

E. H. Kampermann, (II, 1), is directly in charge of all Service Department functions rendered at Whippany.

D. R. McCormack, (I, 7), Central Service Manager. Reporting to him:

A. B. Conner, (III, 1), is in charge of mail messenger and telegraph and office appliance repair services.

F. Haese, (II, 2), is in charge of the photograph, photocopy, blueprint and tracing reproduction services.

Miss Helen Cruger is in charge of the Central Files.

Miss I. H. Benedict supervises Transcription at West Street, Graybar-Varick, Deal and Holmdel.

E. G. Conover, (I, 2), Merchandise Manager. Reporting to him:

M. L. Clarke, (III, 8), is in charge of the Central Instrument Bureau.

W. R. Stuart, (III, 2), is in charge of central, local procurement and salvage stockrooms at West Street and Building R, as well as central storage, including the Baker-Williams warehouse.

C. T. Boyles, (III, 6), as Traffic Supervisor, is in charge of the shipping, receiving and salvage at West Street and at Graybar-Varick.

R. C. Carrigan, (II, 3), is in charge of the Stock Control Department and is also responsible for the normal staff functions of the General Service Department.

H. W. Salch, (II, 7), is responsible for procuring stock materials as part of the stock control group.

R. E. Merrifield, (I, 5), Service Manager at Murray Hill. Reporting to him:

G. B. Hamm, (I, 1), heads the Murray Hill branch of the Central Instrument Bureau, the local order, laboratory order, traffic and stockroom service, shipping and receiving.

Mrs. M. G. Wright is in charge of the mail, messenger service, transcription and central files at Murray Hill.

H. W. Dippel, (I, 3), as Purchasing Agent, directs the operations of the Purchasing Department. Reporting to him:

L. R. Shropshire, (not shown), is Assistant Purchasing Agent in charge of the purchase of raw materials, hardware, office supplies and building material. He also heads the order expediting group.

G. H. Martin, (III, 7), is Assistant Purchasing Agent, in charge of the purchase of electrical supplies, radio and power equipment and heads the "S" or small order group.

C. W. Lowe, (II, 8), priorities specialist, is in charge of priorities and of their control.

C. Deyo, (III, 3), supervises the office services of the Purchasing Department and is in charge of order typing, files, bills and other services.

H. S. Price, (III, 4), is Purchase Engineer and handles special purchasing problems.

News Notes

W. G. Shepherd's paper, *Deionization Considerations in a Harmonic Generator Employing a Gas-Tube Switch*, presented at the New York meeting of the I.R.E. on April 1, 1942, was published in the February issue of the *Proceedings of the I.R.E.*

Voices of Victory, a film demonstrating how essential to the war effort is the work of women at the switchboards of the nation, was shown at West Street on February 19.

M. J. Kelly, Harvey Fletcher and Ralph Bown visited the RCA Laboratories at Princeton.

K. K. Darrow is delivering a series of five lectures on *Nuclear Physics*, March 15 to April 12. These lectures are sponsored by the Communications Group of the New York Section, A.I.E.E. The time and effort of Dr. Darrow in this presentation are contributions of the Laboratories and himself to the A.I.E.E. Dr. Darrow, at Philadelphia, attended a committee meeting of the Bartol Research Foundation and the general and the committee meetings of the American Philosophical Society.

To each of the boys leaving our Development Shop to join the Armed Forces a gift of twenty-five dollars is given by his co-workers in the 3B and C and the 4B and C shops, regardless of his amount of service. Up to March 1, more than fifty boys have left from these groups. Letters of thanks have been received from boys all over the country and from foreign lands.

Miss Cruger, Mrs. Wright and Miss Benedict, supervisors in the General Service Department

Report of Employees' Benefit Committee

The following report is presented of operations under the "Plan for Employees' Pensions, Disability Benefits and Death Benefits" for the year 1942.

There were twenty-three members of the Laboratories who retired during 1942 as compared to a yearly average of twelve over the past five years. Nine withdrew from active service under the Retirement Age Rule, eight because of disability and six at their own request. Of the fourteen pensions terminated, one was because the individual who had been retired for disability regained his health and thirteen were because the individuals died. Of this thirteen, eight had been on disability pensions. At December 31 the retirement roll consisted of 122 receiving service pensions, eleven disability and three special pensions.

Eight active employees of the Laboratories died during the year and payments to surviving dependents were authorized in all instances where there were beneficiaries qualified under the Plan.

In 1942 the number of accidents involving lost time and medical expense because of personal injuries reached the highest peak since the incorporation of the Laboratories, with one exception in each classification, 1929 and 1930, respectively. However, taking into consideration the growth of the Laboratories' staff, cases per 1,000 employees are not far out of line with the usual trend. Similarly, actual payments of accident disability benefits and related expenses are somewhat higher than before but payments in proportion to the total payroll are lower.

A decrease is noted in sickness absences of more than a week's duration among employees eligible to benefits under the Plan, but in view of more long-term cases, there was a resultant increase of 800 in working days lost. This is a rather interesting picture, in view of the considerable amount of overtime and pressure under which we are now working, as it would seem more likely that the trend of sickness incidence would have been upward. There is an increase in sickness disability payments under the Plan, although as pointed out in the preceding paragraph, payments per $1,000 of total payroll are at a lower rate than in 1941. Other disbursements made due to sickness absences amounted to $221,777, which represents payments charged to departmental expense for sickness absences of less than one week's duration, for first week absences of benefit cases, and for absences of those with insufficient service to be eligible to sickness benefits.

Special benefit and supplementary and special pension payments amounting to $13,043 were paid to active and retired members of the Laboratories during 1942.

There were outstanding at the beginning of the year ninety-four leaves of absence.

Statement of Benefit Payments for the Year 1942

Under the "Plan for Employees' Pensions, Disability Benefits and Death Benefits" the following benefit payments were made during the year 1942:

Payments by Trustee from Pension Trust Fund:	
Service Pensions	$215,299.57
Payments by the Company:	
Disability Pensions	9,793.12
Payments after Death of Pensioners	12,620.42
Accident Disability Benefits and Related Expenses	16,378.19
Sickness Disability Benefits	166,625.52
Sickness Death Benefits	54,193.29
Total Benefit Payments	$474,910.11

Bell Telephone Laboratories, Inc.,

(Signed) A. O. Jehle,

General Auditor.

March 4, 1943.

During the year 329 leaves were granted, forty-six completed, leaving a total of 378 current as the year drew to a close. This increase is, of course, a direct result of the war as can be seen in the fact that there were outstanding at December 31, 285 military leaves and fifty-two personal leaves to engage in a civilian capacity in war work with the Government or governmental agencies.

W. H. Harvey, 1889-1943

The "Plan for Employees' Pensions, Disability Benefits and Death Benefits" is administered by the Employees' Benefit Committee, which consists of R. L. Jones, Chairman, E. W. Adams, A. B. Clark, J. W. Farrell, M. J. Kelly, L. Montamat and G. B. Thomas. J. S. Edwards is Secretary of the Committee and G. A. Brodley, Assistant Secretary.

(Signed) J. S. Edwards, *Secretary, Employees' Benefit Committee.*

News Notes

J. A. Ashworth attended an American Society for Testing Materials meeting in Buffalo on March 2.

W. E. Campbell, on February 17, attended a meeting of the Subcommittee on Friction, Lubrication and Wear of the Committee on Power Plants for Aircraft of the National Advisory Committee for Aeronautics at its Engine Research Laboratories at Cleveland.

Electrographic Analysis was the subject of Beverly L. Clarke's talk at the Delaware Section of the American Chemical Society on February 17.

W. A. Shewhart is a member of the Committee on Applied Mathematical Statistics of the National Research Council. At present the committee is particularly interested in the use that industries and government agencies may make of statistical quality control in production. The general oversight of this phase of the work of the committee is in charge of Dr. Shewhart.

R. L. Jones has been appointed a member of the Board of Examination of the Standards Council, American Standards Association, for the year 1943. The duties of this Board are to make recommendations to the Standards Council on matters concerning the initiation of projects and approval of scopes, personnel and standards, where the projects have not been specifically assigned to any of the correlating committees.

R. W. DeMonte and L. W. Morgan visited the Automatic Winding Company in East Newark in connection with transformer problems.

W. B. Harris spent a week at the Hawthorne Plant in connection with the manufacture of special coils for government use.

C. J. Davisson was elected an Honorary Life Member of the New York Academy of Sciences.

R. T. Staples went to Baltimore on special cable problems.

During February J. H. Bower spent time in Washington on battery problems.

A. J. Grossman and E. W. Holman made a trip to Chicago to study special networks.

W. H. Harvey Dies

William H. Harvey of the Switching Apparatus Development Department died suddenly on March 2. After graduating from Tulane in 1910 with a B.E. degree, Mr. Harvey was successively with the General Electric Company, Interstate Electric Company and the Columbia Graphophone Manufacturing Company.

He joined the Engineering Department of the Western Electric Company late in 1920 as a specification engineer. He later transferred to the Apparatus Development Department on the development of relays. From 1929 to 1934 he designed and developed potentiometers, rheostats and switches and then transferred to the subscriber station apparatus group where he was particularly concerned with coin collectors. For the past two years Mr. Harvey had been engaged in the development of relays for telephone systems and for government projects.

Men of the Laboratories

(Chosen by Lot)

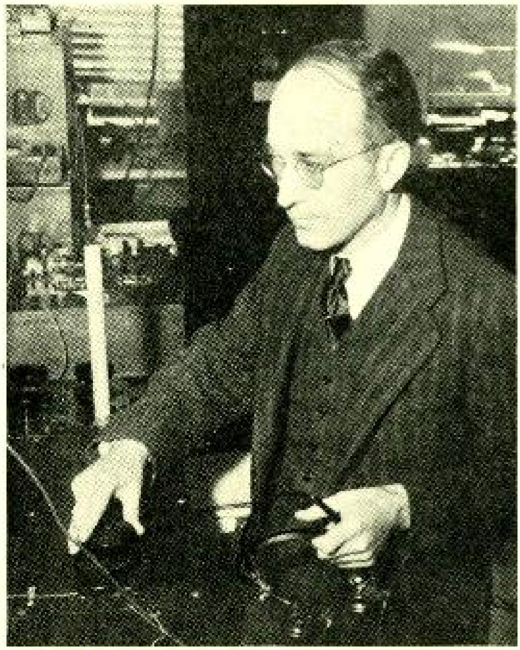
"KING OF CORDS" he should be called, as there are two other men called WILLIAM JOSEPH KING in the Laboratories, and because he has been testing and designing cords (and indoor cables) for the last seven years. Bill graduated from Flushing High School in 1934, and then came here. A messenger for two years, in 1936 he became a T.A. and just last month a Member of the Technical Staff. In June he will graduate from N. Y. U. with an electrical engineering degree and membership in Eta Kappa Nu and Tau Beta Pi. His work continues to be cord development, but with a decided slant toward the war.

Last July, Bill married Eleanor Manthey, then—and still—of Apparatus Files. Bill is enthusiastic about golf and always played in Laboratories' tournaments. Forest Hills, where the Kings live, is conveniently located; but try to find the time for golf when you add a few activities, such as A.I.E.E. and the N. Y. U. magazine, to a war-work job in the Laboratories!

WILLIAM J. KING

* * * * *

H. J. WILLIAMS claims no overpowering interest outside of his regular work on magnetic research at Murray Hill. But his life is not quite so unruffled as he claims, for he is the father of active boys six and eleven years old. He enjoys both winter and summer sports, particularly those in which the boys can participate. The Williamses take pride in their new home in Chatham and devote considerable time to it. Born in Iowa, Howell was graduated from the Poynette High School in Wisconsin and attended Ohio State and the University of Wisconsin. In 1925 he graduated from the latter institution. After a year with the Western Electric Company at Hawthorne he returned to Wisconsin for two years' graduate work. In 1929, Howell came to the



HOWELL J. WILLIAMS

Laboratories and shortly thereafter availed himself of the opportunity of taking part-time graduate work at Columbia University. He has been engaged in research on the fundamental nature of magnetic phenomena. Until recently the "domain" theory of magnetism was his particular interest, but now he is spending all of his time on war work.

* * *

Lawson Egerton is a gun fan. He enjoys hunting, fishing and target shooting as well as skating and bob sledding which are favorite sports in Colorado where he lived before coming to the Laboratories. He is a member of the Union County Rifle Club and is also interested in collecting and remodeling firearms. A graduate from the University of Colorado with the degree of B.S. in Chemical Engineering in 1928, Lawson came to the Laboratories in 1929, after working a year and a half as chemist with the American Smelting and Refining Company. He has spent most of his time since investigating the stability of condenser papers and similar dielectrics and holds patents on impregnants for these materials. The Egertons have lived for several years in the vicinity of Murray Hill; they have two boys in high school and "Dad" had been looking forward to going hunting with them, but that is out for the duration. For light reading Lawson reads good mystery stories and historical novels; he enjoys a good show occasionally and has begun collecting phonograph records of classical music.

H. W. Mickley

H. W. Mickley Retires

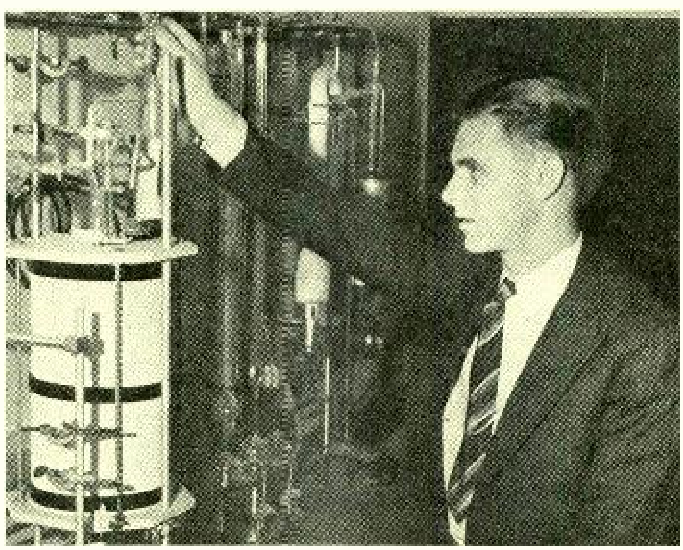
On the thirty-first of March, Herbert W. Mickley retired under the Retirement Age Rule. At the age of sixteen he took a job with the Thames Street Shop of the Western Electric Company. After a year of manufacturing work, he left to finish school; and in 1902 he returned, this time to engage in equipment drafting at West Street.

From 1907 to 1914 Mr. Mickley was engaged in drafting activities for other firms, first on hydroelectric power stations for the Electric Bond and Share Company and later on the layout of plants for the American Laundry Machinery Company. For some three years following his return to West Street, he had charge of training the technical assistants who joined the Systems Drafting Department. Since that time Mr. Mickley has been concerned with drafting work in connection with all types of central-office switching systems.

* * * * *

Statistical Control in Research — A New Tool for the Chemist was the subject of a talk by P. S. Olmstead before a group meeting of the New Jersey Section, American Chemical Society, held in Newark.

R. P. Ashbaugh of Kearny went to St. Louis, Missouri, for consultations with a supplier on cable termination problems.



Lawson Egerton

Women of the Laboratories

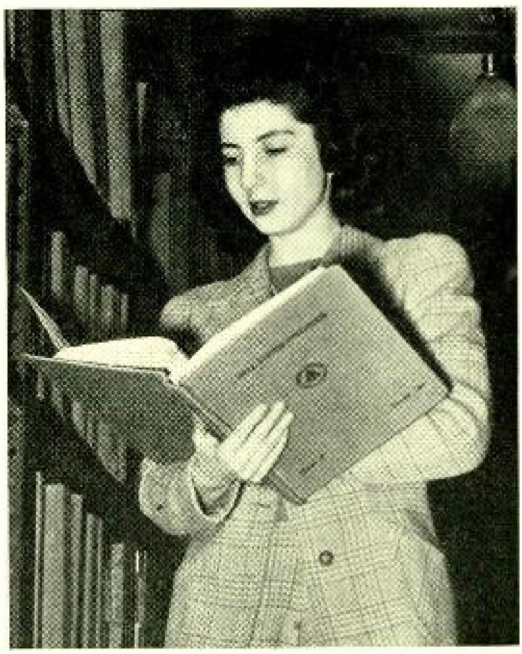
When Beatrice Mead was an undergraduate at Cornell it seemed that many of the interesting events in communications happened at "Bell Laboratories." Now she is an engineer in the crystals unit group where she feels that part of her work is causing things to happen on our battle fronts. Bea designs crystals, makes models, tests them and writes specifications for their manufacture. She has an E.E. degree, is a member of the Sigma Kappa sorority, of the A.I.E.E. and of the I.R.E.

She was born in Brooklyn and grew up out in Amityville, Long Island. After graduating from Lindenhurst High School she spent two years at Adelphi College and three at Cornell. Summers while at college she was a professional swimmer in the ballet at Jones Beach; winters she worked part time as a radio control operator at station WHCU. Studying and working go hand in hand in Bea's plans. After her long hours at the Laboratories she goes to Brooklyn Polytech to take a course in filters. Most of her spare time is spent in commuting and studying, and making plans for her marriage this summer to a Cornell man, an engineer in the Air Corps at Wright Field. However, she still finds time to play bridge at noon and sometimes in the evenings and to take care of Klystron, a pedigreed Scotty who was a graduation present.

Beatrice D. Mead

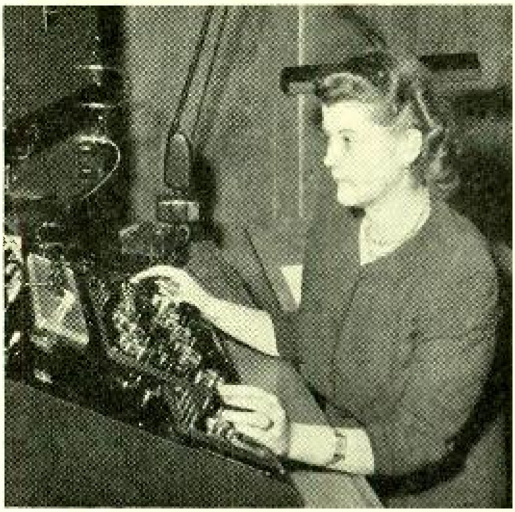
* * * * *

A lyric soprano whose voice gives much promise is Edith Pappin of Central Files. She sings with the Bell Chorus and with a club in her home town of Hackensack. After graduating from Rutherford High School she came to the Laboratories as a messenger and later was promoted to the Central Files where she looks after photographs, keeps up-to-date all Bell System Practice books, including those permanently charged to engineers. She also types labels and binds all of the A T & T Circular Material and BTL Development letters.



Edith Pappin

Practicing for her weekly singing lesson



Eloise Koonce

and attending rehearsals take most of Edith's spare time. However, as chairman of the war service committee of her singing club, she arranges entertainments for the soldiers at nearby Camp Shanks. She enjoys tennis and dancing, and for relaxation she has learned to weave.

* * * * *

Eloise Koonce has had a varied career since she left Louisburg College, North Carolina, where she specialized in chemistry. For a year she was a technician at St. Vincent's Hospital, Staten Island. The following year she did social work in North Carolina; then returned to New York as X-ray and clinical laboratory technician at Stapleton Medical Center. For several years prior to joining the Laboratories as a technical assistant, Eloise was an employment interviewer for the Federal Works Agency. She is now at Murray Hill where she makes precision measurements on carbon resistors. In college Eloise played tennis. Her most active entertainment interest is musical concerts. She is the sister-in-law of A. R. Saunders.

* * * * *

Laboratories First WAAC

Laboratories people at Murray Hill will no longer see Mrs. Helen Elberson in her bright red slacks and sweater cycling over the Jersey Hills to her work in the Restaurant. Helen has doffed her bicycle outfit and her yellow waitress uniform for the olive drab of the WAACs. Prohibited, by a Navy rule, from joining the WAVES or the SPARS because her husband enlisted in the Navy's Seabees in December, she determined to do what she could for her country and was sworn into the Army on January 14. On the morning of her induction she fractured her ankle and while recuperating was still at Murray Hill.

Helping to win the war is the rule in Helen's family. Her twin sister is a civilian soldier working side by side with her husband in the Douglas Aircraft Company in California. A graduate of Scotch Plains High School, Helen attended a business school and worked as a saleswoman. Upon the opening of Murray Hill Laboratories she became a part-time worker in the Restaurant. She enjoys skating and tobogganing and is an ace at turning cartwheels, though she's reluctant to admit it.

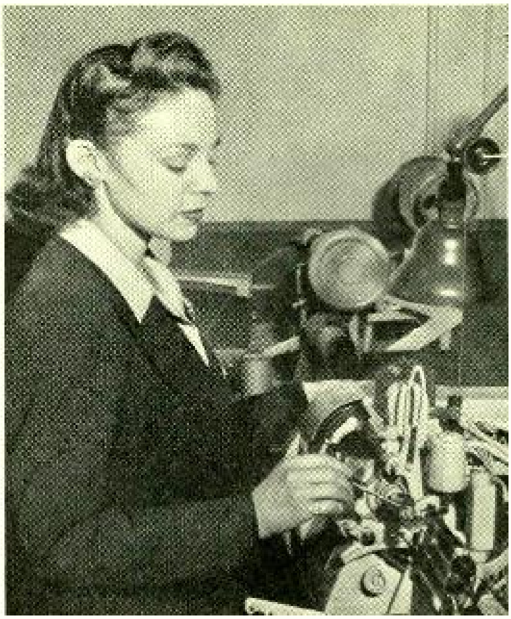
This is the longest letter ever received at the Laboratories! It was sent to Mary Suchonik, a ninth-floor mail girl, by a soldier friend who had promised to write her a "long" letter. It took him most of his day off to write it, and Mary and her friend, Rita Veverka, spent a lunch hour reading the letter

Amelia Arra's story runs from dress designing to coil work, because, she says, "I wanted to do my share in the war effort." She was graduated from Textile High School and from Pratt Institute where she majored in designing. Amelia is brimful of enthusiasm for her work at the Laboratories. The patterns woven by her winding machine fascinate her as her deft fingers control the speed and the construction of the coils. "Learning coil work," she says, "is a challenge because it requires patience, concentration, a clear understanding of the blueprints and a great deal of attention and discretion in the handling of the machine, especially when the wire breaks or does not layer properly."

With a brother in the Air Corps and a fiancé in the Armed Forces, she considers her work in the Laboratories more vital than styling sport clothes. Besides designing and making all her own clothes, Amelia sometimes designs scenes and costumes for school plays. A capable sportswoman, she sails a boat well.

* * * * *

Draftswoman on war projects is Marie Vincent, a graduate of Sewanaka High School, Floral Park, L. I. She studied at Cooper Union before coming to the Laboratories and after her busy days at a drafting table in the Research Drafting Department she returns to Cooper Union evening classes to study advertising and oil painting. For recreation Marie belongs to a fencing club which meets once a week and she visits art galleries when she can find time. Marie also enjoys reading current literature at her home in Elmont, L. I.



Amelia F. Arra

Marie Vincent

We See By the Papers, that

The brick colonial dwelling at 66 Ralph Avenue has been sold to Allen I. Crawford of the Bell Telephone Laboratories. The property includes eight rooms, three baths and a two-car garage.—*Reporter-Dispatch, White Plains, N. Y., Feb.* 4, 1943.

The local League of Women Voters has prepared for the township voters a brief article on the facts concerning each candidate for the school board tomorrow. . . . David Bodle is seeking one of the three-year terms. (*He got it.*) He was born near Port Jervis, N. Y. His education was in New York City Schools and the New York University School of Engineering. He is an electrical engineer of the technical staff of Bell Telephone Laboratories. He has lived in Pequannock for five years.—*Pequannock Notes, in Paterson News, February* 8, 1943.

LT. and MRS. S. CURTIS TALLMAN, formerly of 11 East Gouverneur Avenue, Rutherford (*and of Station Apparatus Development*), are parents of a son, Curtis George, born Wednesday at Passaic General Hospital. Lt. Tallman has been in England since September.—*Newark Evening News, February* 16, 1943.

CORPORAL and MRS. ALBERT RUOFF are on a wedding trip following their marriage. . . . The bride is a graduate of St. Agnes Academy and is employed in the Bell Telephone Laboratories. Corporal Ruoff, a graduate of Smithtown High School, is stationed with the Army Medical Corps at Fort Bragg, N. C. — *Long Island Star-Journal, February* 16, 1943.

The engagement of MISS VIRGINIA MARIE WITTENBERG to CARL G. BRAUN of Brooklyn was announced. . . . Mr. Braun, a graduate of Stuyvesant High School, received his engineering degree at Brooklyn Polytechnic Institute, where he was elected to Eta Kappa Nu, honorary fraternity of electrical engineers; Tau Beta Pi, honorary engineering fraternity; and Alpha Kappa Pi. He was president of the student council in his senior year, and is associated with the Bell Telephone Laboratories in New York City.—*Freeport Review Star, February* 22, 1943.

ROBERT L. NORTON, 19, son of Mrs. Helen Norton of 95 DeMott Avenue, Baldwin, is training to be a pursuit pilot and is at the Army Air Force Cadet School at Miami Beach, Fla. He enlisted October 9, resigning from his position with the Bell Laboratories (*actually on leave of absence for military service*). "Bob" graduated from Mephan Central High School, Class of '41. He played first clarinet in the school band.—*Freeport Review Star, February* 20, 1943.

One hundred of the best technical books produced in the United States between January 1, 1938, and February 15, 1943, will comprise the first exhibition of technical books ever to be selected for their excellence of design and workmanship by the American Institute of Graphic Arts. This exhibition will have a New York preview on April 1 at the New York Public Library. . . . The final selections will be made by a jury consisting of Harrison W. Craver, director of Engineering Societies Library and past president of the American Library Association; ARTHUR R. THOMPSON, of the Bell Telephone Laboratories and president of the American Institute of Graphic Arts; and John Begg of Oxford.—*Publishers' Weekly, Camden, N. J., February* 13, 1943.

An article by A. HERCKMANS (Bell Laboratories RECORD, October, 1942) describes a new amplifying set which recently has been developed, for use with the regular telephone set, to assist the hard of hearing—the new set provides the help needed for about 90 per cent of those people who are conscious of hearing impairment.—*Nature, Jan.* 16, 1943.

Physics is a human activity and, like all others, depends upon the interest with which people in general regard it. In the long run, solid achievement is the best road to general recognition, but even achievement can be overlooked, taken for granted, forgotten through familiarity, or credited to the wrong agent. Unless physicists and their friends occasionally take positive steps to demonstrate and call attention to the advances and services of physics, public attention will readily be diverted to fields which are better displayed and more repeatedly praised. Publicity is not 100 per cent palatable to physicists, but there are forms which come a close second to pure education in acceptability. The Institute has used and has encouraged physicists to use such forms.—*"A Report to Physicists" by H. A. Barton, Director, American Institute of Physics.*

M. J. Kelly   E. E. Schumacher

Twenty-Five-Year Service Anniversaries

About this time twenty-five years ago, the Laboratories, in the midst of World War I, was adding rapidly to its personnel. Many of those men and women are now eligible for biographies in the Record. To allow a larger number of them to be published in the allotted space, a "Who's Who" style for presenting them is being adopted with this issue.

* * * * *

Mervin J. Kelly, Director of Research. Missouri, B.S. 1914 and D.Eng. (hon.) 1936; Kentucky, M.S. 1915; Chicago, Ph.D. 1918. Bell Laboratories, 1918. Fel. Phys. Soc., Acoust. Soc., A.I.E.E., mem. Franklin Inst., I.R.E., A.A.A.S., Council on Applied Physics of Am. Inst. Phys., Membership Committee of Phys. Soc., Telephone Pioneers. Author, papers on photoelectric cells, vacuum tubes, high-frequency oscillators. m. Katherine Milsted; ch. Mary Katherine, Robert Milsted; r. Short Hills, N. J.

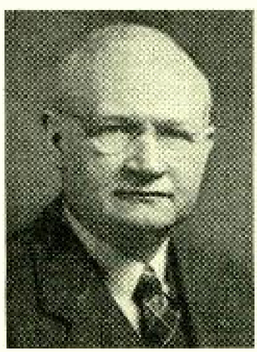
From 1918 to 1930 Dr. Kelly, as a research physicist, was intimately associated with the development of vacuum tubes, photoelectric cells, vacuum thermocouples, ballast lamps and other thermionic devices for communication uses. During this time he made several inventions in the vacuum-tube art having to do with the structure and manufacture of tubes. He became Vacuum Tube Development Director in 1930, Vacuum Tube and Transmission Instruments Director in 1934 and, in 1936, Director of Research. In addition to research activities he is in direct charge of the Commercial Products Development Department of the Laboratories which designs radio and related equipment for the use of the Army and the Navy. As Director of Research he reports directly to the President of the Laboratories.

Dr. Kelly has important relationships with both the Army and the Navy and maintains technical contacts with many of their departments. He also has similar responsibilities in connection with many of the projects of the National Defense Research Committee upon which the Laboratories is working.

Earle E. Schumacher, Research Metallurgist. Michigan, B.S. 1918. Bell Laboratories, 1918. mem. A.I.M.M.E., British Inst. of Metals, A.S.T.M., Am. Foundrymen's Assn. and others; Chairman, Papers Committee, Am. Inst. of Metals, and on several committees of A.S.T.M. Author, numerous technical papers on metallurgical subjects. m. Ruth Widmayer; ch. Earle E., Jr.; r. Maplewood, N. J.

Mr. Schumacher was graduated by the University of Michigan where he specialized in physical chemistry and served for two years as Research Assistant to the Head of the Physical Chemistry Department. On entering the Laboratories, he first worked on vacuum-tube filaments and had much to do with the development of the oxide-coated platinum-nickel filament which was used so successfully for many years in the Bell System. He later transferred to the Chemical Laboratories where he is now Research Metallurgist, and directs the work of the group conducting studies on metals and alloys. His personal contributions are indicated by the many patents which have been issued to him and by his technical articles covering metallurgical subjects.

Paul B. Findley, Assistant Director of Publication. Princeton, B.S. 1909, E.E. 1912. Bell Tel. Co. of Pa., 1912-16; Editor, Elec. Age, 1916-1917; Westinghouse, 1917-19; Signal Corps, 1918; Adv. Mgr., The Fairbanks Co., 1919-21; A T & T., 1921; Western Electric, 1922-25; Bell Laboratories, 1925. A.I.E.E., I.R.E., Telephone Pioneers. m. Ethel P. Sturtevant; r. Flushing, L. I.



P. B. Findley   P. P. Cioffi

During his four years as a Telephone Company man Mr. Findley turned to editorial work and advertising. When the Laboratories was incorporated in 1925 his transfer from Western Electric was requested and he was given charge, as editor, of Bell Laboratories RECORD which issued its first number in September of that year. As Assistant Director of Publication he is responsible for contacts with the magazine and newspaper press and handles news releases from the Laboratories and inquiries from the press and specialty writers. He has been active for many years in Scouting, Red Cross and other community activities.

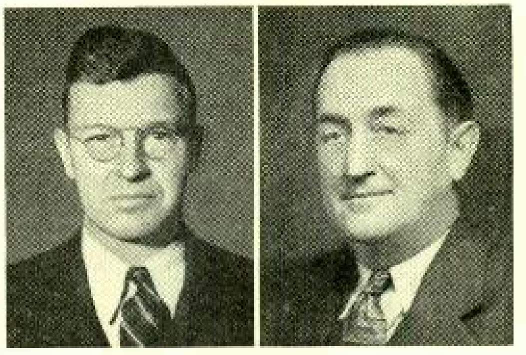
Paul P. Cioffi, Member of Technical Staff. Cooper Union, B.S. 1919, E.E. 1923; Brooklyn Polytechnic, one year graduate work; Columbia, M.A. 1924. Bell Laboratories, 1917. Fel. Phys. Soc., mem. A.I.E.E., Telephone Pioneers. m. Anne Frances Rossano; ch. Paul Lawrence, Lucia Ursula; r. Summit, N. J.

Mr. Cioffi, after early work in electronics and studies of the magnetic characteristics of the permalloys, became concerned with investigations of magnetostriction, the preparation and study of the magnetic characteristics of large single crystals of magnetic materials and the problem of magnetic iron, the latter leading to his discovery of high permeability in iron. More recently he has been associated with the problem of the magnetic curve tracer, precision magnetic measurements and the study and design of magnetic circuits.

Lillian Hoffman, Draftswoman. Bell Laboratories, 1918. mem. Telephone Pioneers. r. Inwood section of Manhattan.

When Miss Hoffman was presented with her twenty-five-year service emblem on Lincoln's birthday it was remarked that it was the second time she had worked on

MISS HOFFMAN MISS CRAIG



G. E. REITTER I. S. BETZNER

Lincoln's birthday, the other time was the day she was employed; both of these holidays were in wartime work days. Starting as a messenger, Miss Hoffman soon transferred to clerical work in the contact studies group and then was in what is now the 7-A Files of Systems Development. In 1924 she took the Laboratories course in drafting and joined the drafting group of the Equipment Development Department. Since then she has been engaged in general drafting work pertaining to all types of central-office switching systems.

Helen M. Craig, Member of the Laboratories Staff. St. Lawrence University, B.A. 1907; Pratt Institute Library School, 1909—B.L.S. 1942, retroactive. Engineering Societies Library, 1909-15; Industrial Arts Index, 1915-17; Bell Laboratories, 1918. mem. Am. Library Assn., Special Libraries Assn., N. Y. Library Assn., N. Y. Library Club, A.A.A.S., Women's City Club of N. Y., Amateur Astronomers Assn., Telephone Pioneers. r. Midtown section, New York City.

When Miss Craig first came to West Street she started the Technical Library Bulletin. Since then her principal work has been looking up all kinds of information as required by the Laboratories personnel and in compiling bibliographies. This work takes her to all of the important public and private libraries in New York City.

George E. Reitter, Technical Assistant. Cooper Union, 1920-24. Bell Laboratories, 1918. m. Isabel Crosley; ch. George Edwin, John William, Charles David; r. Ridgefield Park, N. J.

Mr. Reitter, an expert mechanic, works in anything—metal, glass, rubber or wood. He is particularly good in constructing delicate apparatus, and with C. J. Davisson's group in Physical Research has contributed much to the design of special vacuum tubes and apparatus for experimental purposes.

P. A. Doscher — F. C. Kuch

Ira S. Betzner, Supervisor of Electricians. Electrical work—Canada, 1903-1908; New York Aqueduct, 1908-13; Western Electric, 1913; Chevrolet Motor Company, Tarrytown, and Rearton Copper Works, Perth Amboy, 1913-18; Bell Laboratories, 1918. m. Mary Horton; r. Ossining, N. Y.

When Mr. Betzner first came to West Street he worked for a year as an electrician in the Plant Department. He then transferred for three years to the Household Utility Laboratory as a mechanic and electrician and also spent a year in the field as a service man on farm lighting outfits. Returning to the Plant Department as electrician he later became a supervisor and now is in charge of electricians engaged in general electrical construction work at West Street, in Building R and at the Graybar-Varick and Davis buildings.

Peter A. Doscher, Accounting Clerk. 1900-13, clerical work; Allied Products, Suffern, 1913-18; Bell Laboratories, 1918. mem. Telephone Pioneers. m. Katherina Ursula; ch. William, Dorothy, John, Alma, Frederick (Army Air Corps), Theodore (Headquarters Company, Fort Dix); r. Valley Stream, L. I.

In the Accounting Department, Mr. Doscher, during the first ten years of service, supervised the expense accounting group with responsibility for the classification of records of expenditures and the preparation of expense control reports. He was then transferred to supervisory duties in the case costs and plant group where his activities consisted of the preparation of invoices to the A T & T and Western Electric for the cost of work performed. Since August, 1942, he has been responsible for the audit of employees' expense vouchers.

Fred C. Kuch, Member of the Technical Staff. Cooper Union, B.S. in E.E. 1925. Bell Laboratories, 1918. mem. Telephone Pioneers. m. Margaret Fahrenkrug; r. New Providence, N. J.

During the last war Mr. Kuch analyzed engineering orders in the Production Department of the old Model Shop. In 1921 he transferred to the Specifications Department where he covered new and repaired apparatus and testing specifications. Since 1928, in Switching Apparatus, he has been concerned with the engineering, development and testing of various kinds of relays and electro-magnetic apparatus. More recently he has been on projects for the war effort.

Joseph F. Johlfs, Chemical Storekeeper. Oil refining, 1894-1902; coastwise and foreign shipping, 1902-1911; miscellaneous work, 1911-1918; Bell Laboratories, 1918. mem. Telephone Pioneers. m. Jessie English; r. East Orange, N. J.

March Service Anniversaries of Members of the Laboratories

Research Department

Miss Vina Allan—25
C. D. Hartman—25
W. H. Kamper—15
A. J. Munn—20
H. T. Reeve—25
R. J. Riley—25
J. J. Rosenberger—15
Raymond Rulison—20
J. C. Schelleng—25
F. S. Willis—30

Apparatus Development Department

A. R. Brooks—15
E. L. Fisher—25
G. P. Lenormand—15
J. E. Ranges—30
Frank Reck—15
G. A. Sanders—15
Henry Watkinson—15

Plant Department

J. Baumgartner—15
Patrick Byrne—15
John Darida—15
James McInerney—25

General Service Department

A. G. Eckerson—25
Allan Hobbs—25

General Accounting Department

E. H. Ackerson—20
H. V. Kerr—15
A. T. McNeill—15
Lawrence Messer—25
F. W. Seibel—15

Systems Development Department

W. W. Carpenter—30
H. C. Essig—20
W. O. Fullerton—20
M. E. Krom—20
A. L. Matte—25
J. F. Neill—20
H. W. Sanford—20

Patent

Miss Louise Brown—20

Legal

Miss V. Niemeyer—15

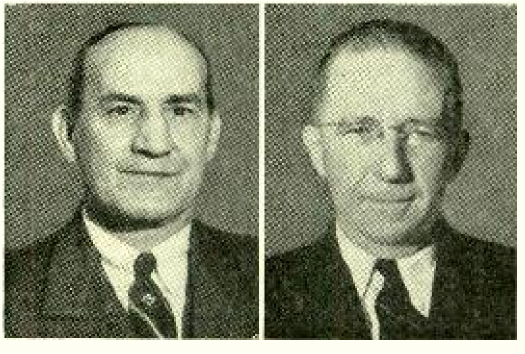
Mr. Johlfs spent four years as a battery man and then became a regular service man. In 1935 he was placed in charge of the third-floor chemical storeroom and for the past year has been in charge of the chemical storeroom at Murray Hill.

Taylor Grant, Member of the Technical Staff. Pratt graduate, two-year course, 1911; Brooklyn Polytechnic, E.E. 1917. Western Electric, summer 1910, '11, '12; New York Central Railroad, 1912-13; New York Fire Dept., 1913-17; Ordnance Dept., U. S. Army, 1917-19; Bell Laboratories, 1919. mem. A.S.M.E., Telephone Pioneers. m. Marjorie Saxton; r. Forest Hills, L. I.

Mr. Grant has been concerned with writing and checking specifications for the manufacture of all types of telephone apparatus. At present he is in charge of a group at Murray Hill on subscriber-station and outside plant apparatus and on special equipment for the Armed Forces.

Milton E. Ellis, Member of Laboratories Staff. New York Central Railroad, 1910-18; Bell Laboratories, 1918. mem. Telephone Pioneers. r. Rutherford, N. J.

Mr. Ellis came to West Street as a wireman in the Plant Department and then was successively in the plant maintenance group,

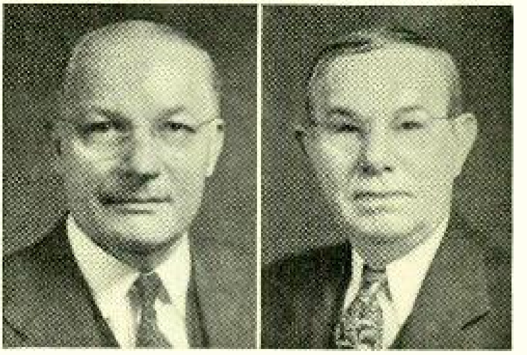


J. F. Johlfs T. Grant

power room foreman, Fire Marshal of the Sound Picture Laboratory and then went back to the Plant Department as foreman of the mechanical group. For the past two years he has been in charge of mechanical and electrical power service equipment at the West Street properties.

Stanley Bernard, Sheet Metal Worker. Daniel McGrath Sheet Metal Company, 1906-11; George Berger Estate, 1911-18; Bell Laboratories, 1918. m. Estelle Atkin; ch. Louis Stanley; r. North Hackensack, N. J.

Mr. Bernard, a sheet metal worker in the Development Shop, has, during his twenty-



M. E. Ellis S. Bernard

five years of service, worked on many important experimental projects, such as sound picture apparatus, telephone booths and other equipment requiring the use of fabricated sheet metal.

News Notes

J. W. Corwin and H. E. Marting visited Philadelphia in connection with the crossbar toll installation.

K2 carrier installation work took G. E. Bailey to Tennessee and Georgia.

H. J. Wallis visited the Western Electric Company at Hawthorne on several projects.

V. T. Callahan has been to Denver and Salt Lake City to discuss engine problems.

J. M. Duguid and C. J. Cancik discussed motor-generator sets at the General Electric Company at Fort Wayne and the Western Electric Company, Chicago.

F. T. Forster observed battery tests at Philadelphia and Trenton.

E. F. Helbing visited the Leland Electric Company at Chicago and Dayton in connection with power problems.

W. H. Spahn and C. E. Brooks were in Chicago to study the performance of the Oakland-Atlantic crossbar offices.

L. S. Inskip and L. K. Swart attended exchange-cable protection conferences in Boston and Springfield. Mr. Inskip, at South Bend, investigated lightning damage recently experienced on K-carrier systems.

A. H. Schirmer spent a day in Washington at the Bureau of Standards, discussing electrolysis and corrosion problems.

E. S. Wilcox, C. H. Gorman and Miss E. Rentrop made type-K carrier crosstalk measurements and balancing tests in Tennessee on the Terre Haute-Atlantic cables.

Behind the Spectacular—*an editorial by* John Mills

After our military authorities decided on an A.E.F. to Africa an enormous amount of work remained. Obscured by the brilliancy of that coup are the myriad activities of those who worked out its details. Just imagine how many schedules had to be planned and dovetailed; how many secret orders had to be typed to coordinate the movement of ships, troops, munitions and supplies that converged on North Africa that November day of 1942.

Behind the spectacular is always an immense amount of preparation which may require even greater originality and ingenuity. That is true of telephony. Behind the transmission achievements of continent-wide multi-channel telephony and of world-wide radio are equally brilliant researches, developments and designs. Somebody had to devise and construct, redesign and improve, all the various elements of the complete system. Without adequate coils and condensers, relays and switching mechanisms, networks and filters, varistors, vacuum tubes and other electronic devices, the communication systems of today would be impracticable.

A similar situation exists in most other engineering arts. Credit goes—and justly—to the pilot and to the plane he controls. But basic to that aero-dynamic mechanism and embodied in it are materials produced by the ingenuity of chemists and metallurgists and innumerable accessories and gadgets each of which has a long history of invention and development. Engineers and designers, physicists and chemists, experts in lubricants and gasolines, in the mechanics of engines and gears—all these whose name is Legion—made the airplanes of today.

During the last six decades coils, condensers and resistors have been subjects of continuous development work in Bell Laboratories. A coil is a coil is a coil is a coil—as Gertrude Stein might say—but to the coil designer it has been a different thing almost each year of its telephonic history. New principles of design, new magnetic materials, new insulating media and new techniques of manufacture—all to meet new and more severe requirements and the use of higher frequencies—have presented problems and opportunities to the coil designer and marked his successes.

For thirty years vacuum tubes have been the object of intensive research by the physicists and engineers of the Laboratories. Starting with H. D. Arnold's basic development of the audion into the high-vacuum tube, and its design as a repeater element for transcontinental telephony, a continuous stream of new designs has issued from the experimental shop of our Electronic Research Department. The tubes of today are enormously increased in power capacity, decreased in cost and in size; more efficient and economical in their emission of thermions; more versatile in their control and improved in reliability and life. Higher and still higher frequencies have been handled by successive designs. And all related electronic devices have profited by those developments: the widely used cathode ray oscilloscope, for example, derives, in large part, from researches in our Laboratories.

Cumulatively, since they started, each of these development projects—coils, condensers, tubes, relays and so on—has contributed to the increased accomplishments of the Bell Telephone System. But they have gone farther and have markedly influenced all arts which employ or adapt the principles and apparatus of electrical communication.

Today, in wartime, their influence is very widely spread. The principles and devices are helping hundreds of manufacturers, and scores of research and development organizations, to design and construct communication devices which are needed by the armed forces of the U. S. and its Allies. Spectacular and vitally important are the military accomplishments of some of these devices. But behind the spectacular are the cumulative developments of hundreds of men and years of brilliant work.