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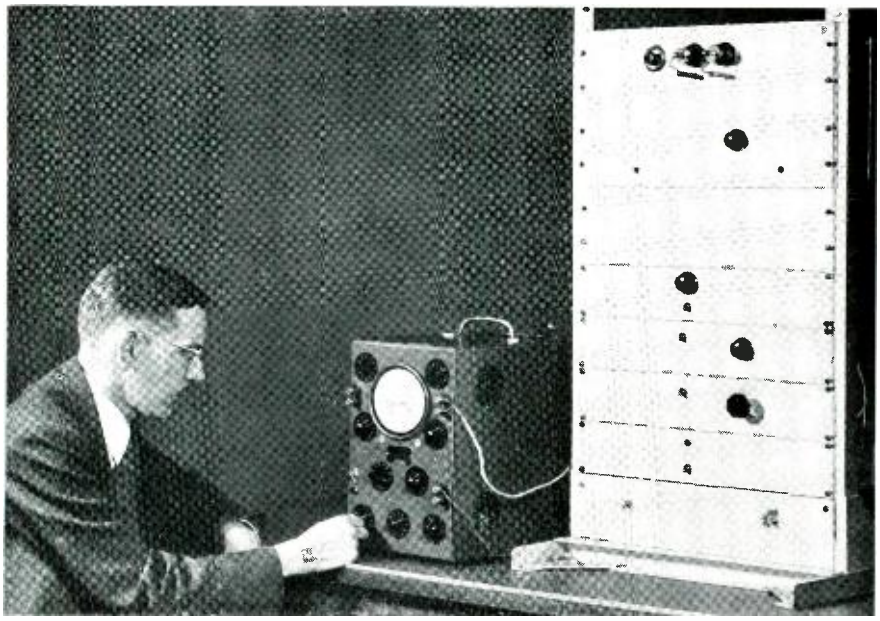

Gas-Tube Harmonic Generator

By L. G. KERSTA
Circuit Research

IN A search for methods of obtaining currents of high and closely controlled frequency for carrier systems, the Laboratories recently investigated the harmonics generated by triggering gas-filled tubes. This method was not adopted for these systems* but the studies showed that gas tubes can produce much higher frequencies than had been thought possible, if operated in a new circuit which accelerates the ionization and deionization of the tube. The harmonics thus generated provide standard frequencies, as high as 25 megacycles, for calibrating oscillators. The sharp current pulses are useful in testing television systems, for making phase distortion measurements in coaxial cables, and in high-speed triggering devices.

A typical gas tube with grid control is a triode filled at low pressure with mercury vapor or argon gas. If the grid is maintained at a constant negative potential with reference to the hot cathode while the plate potential is increased with reference to the cathode, only a very minute electron current passes to the plate until a critical plate-cathode potential is reached. This critical potential depends on the structure of the tube, the gas used and the magni-

*RECORD, *July*, 1937, *p.* 357.

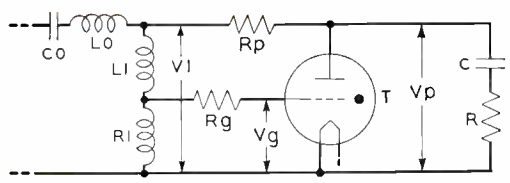

Fig. 1—This new circuit greatly accelerates the ionization and deionization rate of gas tubes

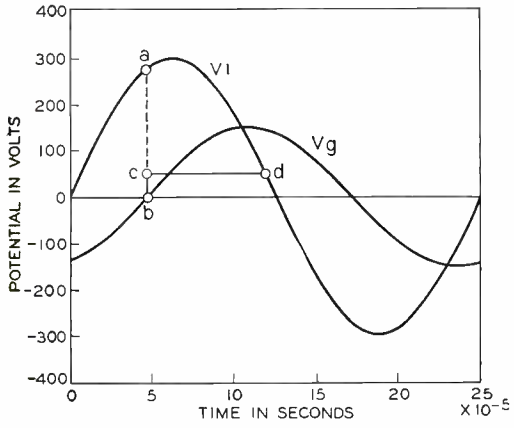

Fig. 2—Plate and grid potentials

tude of the grid potential as well as on the past history of the tube. When the critical potential is reached an arc forms and the tube current suddenly rises. The voltage across the tube simultaneously decreases if an external load is connected in series with the source, and the tube continues to conduct until the plate voltage falls below a minimum value necessary to maintain the arc. When the arc is extinguished the gas ions in the tube migrate to the tube elements and the tube finally becomes deionized. As it deionizes, the grid again regains control and the above process may be repeated. The time required for deionization determines the frequency at which the foregoing cycle may be carried out.

In the new harmonic generator circuit, the grid and plate are both supplied from the same alternating current source. This makes the plate voltage not only decrease to the value required to extinguish the tube, but continue to a negative value. Likewise the grid voltage becomes negative. The negative potentials, primarily that on the grid, sweep the gas ions quickly from the tube, thus increasing the rate of deionization and the maximum frequency at which the tube can operate.

One of the circuits used is shown in Figure 1. Voltage alternating at least several kilocycles per second is applied to the series resonance circuit CO, LO, LI, RI. The drop across the inductance LI charges condenser C through the resistances RP and R. Across CR is shunted the gas tube T and its firing time is adjusted to occur near the peak of the voltage wave impressed on the output circuit CR. This time is determined largely by the relative phases of the grid and plate potentials and to a less extent by their relative amplitudes. When the

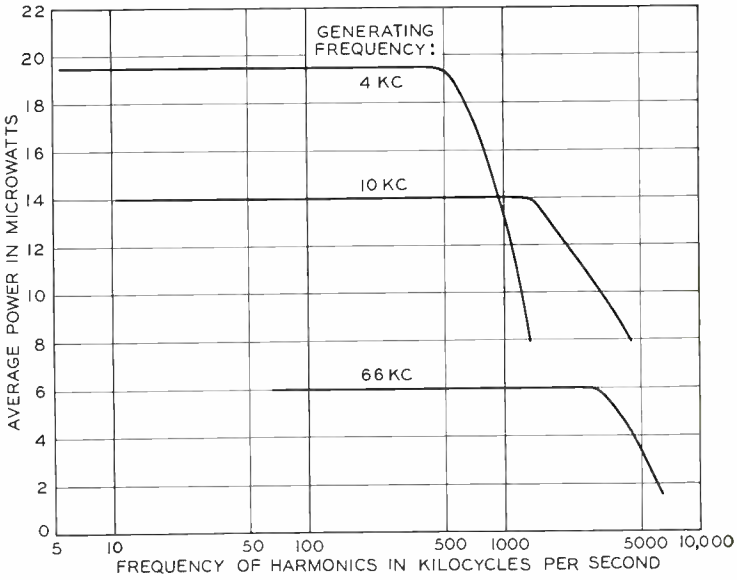

Fig. 3—An extremely sharp current rise, on firing the tube, generates a wide range of harmonic frequencies of equal amplitudes

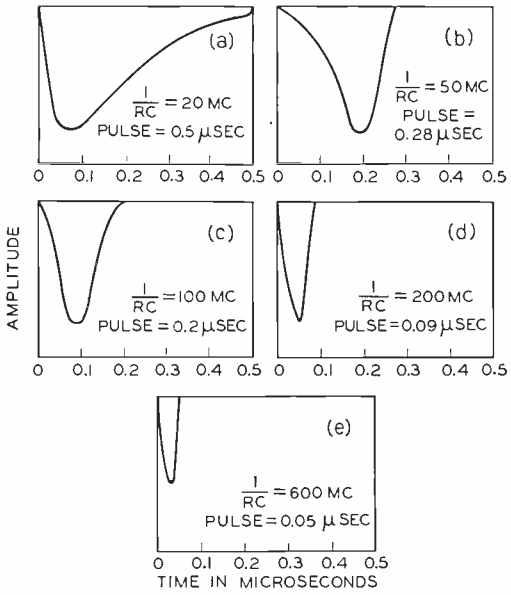

Fig. 4—Oscillograms show that the duration of the discharge pulse varies with the capacity C *of Figure* 1

plate goes positive and the grid exceeds the firing potential, condenser C discharges through the tube and the resistance R, producing a current pulse which increases very rapidly to its maximum value and then falls off exponentially at a rate determined by the product CR. This pulse generates the high-frequency harmonics.

Plate and grid potentials are shown in Figure 2 as a function of time. When their difference nears its maximum at ab the tube fires and discharges the condenser C of Figure 1. This reduces the plate potential to the much lower value c which is maintained during the interval cd, while the tube conducts. At d the tube goes out because the plate falls at this point below the potential required to maintain the discharge. The negative grid potential, acting during the succeeding part of the complete cycle, deionizes the tube.

When operating as a harmonic producer an extremely sharp current rise is advantageous because it generates a wide range of harmonic frequencies of equal amplitudes. With a generating frequency of 4 kc, for example, a flat distribution is obtained with the new circuit to 0.5 megacycle as illustrated in Figure 3, and a substantial amplitude to 1 megacycle. At 10 kc the characteristic is flat to 1.4 megacycles and at 66 kc to 3.5 megacycles. For operation at particular harmonics, or for small bands of harmonics, much greater average powers may be obtained.

The effect on the duration of the discharge pulse caused by varying the capacitance C of Figure 1 is illustrated by oscillogram data shown in Figure 4. For values of 1/RC from 20 to 600 megacycles, the pulses lasted from 0.5 to 0.05 microsecond. These measurements were made with a high-speed sweep circuit which employed a similar fast pulse source in conjunction with a crystal filter to segregate the sweep frequency.

When gas tubes are operated below a frequency which depends on the type of tube and the circuit constants, complete deionization occurs regardless of the negative grid and plate voltages.* Thermal drift of the ions to the elements and

*These and the succeeding studies on deionization phenomena described here were conducted by W. G. Shepherd of Electronics Research.

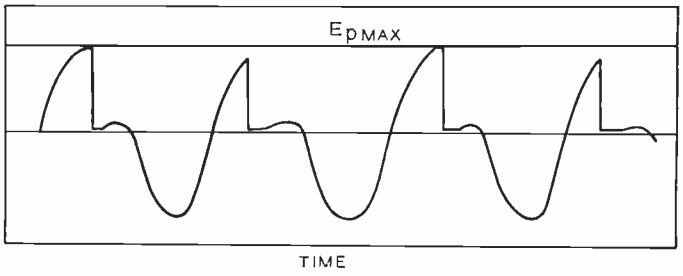

Fig. 5—At high frequencies a gas tube breaks down at different plate-cathode potentials on successive cycles if the ratio of the grid-cathode to the plate-cathode potentials is below a critical value

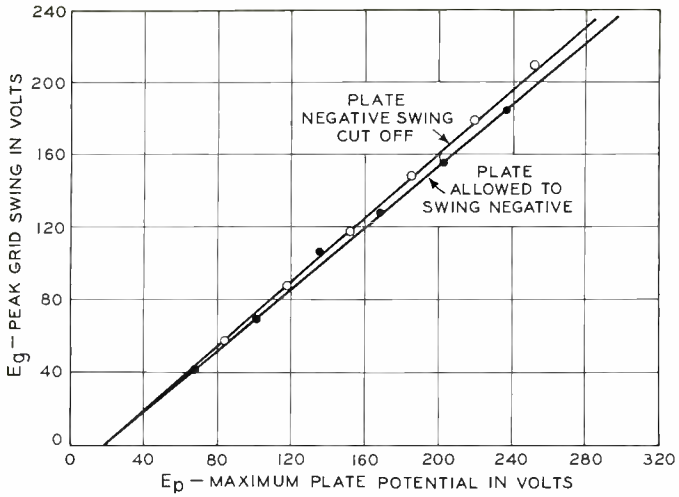

Fig. 6—The plate plays only a small part in deionizing the tube. This was established by determining the minimum swing of the grid required to maintain stable operation when the plate became negative

the walls of the tube completes the deionization without ions being drawn to the grid by the field. At higher frequencies a gas tube breaks down at different plate-cathode potentials on successive cycles as illustrated in Figure 5. The periods of the fundamental required for a complete cycle of the firing potential depend on the ratio of the grid-cathode to the plate-cathode potential. When this ratio is above a critical minimum, the firing potential remains the same from cycle to cycle. For slightly lower values, the tube fires at a lower voltage on the second cycle and returns to the original value on the third. For still lower ratios the change lasts over three or more cycles.

This process may be explained by assuming that the ionization in the tube, after the initial breakdown, is large enough to prevent the tube from deionizing to its initial state within one cycle, this makes the breakdown occur at a lower plate potential on the next cycle. Consequently a smaller production of positive ions results, since the charge passed through the tube by the condenser discharge is less. This may leave the tube sufficiently deionized to fire on the third cycle at the original value. If not, the tube breaks down at an intermediate potential on this cycle.

That the plate performs a minor function in deionizing the tube has been established by determining the minimum swing of the grid required to maintain stable operation under two conditions; first when the plate was allowed to swing negative and second when it was prevented from going appreciably negative by connecting a diode between the plate and cathode. The potentials between grid and cathode and those between plate and cathode were measured from oscillograms when grid voltages were

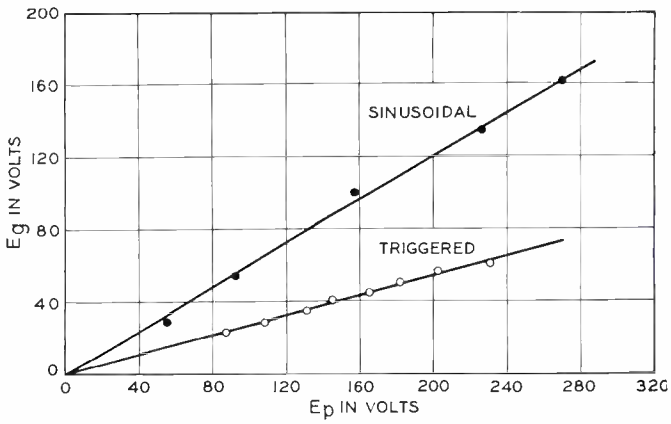

Fig. 7—That the grid does most of the deionizing in a gas tube was determined by changing the grid voltage. The plate grid-voltage ratio required for stable operation varied much more than when the plate voltage was allowed to become negative as indicated in Figure 6

phased to lag as nearly 90 degrees as possible behind the plate voltage. Results of these measurements on a 338-type Western Electric tube are shown in Figure 6 where Ep is the plate-to-cathode voltage when the tube fired. This voltage is practically the same as the condenser potential, which is the quantity wanted, since the condenser's impedance for the fundamental frequency is very much higher than that of the discharge resistance. The peak value of the grid swing relative to the cathode Eg was measured directly at the grid. The small effect of the plate in the deionizing action is shown by the slight changes caused by preventing the plate from going negative. The important region for deionization is that which is screened from the plate by the control grid.

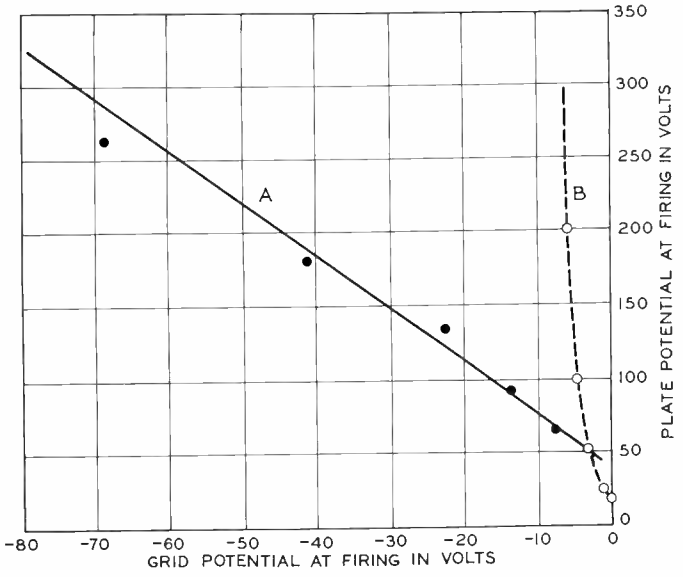

Fig. 8—The grid and plate voltages at which a gas tube fires when operated by high alternating frequencies depend on the state of ionization of the tube. The graph A *was made from oscillographic measurements on a 338A Western Electric tube. For comparison the characteristic for constant plate potentials is given by graph* B

In contrast, the grid performs a major function in deionizing the tube. A comparison was made of the minimum grid-swing necessary to maintain stable operation as a function of the plate-swing under two conditions. The first involved sinusoidal operation of the circuit of Figure 1 and the second that of a circuit in which the tube under test was triggered by a discharge whose phase could be adjusted relative to that of the plate voltage. The results are shown in Figure 7 where Ep has its previous significance and Eg is the bias voltage. The grid resistance was made small so that, except during the triggering operation, this voltage was practically the same at any instant as that at the grid. The change in the critical grid-plate potential ratio is much greater than that which is produced by allowing the plate voltage to become negative as indicated in Figure 6.

The grid and plate voltages at which gas tubes fire at high frequencies depend

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THE AUTHOR: L. G. KERSTA entered the Laboratories in the summer of 1925 as a Technical Assistant. After three years, during which he attended the Technical Assistant School, he left temporarily to continue his studies at Columbia University. Returning in 1930, Mr. Kersta worked in the Research Department on non-linear circuit problems including modulation studies on transatlantic radio circuits, coaxial terminal systems, multiplex and privacy systems and harmonic producers. Since 1941 he has been engaged in special radio projects at Whippany.

L. G. KERSTA

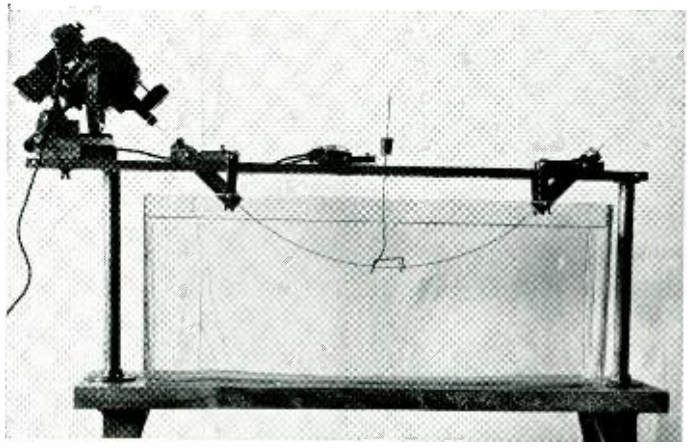
on the state of deionization of the tube. Figure 8 shows a characteristic obtained with the 338A Western Electric tube from oscillographic measurements at 60 kc when the ratio of the grid-plate swings was held at the critical value for the given circuit conditions. For comparison the static characteristic, curve B, is added. The larger negative values of the grid potential when firing occurs under dynamic operation indicate that the tube is incompletely deionized. These results show that the deionization time for a gas tube is not a definite quantity and that the firing characteristics are significant only under specific conditions and for operation at low frequencies. At higher frequencies the firing characteristic depends on the wave form of the grid voltage and on the discharge constants of the circuit.

In one practical application the gas-tube harmonic generator is used to test the fidelity of television receiving equipment. Because it generates sharp wave fronts of controllable duration, black-to-white signal changes of great rapidity can be obtained.

For determining the phase shift of signals in coaxial cables, two gas-tube circuits operate synchronously. Signals from one are used locally and those from the other are transmitted over a looped line. The phase shift is determined by observing the difference between the wave fronts of the two pulses.

The Kenyon Wire Fatigue Machine

The rotary wire-testing machine, shown on page 16 of the September issue, was an invention of Dr. John N. Kenyon of the Engineering School at Columbia University. The machine actually pictured is one of a number constructed in the Laboratories, with his permission, for use in its Materials Engineering and Outside Plant Departments. It follows Dr. Kenyon's original machine, but differs from it in some minor design features introduced by I. V. Williams for greater ease of operation.



The fatigue-testing machine as built by Dr. Kenyon in 1937

Historic Firsts: Thermal Noise

THE task of science is the discovery of the laws of nature; that of engineering, their economical application to man's convenience. The more fully natural phenomena are known, the farther may the engineer progress. What he can accomplish, however, has its natural limits: he must keep within the law. Any attempts to exceed it are doomed to the futility of those who tried for perpetual motion.

J. B. JOHNSON

What the scientist discovers, on the other hand, is really old stuff. Cosmic rays flew for ages before they were recognized. Electronic streams have piloted lightning discharges ever since our earth first got a cloud above its surface. And in the inter-atomic spaces of conductors there have always been electrons moving hither and thither in thermal agitation.

Haphazard motions of electrons mean random shifts of charged particles and hence, between the terminals of a conductor, a small fluctuating difference in potential. Other things being equal, this potential difference should depend upon temperature—the mean square potential being proportional to the absolute temperature of the conductor.

This phenomenon was discovered and measured for the first time about 1926 by J. B. Johnson of Bell Telephone Laboratories. His measurements, generally covering temperatures from liquid air to boiling water, consistently indicated a virtual power in any conductor proportionate to its absolute temperature. The conductors he used were of many different materials, conducting either by virtue of electrons as in metals or of ions as in electrolytes. They included India ink lines on paper, carbon filaments, commercial resistance wires and thin metal films on glass. For measurement the voltage fluctuations were supplied through a multi-stage vacuum-tube amplifier to a thermocouple. When this was replaced by a telephone receiver "noise" was heard—noise, with components of all possible frequencies.

This resistance noise or the "Johnson effect," as it has been called, sets definite limits beyond which the engineer cannot go in the meaningful amplification of signal currents. When a signal is too feeble to stand out against this noise background then amplification is of no avail for the noise is also amplified.

By directing attention to this basic limitation Johnson cleared the way for a more intelligent approach to the problems of amplifier design.

Mica for War Purposes

By F. J. GIVEN
Transmission Apparatus Development

OF ALL the materials essential for military uses, mica has probably received the least attention in the press and in public discussions. Rubber, tin, aluminum, copper and steel have received prominent attention ever since the production program of guns, planes, tanks and ships required the drastic curtailment of ordinary peacetime uses and the greatly augmented production for military applications. Similar rationing action by government agencies has taken place with mica, though little has been said about it, possibly because its uses are rather obscure to the layman. None the less, mica plays an essential rôle in the successful functioning of many articles which permit those same engines of war to function and surpass those that are being employed by the enemy.

Mica is unique in many respects as an insulator. It is high in dielectric strength and dielectric constant, and its losses are low. It can be split into sheets about a thousandth of an inch thick, which can be rolled into quite small tubes without cracking. It withstands temperatures of several hundred degrees. These qualities, together with its stability as time passes, make it far and away the best material for the insulation of radio and telephone capacitors, vacuum tubes and ignition apparatus, all of them required by the war in great quantities.

It also is used in spark plugs and magnetos for aircraft engines. Other uses include marker dials for ships' compasses and linings for gauges on ships' boilers. Smaller sheets of inferior quality are split into thin "splittings" and bonded together to form built-up mica products used for insulation of electrical motors,

generators and high-tension electrical apparatus. Waste or scrap mica unusable as sheet or for built-up mica products is ground into powder and is used for molding compounds, lubricants, and other purposes.

With the all-out production program which must be continuously accelerated until the war has been won, the type of mica suitable for fabrication into useful sheets and films must always be considered as in short supply. In fact, the remoteness of the major sources of supply coupled with a variability in the yield of mining operations (approaching that of gold or diamond mining) make the precise calculation of the supply for any given period almost impossible. Consequently, no accurate balancing of supply with demand is possible. Even after government and industry have done the utmost in stimulating production and assuring efficient transportation, it is vital that engineers concerned with mica products exert every possible effort to make available supplies go as far as possible. Their efforts have to include avoidance of excessive wastage, resort to qualities as low as the individual application will permit, and where possible the resort to other materials.

The mineral from which these valuable films are obtained is called "muscovite." This is a hydrous potassium aluminum silicate which in pure form is clear and white and has a reasonably definite formula. Those from areas free from geological disturbances yield films that are planar and homogeneous and hence the more desirable because of their flatness and uniformity of thickness. The principal deposits are found in India, Brazil, and the United States. Lesser deposits are found in Argentina, Rhodesia, Canada and elsewhere. Even in such areas the quality and size of crystals vary greatly; the quality varies because of impurities of a mineral or vegetable character which affect its color, clearness, strength, density and electrical properties. In many instances the impurities are only physical inclusions between the plane cleavage boundaries; these affect only the adjacent films which can be discarded in processing. In the headpiece of this article, the clear film at the left was split from the stained block at the right. In most instances the impurities are manifested by a distinctive color such as ruby or green—which may or may not be accompanied by significant differences in mechanical, chemical or electrical properties.

In normal times the ruby-colored variety was preferred for its combination of excellent mechanical, thermal and electrical properties. Even from deposits of this variety, the yield of block mica (sheets of 0.007 in. and thicker) is not uniform but consists of several gradations in quality and appearance. The trade has adopted various arbitrary classes for "blocks," the best known being that used for India ruby mica and involving the terms of clear, slightly stained, fair stained, good stained, stained, heavy stained and spotted. Although these terms imply gradation merely on basis of translucence, such is not the case as the successive classes also provide for increasing degrees of undesirable physical defects — wrinkles, ridges, air inclusions, spots, pittings and weakness. Mica processors have tried to obtain the maximum yield of usable films (normally from about 0.001" to 0.003") from the first five of these classes of block. This system has functioned remarkably well for the electrical trade, as importers and mica processors have built up a background of experience by trial and error which permits them to associate the physical appearance with the requirements of each application.

The varieties heretofore considered suitable for splitting into films for capacitors, which is probably the most critical of all applications, are the clear,

slightly stained, fair stained and good stained. The yield of block of these varieties is only a few per cent of the total of general mine run of all types. The losses in splitting, blanking and fabrication into product are so large that over the average only about one-fourth of the usable yield of block appears in the finished articles. Unfortunately, nature has arranged the quality distribution so that we can realize only ten per cent of this in the clear and slightly stained varieties and twenty-five per cent in the fair stained. The most plentiful variety in this group is the good stained. One of the primary problems, therefore, in stretching the supply to meet large demands is to fit the pattern of usage to that of the supply.

Since the total supply of these critical types available to the United Nations is less than the indicated demands, another major problem is to endeavor to use films from the stained variety for capacitors. Such film has been available in the trade—known as "wrapper" film—but its use has been confined to less critical applications such as coil interleaving and spark plug insulation.

Recent work by Bell Telephone Laboratories for the War Production Board under the direction of J. R. Townsend, in the development of electrical test methods proposed by K. G. Coutlee for classifying block mica quality for use in capacitors, has opened an entirely new approach of quality control of mica based on functional requirements. A prime requisite of capacitor mica is that it must have no veins or spots that are electrically conducting. That property is easily established by laying a specimen of block mica on a metal plate of a testing instrument and running an electrically charged test point over the surface. A spark coil supplies the high voltage and if there is electrical conduction a visible glow or sparkle takes place and the piece is discarded as unsuitable for capacitor use.

After the spark test has been passed the next question is, "How much energy is lost in the material at the high frequencies now used in radio?" A specimen of block mica is placed between two metal plates of an electronic testing instrument and a high-frequency voltage applied. A direct measurement of the electrical loss is then read on a meter. The amount of loss indicates the grade of capacitor for which the material will qualify.

Samples of relatively poor quality (as judged by visual standards) from several domestic mines have been made up into condensers. Subsequent measurements in the Laboratories showed that the correlation between the electrical tests on raw material and finished capacitors were satisfactory and that the films from the poorer quality block appear suitable for many capacitor applications.

THE AUTHOR: F. J. GIVEN joined the Laboratories in 1919 after service as a lieutenant in the Signal Corps and graduation from Harvard and M.I.T. with degree of B.S. in 1918. Since that time he has been in the Apparatus Development Department engaged in design and development of loading coils and cases, filter coils, retardation coils, resistors and capacitors. For the past two years he has been actively engaged in application of these devices to the equipment for the armed services being developed by the Laboratories. In addition, he has served on several industry committees for the American Standards Association, National Research Council and War Production Board in connection with specifications and testing problems on mica and paper capacitors for war usage. Recently he served as chairman of the U. S. Mica Mission to England.

F. J. GIVEN

These preliminary tests on block mica samples appear to indicate fairly reliably the electrical quality of film that can be split from it. This means that it should then be possible to use the two testing instruments which are battery operated and portable, at the mine and in the processing plant, to sort out material for various end uses with the expectation of good results. The greatest immediate promise of this proposed system is the release of stocks of mica for capacitor use which are now standing idle due to uncertainty as to exact quality by visual classification. At the request of the War Production Board, an extensive commercial manufacturing trial of capacitors made with such mica classified for electrical quality by the proposed system is now in progress under the direction of the Bell Telephone Laboratories.

There are some who may doubt the wisdom and propriety of extensive moves in this direction. In answer to such doubts, the most effective argument is that the supply situation compels it, or else the adoption of some one of several alternate dielectric materials. While the latter course is in order and must be followed as far as practicable, present data indicate that all of the alternative materials now available are deficient in one or more important respects as compared even to films from the stained quality block. Mica still needed after we have done the utmost in switching to alternatives will undoubtedly exceed the supply of film that is available from good stained and better block.

The writer has just finished a temporary assignment with the War Production Board during which he went to England as Chairman of a Mission to secure agreement with the British Ministry of Supply on engineering aspects of the war mica problem. The most important of these was the establishment of workable visual quality standards for block and film, based on Indian mica. The next was agreement on the qualities tolerable and allowable for various end uses. Another matter involved exchange of information on ways of processing to assure a minimum of wastage in splitting and punching. The subject of development and use of alternative dielectrics was thoroughly discussed and information exchanged on the extent to which they can be employed. The previous lack of agreement on terminology, standards, specifications, etc., had greatly handicapped the work of the Combined Raw Materials Board (two members from each country) in allocating supplies between U. S. and England. As a result of the agreements reached by the Mica Mission, the allocation decisions in the future can be related more directly to production programs.

The problems of the manufacturing engineer will be simplified if the standards of Indian mica are maintained in keeping with observational samples now preserved in New York, London and Calcutta. Further simplification will come if these same standards are adapted to the product from other countries and from our domestic mines. It is to be hoped that quality classification may eventually include electrical tests of the general character outlined.

Unifying Step-by-Step Equipment Arrangements

By W. H. LICHTENBERGER
Switching Equipment Development

A STEP-BY-STEP switch unit is more than a switch since it includes relays and other apparatus not only for operating the switch but for controlling signaling, talking, and supervisory features required for one stage of a connection. In general appearance all such units are similar, but differences in the auxiliary apparatus and in the wiring arrangements enable them to function as line finders, selectors, or connectors, and to provide for a wide variety of types of services. The switch units with their bank multiples are mounted in horizontal rows on steel structures called shelves, and these shelves, in turn, are mounted one above another on steel uprights to form frames. Each shelf includes certain miscellaneous equipment associated with alarms, battery supplies, and other incidental services, and terminal strips as required to serve as connecting points between the shelf cable and the external cables which are used to associate a shelf with other equipment in the office.

When the Western Electric Company began manufacturing step-by-step apparatus some fifteen odd years ago, they produced only ten or a dozen different

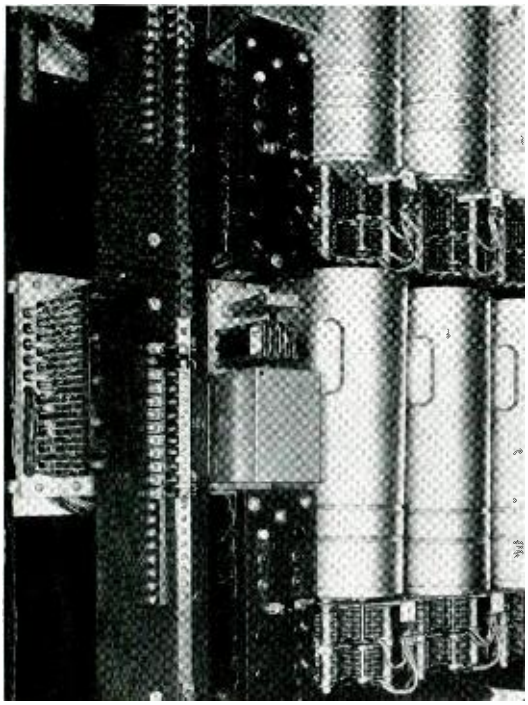


Fig. 1—A connector shelf of the former design showing one arrangement of miscellaneous equipment at the left

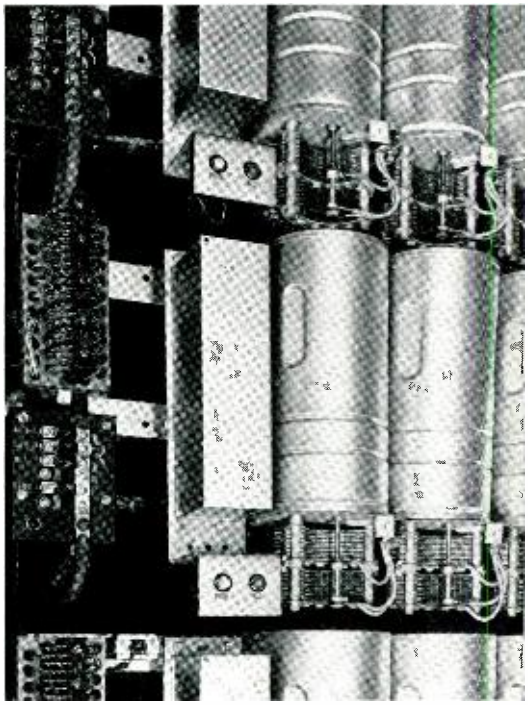


Fig. 2—A selector shelf of former design showing another possible arrangement of miscellaneous equipment

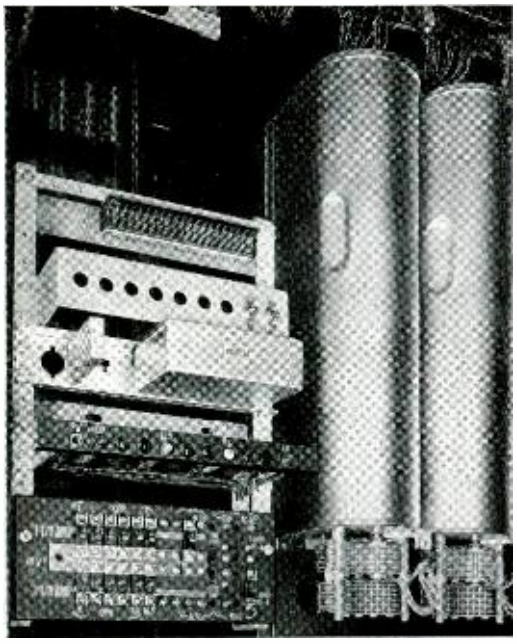


Fig. 3—Front view of one of the new type connector frames showing miniature relay rack that has been designed for this use

types of switch units. Suitably assembled on shelves and frames, these filled all requirements at the time for step-by-step apparatus in central offices, and the classes of service were limited. During the past fifteen years, however, this situation has changed radically. Step-by-step switching has been applied to additional types of offices, ranging down to the small unattended community offices, and to a number of sizes of private branch exchanges as well. In addition, the types of service have been greatly expanded. As a result of this extended application of the step-by-step system, there were 150 basic switch units in 1941 instead of the ten or twelve of fifteen years ago. For each basic unit, moreover, there were a number of wiring options, with the result that more than 1,000 kinds of switches were being manufactured. As the various new services or types of offices were added to the existing ones, specifications were prepared covering the new arrangements of the switches and miscellaneous equipment on the shelves and of the various cables to interconnect the apparatus on one shelf, the shelves on one frame, and the frames in one office. The variety had become so great that even with the record production of 400,000 switches and 40,000 shelves, attained in 1941, maximum economy in manufacture had not been reached.

By this time the possible field of use of step-by-step equipment had been pretty well explored, and it was felt the time had come to make a thorough survey of the situation with the object of establishing certain basic arrangements that could be used for a wide variety of offices, and to establish these fundamental designs in such a way that other types of services could be provided by simple additions to these basic units. In this way the number of manufacturing specifications could be greatly reduced, ordering and installation greatly simplified, and other economies obtained. Dur-

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THE AUTHOR: W. H. LICHTENBERGER started work with the Laboratories in 1923 in the Systems Development Drafting Department. After completing the Technical Assistant Course, he registered at the Polytechnic Institute of Brooklyn, and graduated from there in Electrical Engineering in 1936. In Equipment Development he first spent some time on trial installations and current development problems, but from 1938 until Pearl Harbor he designed step-by-step equipment for central offices, community dial offices and PBX's. With our entrance into the war, he switched to the design of Air Warning Services for the Army, and contributed to that field until he was called from the Cavalry Reserve to the Signal Corps early in 1942.

W. H. LICHTENBERGER

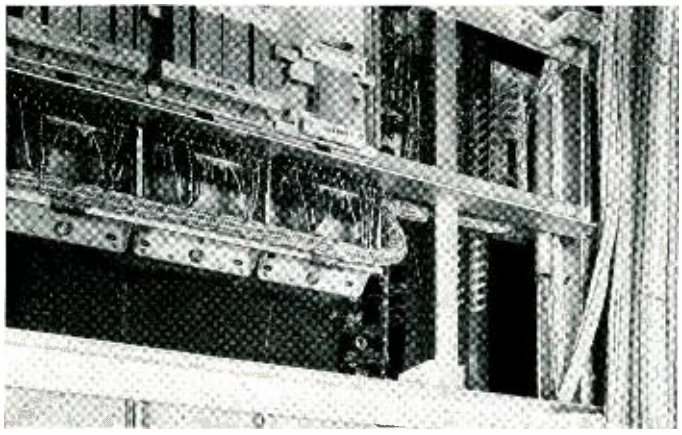


Fig. 4—Rear view of former type shelf showing shelf cable running to incoming terminal strip

ing the period of rapid expansion of step-by-step service, a number of improvements had been developed, and these had been incorporated in the various types of offices under development at the time. It was planned to work all such improvements into the new overall design, which was also to be made adaptable to the new assembly lines and shop procedures being planned by the Western Electric Company. As an example of the unification that has been accomplished, fifteen fundamental shelf equipments now take the place of sixty-one required formerly, and identical shelves proceeding down the factory line may be diverted to widely different uses by deviations in the end processes, much as color and accessory options are added to a car.

The large gains that spring from this development do not result from a few major changes but rather from a large number of comparatively small changes. Every combination of switches, shelves, and frames had to be considered in relation to all possible types of service; the construction of the shelf itself and its method of mounting on the frame was studied and modified to secure as nearly complete uniformity as possible; the wide variety of alarms and power equipments had to be analyzed to permit a shelf arrangement to be designed that would work with any of them; and the cabling had to be studied both in detail and overall plan, since the shelf cables used with former practice played no small part in producing the large number of different types of shelves in use throughout the System.

Some idea of the type of change that has been made may be obtained by considering a few of those most obvious to a cursory glance. At one end of all switch shelves is a certain amount of miscellaneous equipment as already noted. The arrangement for one type of connector shelf is shown in Figure 1 and for one type of selector shelf in Figure 2. For each type of shelf, both the equipment and its arrangement have varied since each arrangement was designed separately for a particular class of service and for the particular type of office with which it was to be used. The fusing, for example, varies for the two

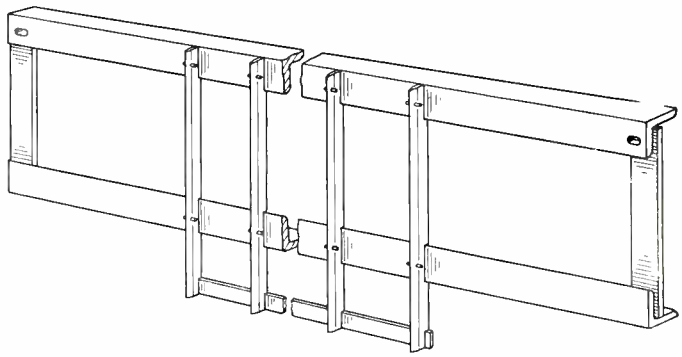


Fig. 5—Basic steel work of former type shelf showing guide bars and horizontal cable support

shelves shown; in Figure 1, the battery lead is a series of vertical bus bars running the full height of the frame, while in Figure 2, separate battery leads are brought to each shelf. On other shelves, other types of fusing are employed and sometimes there is only one fuse panel per frame.

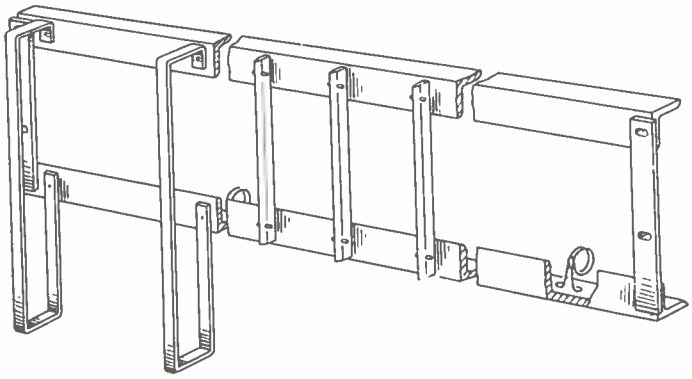


Fig. 6—Basic steel work for the new shelf showing miniature relay rack at the left, the rings for the shelf cable, and the shorter guide bars

With the new design, all miscellaneous equipment mounts horizontally on a miniature relay rack as shown in Figure 3. There is always a fuse panel at the bottom and a small terminal strip at the top. Other equipment will vary with the type of shelf, but a series of mounting plates have been standardized, each taking one class of equipment, and corresponding apparatus is always mounted in the corresponding place.

Another obvious change, made originally in connection with the 355A community office,* is in the local cable used to connect the switch jacks to the terminal strip at the end of the shelf. These jacks are fastened just beneath the lower horizontal supporting member of the shelf, and the switch units have a plug that connects to them when the switch is hung on the shelf. The position of the switch, and thus of the jacks, is fixed by vertical "guide" bars, and the switch is hung on these guide bars by slots in the sides of the switch mounting plate that slip over small pins projecting through the guide bars. This arrangement is indicated in Figure 5, which shows the arrangement of a typical shelf of the former type. The wires from all the switch jacks would be formed into a cable that terminated at a terminal strip at one end of the shelf. This cable was tied to a horizontal steel bar fastened to the lower ends of the guide bars. This arrangement is evident in Figure 4. Beneath this cable is another one made up of the leads from the multiple banks. This cable terminates on a terminal strip that

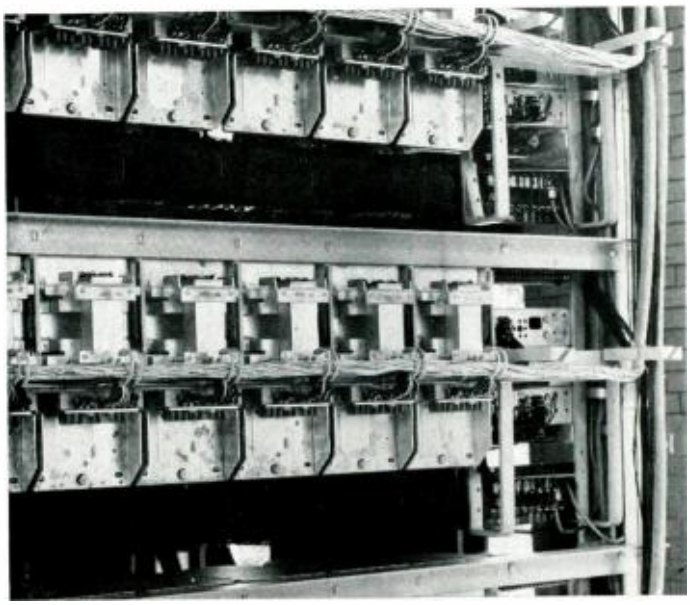


Fig. 7—Rear view of new type shelf showing rings for shelf cable mounted on the upper surface of the lower angle

*RECORD, June, 1941, p. 316.

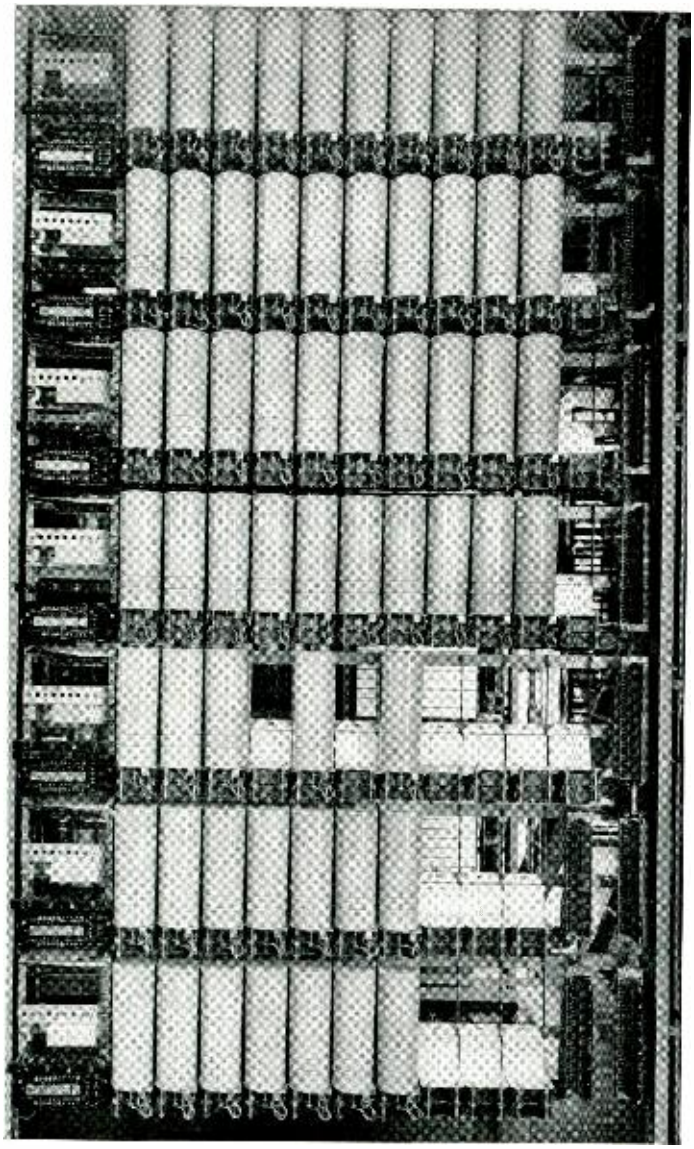


Fig. 8—Complete frame with universal connector shelves in the Westville Central Office in New Haven

is provided at the other end of the shelf.

This shelf local cable has now been largely done away with; instead of a preformed cable, wiring to the jacks is laid in rings mounted on the upper surface of the lower horizontal angle. This change permits a number of economies. In the first place only the wiring that multiples the switches to the alarm and miscellaneous equipment is run in the shop and terminated on the terminal strip. All the wiring individual to the various switches is run in directly by the installer. This permits a smaller terminal block to be used as may be seen by comparing Figure 3 with Figure 2, and the number of wires that must be soldered at terminals is greatly reduced since most of the wires are not now brought to the shelf terminal strip. There is also a substantial saving in copper, partly because of the shorter wiring runs with the new construction, shown in Figure 7, and partly because with the preformed cable of the former practice, a number of extra wires were often run in to make one shelf serve for two or more uses.

Another economy is a reduction made possible by eliminating the strip that formerly supported the shelf cable and in using shorter and narrower guide bars. This will be evident by comparing Figure 6, which shows the construction of the new shelf, with Figure 4. On the new shelf the guide bars are just long enough to carry the two pins on which the switch is hung; the extension below the lower angle is omitted.

Another improvement is in the method of fastening the shelves to the uprights that form a frame. Formerly pieces of angle iron were fastened to the uprights at the proper locations to take a particular type of shelf. A number of different types of uprights were thus required, and uprights for one type of shelf would not in general accommodate another. Now the verticals are drilled

and tapped like relay racks, and the shelves are bolted to them. Only one type of frame support is needed for all types of shelves. This not only reduces the number of different parts but permits different types of shelves to be mounted on the same frame in whatever arrangement is desirable for maintenance requirements or for frame and floor space economy.

The change in the shelf cabling has already been described, but changes have been made in the cabling to and between shelves and frames that have resulted in considerable economies. Where in the past one or two small cables were run to each shelf to carry the wiring to the individual switch jacks, a single large cable may now be run to serve all switches on a number of shelves. Heretofore a shop formed cable carried all the alarm and miscellaneous signal and power leads from all shelves in a line-up of frames to a terminal strip at the end of the first frame in the line. This cable form, approximately thirty feet long and eleven feet six inches high, varied for different types of frames, and was awkward to make and install. This form is not used with the new arrangement. In its place, one standard switchboard cable is run from the terminal strip at the top of the first frame to each frame in the line. The covering of the switchboard cable is cut off at the top of the frame, and the wires are run down through rings and dropped off at the various shelves as required.

Battery and ground leads are also simplified in their arrangement and all shelves are now supplied in the same manner. As already noted, each shelf has its own fuse panel, and short leads fastened to it in the shop are readily clamped to battery and ground leads which are dropped down the left side of each frame.

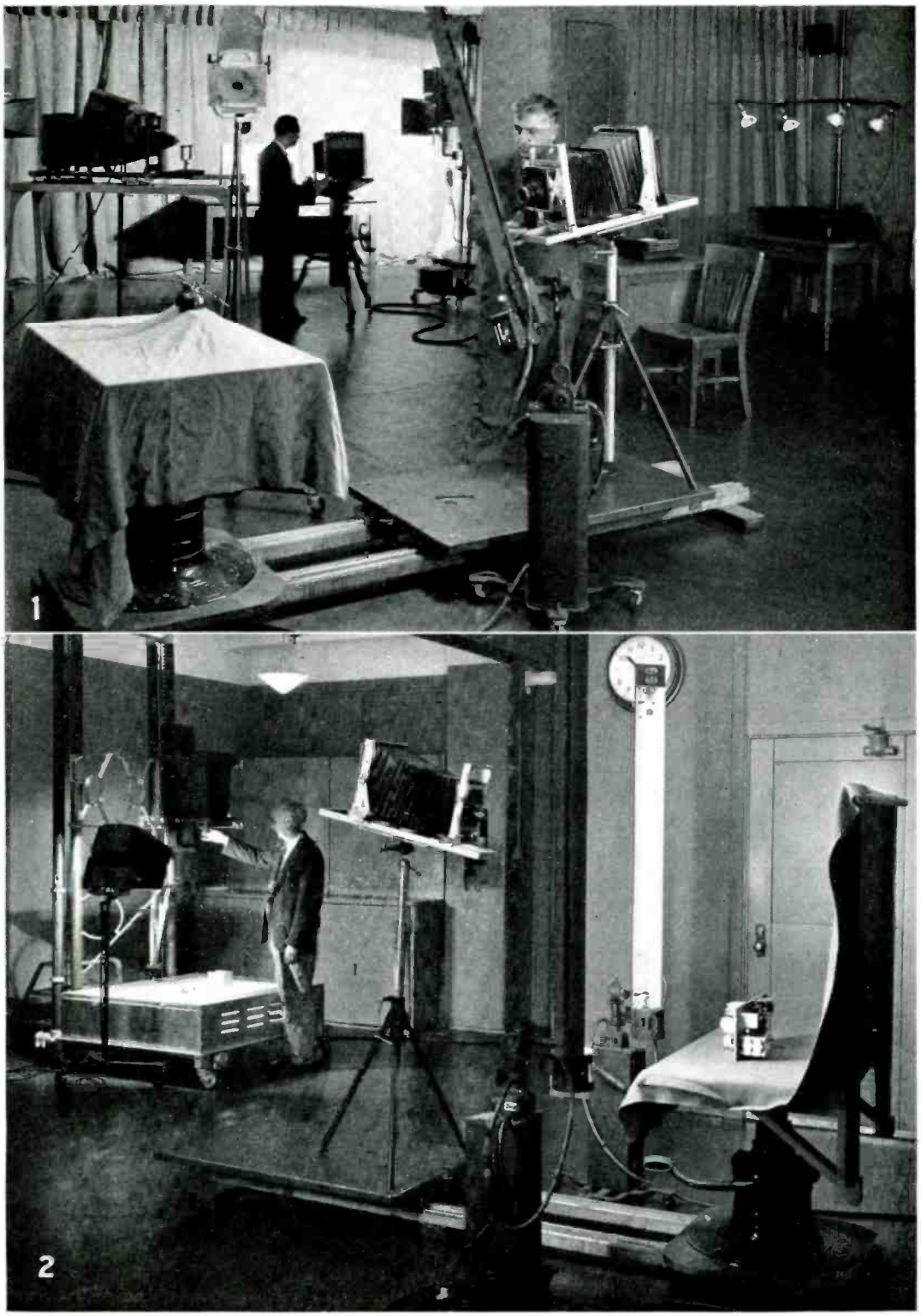
Too many changes have been made for all to receive mention in a short discussion. Indicative of their extent, however, is the fact that thirty laboratory drawings now cover the equipment and cabling of shelves where seventy were needed before. In addition, this development has paved the way for reducing the 150 switches by as much as 25 per cent. Also, when conditions favor it, the unification may be extended to certain dial PBX's and line finder frames, work on which has been postponed.

Photographic Department

By F. VAN HORN
General Service

PHOTOGRAPHY is a necessary part of research and development work, and there has been a Photographic Department at 463 West Street ever since the building was erected for the Western Electric Company at the close of the last century. Beginning with a single photographer and camera, it grew with the organization it served until in 1941 it required the full time of nine men, and included developing and printing quarters and a studio with cameras and other facilities that permitted it to turn out some 4,500 negatives and 63,000 prints each year. By this time, however, the facilities were old and needed replacement, and the quarters were overcrowded. A careful study was therefore made of all needs and the most efficient production methods, and an entirely new layout was made, new equipment acquired, and all needed facilities provided to do the work most efficiently. This new layout was just about completed when war came, bringing with it intensified work, longer hours and increased personnel, and there is no doubt but that the greatly augmented demands for photographic services of various types would have greatly exceeded the capacities of the old facilities. With the new quarters and equipment, a staff of 15 is now producing at the rate of 14,000 negatives and nearly 200,000 prints a year.

The new quarters, on the second floor of Section B, consists of two parts separated by



Figs. 1 and 2—In Figure 1, J. Stark is operating the camera in the background and J. Popino the one in the foreground. In Figure 2, H. Maude adjusts the stop of the vertical camera

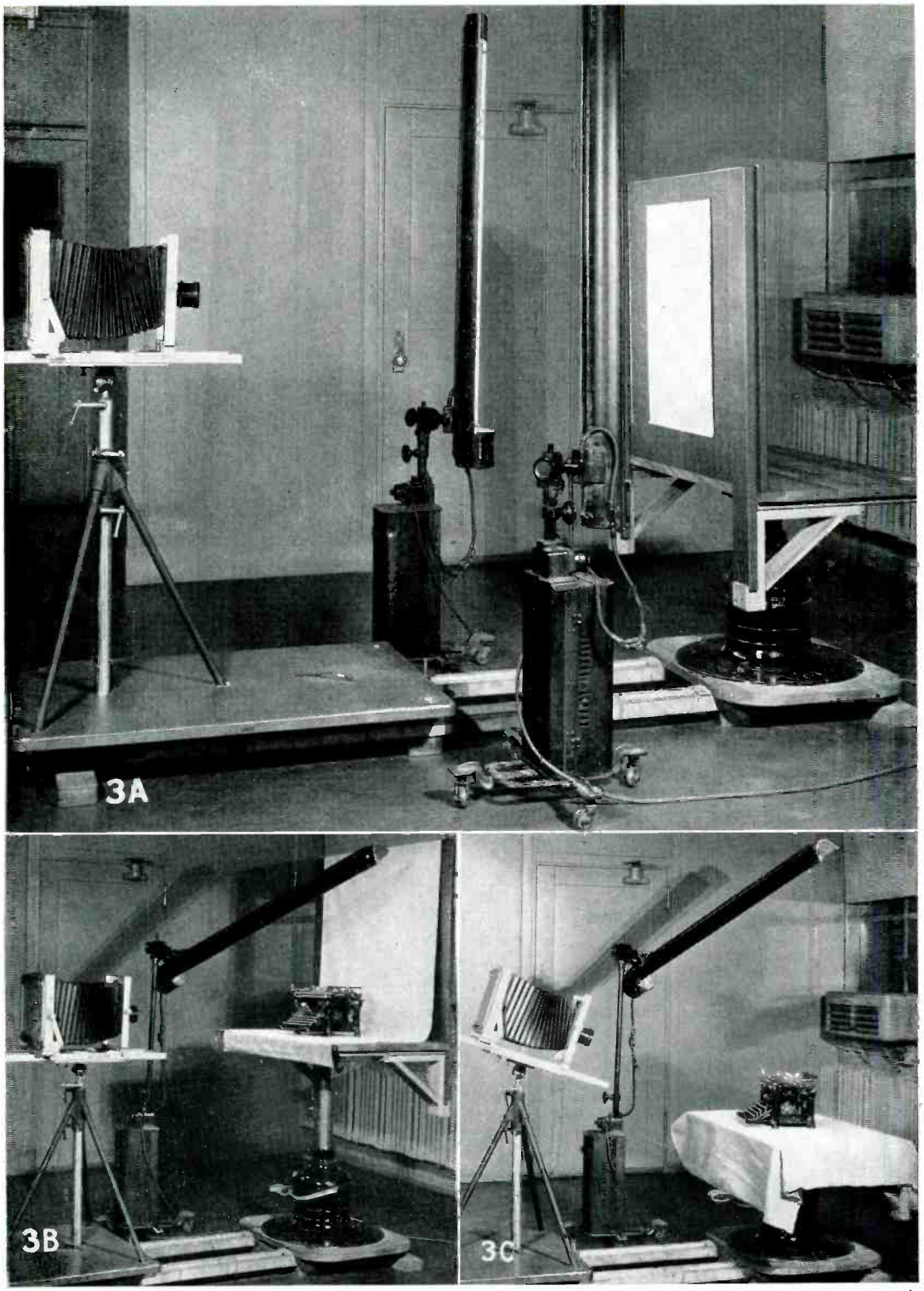


Fig. 3—The photographing unit designed in the department greatly expedites the more usual types of jobs. At A *the back of the stand is turned to the camera while at* C *the back is entirely removed.* B *shows the more usual arrangement*

the building corridor. On one side are the photographic studios and the office, and on the other are the various developing, printing, and finishing rooms. The general arrangement is shown below. An intercommunicating telephone system between the office and the various workrooms facilitates supervision and saves valuable time.

In the main operating studio, Figures 1 and 2, one wall is left white and the others are painted a flat beige tone. With this combination it is possible to get background tones ranging from white to nearly black, depending on how strongly the wall is illuminated. Over two wall surfaces monk's cloth drapes (one dark gray and one light tan) are hung on slides so that they may be made to cover the whole or any part of the wall. Daylight is controlled with beige-colored opaque shades over each window. On the walls near the floor are power outlets of 50-ampere capacity for the larger lighting units and others of smaller capacity for incidental lighting. This allows the operator to light his subject properly while keeping to a minimum the number of wires stretching across the floor. The lighting equipment includes arc lamps, spots, flood lamps, mercury lamps, and incandescent spots. In this main studio are a 35-mm microfilming camera, a vertical 8 x 10 camera with an opal glass-covered light box underneath, three horizontal 8 x 10 cameras, and one macrograph camera, which is capable of making photographs of low magnification.

Among the unusual features of this studio are the two photographing units designed especially to meet the particular needs of our work. As shown in Figure 3, each consists of a track with an adjustable stand at one end for the object to be photographed, and with a camera platform that may be slid along the track and locked in position at the desired distance from the stand. The stand consists of the base of a dentist's chair, which permits the table it carries to be turned, raised, or lowered as desired. The upright back of the table may be used for mounting material to be copied as shown at A, or it may be removed completely as at C. The camera may be placed at either end of the sliding platform. When placed at the end nearest the stand, there is room for the operator to stand while making the picture. When maximum distance from the stand is desired, the camera may be placed at the

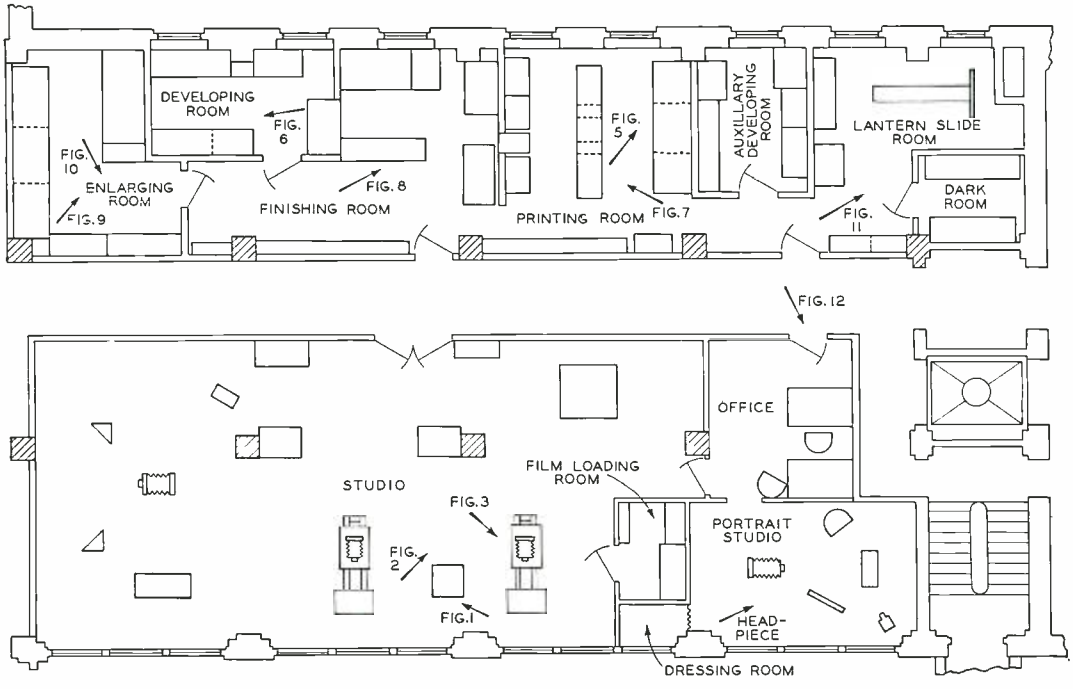
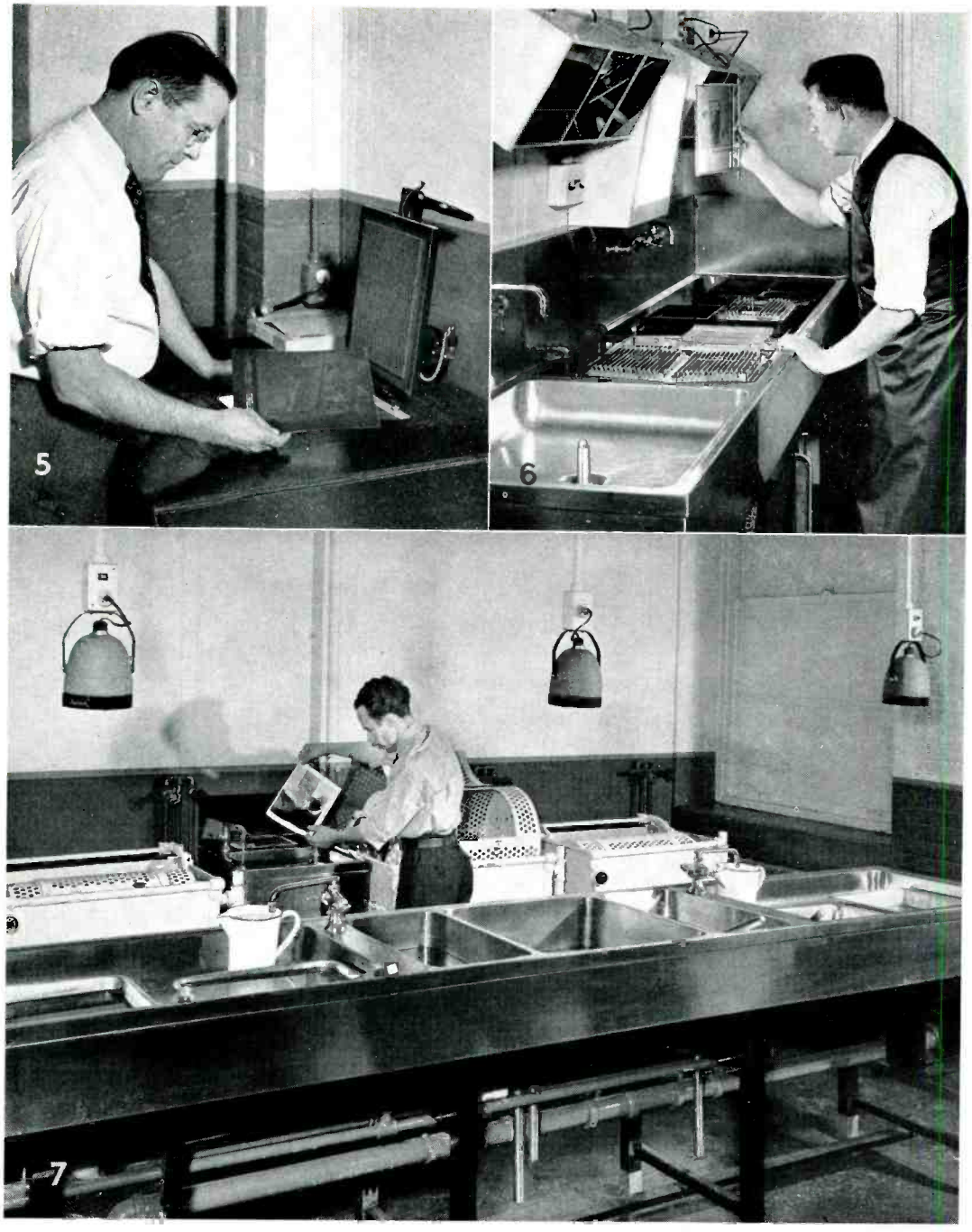


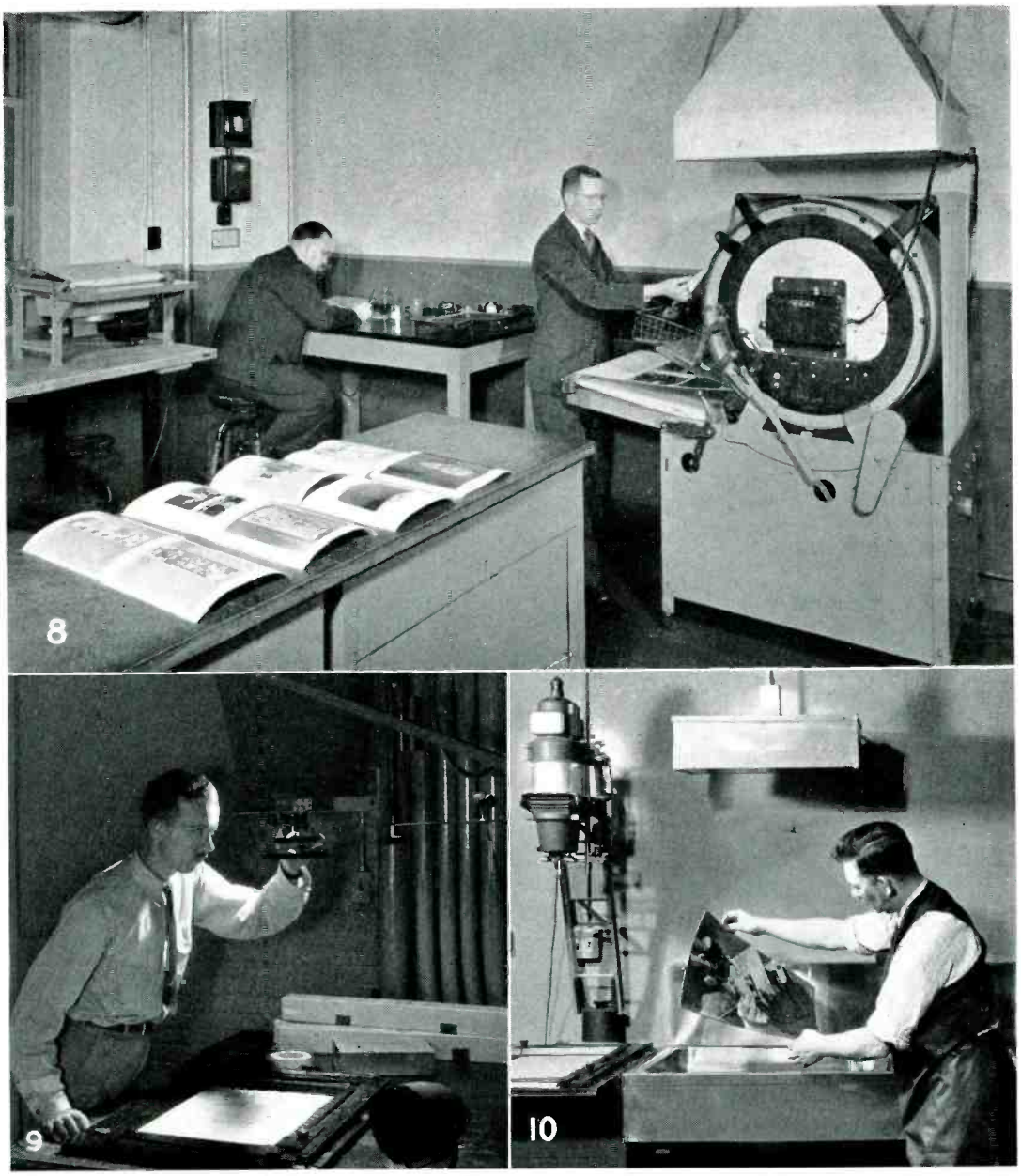
Fig. 4—Arrows with figure numbers show the positions of the camera for the various photographs



Figs. 5, 6 and 7—One of the two printing machines, operated by G. T. Scheeler, is shown in Figure 5. A similar machine is to the right of it, separated by a table. On the opposite or east wall, and separated from the printers by the long developing tanks, are the rotary washers, shown in Figure 7 with F. Fossetta. The developing room includes along the north wall a two-compartment developing tank, shown with S. O. Jorgensen in Figure 6. On the south wall are work benches and on the west wall is the film drier which may also be reached from the finishing room

far end of the platform as shown at A.

Adjacent to the main studio—reached by the door at the right of Figure 2—is a film-loading room, and behind this—reached from the office—is the portrait studio shown in the photograph at the head of this article. An 8 x 10 portrait camera with a Cook 15 in. F4:5 portrait lens together with various lighting units and screens comprise the major items of equipment. Entered from



Figs. 8, 9 and 10—The finishing room, Figure 8, includes a rotary drier, operated by F. M. Tylee, a print straightener at the left rear, together with work benches and a retouching table, where R. Q. Stone is retouching a film. In the enlarging room the 4 x 5 enlarger is shown in Figure 10 with S. O. Jorgensen and the 8 x 10 enlarger in Figure 9 with A. Edwards. This room also includes developing and washing tanks, shown in Figure 10, for processing the enlarged prints

this portrait studio is a small dressing room.

Across the hall from the studios are seven rooms where all developing and printing is done, and also where enlargements and lantern slides are made. Necessary retouching and finishing work is also carried out in these rooms. In the film developing room, Figure 6, are developed all the films made in the studios across the hall or in other parts of the Laboratories. There is a film-drying cabinet on the west wall that has doors on both sides, thus permitting films to be placed in it from the developing room and taken out in the finishing room.

In the printing room are two printing machines located along one side, one of which is shown in Figure 5. Automatic electric timers insure constant printing time on all multiple printing jobs. Down the center of the room are the developing sinks, and along the opposite wall, Figure 7, are three rotary washing machines. After the prints are washed they are placed on the drainboard of a small sink that projects through the wall into the finishing room adjacent to an electrically heated rotary drying machine that dries and ferrotypes the prints in one revolution. The prints are fed into the machine on a cloth conveyor belt, and are squeegeed to a chromium-plated revolving drum which takes six minutes to make one revolution. Since the drier is cylindrical, there is a tendency for the prints to curl with the emulsion side inward. To counteract this they are passed through a print straightener and are then sorted and made ready for delivery. The drier, straightener, and other facilities in the finishing room are shown in Figure 8.

Across the east end of this area, at the left in Figure 4, is the enlarging room. Here are two enlarging cameras—a 4 x 5 and an 8 x 10.

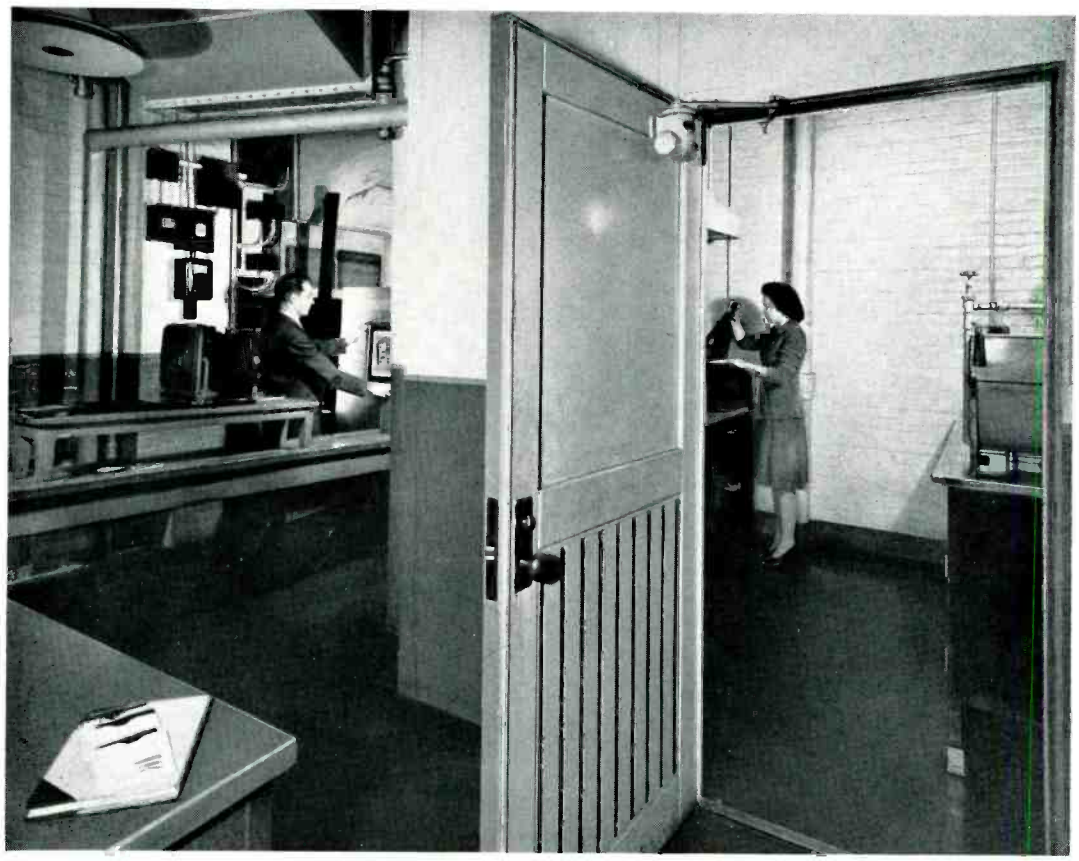
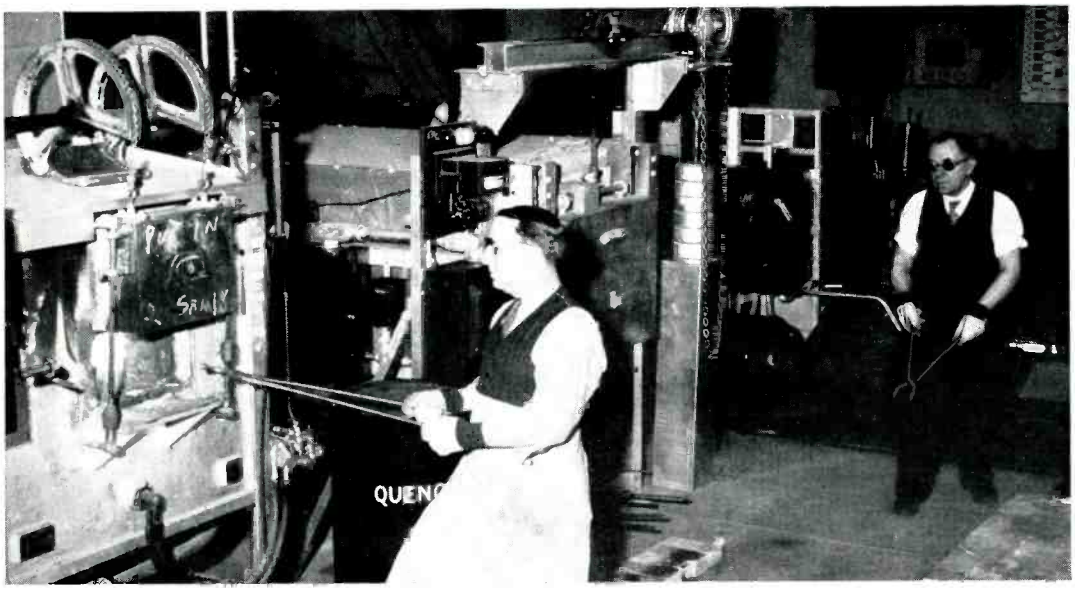


Fig. 11—In the lantern slide room, left, J. Fogel is setting up material for a slide. At the right, in the dark room for developing and printing slides and pass photographs, Bertha Wolpert prints passes. There is also a 4 x 5 enlarging camera in this room for making slides and passes

They are shown in Figures 9 and 10. The enlarged prints are developed in sinks adjacent to the cameras.

In normal times, a large quantity of lantern slides are requested. For this work a special narrow table was built with a large copy board on which tracings or diagrams could be pinned and copied by reflected light. The copy board also has an opening through which transmitted light can pass, making it possible to copy negatives up to 8 x 10. This lantern slide room is shown at the left of Figure 11. At the right of this photograph is a dark room where the negatives made in the lantern slide room are developed. An additional dark room between the printing and lantern slide rooms may be used as an auxiliary as required. All sinks in the various workrooms are of stainless steel, and all floors are covered with a special acid-resistant linoleum. Filtered water is used throughout the work of the Photographic Department and both studios and workrooms are supplied with filtered air.

Fig. 12—E. Van Horn at the left discussing a prospective job with one of the Laboratories' staff



The metallurgical laboratory at Murray Hill is well equipped with electrically heated furnaces and rolling mills for use in studying the properties of metals and alloys. R. J. Reilly is about to remove a heated billet from one of the furnaces. M. Tompa is the second mill operator

News and Pictures of the Month

Dial Switching for Toll Calls

At 3:00 A.M. on August 22 calls began to pass through Philadelphia's new crossbar toll system, and a new era in toll switching was initiated. Quietly and efficiently the crossbar switches clicked rapidly in response to their electrical controls, and outward long distance calls were completed without the assistance of intermediate operators at Philadelphia. More extensive use of this apparatus awaits the termination of the war, but the serious congestion in the Philadelphia toll office required immediate relief; and since the new system, which had been under development from well before Pearl Harbor, was nearly completed, its use seemed the most effective way of giving it. This new system will serve 1,800 toll lines, uses 32 cordless positions, and handles 40,000 outgoing toll calls a day—all trunks being switched on a four-wire basis.

Heretofore all toll switching in the larger offices had been done manually, and the assistance of several operators was sometimes required. It was not feasible in these large centers to bring all toll lines to the outward board. An outward operator receiving a request for a connection to a distant city plugged into a trunk to the toll tandem board and gave the tandem operator the line wanted. She, in turn, plugged into an idle toll line to the desired city, and the operator there was signaled.

With the new system, the operator at the outward board has a ten-button keyset or dial on which she writes up a code for the city desired. The crossbar switches, using senders and markers, test the outgoing group of trunks to that city, select an idle one, and then either signal the distant operator or establish the connection if toll-line dialing is used in that city.

Besides the outward and tandem boards, two other types had been used with former manual practice—an inward and a "through" board. At the former, all inward toll calls were answered by an operator, and either switched manually to the local connection, or, if the calls were merely passing through Philadelphia, were connected to the "through" board, where the operator switched them to the required outgoing line.

With crossbar toll switching, the former inward, "through," and tandem switchboards are eliminated. All outward and incoming toll lines terminate on crossbar switches,

where they may be interconnected or switched to local connections as required. It is expected that toll line dialing will ultimately be used for most of the calls handled by the new toll system, and for such calls the crossbar toll system acts in response to signals coming over the line from the distant end. Except at times of serious delay, all cords and plugs are eliminated; the crossbar equipment responds to dial signals coming in over the toll line, locates lines, tests for busy, establishes connections, and signals through to the subscriber or an operator with rapidity and precision.

Calls not employing toll line dialing are automatically connected to the headset of an operator at a desk position. She also has a keyset on which she writes up a code that either completes the call to the desired local subscriber or connects it through to another toll line as desired. No intermediate operators are required to complete the call. The interesting features of this system will be described in forthcoming issues of the RECORD.

Among the Laboratories engineers who were in Philadelphia for the cutover were B. C. BELLOWS, D. L. MOODY, F. F. SHIPLEY, G. E. BAILEY, C. H. MCCANDLESS and E. W. HANCOCK. The accompanying illustration, taken before the cutover, shows, kneeling, J. E. MURDOCH (left), Chief Engineer, Eastern Area, Bell of Pa., and A. B. CLARK, Director of Systems Development, Bell Laboratories; standing, left to right, F. J. Chesterman, Vice-President, Operations, Bell of Pa.; C. H. MCCANDLESS, Switching Development, Bell Laboratories; and C. R. Freehafer, Vice-President and General Manager, Eastern Area, Bell of Pa.

Commendation From the Navy

Western Electric has received the following letter from the Bureau of Ships, United States Navy:

"The Bureau wishes to take this opportunity to express its appreciation of the high standards of quality and design contained in the battle announcing equipment your company is currently manufacturing for Navy use. In looking back over the progress made in the past two years, it is felt that Western Electric and the Bell Telephone Laboratories have contributed materially to the advancement of the art of amplified voice communication on shipboard.

This Western Electric photograph shows a sailor operating a battleship announcing system

Such a situation is especially gratifying in these frantic days when all too often standards are being relaxed in the interests of speed and quantity of production.

"The present amplifier rack, with its greatly increased resistance to shock, the ready accessibility of its component parts, and its use of dry disk rectifiers, is considered vastly superior, both mechanically and electrically, to the type of equipment which preceded it. The chief factors responsible for these improvements have been the growing spirit of coöperation with the Bureau on the part of your company and the Bell Laboratories, the willingness to accept constructive criticism and adverse comments, an eagerness to improve performance wherever possible and to correct defects when discovered.

"Notable examples of your recent contributions are the improved intelligibility of speech in aircraft carrier hangar decks, the increased efficiency of sound coverage on aircraft carrier flight decks by the use of super-power reproducers made up in various sizes and shapes, the development of a workable 'anti-feedback' circuit, and the development of distinctive simulated alarm signals designed to make the fullest use of the system with which they are used.

"The above comments are made in recognition of a 'good job well done' in the hope that your commendable policy will be continued in all your present and future contacts with the Navy.

"C. G. GRIMES,
"*By direction of Chief of Bureau.*"

R. W. Blaschke

J. F. Daly

Lt. V. M. Meserve

C. W. Muccio

In the Nation's Service

Lieut. George M. Richards

"Well, we did it again! I wish I could give you all the details. It was a beautiful job of marksmanship and is a heavy loss to the Japanese. I just received the official report confirming my first medal, the Air Medal for that incident I wrote about. The recommendation for the Silver Star did not go through but was changed to the Air Medal. We may all get the Distinguished Flying Cross for the job the other day." (*He received it.*)

This is an excerpt of a letter from Lieut. George M. Richards who has returned home with 287 hours of combat flying to his credit. George was the navigator, his next-door neighbor in East Orange the bombardier, on a plane which has been credited with the destruction of twelve Zeros and a number of probables. His combat flying included raids on the Celebes Islands in which a Jap cruiser was sunk and on Rabaul, the Jap stronghold in New Britain. Just back in this country as this issue goes to press, George has been awarded the Oak Leaf Cluster, in lieu of a third Air Medal, for the skill and courage he displayed in guiding the ship on the 2,000-mile round trip to Macassar in the Celebes.

"The Japanese are fine fliers, but luckily for us they're not good shots. The theory that as a nation they're myopic has been discarded," George thinks. "Either they have inferior guns or they lack gunnery training. You'd expect the plane to be full of holes, but upon inspection there are only a few marks of direct hits."

Lieut. Robert C. Nance

"I have repeatedly postponed writing any information concerning my Army experiences for the simple reason that it had been strictly routine. However, in the past few months I was fortunate enough to be in on the Attu invasion. That was one time the proverbial 'Having a fine time, wish you were here' wouldn't fit in.

"Somehow the Record seemed to follow me around, even to the extent of arriving in the Aleutians with the first mail I received. Returned to the States the end of June to a very temporary assignment and at present I'm not authorized to explain my work."

William J. Conner

"Greetings from North Africa. I have been stationed in this theater for a little time now and some really interesting things have occurred. One of the nicest is my contact with Labs work and with men who have been connected with the Labs on developing various equipment.

"Lieut. Comdrs. Burrin-Meyer and Mallory are here. Mr. Mallory told me this morning that he is well acquainted with various department heads in West Street and that both of them had worked with Mr. Vieth and others on projects and contracts.

"Living here is not on an extravagant scale and all hands long for the States and a good meal of almost anything.

"Mrs. Usher's husband is here with me and we spend a lot of time discussing mutual friends and events. Mrs. Usher is in the Transcription Department."

Raymond P. Chapman

"Things which we accepted as commonplace at home assume great importance here—food, mail, the RECORD, clothes, equipment. After being on the British Isles for several months I came to Africa. I expected to see a lot of desert but instead most of my time has been spent in the mountains. We took an unusual 800-mile trip west from Oran and saw wonderful scenery. The mountains are very old and all that remains of them is rock covered with brush. From a distance they appear like a huge relief map such as you sometimes see in *Life* magazine.

LIEUT. G. M. RICHARDS

"We have visited Tunis, Bizerte, Mateur, Oran and several other towns. The effects of modern bombing are terrific; in some towns every building has been hit.

"I have seen some fighting and take my hat off to the Infantry. Those boys have wonderful courage and with a little experience will be unbeatable. We have gained respect for the English troops; they are really tough and stand up well in battle.

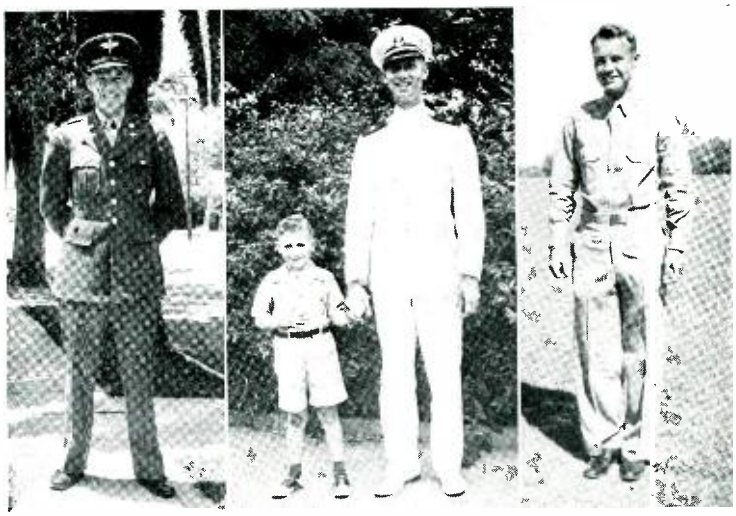
"The contrast in people is very great; the French are quite modern but the Arabs are backward, living in mud huts and employing the most primitive methods of agriculture.

"Please accept my congratulations on winning the star for the Laboratories' Army and Navy 'E' pennant."

John R. Boyle

"I'll talk about night flying. It's a new sensation in flying. You seem to be the only person awake, but then you see the headlights of cars on the highway below and you wonder who they are and what they are doing or if they know you are flying a thousand feet above their heads. You look at the stars—they seem bigger, brighter, nearer. You kick yourself for being alone on a night like this and you wonder what your girl is doing tonight. As you circle the field you get a white light—the signal to come in and land. You can't see the ground but there is a row of flare pots which designates the limits of the runway—the same kind of flare pots they used in the city when they tore up the trolley tracks. You glide in for a landing. You can't see the ground. It's a guessing game and you hope you guessed it right. But you didn't. The control man flashes a red light. You hit the throttle and zoom up to avoid a tree you couldn't see. Going around—you come in for another landing, this time avoiding the trees. As you near the ground you ease back on the stick and assume a landing attitude. Suddenly you see the ground and then you feel it when your wheels touch. It is a safe landing."

Mr. Boyle, a former member of the Apparatus Drafting Department, is a naval cadet.



Left to right: Stanley W. Erickson, birdman from 4B, now flying in the Mojave Desert; Fred J. Schwetje of Systems Drafting, idol of his brother; and William R. Carolan, Apparatus Drafting, a recent visitor to West Street

Major H. W. Holmlin

"It's two and a half years since I was called to active duty in the Corps of Engineers; I've been training and organizing new engineer units in this country so far. For the last six months I've been Executive Officer of the Combat Battalion of Engineers in the Ozark Division at Camp Maxey, now getting ready for maneuvers. The pace is terrific, leaving so little time for entertainment that I'm a bachelor in spite of the 'Texas Beauties' which are not folk tales.

"I see by the RECORD that my old 'top-kick,' L. W. GILES, designed the new headset for steel helmets. We just received two for our Message Center."

Charles J. Kuhn

"I left San Francisco on May 26, 1942, and sailed for New Zealand. We landed at Auckland, and were welcomed like kings. The cities and towns were opened wide for us. Our group stayed a short time there and on June 27 we sailed; on June 30 we arrived at Suva, Fiji. The Fijian Islands are really a beautiful group of islands and we sure made ourselves at home there. The Fijians are a grand, friendly and educated type of native. We made a big impression with them and we were all sorry when we departed.

"I'm not permitted to reveal what we did there or anything in regards to military or naval value. Ten months were spent with those Fijians and I know those months were spent in an enjoyable manner.

"From the Fiji Islands we sailed again but I'm not allowed to mention or hint about the place where I am now stationed.

MAJ. H. W. HOLMLIN B. C. GUINTER

"I'm well, and doing my best here. The climate is pretty difficult to get accustomed to, but we don't mind that much. Our food and living conditions are better than we had expected.

"I haven't very much more to say now so I'll close with best regards to all the fellows in Department 7521."

Carl E. Smedberg

"I'm on the island of Sicily now—in the heart of the grape country. The Italian people don't seem to mind the Americans being here. They're pretty tired of Muzzy and Hitler. All you see around Sicily is donkeys and mules and the donkeys are forever braying at someone or something. I'm sitting here eating grapes and plums—it's swell to have fresh fruit again. They keep us working hard. This is a big island, 100 miles wide, 50 miles long. The towns are old and dirty looking. Their money is the same as ours except, of course, there's a different name on every bill and coin, but we don't have any trouble figuring it out."

JOSEPH KELLY G. J. MCARDLE

Arne J. Elvejord

"I am in an Amphibian Tractor outfit, but my application for the Air Corps has been accepted. Because I was overseas I'm due for a thirty-day furlough.

"Malaria has come back at me three times and my eyes still hurt. For a time I thought I was going to stay blind but everything turned out all right. With all that I sometimes wish I were back 'out there.'

"Have a buddy here who was on the ——. Took a terrible beating, that ship. The only thing that saved my ship was that there was a flag (Admiral) aboard."

Lieut. Herman E. Manke

"Being a pilot makes me one of the birdmen of the United States, or I should say of the world. Already I have experienced the feeling of having two powerful engines, one on either side of me, turning the three-bladed propellers which pull me through the air at two hundred miles an hour. There's nothing like cutting through the night air listening to your favorite band over the radio with the pattern of lights below you. This is the pleasant part of night flying." (*Mr. Manke is taking advanced flying.*)

Edward H. Bueb

"Here at Fort Monmouth where I'm going to school I am learning alternating currents and direct currents, shop work, B circuits, and central-office maintenance. I am supposed to be sent out as a central-office repair man. My wife and the baby are living at Monroe for the duration (*Mrs. Bueb was formerly Edith Coulman of the Patent Department*) and the baby looks just like Edith. That's the thing I miss, not being home to see her grow up."

Lieut. Comdr. N. C. Youngstrom with Major M. M. Bower

Military Leaves of Absence

There were 594 members of the Laboratories on military leaves of absence as of August 31.

Army 399 Waves 18 Wacs 7

Marine Corps Women's Reserve 1

Navy, Marines and Coast Guard 169

RECENT LEAVES

United States Army

Harold V. Berlin	James B. Kennedy
Warren J. Boo	Ralph Nelsen
Rolf Dalane	George H. Reinhardt
John H. Devereaux	Warren C. Rouse
Edward L. Fischer	John Scharf
Douglas W. Graham	Walter R. Schleicher
Clifford N. Greene	Lt. Edward G. Shields
Harold H. Hoffman	Victor Silzer
Wilbur Insull	William J. H. Thoele

Arthur Wright

United States Navy

Maxwell C. Andrews	Louis J. Koos
Edward J. Buckley	Roger J. LaFrance
Walker D. Elliott	Letitia G. Lauten
William R. Frees	Joseph C. Meats
Robert J. Gieser	Joseph M. Mills
Thomas R. Harden	Lt. Cmdr. J. B. Newsom
Thomas Johnson	Ensign P. H. Thayer

United States Marines

Patricia M. Illingworth

Military News

"THE ARMY was never like this. A modern dormitory with maids to make the bed and sweep the floor—the answer to a soldier's dream." So writes EDWARD M. KENNAUGH from Ohio State University where he is studying electrical engineering.

BERNARD C. GUNTER of the Marines who has been assigned to the Post Office at Parris Island was formerly in the Mail Room at Whippany.

JOSEPH KELLY, naval aviation cadet, visited the Laboratories before being assigned to further studies at Siena College. He was an apprenticed machinist in the 4C Shop before enlisting.

GEORGE J. MCARDLE is now a corporal at Camp Crowder, Missouri.

On a recent furlough, Charles W. Muccio visited his friends at West Street. He has been transferred to San Francisco and now has an APO number.

Joseph F. Daly has received a promotion to Warrant Officer.

The following members of the Laboratories who were on military leave have returned: Marian F. Adler, Joseph A. Seifert and John Nichol.

F. E. Schellhorn

A. J. Nolan

Lieut. Vincent M. Meserve who visited West Street after completing studies at Harvard and M.I.T. has been assigned to duty in Philadelphia.

Robert W. Blaschke, U.S.N.R., is at present stationed in the south of England. Before entering the Navy he was a night watchman at Murray Hill.

Lieut. Bertram M. Froehly and his wife flew to this country from North Africa. Mr. Froehly will be stationed in Louisiana. His wife, who was a nurse on the African front, will not be going back to the war front. May we tell why, Bert?

"The air station at Glenville, Illinois, is beautifully laid out and it's a pleasure to be here," writes Aviation Cadet Fred J. Schwetje. "The food is the best (no shortages out here) and the recreational facilities tops. I really enjoy this place."

Lieut. Ralph D. Horne writes: "I was graduated as a Second Lieutenant and have returned to New Mexico for further training on B-17's. After almost three months on this post I met a chap who used to work for the Labs. He left shortly before I did, but not on a military leave. Perhaps some of the boys from Summit remember him—John Hall."

"I am studying 'Elements of Radio' and it has turned out to be the most interesting course I've studied. Give my regards to all in the Labs." From Lawson F. Cooper.

"As C. W. Peterson says in the July Record, I, too, am one of the A. E. F.'s—Americans Exiled in Florida. It will be for a short time though, and then we'll go overseas along with a lot of Bell Lab equipment." This note came from Eugene F. Krautter.

After graduating from the School for Aviation Machinists' Mates, William J. Schneider was transferred to Cherry Point, North Carolina, with the rank of Corporal. His present work is as a mechanic with an observation squadron.

Major Harold T. King, "Ex-Graybar," as he signs cards to the Record, is still fighting this war at Fort Bragg where he spends most of his time in the field.

Richard A. Shine is on the Mediterranean Sea. He has been at Malta and has taken part in all the military operations we are reading about in the newspapers.

At Camp Murphy, Florida, where he is instructing on Signal Corps equipment designed by the Labs, Gustav A. Backman takes great pride in saying he's from the Labs. He sends his greetings to 1420.

Morgan F. Hickey has arrived safely in England where the people are wonderful to the soldiers. "The country is beautiful," he adds, "the weather nice and cool and the food very good."

R. R. Stephens tells of his training in "small arms," the Marine Corps specialty, in a recent letter and goes on to say that he hopes to specialize in * * *.

Courtesy National Carbon Co.

"Weird, isn't it?"

WAYNE F. WILSON is at Camp Crowder, Missouri.

JOHN E. GALBRAITH was home on a furlough during August. He has been assigned to a Radio Intelligence monitoring station or "listening post" where his job is to help the around-the-clock policing of all radio communications channels for the purpose of detecting and locating unauthorized stations operating in violation of wartime regulations. Since the whole radio spectrum is covered, listening posts make it virtually impossible for outlaw stations to operate.

JOHN J. TURLEY of the Store has arrived overseas with a Signal Air Warning Company.

W. F. BODTMANN

F. J. HOWE is in Richmond, Virginia, with Headquarters Anti-Aircraft Command; F. C. KOZAK at Fort Sill, Oklahoma; R. H. KOEHN, aviation cadet in Peru, Indiana; F. R. HULLEY at Maxwell Field, Alabama; J. G. PHILLIPS at Syracuse University; and W. E. ARCHBOLD at the University of Vermont.

WILLIAM R. CAROLAN is going to college at Salt Lake City, Utah.

W. P. WEILER has been assigned to duty in Brooklyn for a few months.

A VISITOR to the Fourteenth Street and Eighth Avenue Building of the Laboratories in early August was Second Lieut. F. W. WHITESIDE.

WORD HAS been received that AMBROSE J. VALLELY has been sent to Iceland.

WORD has been received from Australia of the promotion of CHARLES J. MCDONALD to the rank of first lieutenant.

FROM CAMP VAN DORN, where he is in the message center platoon, EUGENE MIRITELLO sent a card saying that he was enjoying his new work though he still misses his old gang very much.

"I'M A SOLDIER now, having been sworn into the Army on August 5," writes HELEN A. ELBERSON. "I'm in the Motor Pool at Fort Wright, New York, and drive trucks. It's quite an adventure."

CAPTAIN E. C. GRAUNAS, now away from the Labs for two and a half years, sends one card a month to the RECORD from his station in Australia.

MAJOR WILLIAM KES has been a recent visitor to the Laboratories. He has returned from North Africa.

ELIZABETH A. FITZSIMMONS of the Waves is at the Naval Air Station, Whiting Field, Milton, Florida.

ROBERT E. HENNEBERG was transferred from Fort Custer to Ruston, Louisiana.

LIEUT. GEORGE F. PLATTS, U.S.N.R., is at the Eastman Kodak Company, having been transferred from the Sylvania Electrical Products, Inc., at Ipswich, Massachusetts.

"I HAVE recently completed the acrobatic stage and am now night flying and formation flying. Having a wonderful time but losing lots of sleep." This news came from JOHN P. MANNING of Olathe, Kansas, Air Station.

S. CURTIS TALLMAN has been promoted to Captain. He is with the Mechanized Cavalry in England.

BOYD E. BROWN, formerly of the Electronics Tube Shop, Building "T," is one of several Laboratories men taking the radio course at Fort Monmouth.

CHARLES M. VOSS is attending Ohio State University where the campus is full of girls "who help to keep a soldier happy." Charles was in Research Drafting.

FROM BALL COLLEGE, where he is studying Mechanical Engineering, CHARLES S. GRAHAM writes that he enjoys Indiana hospitality and the fine treatment accorded soldiers in that section.

NOW AT Wilbur Wright Junior College, taking a nine-month course to become a Radio Technician, F. E. SCHELLHORN paid a call on friends at West Street after he had completed his boot training at Sampson, New York.

W. RICHARDSON has been assigned to the Engineers at Camp Breckenridge, Kentucky.

PERSONAL LEAVES of absence have been granted to ROBERT A. MCMURROUGH, Army Specialized Training Program; JAMES ONDERWATER, U. S. Merchant Marine; and RAYMOND L. WEGEL, N. D. R. C.

Join the Telephone Chorus

Bell Chorus of New York extends a cordial invitation to all members of the Laboratories who enjoy singing to join in the fun of preparing for a Christmas concert. The Chorus will also present a spring concert again at Town Hall in May. Rehearsals are held at the New York Telephone Company's auditorium on the thirty-first floor of the 140 West Street building on Thursday evenings from 6 to 8. Further details may be obtained from HILDA R. MULLER, Ext. 1902.

What One Jungle Fighter Thinks of Telephones

Service representatives have as part of their war job today the work of explaining to customers that the telephone company is unable to furnish all "peacetime" services because metals which would normally be used for new construction are going off to war. Jean Simms, Service Representative of the Illinois Bell Telephone Company, wrote this in a letter to her husband, who is a lieutenant in the Army.

Here is what he wrote back from a rest camp in New Caledonia, after being in action in New Guinea:

"Any time anyone squawks about not being able to have telephone equipment because it is being shipped off to various places in the world, you tell them off for me and the rest of the armed forces. By God, I know of three occasions when you wouldn't have a husband now if it weren't for that little beauty of a telephone about six inches from my head.

"I could tell you a whole lot about how we love those phones, but it might be deleted. I carried two phones all the way back from the front just to be sure we would have enough of them in case they changed their minds and sent us into action unexpectedly."

Nelson Blount, 1879-1943

Nelson Blount, a former member of the Station Apparatus Development Department who retired last May, died on August 30. A biography and photograph of Mr. Blount appeared in the June RECORD.

Admiral Nimitz inspects apparatus of B. T. L. design for the recording of electrical data taken at the rate of 40 observations a minute. Each observation involves a balancing operation. Results are recorded on a teletypewriter

News Notes

THE GOVERNING BOARD of the American Institute of Physics accepted unanimously a resolution recommended by its War Policy Committee authorizing the Institute to conduct a campaign for funds with which to purchase a building to be devoted to the interests of physics and physicists. A Physics Building Fund Committee was appointed. The following members of the Laboratories have accepted membership in the committee: F. B. JEWETT, O. E. BUCKLEY, K. K. DARROW, HARVEY FLETCHER and E. C. WENTE.

THE WESTERN ELECTRIC Company has recently added to its facilities by establishing a new plant at Haverhill, Massachusetts, in which from 1,500 to 2,000 people will be employed. Two large mill buildings have been leased for various manufacturing and warehouse purposes.

The group that rides to Whippany with A. D. Beers has imposed a penalty upon themselves each time anyone is late in meeting Art's car, or forgets a pass or special Whippany identification which holds up the car. The money collected is used to buy cigarettes for the Army. Here we see Julia Lynch presenting some to Lieut. Fernandez and Cpl. Feely of the Military Police

THE MOTION PICTURE CAMERA CLUB will open its fourth year of activity on Wednesday, October 6, 1943, at 5:45 P.M., in the Auditorium. Mr. Charles Perry Weimer, noted traveller and photographer, will show his forthcoming picture, *The Second Cavalcade of South America*. Mr. Weimer takes us into the interior of South America and shows the life and industry of our neighbors.

R. J. HEFFNER visited Los Angeles, San Francisco, Portland, and Seattle during July and August, to discuss with executives of the Southern California Telephone and Telegraph Company the possibility of borrowing additional qualified engineers for war work in the Laboratories.

R. H. WILSON gave a lecture on *Inventory Control Under Wartime Conditions* at the Harvard School of Business at the "Upgrading" Training for Executives course.

L. G. ABRAHAM, A. L. FOX and R. J. NOSSAMAN attended a conference in Washington in connection with the preparation of a manual on spiral-four cable for the Signal Corps.

I. W. BROWN discussed PBX problems with telephone and Western Electric Company representatives in Washington.

September Service Anniversaries of Members of the Laboratories*

10 *Years*

Kenneth Durham
William Ryan

15 *Years*

Helen Adams
T. C. Bassett
D. T. Bell
W. K. Caughey
E. T. Creaven
Catherine Cronin
A. F. Duerr
B. J. Edwards
L. A. Fay
W. T. Gebhard
C. A. Goble
B. C. Griffith
H. F. Lynch
Daniel Mahoney
L. V. Matzuga
H. E. Mendenhall
J. S. Parsons
Thomas Powers
Margaret Remmelman
P. H. Richardson
Antonio Ripepi
W. F. Ruede, Jr.
J. F. Schneider
E. K. Van Tassel
M. J. Van Weelden
Michael Walsh
L. H. Whitman

20 *Years*

Edward Alenius
A. E. Bowen
R. M. Bozorth
Madlyn Broomfield
F. S. Corso
G. W. Cowley
E. F. Dearborn
V. R. Gabson
E. H. Gilson
K. H. Guerard
Minta Hatfield
C. C. Kingsley
G. T. Kohman
G. J. MacDonald
J. J. McDermott
Bayman McWhan
K. W. Pfleger
E. H. Quoos
H. H. Spencer
L. F. Staehler
A. W. Sylvan
R. S. Tucker
E. P. Williams
Sylvester Young

25 *Years*

Rose Kirk
Charlotte Norton
G. A. Ritchie
Alice Ryan

30 *Years*

Robert Nordenswan

35 *Years*

A. A. Schwinn

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

Fire-Protecting the Worker at Home

Industry is engaged in a fight against the hazards causing mounting fire losses in the nation's war plants. But to the average man and woman the safety of the plant in which they work means little if they cannot also count on the fact that home and family are safe against the danger of fire.

The first step is to acquire a knowledge of the causes of residential fires. The National Fire Protection Association has listed the most common causes, all of which can be wiped out with time and effort.

Heating plants from furnace to chimney should be cleaned and put into sound repair at least once a year.

Inflammable wooden roofs which can be ignited by any wind-blown spark or firebrand should be re-covered with a fire-resistant roofing material.

Worn electric cords should be repaired or replaced, and only electrical equipment bearing the approved label of the Underwriters' Laboratories should be purchased.

These are structural safeguards essential to the fire defenses of every home. They are the man-of-the-family's responsibility. But careful habits must be practiced by all members of the family if fire is to be avoided.

Electrical appliances, for instance, should be disconnected immediately after using.

Gasoline, benzene and naptha, all highly inflammable fluids, should never be used for home dry-cleaning or kept in the house for any other purpose.

Matches should be kept in metal containers beyond the reach of small children.

Cigarettes should be extinguished before they are discarded and hot cigarette ashes should never be dropped into a waste basket filled with any kind of trash.

Rubbish should be cleaned out regularly, as it may ignite spontaneously if allowed to accumulate any place on the premises, and will feed any fires that start.

The fact that homes are precious, scarce and difficult to replace these days would be reason enough for protecting them. But lives are also lost when homes are destroyed by fire, and lives can never be replaced. For these reasons all are urged by the NFPA to enlist in the observance of Fire Prevention Week by applying to their homes the same principles applied against fire on the job, and to provide their families with as strong a shield as is possible against the danger of needless fire.

* * *

WILLIAM A. EDSON is joint author with R. I. Sarbacher of the book *Hyper and Ultra-High Frequency Engineering.*

Your Work Is Secret!

Guard it carefully.
Do not discuss it with unauthorized people, not even friends or family.

Does your home have any of these fire hazards? National Fire Prevention Week—October 3 to 9—is a good time to make a thorough check. And while you're at it, maybe you can find something for your local salvage drive

BLOOD DONORS

W. Fondiller — Ralph Nelsen
Catherine Reardon — W. C. Bengraff
Vivienne Snyder — Caroline Large
Margaret Carabella — A. L. Stillwell
Ann Engelmann — Helen Capages
Edna Herzog — Rose Iacovone
Theodore Benseler — Elsie Cooper
Ann Iwaniw — Theresa Bodian
Myrna B. Swartz — Anna Mae Brickner
Carlin Evans — Janice Murphy
Leonora Daniel — Irene Ryan
Murray Brandin — Bertha Wolpert
William Taeger

A chapter of the book, published in the August issue of *Proceedings of the I.R.E.*, is entitled *Tubes Employing Velocity Modulation*. The condensation of another chapter, *Positive Grid or Retarding Field Oscillators*, appeared in the August *Electronics*. Dr. Edson wrote the book while associated with Dr. Sarbacher in the Department of Electrical Engineering at the Illinois Institute of Technology, Chicago.

THE 1943 ROSTER of officers and committees of the Institute of Radio Engineers includes the following members of the Laboratories: R. A. HEISING, *Treasurer;* H. T. FRIIS and F. B. LLEWELLYN, *Board of Directors;* E. L. NELSON, F. B. Llewellyn and WILLIAM WILSON, *Board of Editors;* C. R. BURROWS and G. G. MULLER, *Annual Review;* G. G. Muller and L. J. SIVIAN, *Electroacoustics;* S. B. INGRAM, J. A. MORTON and J. R. WILSON, *Electronics;* PIERRE MERTZ, *Facsimile;* C. R. Burrows, *Radio Wave Propagation;* H. B. FISCHER, *Radio Receivers;* C. R. Burrows and G. G. Muller, *Standards;* C. R. Burrows, *Symbols;* A. G. JENSEN, *Television;* J. F. MORRISON and J. C. SCHELLENG, *Transmitters and Antennas.*

WILLIAM J. KING of the Transmission Apparatus Department received the degree of Bachelor of Electrical Engineering from New York University in July.

"THE TELEPHONE HOUR"

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

OCTOBER 11, 1943

Furiant — *Smetana*
from "The Bartered Bride"
Orchestra

Siciliana — *Händel*
Marian Anderson

That Naughty Waltz — *Levy*
Orchestra

Nobody Knows de Trouble I've Seen — *Spiritual arr. Burleigh*

Let Us Break Bread Together — *Spiritual arr. Lawrence*
Marian Anderson

Intermezzo from "Suor Angelica" — *Puccini*
Orchestra

Casta Diva from "Norma" — *Bellini*
Marian Anderson

OCTOBER 18, 1943

With a Song in My Heart — *Rodgers*
from "Spring Is Here"
James Melton

A Venetian Love Song — *Nevin*
from "Day in Venice"
Orchestra

I Remember — *Strickland*
Sugar Plum — *Wolfe*
James Melton

Les Preludes — *Liszt*
Orchestra

Ay, Fuyez douce Image — *Massenet*
from "Manon"
James Melton

OCTOBER 25, 1943

Gypsy Dance from "Aleko" — *Rachmaninoff*
Orchestra

Caprice Viennois — *Kreisler*
Grace Moore

Musical Snuff-Box — *Liadoff*
Orchestra

Indian Love Call from "Rose-Marie" — *Friml*
Grace Moore

Queen Mab Scherzo — *Berlioz*
Orchestra

Vissi d'Arte from "Tosca" — *Puccini*
Grace Moore

NOVEMBER 1, 1943

Overture to "Oberon" — *von Weber*
Orchestra

Habañera — *Ravel*
March — *Korngold*
Jascha Heifetz and Orchestra

Concerto in D Major— — *Tschaikowsky*
2d and 3d Movements
Jascha Heifetz and Orchestra

Men of the Laboratories

Chosen by Lot

J. W. KITTNER, JR., came from Louisville, Kentucky, but he disclaims any special interest in horse racing despite the intriguing environment. Immediately after graduating from Purdue University in 1939 Jack came to the Laboratories and joined the Outside Plant Development Department to design electrical testing equipment. He plays golf in summer and bowls in winter. A season ticket to the Boston Symphony Orchestra concerts at New York satisfies his love for music and he takes Kodachrome pictures as an art hobby.

* * * * *

A NATIVE of Butler, New Jersey, A. C. PFISTER is nearly back home again at Murray Hill. He was studying the nature of microphonic action there until his efforts were diverted to war work. Anthony joined the Laboratories in 1930 as a messenger. The following year he began studying for his college degree of B.S. in Mechanical Engineering, which he received from Brooklyn Polytechnic Institute in 1939. His diversions are chess, bridge and bowling. He has a Victory garden "just large enough for my wife to take care of," as he puts it.

JOHN W. KITTNER, JR.

HANDY with electrical apparatus is BILL CONNICK, Plant Maintenance Hand in the Davis building, who followed his father, W. C. CONNICK, into the Laboratories' employ two and a half years ago. Previously employed in a mirror and reflector plant where he became a specialist in silvering parabolic reflectors, Bill's first toe hold on the Laboratories was in the West Street restaurant. From there he transferred into the power room as an apprentice before

ANTHONY C. PFISTER

taking over his present duties—the care of large motor-generator sets and storage batteries to insure a reliable supply of power for the many complicated electronic devices used by Army and Navy technical students in the School for War Training. He likes electrical work and is determined to learn more about it so that he can move to broader jobs, in the same manner that he has advanced to his present position.

With his wife and eighteen-month-old daughter, Rose Ann, Bill lives in the Bronx.

WILLIAM W. CONNICK

He is a graduate of Morris High School and an expert swimmer, having learned the hard way when he was forced to save himself from a swift Hudson River tidal current that swept him under a pier.

News Notes

R. W. DEMONTE was at Point Breeze on August 16 to consider power coils with Signal Corps and Point Breeze engineers.

C. T. WYMAN, at Hawthorne, investigated the manufacture of special networks.

E. B. PAYNE visited the Radio Research Laboratory in Boston during August.

SPECIAL CABLE STUDIES took R. T. STAPLES to Boston.

H. H. STAEBNER discussed cord development problems in Washington and power cords in Boston.

F. W. WEBB and D. T. BELL went to Chicago on special testing apparatus.

W. J. KING discussed cables on a recent trip to Chicago.

W. A. EVANS was a member of the committee which developed the new American War Standard, *Glass-Bonded Mica Radio Insulators*, prepared at the request of the War Production Board. K. G. COUTLEE was the alternate representative for Bell Telephone Laboratories.

J. A. CARR and R. J. NOSSAMAN conferred with the Signal Corps at Fort Monmouth on the preparation of a manual on *Open Wire Lines for the Signal Corps*.

E. G. D. PATERSON has been appointed Systems Quality Engineer, reporting to G. D. EDWARDS, Director of Quality Assurance. Mr. Paterson succeeds A. G. DALTON who has been transferred to the Western Electric Company at its request. H. A. LARLEE has been transferred from the Station Apparatus Development Department and is Station Quality Engineer, reporting to Mr. Paterson. Others reporting to Mr. Paterson are W. G. FREEMAN, Central Office Quality Engineer, and R. C. KOERNIG, Outside Plant Quality Engineer. During Mr. Edwards' occasional absences on special Army work, Mr. Paterson will be in charge of the Quality Assurance Department.

Prize-winning produce from H. W. Dudley's garden which was judged the best Victory Garden in Summit's community plots. Mr. Dudley had taken one ton of vegetables from his garden at the time he won first prize, and has since garnered in part of the second ton

Retirements

Four members of the Laboratories retired on September 30: FRANCIS A. COX with a Class A pension under the Retirement Age Rule upon completion of forty-six years of service; and, at their own request, MISS STATIRA CRAWFORD, Class A, twenty-four years of service; GILBERT T. FORD, Class C, thirty-one years of service, and ERMY R. SMITH, Class B, thirty-three years of service.

Francis A. Cox

Mr. Cox joined the Switchboard Cabling Department at the Clinton Street shop of the Western Electric Company, Chicago, in 1897. Four years later he became one of the original members of the Engineering Inspection Department, formed in 1901. In 1902 he came to New York and for the following three years served in the Equipment Engineering group. All but a year and a half of Mr. Cox's next fourteen years were spent abroad. For the first nine he was in Antwerp as Equipment Engineer and later as Chief Engineer. His brief return to New York was followed by three years in Adelaide, Australia, as engineer in charge of the first Western Electric machine-switching installation in that country.

FRANCIS A. COX

Since his return to the Laboratories in 1919 Mr. Cox has been in the Switching Development Department developing specifications of Bell System Practices for the requirements placed on central-office apparatus to control its adjustment and performance at the time it is placed in service and during its subsequent maintenance; and also specifications covering information for ordering and assembling repair parts. More recently he has been associated with the preparation of Practices covering the testing and inspection of central-office circuits, the operating methods employed in maintaining them and the development of requirements for the relays used in telephone switching circuits.

Statira Crawford

MISS CRAWFORD was engaged in 1917 by the Western Electric Company as a nurse and continued in that capacity until 1920 when she became Executive Nurse and then in 1922 Supervising Nurse. Shortly thereafter she was granted a leave of absence to go abroad where she spent two years with the American Hospital in Paris. In January, 1926, she returned to the Laboratories in her former capacity. She was with the Medical Department at West Street during all its period of growth and transferred to Murray Hill at the beginning of 1942 to assist in the establishment and later the maintenance of the Medical Department there. Miss Crawford received an A.B. degree from Columbia College for Women in 1908 and from 1912 to 1915 attended the Presbyterian Hospital Training School.

Gilbert T. Ford

AFTER receiving his B.S. in Electrical Engineering from the University of Tennessee in 1912, MR. FORD immediately joined the student course of the Western Electric Company at Hawthorne. The last four months of this course consisted of installation work at Omaha. Following this he returned to the Equipment Engineering Department at Hawthorne where he prepared project specifications for small manual switchboards. In 1919 Mr. Ford transferred to the equipment section of the Systems Development Department in New York where he actively engaged in equipment work for the panel system which then was being inaugurated on a widespread program. At this time he taught an Out-of-Hour course on the new dial system. From 1922 to 1925 he was in charge of the groups analyzing manual, step-by-step and panel

GILBERT T. FORD

central offices and handling their associated power equipment. Since 1925 Mr. Ford has been associated in a supervisory capacity with the development of manual systems in the Equipment Development Department. This work has covered the development of the 11-type and 12-type switchboards, test, information and service observing desks and test sets common to all systems.

Ermy R. Smith

MR. SMITH began his telephone experience in 1902 with the Western Electric Company Installation Department with headquarters at Philadelphia. After a few years' absence from telephone work he became engaged with non-associated Telephone Companies in maintenance and switchboard installation work. In 1916, when the York State Telephone Company was consolidated with the New York Telephone Company, he was transferred from District Wire Chief at Binghamton, New York, to the Equipment Engineering Department with Headquarters at Syracuse, N. Y. Later in 1916 following a brief leave of absence he became associated with The Bell Telephone Company of Pennsylvania and was engaged in maintenance inspection work. During World War I he was responsible for the maintenance of the Communication System of the Commandant's Office at League Island Navy Yard.

ERMY R. SMITH

During 1919 Mr. Smith transferred to the Systems Development Department of the Laboratories, engaging in toll circuit development. A year later he was one of a special group formed to develop the toll system involved in the toll cable project between Stockholm and Goteborg in Sweden. In this connection he was active in telephone repeater and signaling circuit development and, upon completion of the Swedish job, continued this type of work until 1923 when he became engaged in toll switchboard development. In this work he was particularly active in the development of straightforward toll tandem switchboards of the Switching Development Department. More recently Mr. Smith had been associated with war projects and with important phases in the development of the No. 4 toll switching system recently placed in service in Philadelphia and described on page 78.

News Notes

LLOYD ESPENSCHIED's paper, *Electrical Communications, the Past and Present Illuminate the Future*, appeared in the August, 1943, *Proceedings of the I.R.E.*

Internationalism in Science, a broadcast by K. K. DARROW, delivered under the auspices of the American Philosophical Society, was published in the August 6 issue of *Science*.

F. F. LUCAS visited the Bureau of Ships, Washington, and the Naval Experimental Station at Annapolis.

K. G. COMPTON attended a conference at Gibson Island, Baltimore, on corrosion.

G. N. VACCA was at Point Breeze in connection with rubber-covered wire problems.

J. CRABTREE attended a conference on infra-red spectrographs at the University of Michigan on August 5 and 6.

SYNTHETIC rubber development problems took G. G. WINSPEAR to Hawthorne, Cleveland and Akron.

C. J. FROSCH made trips to Hawthorne, Grand Rapids, Cleveland and Philadelphia on plastic problems.

A. J. CHRISTOPHER discussed condensers at the Aerovox Corporation at New Bedford.

Women of the Laboratories

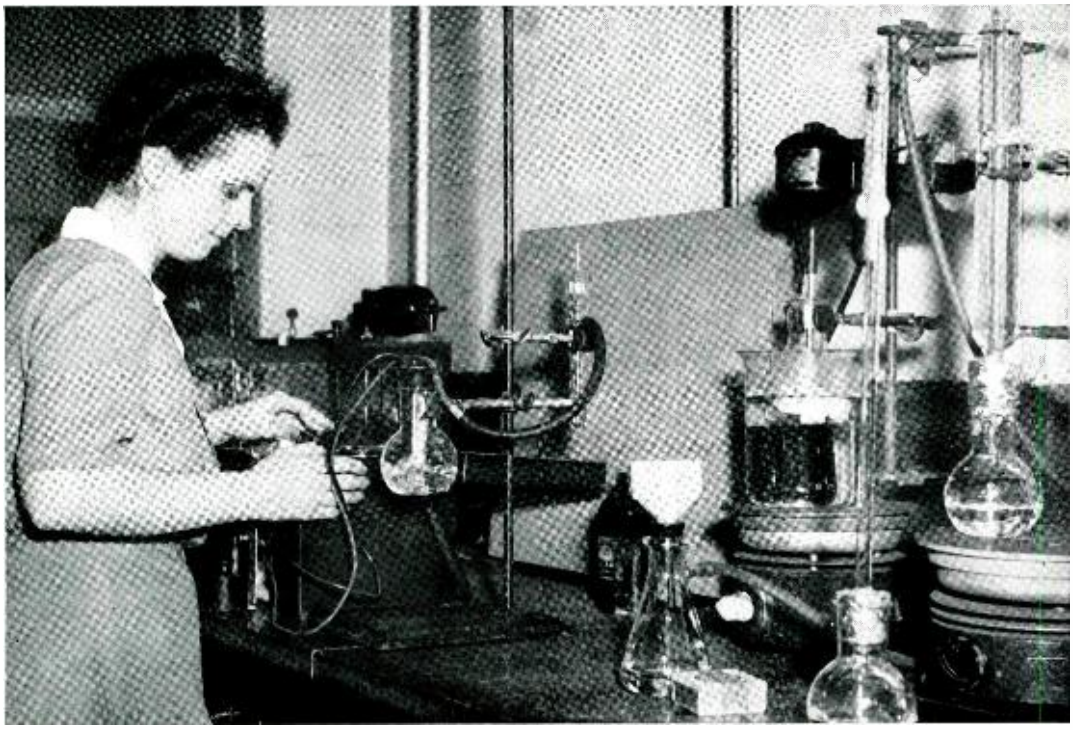
WESLEYAN MANNING is the daughter of a dermatologist, so it isn't surprising that after she had attended the New York School of Fine and Applied Arts for three years she decided to follow her father's career instead. Working as his secretary and technician, she took some pre-medical work evenings at New York University and received her B.A. in zoölogy from the University of Maine. Instead of continuing through medical school she gave up her career for marriage and motherhood.

It took the war to bring Mrs. Manning to the field of analytical chemistry where she feels she has found her life's work. She was carrying out tests for determining the acidity of paper for electrical insulation when her picture was taken. The method was developed here at the Laboratories by H. A. BIRDSALL with whom she works part time.

She devotes Sundays and some of her free time to her child, Robert, now nearly five years old, and finds time to serve in civilian defense, as Air Raid Warden and as a member of an American Red Cross First Aid Detachment in Mount Vernon. Mrs. Manning turns to the piano, the violin and to painting for relaxation; she swims, plays golf and dances for recreation.

* * * * *

WIFE OF a Summit business man, MARGUERITE DOYLE's life before the war followed the pattern of that suburban town. Her home duties looked after, she had time free for the Board of Recreation, for a Red Cross Home Nursing Course, for an afternoon game of bridge. Then the war came to Murray Hill, and Mrs. Doyle went there to



Mrs. Wesleyan S. Manning of the Chemical Laboratories carries out a test for determining the acidity of paper used for electrical insulation

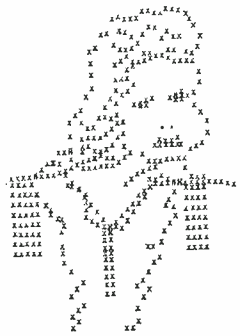
MARGUERITE DOYLE

LUCILLE SIMPSON POTTER

contribute her share. She makes thermocouples, of wire so fine that the welds are made under a double-barreled microscope. And she still finds time to enjoy the theater.

* * * * *

Happy as she is as a secretary, ALICE HILL often wonders how she came to like her work so well since the theater and nursing have always been her ambitions. However, her job is exciting. One man for whom she works designs battle announcing equipment, the other speech input equipment for the Armed Forces.



Alice's leisure time for the most part is spent seeing Broadway shows. This season "Something for the Boys" is the production she liked best. "It is well performed and has color and gay music," she says. Besides the theater she likes to write to friends in service and to sketch caricatures on her typewriter, the one of herself on this page being a sample.

Some day she hopes to have a crude cabin in the White Mountains, her favorite vacation spot, and to own a good Western horse. Alice is an all-round sportswoman with riding and archery her first choices.

* * * * *

WIFE OF AN Army engineering student, LUCILLE POTTER took a job in the Murray Hill Development Shop and entered the Laboratories on the day her husband joined

ALICE HILL

To satisfy the curiosity of readers who were intrigued by last month's cover girl, this is how Laura Chamberlin looks when you see her "on the level."

the Army. Now, just one year later, she is a full-fledged bench machine operator and assembler. She has completed the sixty-hour course in blueprint reading, shop processes and arithmetic with sound motion pictures and lectures to help her to understand how to run milling machines, drill presses and engraving machines and how to do elementary assembly work. She has a set of tools for her work and is familiar with micrometers, squares and scribers.

Mrs. Potter grew up in East Orange and graduated from the local schools. From there she went to Skidmore College where she received her degree in sociology and English. Upon her marriage in 1941 she gave up her job in a bank. Her days from then on were divided between housekeeping in their bungalow in Chatham and helping her husband in the machine shop he ran.

Now that he's in service, Mrs. Potter still lives in the bungalow. Neighbors do little jobs to make life more pleasant. Her time after doing her housework is given to writing to her husband, to her brother, a Naval flier, and to her sister, an Army dietitian in India.

* * * * *

INFORMAL LUNCHEON GATHERINGS are being held by girls who are members of the technical staff or technical assistants. If you're interested in joining the group please carry your tray to the Conference Dining Room off the West Street restaurant. The girls meet every Wednesday from eleven-thirty to one o'clock.

Ten Rules for Business Girls

(1) **Get the health habit.** Use an ounce of prevention: eat vitamin-wise, sleep long, burn the candle at one end, have periodic medical check-ups.

(2) **Let love broaden, not blast, your ambitions.** Marriage certificates aren't always meal tickets. Besides, your virtues as a worker are your virtues as a wife. Too, a man may fail you; a livelihood, never.

(3) **Polish your personality.** Charm often pays better than brains. Lower your voice, soften your heart, widen your smile. True charm is impartial, makes no distinction between the office boy and the big boss.

(4) **Put your brains to work, be inventive about your job.** See it with a fresh eye each day—creatively, unmechanically. Learn all you can about your firm. When bright ideas enter your head, don't hesitate to submit them.

(5) **Meet more people.** Step out of that ivory tower. In business, contacts pay and anonymity doesn't. You know you're on earth, see that others do too. When opportunity knocks, they'll have you in mind.

(6) **Look to your looks.** Faultless grooming and tasteful clothes aren't merely externals, they're a definite indication you've got something between the ears.

(7) **Shun office intrigue.** When gossip and personal feuds tempt your sense of the dramatic, develop an aloof, get-thee-behind-me attitude. Refuse to dish the dirt but don't be snobbishly superior when others do.

(8) **Sweeten your disposition.** Rage or resentment upsets the liver, depletes efficiency, gets you nowhere even when you're right. Laugh it off. Compromise. The art of coöperation is a pearl more priceless than a Ph.D.

(9) **Look where you leap.** Plan your work, make every minute count. Have a clear goal each day, each year. Shape events—if you don't, they'll shape you.

(10) * * *. (See *Glamour*, March, 1943.)

Courtesy of "Glamour"; Copyrighted, 1943, Conde-Nast Publications.

Elsie Pavlic swings into stride on Bethune St.

Try the Wac Walk

The walk from West Street to the subway or ferry at night can be a beneficial relaxation for tense, tired workers. Try it tonight! Head up, chest high, tummy in, and swing your legs from the hips—no shuffling along from the knees.

You might adopt the official Wac walk. It calls for a thirty-inch stride, an ambitious reach even for long legs, and one hundred twenty steps a minute, two steps a second. Measure your steps and swing into stride. Walking is a tonic in October weather.

Mail Christmas Gifts Early

Be sure to buy your friends and relatives in service gifts they can use and mail the gifts early. Christmas is just around the corner for them—September 15 to October 15 is the time for mailing presents to soldiers and Wacs while Navy, Marine and Coast Guard packages may be sent as late as October 31. No letter of request from the folks in service is necessary if the package is marked *Christmas Gift Parcel.*

The United States Post Office Department has issued further instructions:

Packages for overseas shipment should weigh not more than five pounds and be not more than fifteen inches in length or thirty-six inches in length and girth combined. (A safe guide is an ordinary shoe box.)

Packages should be wrapped in strong corrugated boxes and stout paper and tied with twine in a way that permits inspection. Do not seal the box. Pack your gifts strongly enough to withstand the heat of a ship's hold and the rough handling at numerous busy postal centers.

Label carefully with the name and address of the sender, the name, rank or rating of the addressee, the service unit to which he is assigned or the name of ship and fleet post office, or A.P.O. through which his mail is routed. For safety, write this information on each layer of wrapping in case the outer wrapping is damaged.

News Notes

F. G. Colbath was in Washington in connection with the installation of a special PBX for The Chesapeake and Potomac Telephone Company.

G. J. Connors visited Annapolis and Cheltenham, Maryland, in connection with installation work at those points.

Elizabeth Bell wraps a sample package as it should be wrapped for servicemen

W. L. Bond, who has been in Washington on part-time work for the War Production Board, returned to the Laboratories on August 15 after four months' absence.

H. P. Franz was at the Patent Office in Washington during August.

The Laboratories were represented in interference proceedings at the Patent Office in Richmond by E. B. Cave before the Primary Examiner.

We See by the Papers, *that*

The Ministry of Production is making a special drive through the Regional Boards to help manufacturers extending the use of quality control. As part of these arrangements they are recruiting and training demonstrators to be available in every region. . . . Quality Control—or Q.C., as it is now coming to be called—is a new production technique with a rather forbidding title, but is recognized as one of the biggest advances in large-scale production. . . .

There has been some discussion whether the method was first used in America or this country. In fact, it was originated in 1922 by Dr. W. A. Shewhart of the Bell Telephone Laboratories in New York.—*Sheet Metal Industry, London, August*, 1943.

It is notable that investors are buying into securities representing good management, and this is a factor in the continued purchasing of American Telephone around the highs of 1943 when most of the market is wavering. One broker reported that 10% of his investment clientele have made purchases of telephone shares in the past three months.—*Wall Street Journal, September* 11, 1943.

Newest weapon . . . is a vessel known to the Navy by the designation LST (Landing Ship-Tank). Its primary purpose is to land large war machines at invasion beachheads, and for this reason it was designed with a very shallow draft, but in spite of this fact it is extremely seaworthy. No small boat, it is a full-sized vessel, and those LST's that took part in the Sicilian operations crossed the ocean from the United States to North Africa under their own power.

. . . In spite of the heavy surf, the LST's ran up almost onto land before their huge bow doors opened and a complete invasion force, including Mark IV tanks, half-tracks, tank de-

U. S. Navy Photo

Familiar to ferry riders, these LST's are becoming equally well known on Italian beaches

Engagements

George T. Albert, U. S. Army—*Mary Driscoll
*F. J. Biondi—Virginia Willis
*Gregory Chabra, U. S. Army—*Jenny Chromey
William Jackson, U. S. Army—*Marjorie Wright
*Michael Konash—*Mildred Bourne, U.S.M.C.
H. P. Megargee, Jr., U. S. Army—*Jean Lafitte
Frank Niedhamer, U. S. Army—*Anne Stec
John Puls, U. S. Army—*Helen Kuehne
John J. Shannon, U. S. Army—*Mary Jane Wilson
*James L. Smith, U. S. Navy—Ruth Carswell

Weddings

Henry E. Arnesen—*Grace Conroy
*Guy West Atkins—Alma Moeller
Lawrence Bates, U. S. Navy—*Betty Ann Stewart
*Theodore G. Blanchard—Ruth DeBoer
J. W. Gibb, U. S. Army—*Dorothy Pickering
*Edward B. Kopetz—Elfrieda Neuman
Edward J. McCormack, U. S. Army—Leonara Wood
*Joseph Niedzwiecki—*Doris Moore
David Preis, U. S. Army—*Doris Walz
Robert Robbins—*Katharine Badger
Robert D. Rothrock, U. S. Army—*Harriet Rosenthal
*David Van Slooten—Blanche Wiegers
*Carl F. Wollner—Helen Parker

*Members of the Laboratories. Notices of engagements and weddings should be sent to Mrs. Helen McLoughlin, Associate News Editor, Room 1103, West Street.

stroyers, trucks, jeeps, and other motorized war machines poured forth.—*Sea Power, August*, 1943.

A sergeant who had been delayed while on a solitary mission in an unfamiliar stretch of jungle was overtaken by darkness when he still had four miles to go. He was on a typical trail, full of twists, drops, mud-holes, and protruding roots, and to navigate it at night without a flashlight would have been inconceivable. Faced with the unpleasant choice of spending the night where he was without a mosquito netting or floundering about and probably losing the trail altogether, he thought the situation over, then calmly groped around until he caught hold of a wire at the edge of the trail. He got home by feeling his way along the wire, realizing that a telephone line could be the shortest and safest distance between two points.—*Infantry Journal, Sept.*, 1943—*excerpt from the book "G. I. Jungle" by E. J. Kahn, Jr.*

HELP NEEDED

To All Members of the Laboratories:

The Laboratories is in urgent need of people for the following kinds of work:

Women	*Men*
Blueprint Operator*	Cleaner
General Clerical	Draftsman
Machine Shop Trainee	Machine Shop Mechanic
Messenger	Machine Shop Trainee
Restaurant Service	Messenger (under 17½ yrs.)*
Technical Assistant	Restaurant Service

*Needed in New York only.

Our previous appeals to the members of the Laboratories have been so successful that we again are asking you to assist us with our problem.

Will you make a canvass of your neighbors, friends and relatives for people who are not at present working or who are not actively engaged in the War Effort. These people need not be personally known to you. Experience may be of value even if not recent. Many current openings require no experience.

The Laboratories may not consider any individual who is now employed, or has been employed within the last thirty days, in war work or other essential civilian activity. This is an important point. Also, in the case of men applying for positions where considerable training on the job would have to be given, only those over age 37 or in class 4-F can be considered.

Will you suggest to any people who may be interested that they apply in person, not by telephone, Monday through Saturday between 10:00 a.m. and 4:00 p.m. or, for those who are now working, Monday and Tuesday evenings between 6:00 p.m. and 8:00 p.m. (New York only).

New Jersey

Employment Department, Murray Hill Laboratories, F. D. Leamer, *Personnel Supervisor*

New York

Women's Employment Department	Men's Employment Department
744 Washington Street	57 Bethune Street

H. W. Gillette, *General Employment Manager*

Projects and Functions—*an editorial by* John Mieg.

One of the first organizations to set up deliberately – rather than by casual evolution – a functional arrangement of departments was the A. T. & T. Co. I remember while taking a course at M.I.T., early in the 1900's, being impressed with the logic of functionalization as illustrated by its organization charts. An operating company where the work is similar in each area lends itself directly to such a scheme: plant must be constructed and maintained, traffic handled, engineering problems solved, and also there must be commercial relations in selling services and various corporate activities from legal to publicity. Duties are relatively definite and men can be chosen for specific responsibilities.

Whenever work is less stereotyped a functionalized chart is usually modified according to the peculiar abilities, interests and strengths of individuals. The chart is pure no longer but instead complex. A man promoted to new authority may take with him some responsibilities from his former job or slough off duties for which he has less aptitude in favor of others in which he has intense interest. The chart preserves a superficial appearance of functionalization but reflects its modification by personalities. The organization is built around individuals; and job specifications become secondary to man specifications. Some efficiency is gained thereby but some is lost for, other things being equal, functionalized operation although less flexible is inherently highly efficient.

Functionalized operation presupposes continuity in types of work without radical changes and is not necessarily adapted to an industry in a revolutionary phase of development. Remember the early days of vacuum tube repeaters. These were products of the "project" of accomplishing transcontinental telephony which had been assigned to the Research Department. This department designed, manufactured and installed that electronic equipment because those operations were outside the then experience of the groups which on a chart basis would have been responsible. In effect, the Research Department set up a "pilot plant" for long distance telephony. When the possibilities had been demonstrated the several operations passed to other departments which undertook also their further development.

Today, in the Laboratories most of the work is functionalized but there are many projects which cross departmental lines and in which functionalized departments act as subcontractors on specialized tasks.

It is this flexible combination of functionalized operations and of individual projects which accounts for much of the power of the Laboratories. It has expedited many important developments for our Armed Forces, just as it has in the past for the Bell System. It represents, however, a method of operation which could run on the rocks and is possible only in a coöperative coordination of experienced personnel whose first motivation is: get the job done.