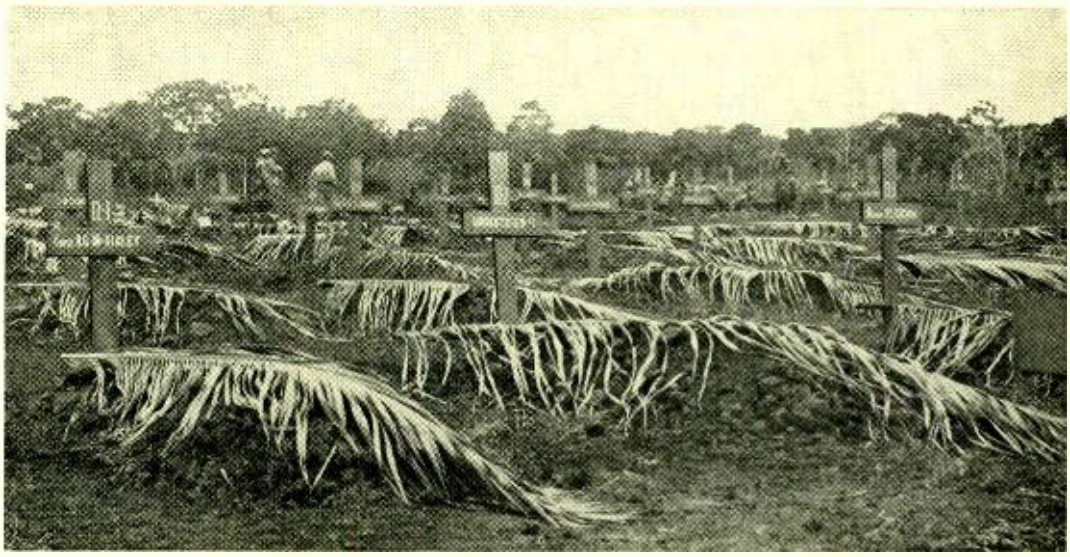
BELL LABORATORIES RECORD

DECEMBER 1942 VOLUME XXI NUMBER IV



"It is for us, the living . . . to be here dedicated to the great task remaining before us—that from these honoured dead we take increased devotion to that cause for which they gave the last full measure of devotion; that we here highly resolve that these dead shall not have died in vain. . . ."

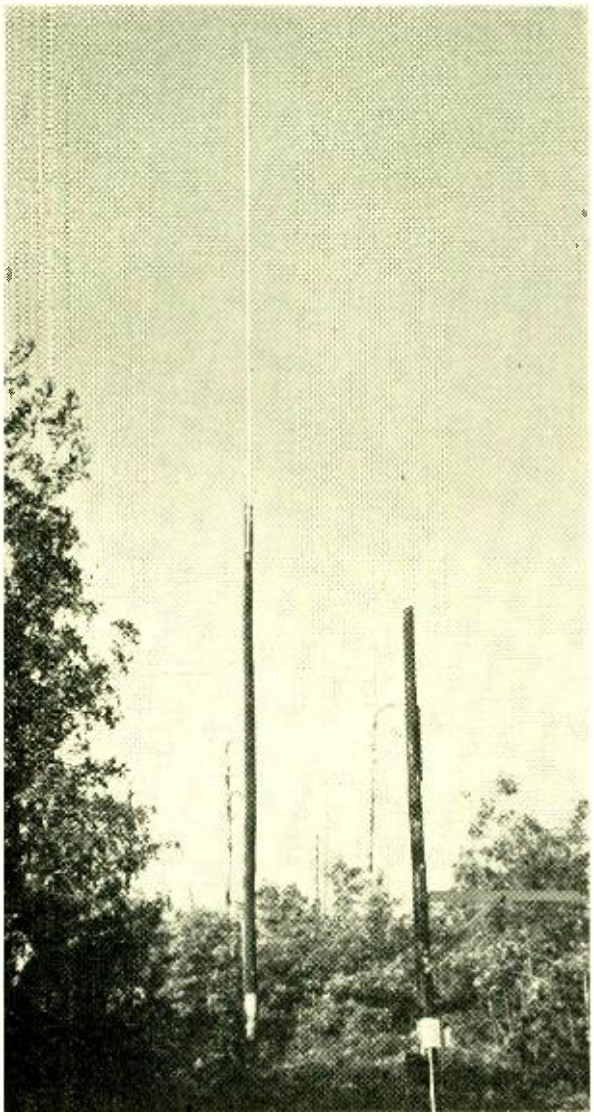
THEY lie in the Marines' Cemetery on Guadalcanal—Corporal McKinley, Major Brown, and between them one soldier, unidentified. Over each mound a palm frond, laid by a comrade instead of their loved ones.

And we—dedicated though we are to the great task remaining before us, honored though we have been by the Army and Navy Award—have we implemented that dedication by personal decision:

—to waste no time or material
—to salvage all useful scrap
—to conform loyally to rationing
—to protect our health
—to save regularly for taxes and War Bonds?

December begins our second year of warfare. Let it be a month for heart-searching, for review of our individual contributions to the war, for each of us to lay our own plans for further sacrifice. Without fear,

Let us go forward with the determination that each of us will have deserved a share in our final victory.



Waiting for Lightning

By J. J. MAHONEY, JR.
Protection Development

Some parts of the country are more subject to lightning than others. In such an area, near Lakewood, New Jersey, a number of steel masts were connected to about four miles of cable, buried for the tests in 1939 and not connected in any way to the Bell System plant. As shown in the headpiece, a tall steel mast is attached to the top of a wood pole to direct lightning to buried telephone cables. The lightning current is conducted over a wire to the shorter pole in the foreground, on which measuring equipment is installed.

The tests include measurements of the crest value of the lightning current which enters the cables, steepness of the wave front, the quantity of electricity in the lightning surge and the crest voltage across the insulation of the buried cable conductors. When plant damage occurs, an attempt is made to correlate it with the characteristics of the observed stroke. The ability of bare copper wires of various sizes to carry lightning current is being studied incidentally.

THAT lightning has been well selected as a symbol for the unpredictable, the present author will concede. In three years of trying to snare a thunderbolt, only three came near, and only one of those actually struck one of the tall steel masts put up as lures. But the bolts left their impress on registering devices, and as time goes on the knowledge gained will be valuable in the design of the buried cable plant.

Since months may pass before a stroke is observed, simple inexpensive devices must be used. Their record is in the permanent magnetism given them by the lightning. In one form these "magnetic links" are a straight

piece of laminated iron, about 1½ inches long, enclosed in a bakelite shell. These links are manufactured by the General Electric Company, and have been used for some time by lightning investigators. Mounted as shown at the left of Figure 1, they intercept a magnetic field of greater or less strength, depending on their distance from the conductor, and so will record currents from 500 to 10,000 amperes. The upper limit has been extended by the use of special brackets which provide greater spacings between the link and the current carrying conductor. For small currents D. M. Chapin has developed the "doughnut link" which is a pair of iron alloy rings, Figure 1 right, mounted coaxially on No. 6 wire. By different heat treatments one ring is made to detect currents from 60 to 300 amperes and the other from 150 to 900 amperes. With both types of links the entire range of currents likely to be encountered can be measured. The links are calibrated in advance by determining the intensity of magnetization that is given to them by known currents.

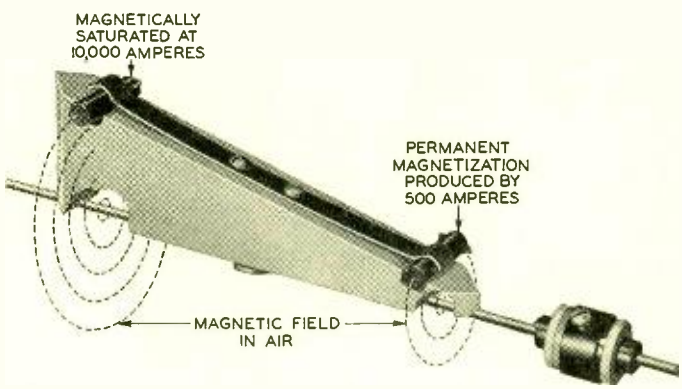


Fig. 1—The crest value of the lightning current is measured by the permanent magnetism given to small pieces of magnetic material that are arranged near the lightning conductor as shown above. They are called magnetic links

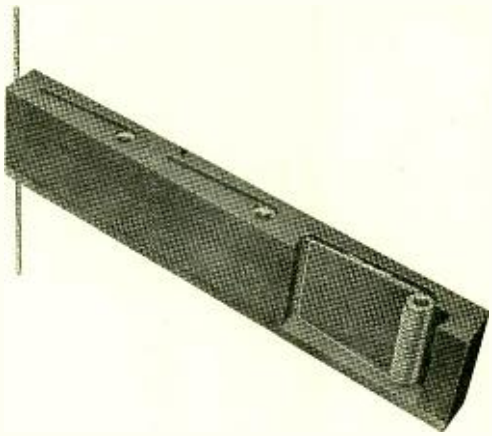


Fig. 2—The steepness of the wave front of the lightning surge is determined by a rectangular loop of wire near the lightning conductor, one side of which is a solenoid to enclose a magnetic link

To find the steepness of the wave front of a lightning surge a magnetic link is inserted in a coil which is coupled with the lightning conductor. The apparatus, Figure 2, has a rectangular loop of wire, one side of which is wound as a solenoid to enclose the link. When mounted a short distance from a conductor carrying a lightning surge, the link becomes magnetized and measures the peak current in the test circuit. From this and the crest value of the current in the lightning conductor, the time when the crest value of the discharge current is reached can be calculated from the resistive and inductive constants of the test circuit. Three loops are usually used at different distances from the conductor in order to increase accuracy of measurement.

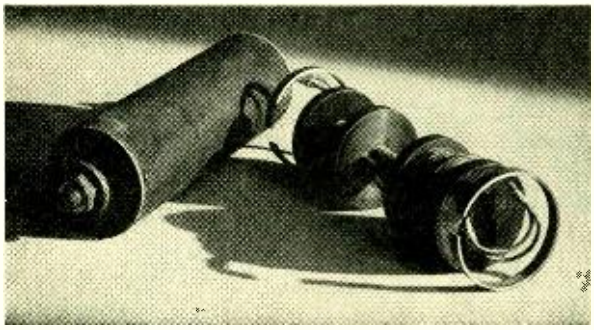


Fig. 3—The electrical charge of a lightning stroke is found by connecting in series with the lightning conductor a non-magnetic conducting tube within which are two air-core inductances of different values connected in series and shunted across the tube

The electrical charge of a lightning stroke is found by connecting a resistance in series with the lightning conductor and shunting an inductance across the resistance. The crest value of current in the inductance is measured by a magnetic link and the charge then calculated from the product of the current and the inductance divided by the resistance. These principles have been applied in a surge integrator, manufactured by the Westinghouse Electric and Manufacturing Company for lightning investigations on power lines. Several were used in the present studies and also a new one developed by E. D. Sunde which is more adaptable to the telephone plant. Its resistance is a conducting tube of non-magnetic material, Figure 3, within which there are two air-core inductances connected in series and shunted across the tube. A magnetic link is placed in each solenoid to measure the current. One inductance has five times the turns of the other to increase the range of the charges measured.

Peak voltages produced in telephone conductors by lightning are measured by a klydonograph which consists of a blunt electrode in con-

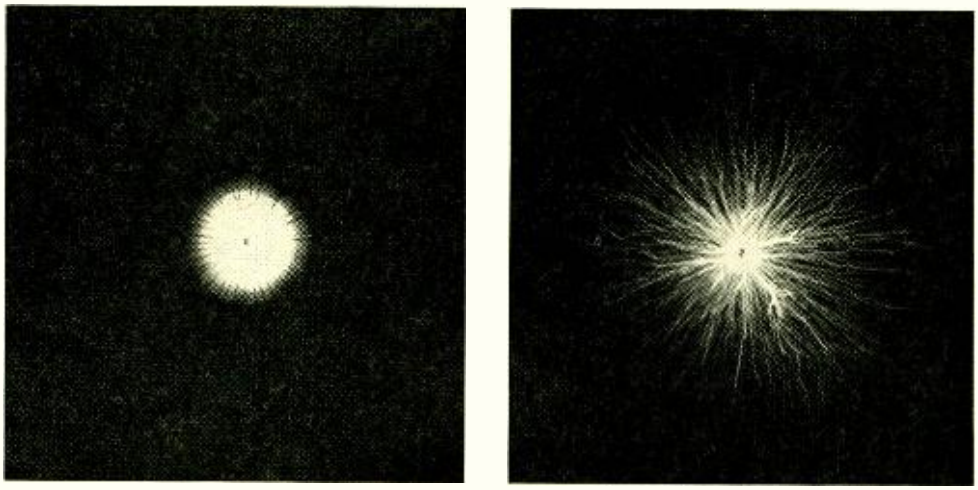


Fig. 4—Peak voltages are indicated by the size and appearance of figures made on a photographic plate by the lightning discharge from a blunt electrode held against the emulsion. This device is called a klydonograph. The pattern at the left was made by negative discharge of about 16 kilovolts. That at the right shows a positive pattern produced by 18 kilovolts

tact with the emulsion of a photographic plate backed with sheet metal and protected by a light-tight housing. Impressing potentials of 2000 volts or more between the metal backing and the electrode produces latent figures on the plate around the electrode. The magnitude and polarity of the applied voltage can be determined by the size and appearance of this figure after development of the plates, as shown in Figure 4.

To measure the ability of lightning current to fuse bare copper wires of different gauges, several short lengths are connected in series on a terminal strip, Figure 5, and inserted in the lead from each mast. Arcs between the ends of the bent wires carry the discharge past test wires which have fused.

All of the instruments used in these studies are simple to install, inexpensive and require no attention except that they are checked after each lightning storm by bringing a pocket compass near the links to test them for magnetization. Those found magnetized are removed for more accurate tests and the photographic plates of the voltage recorders in the circuits affected are developed. The cable conductors are checked at the same time to detect plant damage.

Of the three lightning strokes which have hit this experimental plant only one struck a mast and splintered it slightly. This occurred in July, 1939, before the buried cable and measuring equipment were installed. The second stroke came in October of the same year. It struck a tree and entered a test cable near it by arcing from the

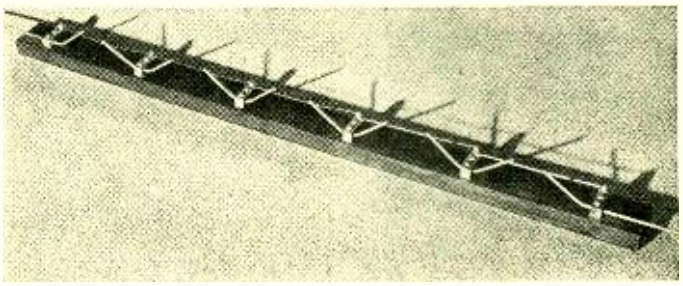


Fig. 5—To determine the ability of copper wires of different sizes to carry lightning current, short lengths are inserted in series in the lead from each mast. The bent wires carry the discharge past wires which have fused

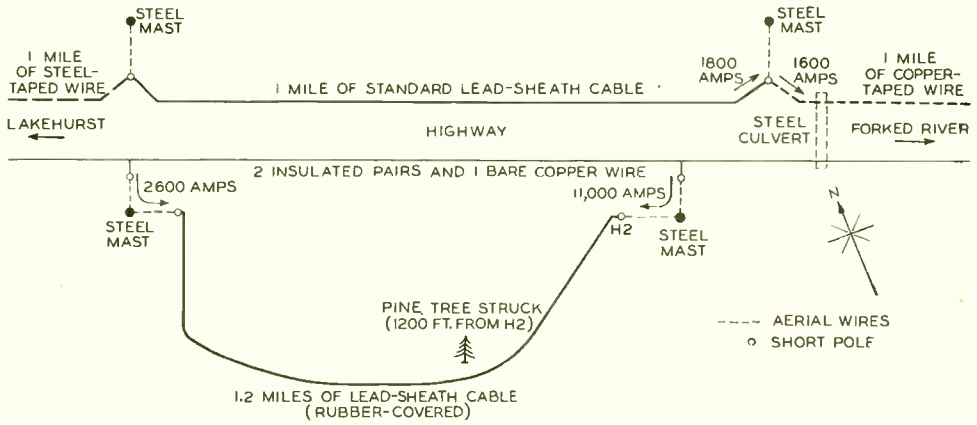
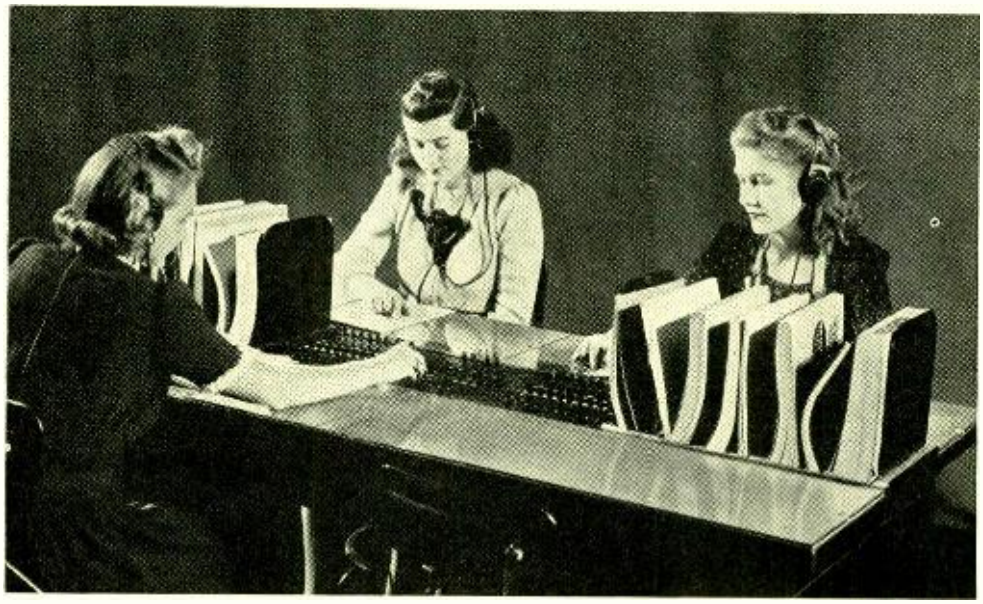


Fig. 6—Schematic layout of experimental plant used in lightning stroke of July 2, 1941

tree's roots. The nearest measuring equipment, approximately 500 feet away, recorded a crest current of 12,000 amperes. The cable was considerably damaged.

A third stroke occurred in July, 1941. It also hit a tree and the lightning current entered the same cable through tree roots. Peak currents from this stroke varied from about 1,600 to 11,000 amperes at different points of the installation, as indicated in Figure 6. Voltages ranged from two to ten kilovolts and the quantity of electricity from one to four coulombs. Surge recorders showed that the time from start to crest of the discharge was 16 microseconds. Bare copper wires of 24 and 28 gauge fused on the poles nearest the tree hit. A steel culvert conducted current to the cables buried north of the road. The cable which was struck was about one-half inch in diameter including its lead sheath and was enclosed in a vulcanized rubber covering about 1/16-inch thick. Small puncture marks were found in the rubber where the lightning current entered the sheath. No other damage was found.

Considering that only four miles of experimental plant were installed for this study, the rate at which strokes are being received—one per year—is considerably higher than might appear. Even in limited areas where lightning troubles have been high in one or two particular years, the strokes to Bell System buried cable have not been more than six or seven per 100 route miles per year for the "heavy" years. For the plant as a whole, the observed rate has been much lower.



No. 7 Information Desk

By S. J. BRYMER
Equipment Development

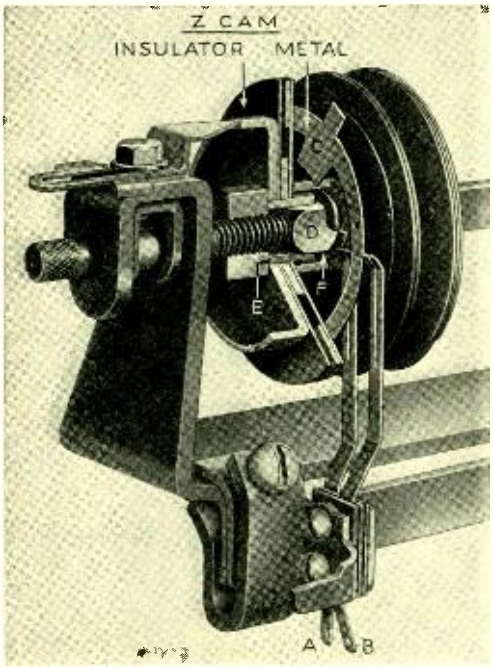
WITH the increase in telephone business occasioned by the war program and the corresponding load on manufacturing and installation facilities for telephone equipment, one of the problems encountered has been that of providing for auxiliary services such as information and intercepting traffic in offices which do not have separate auxiliary desks. Short schedules have not permitted building additional switchboard positions to handle the increased volume of the regular and auxiliary services. In some locations it has been necessary during the busier hours to cease use of the existing information and intercepting facilities at the switchboard to handle regular telephone traffic.

This removal of the auxiliary services from the switchboard is in line with the aims of development work which had been carried on to provide an economical auxiliary desk for small dial or manual offices. As a result, the No. 7 information desk has been made available in time for these emergency applications. It is primarily an equipment arrangement which consists of a completely assembled and wired unit with the necessary lamps and keys for incoming and outgoing trunks and a limited number of positional and desk circuits. The apparatus is installed in a commercially available table. It accommodates four operator positions, thirty incoming trunks and eight outgoing trunks and the circuits are similar to those now used in the standard No. 2 information desk, which serves somewhat larger centers.

The key panel of the No. 7 desk is equipped with keys for the trunks and

the telephone flash and hold circuits. A lamp rail between the rows of keys mounts the incoming trunk signal lamps. At the center of the table are the night alarm, transfer, make busy and supervisors' calling keys which are common to the desk. The thirty incoming trunks are multipled at each position. The eight outgoing trunk keys may be wired separately to provide two trunks for each position or multipled to give two per desk. All the relay equipment associated with the desk circuits is located on one unit and mounted on a relay rack, which is usually located in the terminal or switch room. The desk shown in the headpiece is equipped for twenty incoming trunks and has apparatus blanks in the space provided for the rest of the equipment. Directory racks, for auxiliary records, are located at each end of the table to be readily accessible to the operators.

The No. 7 desk can handle manual or dial information and intercepted traffic, as well as any of the toll auxiliary services.



Sequence Switch Cam

ONE of the elements of the panel-dial telephone system is a sequence switch which bridges a series of contact springs to close control circuits. It has in the past had a maximum of twenty-five separate cams which are mounted on a common shaft and rotate with the shaft. The position of the segments determines when contact is made with the springs and any desired timing of twenty-five signals can be obtained.

Recently there has been a demand for an additional control circuit in some panel offices and since the sequence switch was already used to capacity, it had to be modified in the field to add another cam. H. B. Brown of Switching Apparatus worked out a method of doing this which does not affect the other cams.

Limiting factor in existing switches was the length of the squared shaft; to extend it, a square sleeve was provided. In the field, the installer loosens the rear bearing and removes the shaft; then he removes the clamping nut and the old index wheel. Over the end of the shaft he slips the spring washer F and the sleeve E and over the sleeve the new index wheel and the cam, designated as "z"; after replacing the nut, the shaft is replaced. The assembly is then clamped as shown.

This solution was much more efficient than doubling the functions of existing cams would have been because that would have required apparatus and wiring changes in the field.

A Bridging Filter for Open-Wire Lines

By E. A. SCHRAMM
Transmission Networks Engineering

CONNECTING two small towns in rural districts, there are occasionally open-wire lines that have one or more toll stations bridged on them at intermediate points. In this way a trunk may serve as a toll line between the two towns, and at the same time give toll service at one or more intermediate points. When additional circuits between these towns are needed, as they frequently are under present conditions, often the most practicable way of providing them is to apply a carrier system to the existing open-wire line. The bridged lines, however, would seriously interfere with carrier operation, and thus the application of carrier would not be possible without modifying the method of connecting the bridged line to the through circuit.

One method of accomplishing this is to connect a low-pass filter between the drop line and the bridge point on the through line. Such a filter would pass voice frequencies into the drop line with almost no loss, and would prevent any high frequencies originating in the telephone set from getting on to the carrier channels. The high impedance of the filter to carrier frequencies, moreover, would avoid appreciable loss to the carrier frequencies and would also prevent carrier frequencies from interfering with the voice conversation on the drop line.

Although such filters have been used, they have one major disadvantage in that when the filter is unterminated, that is, when the subscriber hangs up, it presents an impedance to the through line that varies with frequency. At each resonance point the impedance will be so low as practically to short-circuit the line. This generally necessitates a filter with only one resonance designed to be midway between the voice and the lowest carrier channel. The peak of loss then occurs at a frequency that will not interfere with normal transmission. Its inherent restrictions, however, generally prevent this type of filter from meeting the requirements of the Bell System.

Another, and more flexible, method of connecting a drop line to a carrier circuit is to use a transfer set as shown in Figure 1. This consists of a pair of line-filter sets connected back

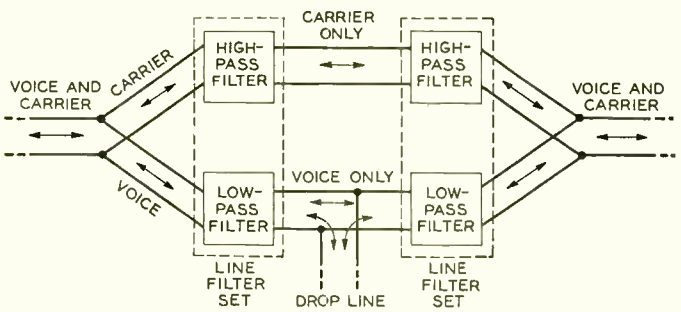


Fig. 1—A transfer set will avoid interference between through carrier and bridged voice circuits by separating the two channels at the point of bridging

to back. Each set consists of a high-pass and low-pass filter connected in parallel at one end so that the voice and carrier frequencies are effectively separated, and pursue independent paths until they are recombined at the other end. The bridged station may thus be connected across the voice path without causing any disturbance to the carrier circuit under any conditions. Although this provides a very effective solution of the problem, there are several factors that discourage the application of such transfer sets. In the first place, their use is hard to justify since four filters are required for each bridged telephone. In addition, the line filters now available are not recommended for outdoor use since they are not designed to withstand a wide temperature range.

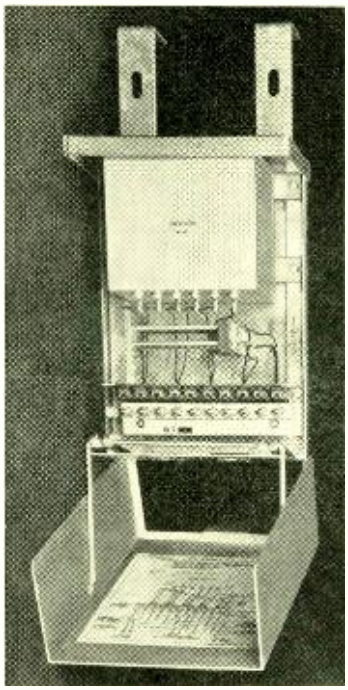


Fig. 2—The 133A filter set with cover open

Because of the restrictions to the use of both of these bridging arrangements, a new unit known as the 133A filter was developed. Relatively inexpensive, it was designed especially for outdoor use and is equipped with brackets for hanging from the crossarm of a pole, as shown in Figure 2. The filter itself is enclosed in the hermetically sealed can in the upper part of the mounting. Beneath it are two resistances used for phantom balancing, as described later, and along the bottom are the protectors and terminals. Leads from the open-wire lines are brought in through punched-out holes on the under side of the housing, where rain cannot readily enter. The front cover is hinged to give easy access to the protectors, and slides shut into grooves, which are arranged to deflect any wind-blown rain to the bottom of the housing, where it can escape without wetting the components.

This 133A filter is essentially equivalent to the four-filter transfer set of Figure 1, except it is a single unit instead of four. A circuit schematic is given in Figure 3. It is an all-pass network, and ideally would offer no loss at any frequency when terminals 5 and 6 are open, which is the condition when the subscriber's receiver is on the hook. Because of the resistance of the coils and condensers, however, there is a small loss at all frequencies. As shown by Figure 4, there is just one region of high loss, and the filter has been designed to bring this between the voice and carrier channels. The loss over the voice channel is not quite flat and as a result there is a small amount of distortion, but even with two filters in tandem, the distortion is small enough to be practically unnoticeable.

When the bridged telephone set is in operation, connected across terminals 5 and 6, the through loss over the voice band becomes about as great as though the telephone were directly bridged on the open-wire line, but this is of little consequence since the through and bridged voice channels are not both used at the same time.

The through channel loss at carrier frequencies is not affected by operation of the bridged telephone set, and remains unchanged regardless of the impedance connected to the drop terminals 5 and 6.

For transmission between the bridged telephone and either main line station, the filter passes voice frequencies and suppresses carrier frequencies. Figure 5 shows that the discrimination between voice and carrier frequencies is at least 30 db. Tests show that this is sufficient discrimination to reduce noise in the carrier channels produced by talking on the bridged telephone to a value that is not objectionable under the worst operating conditions; normally the value is so low as to be negligible. Approximately the same reduction in interference into the bridged telephone due to talking on the carrier channels will be afforded by the filter.

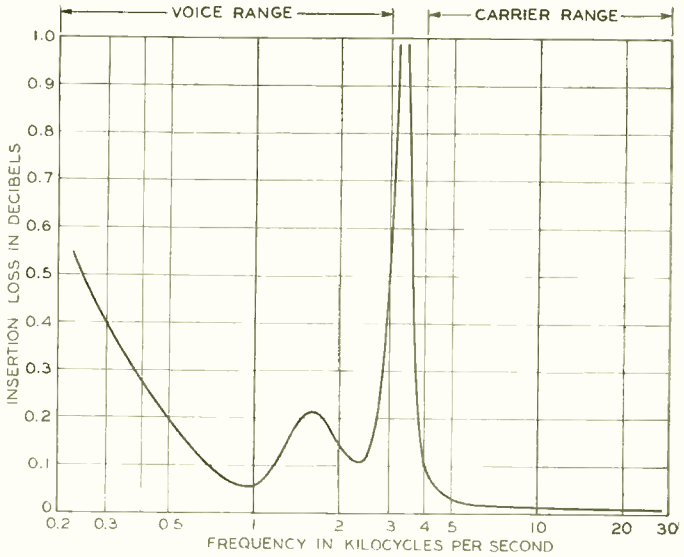


Fig. 4—Bridging loss of 133A filter on through line

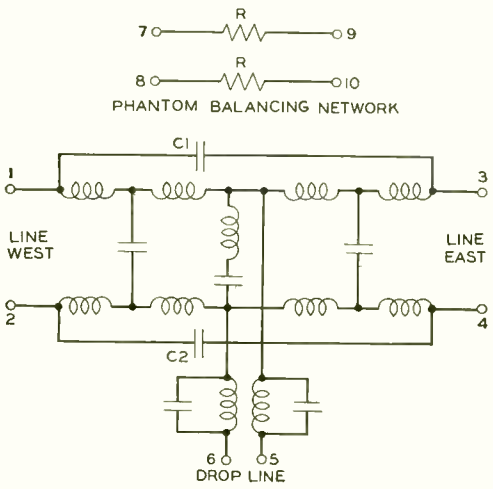


Fig. 3—Circuit schematic of the 133A filter

Since carrier frequency lines are carefully balanced to ground to equalize any longitudinal currents flowing over them and thus to reduce noise and crosstalk, it is necessary to insure that any inserted apparatus does not decrease the overall line balance. The 133A filter provides a high degree of balance over the useful voice and carrier frequency ranges. In the construction of this filter stabilized mica condensers were used in the carrier frequency branches, C1 and C2 in Figure 3, to secure the necessary stability under the extreme temperatures likely to be enountered in exposed locations. These condensers are potted in a case containing a high melting point compound, and the hermetically sealed container avoids the adverse effects of moisture.

Just as the two wires of an open-wire line must be balanced to ground to reduce noise and crosstalk, so must the pairs of lines used for a voice frequency phantom circuit be bal-

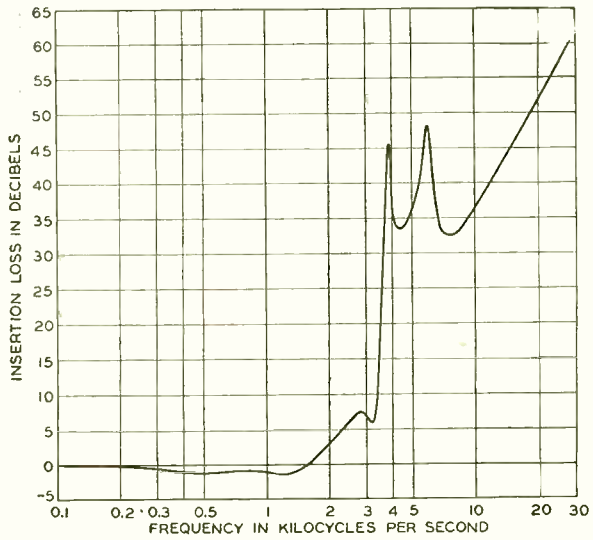


Fig. 5—Loss characteristic of 133A filter in relation to the drop line

anced to ground and against each other. Since the filter introduces a longitudinal impedance into one side of the phantom, the phantom circuit would be unbalanced unless its equivalent impedance were introduced into the other side. Fortunately, the design of the filter is such that its longitudinal impedance at voice frequencies may be approximated with a sufficient degree of accuracy by means of a resistance alone instead of a more expensive reactive network. When the line connected to the filter is one pair of a phantom circuit, therefore, the other pair is connected through the two resistances shown in Figure 3. This phantom balancing network is supplied as a component part of the 133A filter, since it will be required in most installations. In those installations where two bridged telephones are required, two 133A filters can be connected into phantomed-line pairs and provide satisfactory balance against each other without the need of the balancing resistances.

Pole mounted apparatus connected to open-wire lines is sometimes subjected to severe transient voltages during electrical storms, and provision must be made for its protection from high-voltage breakdown. The carbon block protectors connected from each filter terminal to ground are designed to flash over if the impressed potential exceeds about 800 volts, and thus limit the voltage applied to the filter. A particularly heavy voltage surge might permanently short the protector blocks and necessitate their replacement, however, and for this reason, and also to simplify periodic maintenance inspection, the cover of the filter is hinged for easy access.

Although the 133A filter was designed primarily for use with type-H* carrier telephone systems, its transmission performance is such that it may be used successfully on types D, G† and, under certain conditions, type-C carrier systems as well. Since the filter coils have magnetic cores, the modulation products produced in the filter by carrier currents at high levels may introduce noise in the carrier channels. This effect will not ordinarily be appreciable except when operating on a type-C system quite close to a terminal or repeater point.

*RECORD, *Nov.*, 1937, *p.* 76.

†RECORD, *Aug.*, 1936, *p.* 393; *Jan.*, 1937, *p.* 157; *March*, 1937, *p.* 210.

NEWS AND PICTURES OF THE MONTH

Three fifty-dollar War Savings Bonds—$112.50—will equip this soldier. He pledges his life—will you pledge your money?

William Wilson Retires

DURING the early summer of 1914 two young Englishmen who had been teaching at the University of Toronto made a visit to New York. They called on E. H. Colpitts whom they had met at meetings of the American Physical Society; and he offered them employment in the research group recently formed in the Western Electric Company's Engineering Department. The Wilson brothers, William and R. H., joined that group at a time when transcontinental wire telephony had just been accomplished; when its interest in electronics was increasing, and when radio telephony was just inside the horizon. And now, after twenty-eight years in the Bell System, a prolonged illness has brought about William Wilson's retirement on a well-earned pension.

William, the senior brother, was born in Preston, England, on March 29, 1887, to William and Jane (Whittingham) Wilson. His education was marked by honors and accompanied by scholarships. Two successive two-year scholarships carried him through the Manchester Grammar School—which the English call a "public school," meaning a high-tuition private school, staffed by honor men from the large universities. Graduating as "Science 6th," that is, in the highest scholastic group, he won a scholarship to Victoria University in Manchester. For entering a university he had more preparation than American universities require; for example, he had completed calculus, considerable physics and two years each of inorganic and organic chemistry.

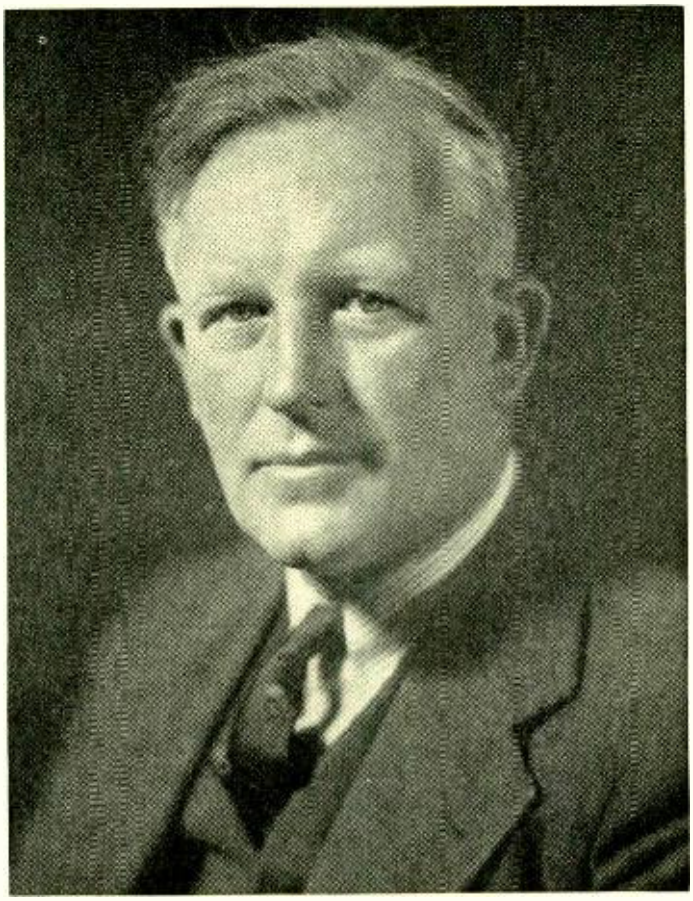
At Manchester he obtained a first class honor degree—and again there is a national difference since in the honors course the first year is about the same as the last year for the ordinary degree. At Manchester, still supported by the highest paying scholarships, he had the opportunity of doing work in radio-activity under Sir Ernest Rutherford for which he received the M.Sc. degree. Then followed two years at Cambridge, accompanied by sufficient scholarships to create a *cause celebre*, for in the same year he did the completely unexpected and won not only the Langworthy Scholarship but also the 1851 Exhibition Scholarship which was open to anyone in the British Empire—with the result that the rules were changed so that no equally brilliant successor could ever hold both scholarships. At Cambridge he had the formative opportunity of working under Sir J. J. Thompson, the pioneer in electronic investigations. There he received the usual degree, namely the B.A. His D.Sc. was received a year later from the University of Manchester. In the autumn of 1912 he accepted a position, as lecturer in physics, at the University of Toronto where he was followed a year later by his brother Harry who taught electrical engineering.

His background of training and research experience eminently fitted him for the work which was so rapidly getting under way in the Research Department. That he liked the work, appreciated its opportunities and accepted it as a career, is evidenced by his next act—his marriage to Ada M. Edlin of Manchester, which took place in East Orange on October 15, 1914.

His first work in the Laboratories was a mathematical investigation of the vacuum tube. This was the high-vacuum thermionic tube into which Dr. H. D. Arnold had developed the audion of Lee De Forest. In the meantime preliminary work on the radio telephone project had reached a point where plans could be made for trial transmission from the U. S. Navy antenna at Arlington, Virginia, to widely separated points such as Paris (France), Darien (Panama), Mare Island (San Francisco), the Navy station at San Diego, and Honolulu. Wilson was sent to San Diego to set up there receiving apparatus in an attempt to get C-W telegraph signals and spoken words from Arlington. On that work he spent the summer of 1915. In the late autumn he joined Arnold and Hartley at San Francisco for a demonstration of the newly developed system for radio telephony. Vail, President of the A. T. & T.

Co., talked by wire from New York to Arlington, by radio to Mare Island; there, Carty replied over the transcontinental telephone line that had recently been opened.

Returning from San Francisco, Wilson was put in charge of the research on the vacuum-tibe filament, the element which supplies the electrons whose motions are controlled by the other electrodes. For telephone repeaters vacuum tubes were needed whose filaments would have long life and reliability and at the same time supply the largest number of electrons per unit of heating energy. At that time, and indeed for many years later until the Western Electric Company's manufacturing department took over the task, all the tubes used in the Bell System were constructed in the experimental tube shop in the Research Department. This shop also made all the experimental glass-enclosed apparatus and model tubes which were required by the research program. The larger part of its production were the small tubes used for telephone repeaters and for the carrier current systems, which were rapidly coming into use as a result of a development which had paralleled that of long-distance radio telephony. For radio tubes many times more powerful than repeater tubes had already been constructed. The development of a commercially practicable system of radio telephony was of immediate importance to the Signal Corps of the U. S. Army; and demands for vacuum tubes both for transmitters and for receivers began to grow. Wilson added to his responsibilities the whole field of vacuum tube research, the development and design of tubes and their manufacture in the tube shop. Due to the war demands, the size of the shop rapidly expanded until he was responsible for the activities of several hundred mechanics, glass-blowers and manufacturing operatives.



WILLIAM WILSON

These enlarged responsibilities he carried until the autumn of 1933. He was thus intimately concerned with the important early days of the high vacuum tube. During that time the vacuum tube grew not only in types and in numbers produced but also in its power capacity. Tubes capable of handling a kilowatt or more of power were designed and constructed for broadcasting stations and for transatlantic radio. Subsequent development of tubes, incidentally, has been largely along the line of greater complexity with more electrodes and with ability to handle alternating currents of much higher frequencies than those used in those early days.

In 1925 radio research was added to Dr. Wilson's responsibilities. In 1927 he became Assistant Director of Research; and in 1934 he was placed in charge also of the research work on problems of wire communication.

The line of demarcation between wire and radio communication had long since broken down; both employ carrier currents, use vacuum tubes—although in general of markedly different power capacities—and have many basic principles in common.

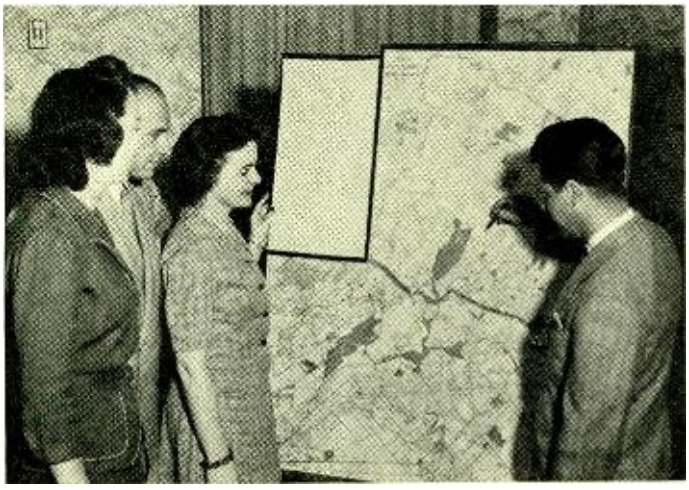
Late in 1936, in the reorganization which accompanied the appointment of Dr. Jewett to Chairman of the Board and of Dr. Buckley to the Presidency of the Laboratories, Dr. Wilson was appointed Assistant Vice-President in charge of the departments of Personnel and Publication. He thus became responsible for the relations of the Laboratories with its public and its employees. Not so startling a change of responsibility, after all, to anyone who knew of the remarkable success he had had during the difficult years of the First World War when a constantly expanding tube shop was working overtime and frequently under difficult conditions to produce equipment not only for the Army and the Navy but also to meet the multiplied demands of Bell Telephone Companies. Wilson's complete democracy, sympathetic interest in his fellows, practical experience and recognized good judgment made him again preëminently fitted to his position, just as his early academic training had fitted him to research.

Bill Wilson is now retiring. He leaves behind a large number of friends and intimates, of whom many look to him with gratitude for his assistance at various times in their own work and careers. This circle extends well beyond the Laboratories and the other Bell System Companies. He was active in the A.I.E.E. and particularly in the I.R.E., of which he was a Fellow, where he served as a member or chairman of various committees, *e.g.* Papers, Standards and Awards, as well as its Board of Editors. For three years he was a director of the I.R.E. He is widely known, particularly throughout the International Scientific Radio Union, for he was a member of the executive committee of its American Section, and attended several international conferences. He was also for a time President of the E. J. Hall Chapter of the Telephone Pioneers.

After retirement he expects to live on Cape Cod and will probably follow his avocation of painting. His immediate family consists of his wife and three sons; the eldest, William E., is working for the I. T. & T.; the next, David H., is doing mathematical analysis for an airplane company; and the youngest, Stephen E., has just been assigned in the U. S. Army to an officers' training camp.

Car Sharing

When it became evident early this year that the scarcity of gasoline and rubber was going to create many changes in the normal transportation habits of the members of the Laboratories at Murray Hill, a committee representing the several departments there was appointed to assist employees with their transportation problems. The committee obtained information as to residence address, hours worked and existing transportation arrangements of all the employees by circulating a questionnaire. The replies were filed alphabetically by communities and counties and from these data alphabetical lists showing employee's name and home address were prepared.



L. G. Rector explaining the pin map prepared for car sharing to Reine Levesque, R. E. Sward and Margaret Tammen

From this information pin

maps of the area within a fifty-mile radius of Murray Hill we e made and placed on display in the Club Lounge for a week. Each day during the luncheon hour committee members were in attendance to answer questions and assist employees in meeting fellow workers whose homes were found on the map in close proximity. Since then the lists have been on display in one of the conference rooms and have proven of considerable value to new employees in obtaining transportation information.

Many groups have been formed as a result of these efforts. One, which includes R. L. Towne, J. A. Burton, D. C. Bomberger, T. A. Durkin and A. W. Treptow, comes from Plainfield over Spencer Hill. They frequently see deer and one recent morning counted nine browsing in the fields. From Bernardsville come R. E. Sward, Miss A. Todd, J. M. Hardesty, I. C. Swicker, F. V. Haskell and J. A. Ashworth. They ran low on gas one evening and only by hope and coasting succeeded in stretching out their supply until they arrived within walking distance of a filling station. The real privation was a seven o'clock dinner.

The groups assemble after work at the North Parking lot but some occasionally have to wait near what has been dubbed the "Wailing Wall' for the arrival of tardy members.

Those responsible for the transportation plans are G. W. Lees, Jr., Plant Department, Chairman; R. E. Merrifield, General Service Department, Secretary; I. W. Whiteside, Personnel Department; A. J. Akehurst, Apparatus Development Department; and L. G. Rector, Research Department. This committee also functions as an advisory group in connection with applications for gasoline and bicycle tires. Their efforts have been effective in assisting employees to clear the required applications through rationing boards with a minimum of delay.

Mr. Gifford Accepts Chairmanship of Red Cross War Fund

The American Red Cross has announced that Walter S. Gifford has accepted appointment as Chairman of the 1943 Red Cross War Fund. March, 1943, has been designated as Red Cross Month, when the campaign will be held.

Mr. Gifford's service in this capacity will be the latest in a long list of important governmental, civic and community posts in which he has served. During World War I he served as director of the Committee on Industrial Preparedness of the Naval Consulting Board, and in 1916-18 was director of the U. S. Council of National Defense and Advisory Committee. Also in 1918 he was secretary of the U. S. Representation on the Inter-Allied Munitions Council in Paris. He was a member of the National Citizens

[This is a contribution to Victory by Arthur Folwell and Ellison Hoover—Courtesy New York Herald Tribune Syndicate]

Committee of the Mobilization for Human Needs, 1932-37. He is chairman of the Community Service Society of New York, the largest private social welfare agency in the country, chairman of the Executive Committee of the Greater New York Fund and a member of the Executive Committee of the U. S. Treasury War Bond Committee of the State of New York.

News from Men in Service

Captain Frank A. Parsons

"It has been quite a while since I last wrote, but I really have been seeing a good deal of this country. Since June I have been all through the South and Middle West engaged in special work for the Ordnance Department.

"I was promoted to the rank of Captain in July and since returning to Aberdeen I have been made Director of Training for the Bomb Disposal School."

Aviation Cadet Ralph D. Horne, Jr.

"Back at Nashville I passed all physical and mental or psychology tests for pilot and shortly afterward was sent out here to the Army Air Base at Santa Ana, California, for my pre-flight training. It is quite an intensive course though as yet quite elementary, serving more as a refresher for those having had algebra and physics and as an introduction to the subjects needed later.

"The weather here is a far cry from what I've been accustomed to, particularly at this time of year back in Massachusetts, where I was last year. Despite the California 'fogs' early in the morning, by ten o'clock the sun is out, and it is really hot.

"So far I haven't had a chance to take a look at the surrounding countryside as, with all new cadets on the Post, we are confined for a period of forty-two days. I should be able to get an impression of some of the rest of California in a couple of weeks."

William J. Conner, Jr.

(Mr. Conner, radio technician, second class, in the U. S. Navy, is stationed at Tompkinsville, S. I.)

"I have been at the section base here for about three weeks and have really been working. We are all awaiting an opening at school. As this is a fighting base we stand armed guard, move ammunition and repair ships for about eighteen to twenty-four hours a day. The work is very hard, being of a laborious nature, but it won't do any of us any harm. I feel much better physically and mentally since I have arrived. The food is very good even though it is very plain. If it is always this way throughout the Navy, I won't complain.

"I am just close enough to have to feel that I am not away but it is impossible for me to get home because of traveling time with the exception of an occasional week-end."

(Just before going to press the Record received another letter from Mr. Conner saying that he had been transferred to the Radio Material School, Naval Research Laboratory Station, Anacostia, D. C.)

* * * * *

Richard C. Fiala is now in the Signal School of the Fleet Marine Force Training Center at Hadnot Point, New River, N. C.

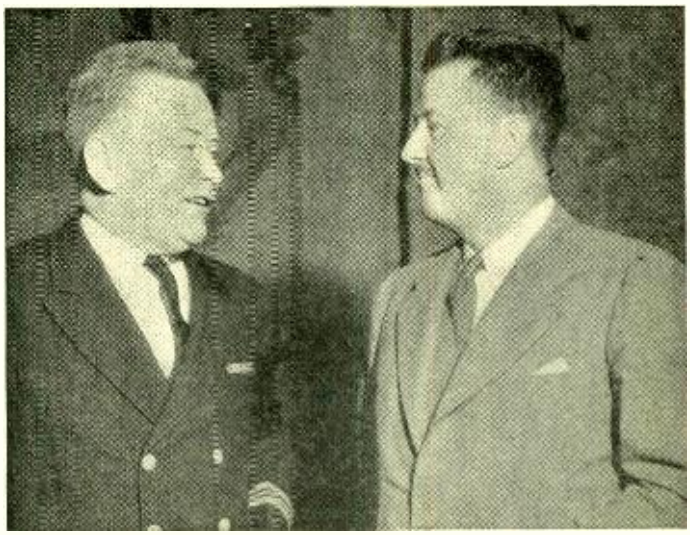
Major Emil Alisch has recently been transferred to an Infantry Division at

Papago Park, Phoenix, Arizona, where his present assignment is Executive Officer of a Battalion.

CHARLES L. SEMMELMAN has been promoted to the rank of First Lieutenant. He is in the Signal Corps and is at present stationed at Fort Monmouth.

MEMBERS OF THE LABORATORIES who have been granted leaves of absence to enter the U. S. Army since those tabulated in the last issue of the RECORD are: WILLIAM B. ADAM, HERBERT BAKER, RICHARD C. BENKERT, HENRY J. BOYLE, HERBERT J. BRAUN, WALTER A. FARNHAM, EUGENE H. JOCKEL, WILLIAM F. JOHNSON, CADET FRANK L. KRZYSTON, CHARLES W. PETERSON, LIEUT. THEODORE N. POPE, HARRY G. REIMELS, SEWELL E. SMITH, JR., and WILLIAM J. TIERNAN; the U. S. Navy, CHARLES H. DALM, EDWARD B. GEMPLER, LIEUT. MARGARET GRAY and FRANK C. WANITS; and the U. S. Marines, SERGEANT WILLIAM R. DAVIS, EDWARD A. FERN and JACK ROBACK.

PERSONAL LEAVES OF ABSENCE have been granted JAMES O. MCDERMOTT, U. S. Maritime Commission; JAMES G. MOTLEY, National Defense Research Committee; and to THOMAS M. PEPE and FRED J. SCHWETJE to take the Civilian Pilot Training Course.



Lieutenant-Commander N. C. Youngstrom with C. J. Gustafson, a former member of the Western Electric Post, American Legion, recently returned from Detroit

MOBILE PUBLIC TELEPHONES FOR FORT CUSTER

AS PART of the Michigan Bell Telephone Company's all-out effort to give Uncle Sam's fighting men convenient, pleasing, thoughtful and personal telephone service, the "Telecoach," mobile public telephone unit, has been assigned to active duty at Fort Custer, Michigan.

It is completely equipped with telephone booths and an attendant's position, as well as a number of interesting communication displays and exhibits.

At Fort Custer it is being used to furnish service men with attended public telephone service on a temporary basis until such time as a special building can be constructed at the same location to house a battery of ten booths and two operators' positions.

The "Telecoach" has four lines to the Battle Creek central office, three of them termi-

Lieutenant Colonel A. J. Engelberg (left) and Major W. E. Stevens at the annual dinner of the Western Electric Post

Mobile public telephone unit assigned to Fort Custer by the Michigan Bell Telephone Company

nating direct on the long-distance switchboard. Three operators serve as attendants, making change, getting rate information, and assisting the soldiers in placing calls.

Greatly appreciated by the soldiers, attended service is particularly helpful in peak hours when there may be delays on toll calls. In such cases, the operator in attendance can explain the situation and Johnny Doughboy can come back later when his call is ready. He doesn't have to go back to the end of the line to try again. There's no change-making problem, and more calls can be handled in a given period of time—all of which means better telephone service for service men.

American Legion Post

The annual dinner and installation of officers of Western Electric Post 497, American Legion, was held on October 20 at the Hotel Taft. Laboratories' members comprise about half of the 300 odd members of the Post and several participated in the program of the evening. H. A. Doll, a Past Commander, conducted a program honoring the ten Post members who are serving a second time in the Armed Forces of our country. Army and Navy schedules permitted four of these to attend the meeting. These were Lieutenant Commander N. C. Youngstrom of the U. S. Navy, Lieutenant Colonel A. J. Engelberg of the Signal Corps, and Major W. E. Stevens of the Engineers' Amphibian Command, all from the Laboratories, and Lieutenant F. C. Williams of the U. S. Navy from the International Standard Electric Corporation. Those who were unable to attend sent messages which served to add to the gaiety of the evening.

The officers for the 1942-1943 year were installed by the New York County Commander of the American Legion, Hugh A. Carson. The new Post Commander is H. R. Allen of the Western Electric Company at 395 Hudson Street, succeeding L. E. Gaige of the Laboratories. Members of the Laboratories who were installed as officers are O. H. Danielson, First Vice-Commander; A. H. Inglis, Second Vice-Commander; J. R. Bardsley, Adjutant; J. E. Ranges, Assistant Adjutant, and L. H. Allen, Finance Officer. Laboratories' members on the Executive Committee are L. B. Eames, E. C. Hagemann and F. J. Prachnaik.

One of the guests of the evening was G. F. Fowler, who is coördinator of all air raid

Lock Those Lips!

A Hawthorne Works girl whose job is on a government project was asked by an inquisitive friend if she knew what her department was making.

"Sure I know what we're making," she replied.

"What is it?" inquired the friend. "I won't tell a soul."

"All right then," answered the girl. "We're making washing machines."

"Washing machines?" exclaimed the friend.

"Sure," asserted the Hawthorne girl. "Washing machines—to clean up the Axis!"

And that's a pretty good way to clean up nosey inquirers and prevent leaks that might benefit our country's enemies.

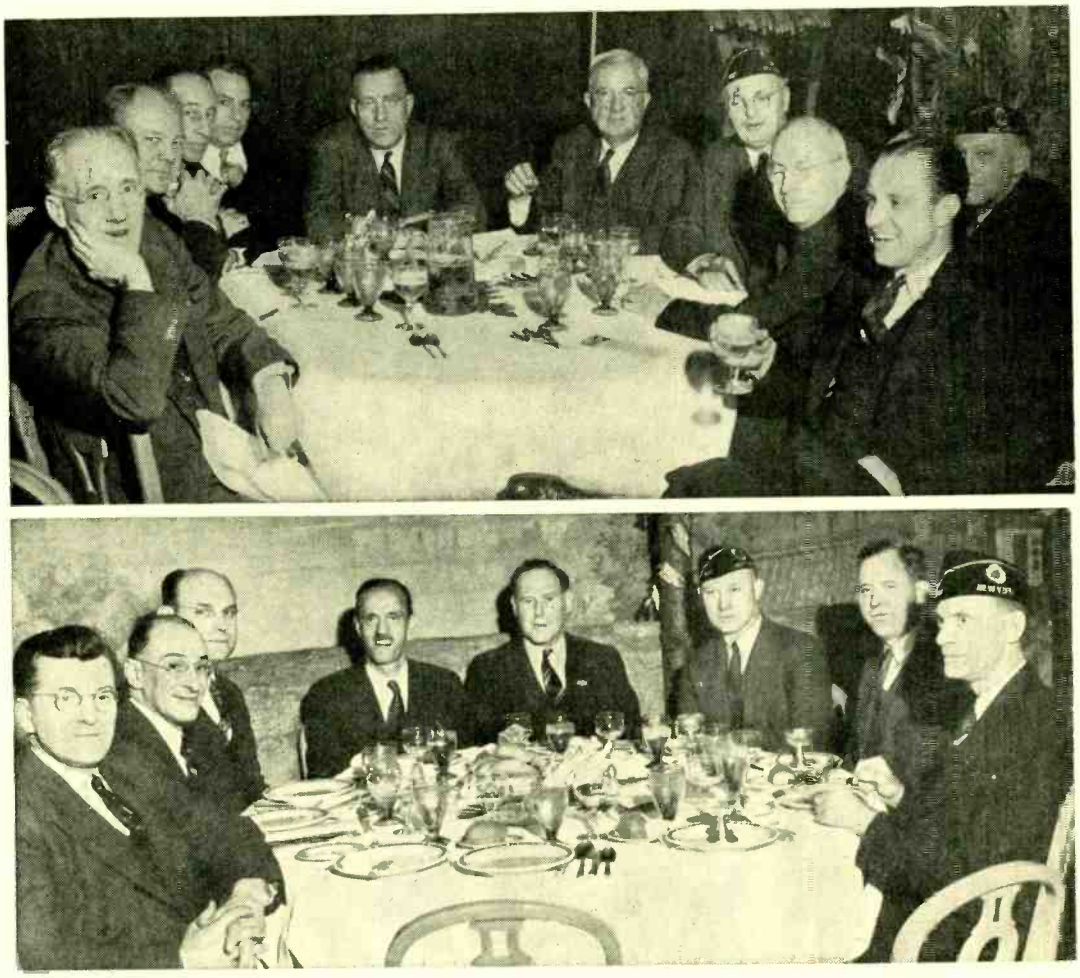
protection activities of the Laboratories. About 140 Post members at the various Laboratories' locations have been engaged in this important activity under the name of "Auxiliary Corps." The functions of the Auxiliary Corps were described in the October, 1942, issue of the RECORD.

NEWS NOTES

O. E. BUCKLEY attended the autumn meeting of the National Academy of Sciences held in Washington on October 26.

JAMES J. PILLIOD, General Manager of the Long Lines Department of the American Telephone and Telegraph Company, has been given a leave of absence to take up a civilian assignment in the War Department in Washington. His work will be in the Production Division, Services of Supply. This division is in charge of Brigadier General W. H. Harrison.

F. R. LACK tendered his resignation as Vice-President of the Western Electric Company and was given a leave of absence, effective November 1, when he entered the services of the United States Government. The organizations that reported to Mr. Lack now report to C. R. Smith, Manager of



AT THE ANNUAL INSTALLATION DINNER OF WESTERN ELECTRIC POST

Above—I. MacDonald, H. Kuhlman, A. Mayer, F. T. Deputy, H. D. Benson, W. E. Mougey, A. H. Leigh, E. Vroom, S. J. Stranahan and G. Dobson

Below—C. D. Davidson, J. W. Kelsch, F. J. Prachnaik, E. C. Hagemann, K. F. Rodgers, J. R. Bardsley, V. E. Legg and J. E. Ranges

Government Radio Contract Service, who reports to Vice-President Hosford.

THE ANNUAL CHRISTMAS CONCERT of the Bell Chorus of New York will be held on December 17. This mixed chorus is made up of members of Bell System companies in the metropolitan area, including several individuals from the Laboratories. The concert program will include selections of Bach, Brahms, Mozart and Schumann and traditional Christmas Carols and Negro Spirituals. Additional information and tickets may be obtained from HILDA MULLER, Ext. 1902.

LOUIS M. ALLEN

LOUIS M. ALLEN RETIRES

L. M. ALLEN, Field Development Engineer of the Switching Development Department since 1928, retired on October 31 after serving the Bell System for over thirty-six years. His work in the telephone industry began as inside night maintenance man for the New York Telephone Company in 1906. After a series of advancements he became night wire chief for Manhattan and the Bronx in 1912. In 1918 he was loaned, first to the New Jersey Bell Telephone Company and then to the Western Electric Company, to gather information on the operation of the semi-mechanical systems installed in the Mulberry, Waverly and Branch Brook offices in Newark.

Mr. Allen was officially transferred to West Street in 1919 when he became a member of the circuit design group; and was placed in charge of this group four years later. Since 1928, as Field Development Engineer, he had charge of the trial and initial installation work of the local systems development projects.

An authority on central-office maintenance, Mr. Allen, while with the New York Company, taught classes in maintenance practices and compiled a bulletin of maintenance instructions which was used for many years. He is also co-author of a book on central-office maintenance.

* * *

AT THE OCTOBER MEETING of the Executive Committee of the Telephone Pioneers of America it was voted that the election of officers for 1943 would be carried out by the Pioneers' General Assembly through the use of mailed ballots. This procedure was agreed upon in the absence of the usual meeting of the General Assembly, cancelled because of travel conditions. Fifteen new councils were authorized by the committee at its meeting, 25 others having been authorized previously this year. The number of Pioneers now exceeds 66,000, slightly over 10,000 being life members.

THE SOUND PICTURE *Trouble Underground* was shown in the West Street auditorium during the week of November 2 before over 1,300 members of the Laboratories. The film showed the numerous steps taken to safeguard telephone service in connection with a reported trouble in underground cable which resulted in the replacement of a section of large size cable. The picture was prepared by the A T & T through the co-operation of the New York Telephone Company, the scene being New York City and the characters employees of the New York Telephone Company. All arrangements for showing the film, including the distribution of tickets covering the eight shows, were handled by W. C. F. Farnell of the Bureau of Publication.

R. J. HEFFNER attended a conference of assistants to the personnel officers of the Bell System companies, held at 195 Broadway on October 13, 14 and 15. The principal subject under discussion was that of manpower problems with which the Bell System is likely to be faced during the war period.

Shellac that would make six records will waterproof the primer cups of 100,000 rounds of .30-caliber cartridges.

R. C. JONES presented a paper, *A Matrix Treatment of Optical Systems, with Polarizing Birefringent and Optically Active Elements*, before a joint symposium of the Optical Society of America and the American Mathematical Society which was devoted to the subject *Mathematics in the Field of Optics*. The meeting was held in New York City on October 30.

E. L. NORTON's article, *Magnetic Fluxmeter*, published in the June issue of the RECORD, was abstracted in a recent issue of *Nature* (London).

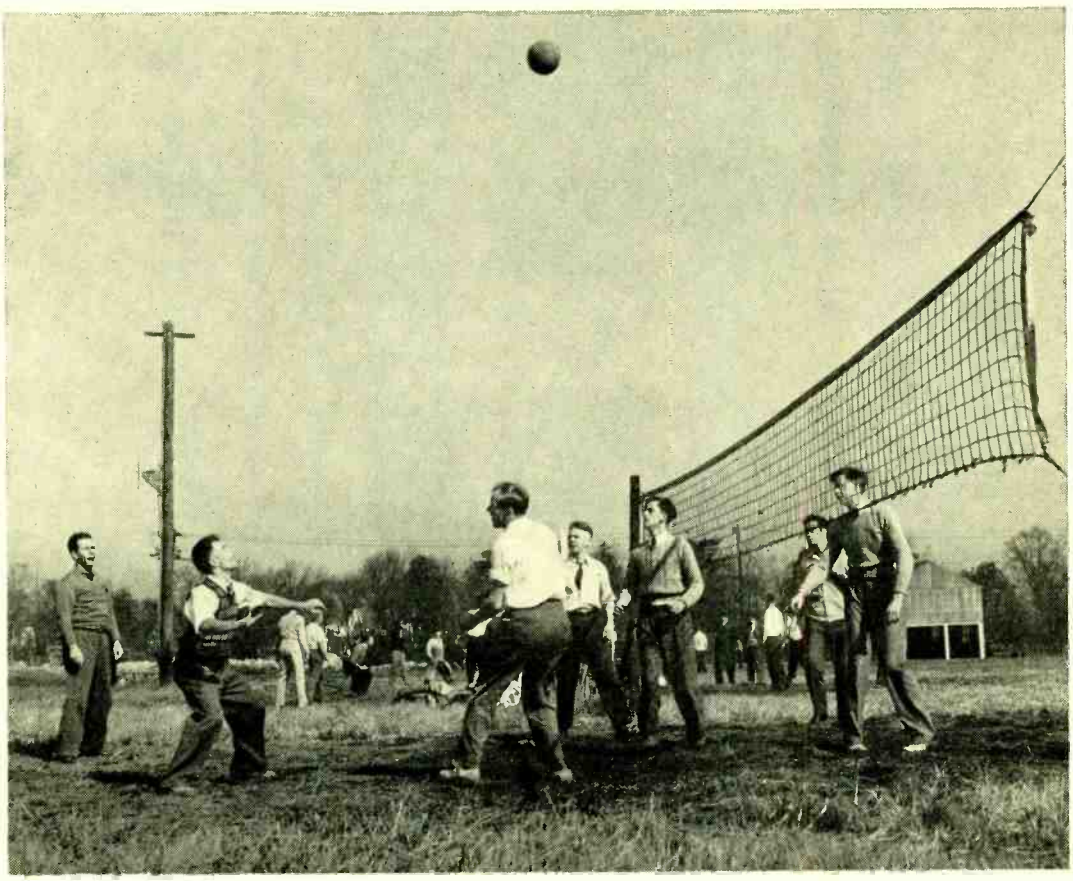
E. E. SCHUMACHER visited Cleveland to attend the Metals Congress and participated in the technical sessions of the A.S.M. and A.I.M.M.E. W. E. CAMPBELL gave an oral presentation of a paper on the *Tarnishing of Silver and Silver Alloys*. Mr. Campbell also visited Pittsburgh in connection with contact studies being carried on in panel offices.

J. H. INGMANSON and J. B. HOWARD visited the Point Breeze plant and the Western Electric Company in connection with rubber-covered wire problems.

R. M. BURNS gave a talk before the Lehigh Valley Section of American Chemical Society on *Prevention of Corrosion*. Mr. Burns and K. G. COMPTON attended meetings of the Electrochemical Society that were held in Detroit.

C. D. HOCKER attended the Executive Committee meeting of the American Society for Testing Materials held in Philadelphia on October 12.

A. S. WINDELER of Point Breeze was at the Graybar-Varick Building in connection with special testing work.



Volley ball at noontime at the Whippany Radio Laboratory

Chosen by Lot

BIOGRAPHIES OF MEMBERS of the Laboratories chosen by lot from those who have been with us more than six months and less than twenty-one years follow.

* * * * *

IF YOUR PIANO needs tuning, just take BERNARD OLIVER home with you; right after cocktails he'll have it apart, take the slack out of its wires, and put it back together before dinner time. Still a Californian at heart, he refuses to own an overcoat, and puts up the top of his car only when his passengers coerce him. He holds a Ph.D. degree from Caltech, and yet is known as "Barney" by his associates in the erstwhile Television Research group. They say he is an exceptionally quick thinker and a wizard with vacuum tube circuits but never impatient when someone asks for help on a difficult problem.

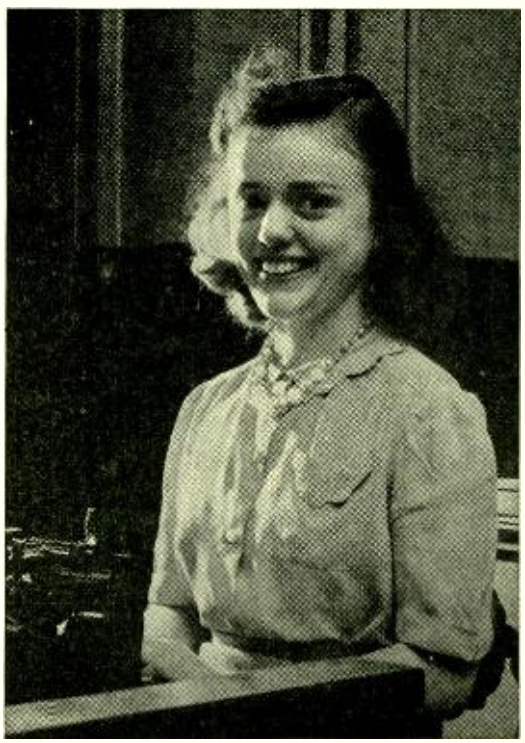
BERNARD M. OLIVER

Mr. Oliver's first important project was a sweep circuit for cathode ray receiving tubes. The motion of the point of light must be absolutely linear with respect to time in both directions of the sweep. Acting entirely on his own initiative he investigated the various physical conditions necessary to secure that result and developed magnet coils, amplifiers, and distortion correcting networks which operated successfully. Within the last year or so Mr. Oliver has been engaged on government work.

To complete the picture, Barney is single, lives in The Village, has one degree from Stanford and two from Caltech; attended the Technische Hochschule in Darmstadt for a year; is interested in music and the drama when time permits.

* * * *

"GENE" ANTHES is a bright ray of sunshine in Transcription, not only for her red hair



EUGENIA ANN ANTHES

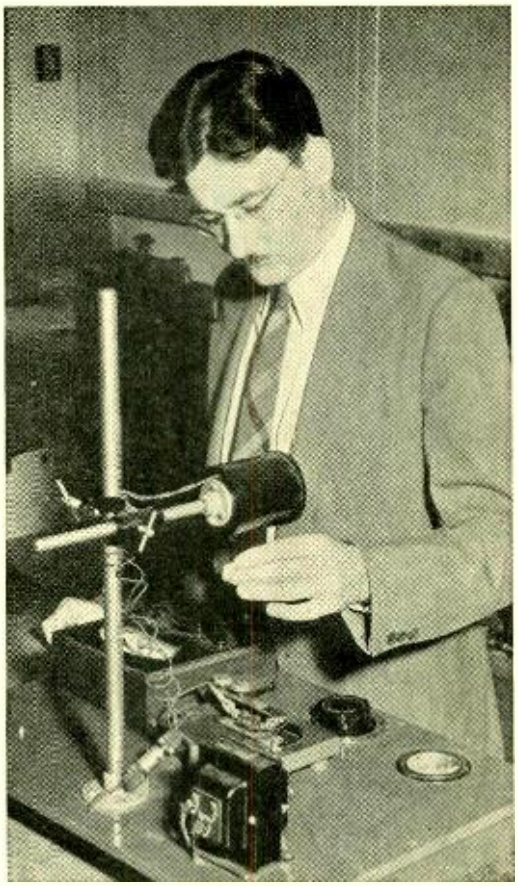
but for her cheery disposition. During the three years that she has been with us—ever since she graduated from the Elizabeth High School—her career has followed the familiar pattern—mail, mimeograph and finally typing. Some day she hopes to be a stenographer. If she has other hopes she must have laid them aside "for the duration."

* * * * *

THE METALLURGICAL GROUP has been keeping J. H. SCAFF busy for quite a while working on high purity metals, so that he is an authority on the effects of minute amounts of non-metals as impurities. These usually have an influence on properties wholly disproportionate to the quantities present. The work has led to a number of contributions to metallurgical techniques for removing or controlling these impurities in metals. For the past two years, Mr. Scaff has been active on war projects where his earlier experience in this specialized field of metallurgy is being applied to advantage.

Mr. Scaff is a native of Mayfield, Kentucky. After education in the local public schools, he entered the University of Michigan, receiving the degree B.S.E. in Chemical Engineering in 1929. He joined the Technical Staff of the Laboratories immediately after graduation.

Anticipating a move to Murray Hill, the Scaffs moved from Long Island to Madison some three years ago. They have three children—a boy and 2 girls—a "mixed foursome and a caddy." Mr. Scaff is a member of Madison's auxiliary police, which training, he says, comes in handy at home. He plays golf, tennis or goes hunting when he has a chance.



J. H. SCAFF

NEWS NOTES

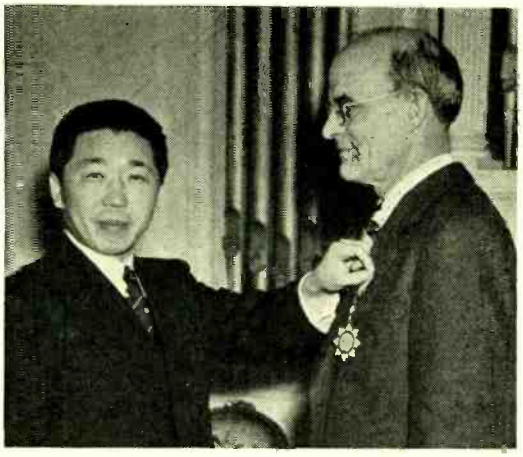
AT THE HAWTHORNE PLANT of the Western Electric Company C. S. Fuller discussed plastics; R. M. BURNS, finishes and chemical problems; K. G. COMPTON, finishes and corrosion; D. W. GRANT, the manufacture of special transformers; W. G. LASKEY and A. W. DASCHKE, the production of meters; R. C. KOERNIG, quality matters relating to station equipment and R. M. MOODY attended a Quality Survey of step-by-step relays; F. A. KORN, various general questions on dial systems; H. J. BERKA and G. W. MESZAROS, the testing of central-office power equipment; and W. W. BROWN, the design and manufacture of the new non-metallic operators' chairs.

Enough steel goes into an ordinary electric washing machine to make six 3-inch shells for a 75-mm. field howitzer.

H. W. HERMANCE visited Buffalo to discuss contact maintenance problems.

J. M. FINCH attended a meeting in New York of Sub-Committee I of Committee D-6 A.S.T.M. on testing methods for commercial and industrial papers. He also attended a meeting of Committee D-9 which is concerned with test methods and specifications for insulating materials. This work includes various insulating papers.

THE OCTOBER ISSUE of Proceedings of the



International News Photo

Dr. Wei Tao-ming, Chinese Ambassador to the United States, presents China's Medal of Honored Merit to R. R. Williams

I.R.E. contains *A New Direct Crystal-Controlled Oscillator for Ultra-Short-Wave Frequencies* by W. P. MASON and E. I. FAIR.

W. J. ALBERSHEIM and DONALD MACKENZIE have received the annual award for the outstanding article published in *Journal of the Society of Motion Picture Engineers* during the year 1941. The title of the paper was *Analysis of Sound Film Drives.*

THE MEDAL OF HONORED MERIT of the Republic of China has been presented to ROBERT R. WILLIAMS "for his services to the world and to China in discovering the synthetic preparation of Vitamin B-1, and for his help in solving the nutrition and drug problems of China." The presentation was made by Dr. Wei Tao-ming, Chinese Ambassador to the United States.

DR. WILLIAMS presented the Linsly R. Williams Memorial Lecture before the New York Academy of Medicine on November 12. The subject of this lecture was *Nature and Man.* Part of his talk covered recent discoveries of vitamins and their importance in nutrition and in this connection he illustrated the structures of various vitamins by the projection of Kodachrome motion pictures of models. Dr. Williams repeated this lecture on November 13, before the College Women's Club of Summit. The motion pictures were taken by F. L. HUNT who also supervised their projection at both lectures.

F. J. GIVEN, with F. E. Hanson of the Western Electric Company, attended a conference in Philadelphia of the Radio Industry held under the auspices of the Army, Navy and War Production Board. The conference was held for the purpose of expediting the production of capacitors for war-communication equipment.

A. J. CHRISTOPHER visited the Tobe-Deutschmann plant at Canton, Mass., to discuss the manufacture of mica and paper capacitors.

J. R. TOWNSEND spoke on *Conservation of Critical Materials in the Telephone Field* at

Noon hour at Murray Hill—touch football

a meeting of The Franklin Institute held in Philadelphia on October 28.

WITHIN RECENT WEEKS three retired members of the Laboratories passed on. HENRY OLSEN, a former draftsman in the Systems Development Department, died on September 30. Mr. Olsen retired with a disability pension in 1927 following sixteen years of service.

GEORGE B. ROCH, who retired in 1938 after twenty-five years of service, died on October 8. Before his retirement he had been a group supervisor in the Development Shop where he had been responsible for "short order" work.

OTTO MULLER, formerly an instrument maker in the Development Shop, died on October 31 in his ninety-fifth year. Mr. Muller, known throughout the old Engineering Department as "the grand old man," retired in 1928 after thirty-five years of service.

THE "BELL WALTZ," written by Don Voorhees and based on the theme music he composed for *The Telephone Hour*, has just been published by Carl Fischer, Inc., New York City, and can now be secured at leading music stores in the United States and Canada. For publication, Mr. Voorhees has written it as a piano solo.

Transportation Conservation
Have your Christmas at home

"THE TELEPHONE HOUR"

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

DECEMBER 14, 1942

My Heart Stood Still from "The Connecticut Yankee" — *Rodgers*
Oh! What a Beautiful City — *Spiritual*
James Melton — *arr. Boatner*
A Kiss in the Dark — *Herbert*
Orchestra
O Cease Thy Singing Maiden Fair — *Rachmaninoff*
Mexican Serenade — *Sacco*
James Melton
Roumanian Rhapsody — *Enesco*
Orchestra
Recondita Armonia from "Tosca" — *Puccini*
James Melton

DECEMBER 21, 1942

O Come All Ye Faithful — *Traditional*
The First Noël — *Traditional*
Away in a Manger — *Spilman*
Hark! the Herald Angels Sing — *Mendelssohn*
John Charles Thomas and Chorus
Children's Fantasy
Orchestra and Chorus
My Sore Thumb — *Mana-Zucca*
Sailormen — *Wolfe*
In Sleepy-Land — *Mana-Zucca*
John Charles Thomas
O Little Town of Bethlehem — *Redner*
Chorus
College Days
Orchestra
The Lord's Prayer — Malotte
John Charles Thomas and Chorus

DECEMBER 28, 1942

One Night of Love — *Schertzinger*
Funiculi, Funicula — *Denza*
Grace Moore
New Year's Eve Medley
Orchestra
Who'll Buy My Lavender — *German*
Grace Moore
Hungarian Rhapsody No. 2 — *Liszt*
Orchestra
Il Est Doux, Il Est Bon from "Herodiade" — *Massenet*
Grace Moore

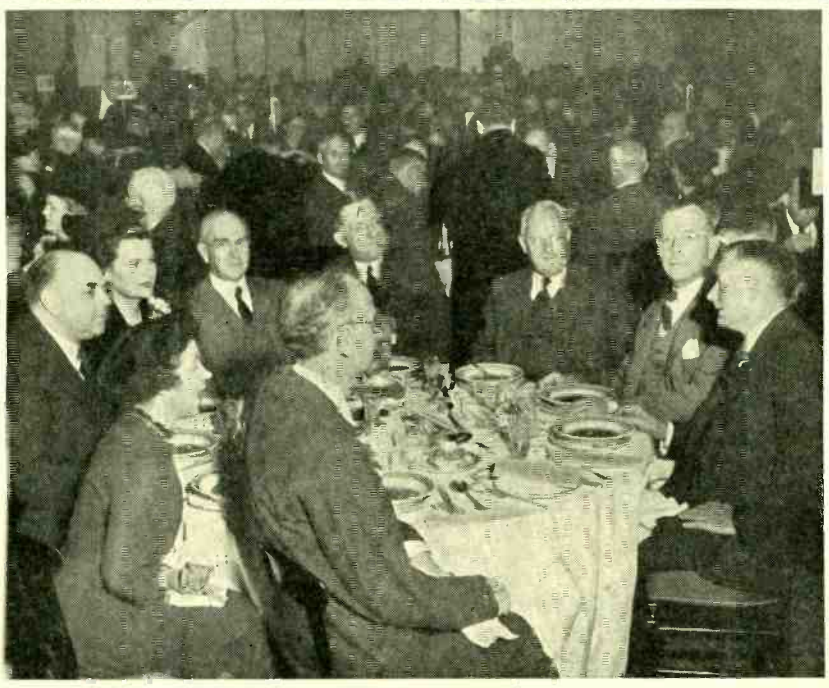
JANUARY 4, 1943

Great Day — *Youmans*
Orchestra
Group of Piano Solos
Alec Templeton
Overture—Fingal's Cave — *Mendelssohn*
Orchestra
Concerto in A Minor—Finale — *Grieg*
Alec Templeton and Orchestra

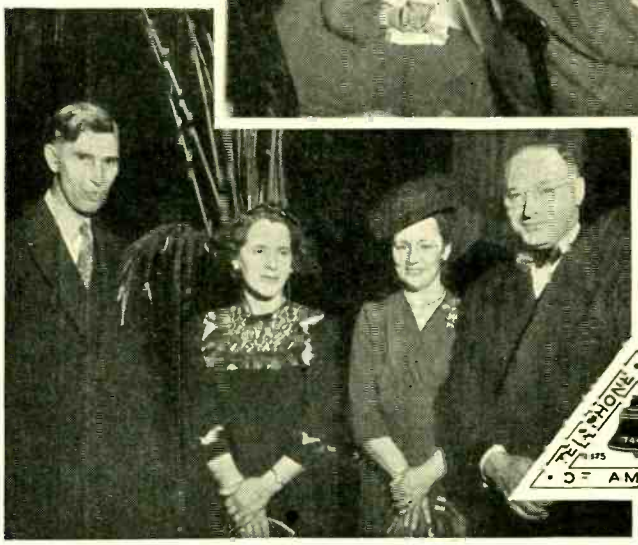
JANUARY 11, 1943

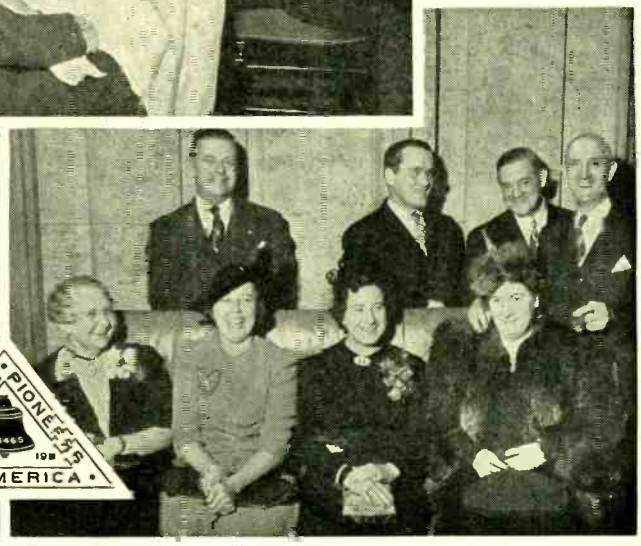
Till the Clouds Roll By from "Oh Boy" — *Kern*
Orchestra
The Blue Danube — *Strauss*
Lily Pons
Casey Jones — *Traditional*
Orchestra
I'll See You Again from "Bittersweet" — *Coward*
Lily Pons
Stenka Razin — *Glazounow*
Orchestra
Queen of the Night from "Magic Flute" — *Mozart*
Lily Pons

EDWARD J. HALL CHAPTER OF THE

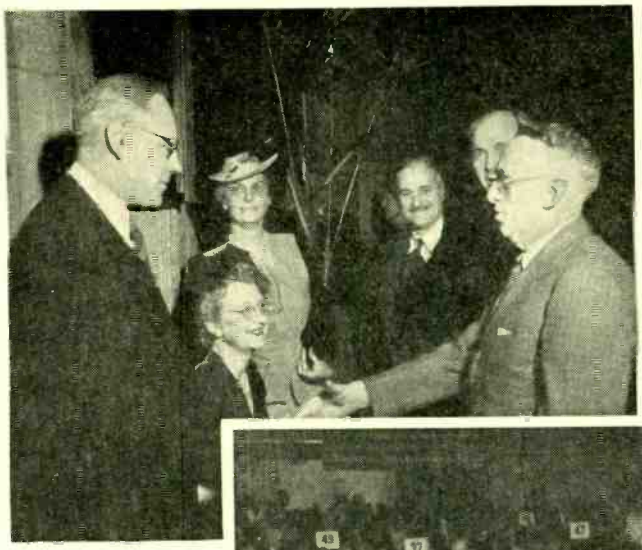


These photographs were taken at the Fall Social Meeting held on November 2. Upper left—Color guard, left to right: W. A. Weikert, George Dobson and W. A. Bellinger. Upper right, left to right—H. S. Warren, A. B. Kraas, W. A. Weikert, Mrs. Weikert, Mrs. Kraas and L. P. Brewer. Center, left to right around table—D. E. Blackwell, Mrs. Blackwell, M. P. Sullivan, guest, H. P. Charlesworth, F. P. Lawrence, M. B. French, H. M. Prescott and H. C. Gretz. Lower left, left to right—H. C. Baarens, Mrs. Baarens, Mrs. R. W. DeMonte and Mr. DeMonte. Lower right, left to right—Mrs. A. C. Merriam, Mrs. H. H. Hall, Mrs. G. F. Voehl, Mrs. C. A. Frank, Mr. Hall, George Schweler, Mr. Voehl and Mr. Frank





TELEPHONE PIONEERS OF AMERICA



Upper left, left to right—S. P. Shackleton, Mrs. S. T. Cory, Mrs. L. C. Roberts, Mr. Cory, Mr. Roberts and Donald Ross. Upper right, left to right—Harold Kuhn, M. W. Redmond, A. Ebinger, H. W. Balch and R. C. Fisher. Center, left to right around table — Mrs. C. E. Thomas, Mr. Thomas, Mrs. E. D. Johnson, Mr. Johnson, Mrs. L. W. Farrell, Mr. Farrell, F. Uhl, S. T. Cushing, Mrs. L. K. Jenney and Mr. Jenney. Lower left, left to right—D. C. Mann, Miss A. B. Mathew, Mrs. Mann, Miss M. J. Meade and Miss M. E. Johnston. Lower right, left to right—C. A. Lowe, Mrs. Helen Lowe (Mr. Lowe's daughter-in-law), and Miss Helen Crager

Women Members of the Laboratories

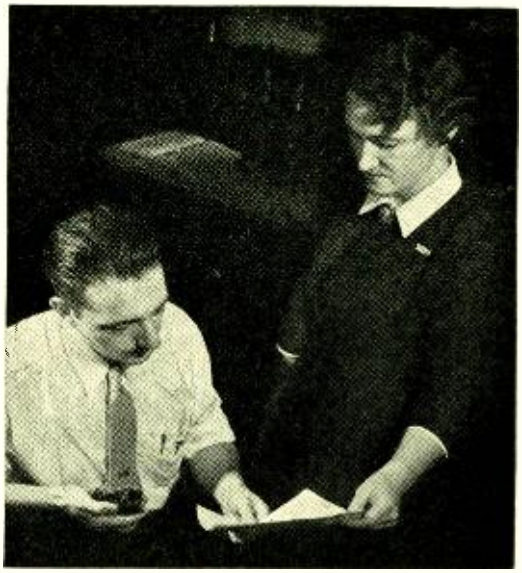
Founder's Granddaughter Enters WAVES

Miss Margaret Gray, a member of the Network Development group, and granddaughter of Elisha Gray, one of the founders of the Western Electric Company, has been commissioned a Lieutenant (j.g.) in the WAVES, and has reported at Smith College for indoctrination. On graduation from Wells College in 1926, Miss Gray entered the Hawthorne Works as an assistant research librarian, and the following year transferred to Bell Telephone Laboratories, New York, as a mathematical assistant. Her work has been largely to evaluate the design constants and performance characteristics of a variety of filters, equalizers and networks. For some time she has been exclusively on various war projects which involve electrical networks.

The Micro-Chemical and Analytical Laboratory

Samples submitted to the analytical laboratory for analysis are received by May Schupp who transmits the job to the proper analyst after assignment, follows the progress and prepares the formal report of the laboratory. The assignment of the sample to the proper analytical group is determined by the nature of the sample and of the information requested. When all factors have been considered the most desirable form of examination is decided upon by the supervisor of the analytical department, and the work turned over to either the microchemical, spectrochemical or general analytical laboratory for analysis. A check is maintained on the progress of the work and upon completion the results are returned to Mrs. Schupp for final writing of the report for supervisory approval. If the sample is to meet quality assurance standards the results must be checked against the specification requirements, which are kept up to date by reading and abstracting new specification issues at frequent intervals.

Final measurements on a vacuum tube are being made by Eleanor Stralkowski of Electronics Research



H. V. Wadlow of the Chemical Laboratories receives a relay from May Schupp for an analytical analysis

A file of analytical methods used by the chemists is maintained and indexed by Mrs. Schupp. These methods must be catalogued not only in accordance with the title but also

regarding the applicability of the procedure to any other type of material.

Searches for and the compiling of results on previously reported material is another service frequently rendered to the engineers.

In addition to acting as secretary to the materials chemist, Mrs. Schupp also receives incoming telephone calls of the engineers in the finish, corrosion, and electroplating groups during their absence and where possible transfers the calls to the man best qualified to handle each specific problem as it is encountered.

Barbara Stratton signs for the receipt of a personal package delivered to the Parcel Room at West Street by an outside supplier. Mabel Gatehouse operates this room under the supervision of the Plant Department

News Notes

A. P. Jahn recently inspected the metal samples exposed outdoors by the A.S.T.M. at Pittsburgh, State College, Sandy Hook and Bridgeport.

R. H. Colley attended an Executive Committee meeting of the American Wood-Preservers' Association in Chicago on October 22. He also visited the Forest Products Laboratory at Madison, Wisconsin, for review of emergency wood preservation problems and study of modern developments of wood plastics, and then continued observation of commercial open tank treatments of northern pine crossarms at the Valentine Clark plant at St. Paul.

The Laboratories needs more draftswomen. Any of those interested in this opportunity should see Miss Mary Brainard in Women's Employment.

R. B. Miller, in company with Western Electric Company installation and shop representatives, visited Canton and Chicago in connection with quality of soldering on step-by-step banks.

F. J. Daniels was in Chicago and Cleveland with H. K. Downing of the Western Electric Company on a quality survey of installation adjusting sets.

R. B. Miller went to Philadelphia to discuss layouts for field verification of shop soldering and apparatus adjustments for toll-crossbar equipment with representatives of the Installation Department of the Western Electric Company.

W. G. Freeman, with E. G. Peterson of the Western Electric Company, visited Hartford to inspect carrier equipment in process of installation.

L. R. Smith discussed quality matters re-

lating to copper steel conductors with the Copperweld Steel Company at Glassport, Pennsylvania.

B. R. Eyth visited Tottenville, N. Y., and Chicago on Quality Surveys covering solder and lead sleeving.

L. N. St. James and E. G. D. Paterson attended a Quality Survey of rubber-covered wire at Point Breeze.

J. W. Van de Water, Laboratories Field Engineer at Omaha, accompanied by E. M. Dixon of the Western Company at Point Breeze, spent several days along the buried cable route through the wilds west of Salt Lake City in connection with difficulties experienced with the gopher protected cable being placed in that section.

H. W. Heimbach, F. A. Korn and J. W. Corwin were in Philadelphia observing the installation of the No. 4 toll office at the Race Street office of The Bell Telephone Company of Pennsylvania.

G. T. Ford, J. W. Woodard, W. L. Filer and L. J. Bowne were in Washington to discuss switchboard equipment.

Twenty-Five-Year Service Anniversaries

L. N. Hampton graduated from the Cooper Institute of Technology in 1916 and joined the Engineering Department of the Western Electric Company in 1917. During the next year he was in the apparatus drafting group working on various devices for detecting airplanes and submarines. He then transferred to the Apparatus Development Department where, in addition to developing apparatus for the above uses, he designed radio apparatus for the Signal Corps. Since then, in what is now the dial apparatus group of the Switching Apparatus Development Department, Mr. Hampton has been in charge of the development of a wide variety of apparatus for use in the telephone plant, particularly in connection with maintenance apparatus. For the past few months he has been associated with the development of apparatus for our armed forces.

The Hamptons live in the Bronx and have a delightful summer place at Lake Katonah, N. Y. Mr. Hampton is fond of outdoor sports—swimming, golf and skating in particular. He is a Telephone Pioneer.

* * * * *

Following two years of study at the University of Iowa, H. H. Schneckloth joined the Western Electric Company at Hawthorne on switchboard assembly. About a year later he transferred to the Plant Department of the Northwestern Bell Telephone Company where he worked on switchboard maintenance in various local and toll offices including the first panel project at Omaha. In this connection he also taught in a panel operation and maintenance school.

Leon N. Hampton

Harry H. Schneckloth

Francis M. Costello

CARL H. HITCHCOCK
of the Switching Apparatus Development Department completed thirty-five years of service on November 6

FRANK B. LIVINGSTON
of the Outside Plant Development Department completed thirty years of service in the Bell System on November 4

EDGAR W. ADAMS
of the Patent Department completed thirty years of service in the Bell System on November 1

Then, at Minneapolis, he attended the University of Minnesota while continuing his work with the telephone company on an evening shift. After receiving his degree of B.S. in E.E. in 1925 he spent five months in training on the maintenance and installation of step-by-step equipment. He then entered the Chief Engineer's Department of the Northwestern Company as an equipment engineer on step-by-step and panel central-office equipment. A few years later he became maintenance engineer in charge of the Minnesota division.

In 1929, Mr. Schneckloth joined the PBX equipment development group of the Department of Development and Research of the A T & T. He later transferred to the step-by-step equipment group and continued this work following the 1934 consolidation of the D & R with the Laboratories, being particularly concerned with the development of the community dial program.

During recent years Mr. Schneckloth has made extensive study of telephone switching practices in foreign countries. For the past two years he has been engaged in developing ways and means for the emergency completion of telephone calls associated with the war effort.

The Schnecklothes live in Forest Hills. His principal hobby has been a study of languages, particularly those of European countries and he is now studying Oriental languages. He is interested in photography and vacations are usually spent at Gulfport, Florida, swimming and fishing.

* * * * *

F. M. COSTELLO's service with the Bell System dates back to 1904 when he spent a year with the New York Telephone Company as a trouble shooter. From then until 1918 he worked for the City of New York as a leveler and transit man and then as a topographical draftsman. He attended Cooper Union from 1907 to 1911, when he received his degree of B.S. in Civil Engineering. Mr. Costello came to West Street as a mechanical draftsman in the Apparatus Development Department in 1917 during World War I and was assigned to the design of submarine detection devices and similar devices for the government.

In 1921 and 1922 Mr. Costello was loaned to the card-catalogue group to write up in-

One pound of brass pipe contains metal for 18 .30-caliber cartridges.

JULIAN BLANCHARD

HERBERT W. HODGKINS

ALBERT H. MILLER

formation on telephone apparatus and then spent a year as a specification engineer. From then until a year ago he was a drafting supervisor in the Apparatus Drafting Department. Now in the Plant Shops Department, he is with the group which supervises work in outside shops. This activity has been brought about to augment the Laboratories' Development Shop facilities.

Mr. Costello conducted the Choral Society of the Bell Laboratories Club for two seasons. With three other Laboratories men, he, a baritone, also sang for several years on sustaining programs over several of the major radio networks. He also has sung for many years in church choirs and is the composer of several sacred songs. One of his sons is top sergeant in the Ordnance Division of the Harlingen Army Gunnery School in Texas and the other works for the Budd Manufacturing Company in Philadelphia. One of his daughters is married and the other is in grade school. Mr. Costello, who lives in the Bronx, is a Telephone Pioneer.

The man who has "the low-down" feels important and he is important—to The Enemy, unless he keeps his information to himself.

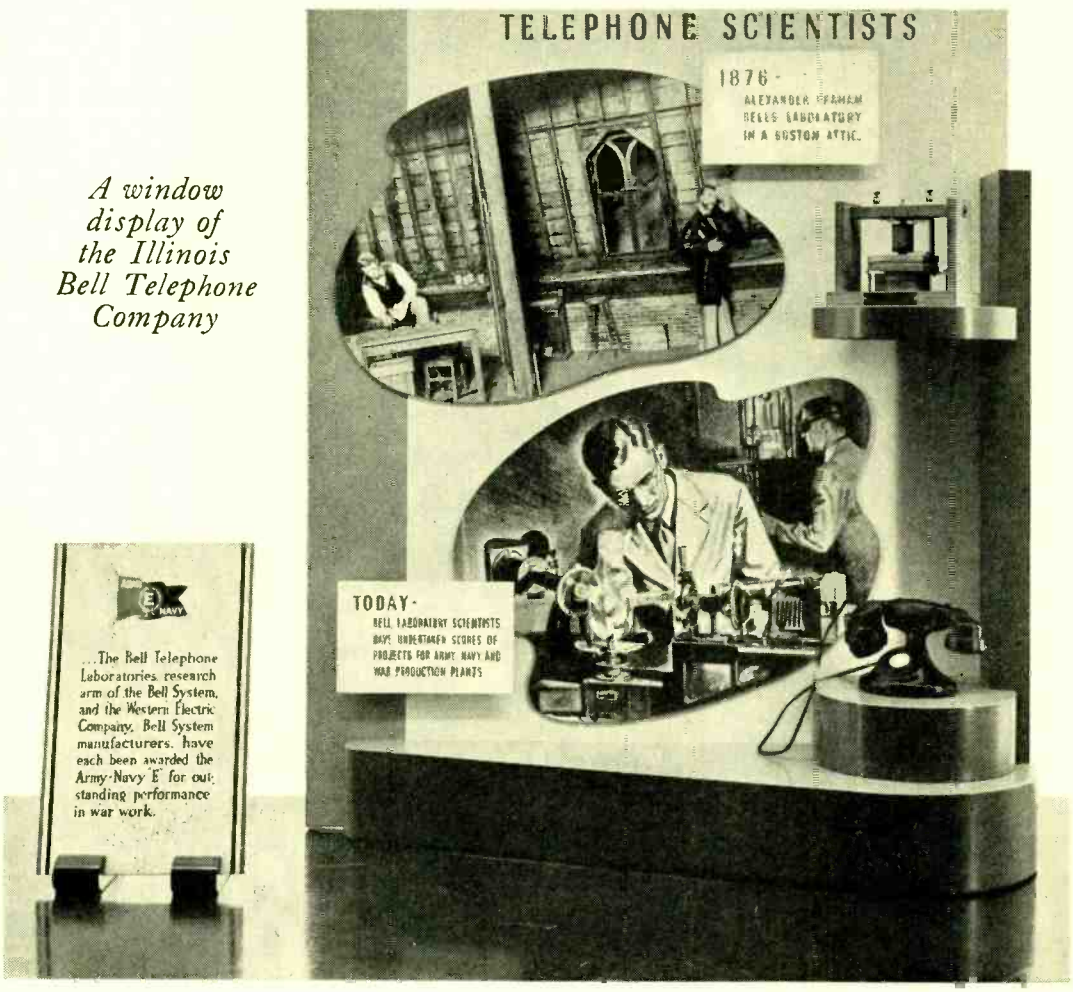
DIVIDED BETWEEN a love for teaching and a leaning towards industrial research, JULIAN BLANCHARD came to a decision, gave up teaching, and joined the laboratories of the Eastman Kodak Company in 1915 where he was engaged primarily in optical investigations. Two years later he come to West Street and was assigned to the department devoted to the development and production of vacuum tubes. Soon after the war he organized and headed a group for the general testing of vacuum tubes and filaments in process of development including life tests, and in this connection devised an improved and faster method for measuring the gain of repeater tubes.

In 1930 Dr. Blanchard became a staff assistant in the department of radio research. During the next few years, in addition to special investigations and reports on radio and vacuum tube matters, he aided in the preparation for the Laboratories' participation in various international radio congresses, in committee work on electrical standards, and in editorial work on technical papers for publication. Over the years he has gathered a large amount of useful reference data on the development and progress of radio and electronics, some of which has resulted in published papers such as his monographs on *Hertz, the Discoverer of Electric Waves* and *The History of Electrical Resonance*. In 1940 he was transferred to the Technical Consulting Staff where he remained until the early part of

the present year. He is now a member of the staff of the Laboratories' School for War Training.

Dr. Blanchard received the degrees of B.A. from Trinity College, now Duke University, in 1905, M.A. from Columbia in 1909, and Ph.D. from the same institution in 1917. Recently he has taken an apartment in Greenwich Village and now is able to enjoy the luxury of walking to work. He has remained a bachelor and has learned to "live alone and like it"—he says. For many years, dating back to his college days, Dr. Blanchard has been a devotee of tennis and has taken part in numerous tournaments and team matches of the Bell Laboratories Club. His indoor hobbies are genealogy, philately, and the branch of numismatics relating to paper money.

H. W. Hodgkins' first work at West Street was with the Equipment Drafting Department where he was concerned with switchboard cabling plans and frame equipment for the new panel offices being installed in New York, Philadelphia, Boston and other large offices in the East. During his first seven years he studied mechanical drawing machine design and industrial electricity at the Pratt Institute evening school. In 1922 Mr. Hodgkins entered the analyzation group and later transferred to the equipment methods group where he was primarily concerned with the editing of engineering data involving maintenance and design information. More recently, in the methods group of the Equipment Development Department, he has been engaged in the preparation of in-



A window display of the Illinois Bell Telephone Company

formation covering materials used in training Army and Navy personnel in the operation and maintenance of equipment developed by the Laboratories. He has also prepared information on the maintenance of portable information and filter centers used throughout the country.

Mr. and Mrs. Hodgkins live in the Munsey Park section of Manhasset with their two daughters, ages 10 and 6. Mr. Hodgkins bowled for many years in the Laboratories Club and now takes an active part in the Bowling League which he helped organize in his community. He is interested in both still and 16-mm photography and what spare time he now has is usually spent in a dark room in his basement. He says that his main outdoor sport is keeping one step ahead of the crab grass in his lawn.

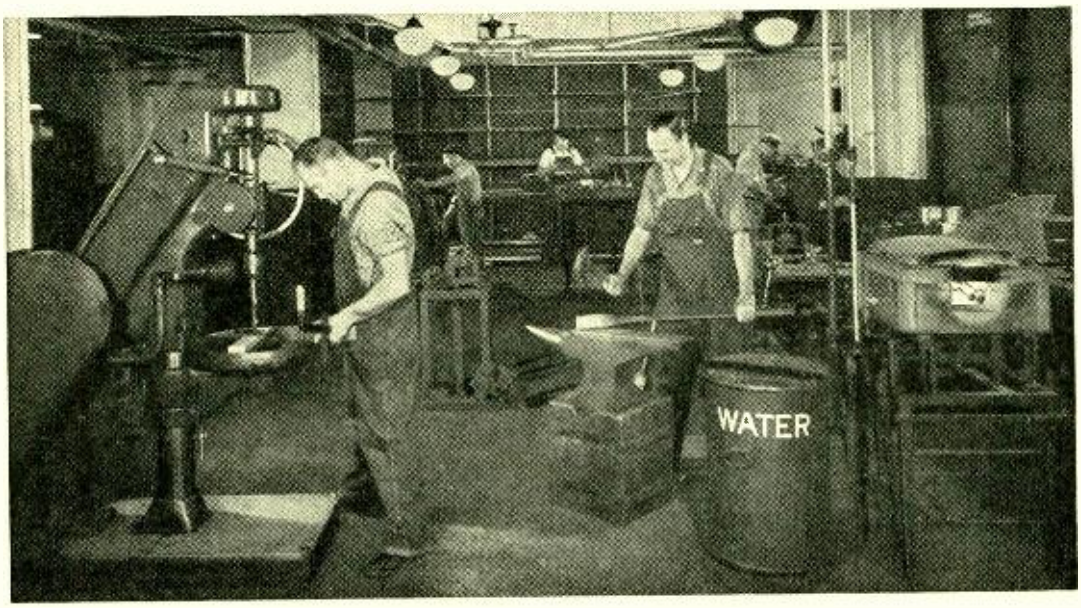
* * * * *

THE DESIGN AND DEVELOPMENT of apparatus pertaining to communication systems for railroads has been one of the jobs with which A. H. MILLER has been connected during most of his twenty-five years of service. Along with this work, in what is now the Commercial Products Development Department, has been many special projects such as the development of a binaural cable system for the Navy in 1919; the distributor and selector type remote control and indicating system for power companies, the first being for the New York Edison Company between its Waterside and Hell Gate generating plants and later used extensively by many other utilities; the design of mine control systems for the Coast Artillery in 1927; and the testing of general announcing systems for aircraft carriers of the U. S. Navy in 1937. At the present time he is concerned, in addition to his train dispatching work, with the testing of battle announcing systems for the U. S. Navy.

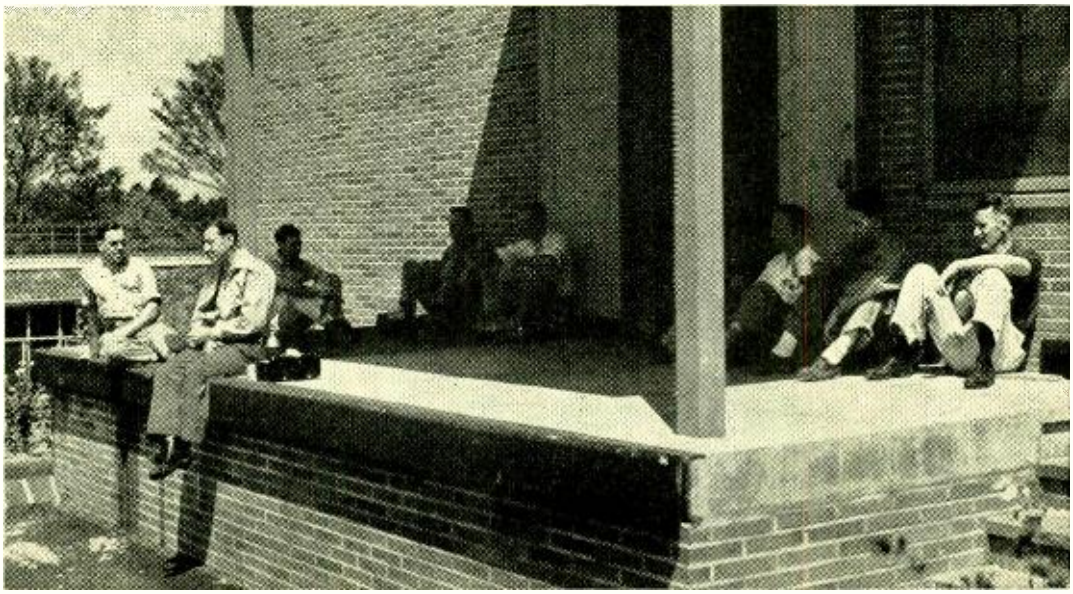
Mr. Miller is an inveterate surf-casting addict and spends much of his spare time around the Long Island coast—he and his wife living in Bayside. He has fished the North Carolina beaches and also those in Florida. He is proud of two of his uncles, one of whom has just retired from the Western Electric Company, Hawthorne, after 42 years of service, and the other, now at Point Breeze, with 29 years. Mr. Miller is a Telephone Pioneer.

* * * * *

AFTER A YEAR with the inspection department of the New York Telephone Company, WILLIAM BUHLER joined the Signal Corps and spent two years with the 407th Telegraph Battalion in France. In 1919 he re-

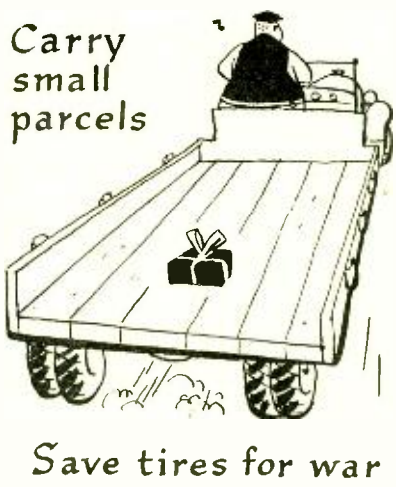


In the Building Shop of the Plant Department



Relaxation after lunch at Murray Hill

turned to the New York Company but shortly after joined the methods of operation group at the Laboratories where he prepared descriptions of the functions of manual and panel circuits. In 1924 he transferred to the relay requirements group with which he spent four years and then, for the next five years, was with the group developing and testing panel circuits. In 1933 he returned to the relay group for a period of three years. Since then, Mr. Buhler has been in the panel and crossbar pulsing studies group of the Switching Development Department. One of the more important projects with which he has been associated was the development and testing of the pulsing circuit in the dial-incoming sender of the No. 4 toll switching system now being installed in Philadelphia. More recently he has been concerned with the testing of circuits involved in the war effort, particularly with those in the civil air-raid warning system.



Mr. and Mrs. Buhler live in Baldwin. He is a member of the Western Electric Post of the American Legion and of the Telephone Pioneers of America. He enjoys boating, fishing and golf and his vacations are spent in New England, usually in the neighborhood of Rutland, Vermont.

* * * * *

FOR THE PAST FIVE YEARS E. C. EDWARDS of the Apparatus Staff Department has been responsible for the maintenance of all departmental personnel records of the 965 members of the Apparatus Development Department, over 600 of whom are engineers now engaged principally on war projects for the Army and Navy. Mr. Edwards' work includes the preparation and execution of papers in connection with military service, preparation of personnel reports and organization charts and making personnel studies.

Mr. Edwards came to West Street in 1917 as an office boy on the executive

JOHN J. SHABET

HERBERT S. SMITH

Born in Brooklyn, Mr. Kennelty lived there until 1940 when he and his wife moved to the Fleetwood section of Mount Vernon. He enjoys golf and was chairman of the Laboratories Club Golf Committee for about five years during the early Thirties. He helped organize the Western Electric Post of the American Legion, was its first Adjutant, its second Commander and for many years represented the Post on the New York County Committee. He is also a Telephone Pioneer.

* * * * *

DURING S. F. HAYES' twenty-five years of service he has been associated with the storerooms of the Central Service Department. Previous to this he had spent fifteen years with a concern handling pharmaceutical supplies followed by two years in the main storeroom of United Electric Light and Power Company in Upper Manhattan and a shorter period, during the first part of World War I, with a detective agency on the protection of docks and ships against sabotage. At West Street during the war he was in the storeroom of the vacuum-tube shop. Later he spent two years in the Receiving Department and then returned to storeroom work. He is at present maintaining supplies in the Development Shop storeroom.

Mr. and Mrs. Hayes have lived on West Twentieth Street for the past 27 years. Mr. Hayes enjoys evening strolls about town. Growing flowers on an extension roof is one of his diversions. He is a Telephone Pioneer.

COMING to the Engineering Department of the Western Electric Company in 1917 as a messenger, J. J. SHABET left a short time later to enlist in the U. S. Army and when the Armistice was signed was in training at Fordham University. Returning to West Street he became a wireman and testing engineer in what is now the Switching Development Department and during the first year following his return completed an electrical course at the New York Electrical School. Most of the time until 1925 he was concerned with testing step-by-step equipment and then was successively with the step-by-step development and the analyzation groups. Since 1929 Mr. Shabet has been associated with the circuit standardization group where he is a specialist in drawing prac-

Steel of 12,000 razor blades equals the steel in the tail assembly of a 2,000-pound bomb.

tices and key sheets covering all types of telephone systems.

Mr. and Mrs. Shabet live in Jersey City with their six children—three boys and three girls—ranging from fifteen years old to their third girl who was born on October 24. Mr. Shabet has bowled for many years in the Laboratories Bowling League and he enjoys watching all types of outdoor sports. He is a member of the Western Electric Post of the American Legion and of the Telephone Pioneers of America.

* * * * *

H. S. SMITH's twenty-five years of service with the Western Electric Company and the Laboratories began in 1917 when he was a laboratory assistant in the transformer group of the Apparatus Development Department. In 1924 he became a member of the Technical Staff, and was selected as one of a group of five involved in interdepartmental exchange of engineers, for the purpose of broadening their experience. He was successively concerned with the development and design of loading coil cases, condensers, cords, wire and cable. He transferred to the Repaired Apparatus Department in 1932 to prepare Bell System Practices covering the repair of telephone apparatus, particularly for those types he had previously developed. This work continued until last January when he joined the Apparatus Specifications Department to aid in the war effort by preparing specifications on coils and transformers primarily for Army and Navy use.

The Smiths reside in Queens Village; their son enlisted in the Navy before Pearl Harbor and is now with the Atlantic Fleet. Mr. Smith is active in civic affairs and is at present president of his local civic association. He is also Senior Air Raid Warden in his community and is a member of the Telephone Pioneers of America. For diversion he enjoys participating in canoe sailing, basketball, baseball and tennis and in bowling is a consistent 180 averager.

NEWS NOTES

THREE out of every four customers to whom the Bell System cannot furnish the telephone service they want have said they understood that war requirements must come first.

M. A. FROBERG and K. E. BOWER made a trip to the Oak Manufacturing Company at Chicago.

C. S. KNOWLTON discussed power problems at Wright Field, Dayton, and at the General Electric Company, Fort Wayne.

The Mirrophone, developed for the Western Electric Company by the Laboratories, already has a number of diverse applications to its credit. One midwestern radio station, for instance, has a Mirrophone set up in its announcers' room. As each announcer comes on duty, he reads his commercial copy to the Mirrophone, then listens to the playback. Station executives say that the announcers, able to hear and criticize their own speech without the delay attendant on processing "wax" recordings, have greatly improved their work. One of the radio stations which uses the Mirrophone is WHO, Des Moines, Iowa. Shown above are, left to right: Colonel B. J. Palmer, President, Central Broadcasting Company, which owns and operates WHO; Bobby Griffin, veteran WHO announcer; and Harold Fair, WHO's Program Director

A. E. PETRIE discussed power equipment with the War Production Board at Washington.

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

G. A. PULLIS spent a few days in Mansfield, Ohio, on problems associated with 1000-cycle signaling.

E. W. HANCOCK and C. H. MCCANDLESS were at Philadelphia to discuss the test-out of cutover procedures of the No. 4 toll-crossbar installation.

P. W. BLYE, C. P. BARTGIS, W. E. REID and P. F. JONES recently visited H. J. CHRISTOPHER at Westfield in connection with the presentation of retirement gifts consisting of a purse with a sum of money, and a book containing mementos of his association with the Bell System.

Michael Ruggerio delivering material from the Receiving Room at Murray Hill

THE LABORATORIES were represented in interference proceedings before the Primary Examiner at the Patent Office in Richmond by H. A. BURGESS, N. S. EWING, H. O. WRIGHT and F. J. SAMERDYKE.

A. G. KINGMAN and J. E. CASSIDY appeared before the Board of Appeals at the Patent Office in Washington relative to applications for patent.

C. BARAFF and F. J. SAMERDYKE were at the Patent Office in Washington during October relative to patent matters.

WE SEE BY THE PAPERS

THE BELL TELEPHONE LABORATORIES in a campaign to sell war bonds used a poster carrying the following poem, written by an American marine now "somewhere in the Pacific":

"And if our lines should form and break,
Because of things you failed to make—
The extra tank or ship or plane
For which we waited all in vain,
And the supplies that never came
Will you then come and take the blame?
For we, not you, will pay the cost
Of battles you, not we, have lost."

A copy of this verse in heavy type should be displayed in every war production plant in America for the duration. Volumes could not say so well, so truly and pertinently, what is said in its eight lines.—*Lynchburg (Va.) Advance, August* 29, 1942.

CLOSE CONTROL of the calcium content is required in the manufacture of lead calcium cable sheath. . . . A new procedure described by G. M. BOUTON (BELL LABORATORIES RECORD, June, 1942) arises from Bell Laboratory studies.—*Nature*, *October* 3, 1942.

A METHOD is described by C. T. WYMAN (BELL LABORATORIES RECORD, July, 1942) of correctly determining the colour of conductor insulation papers, which moreover, permits the use of a range of colours otherwise unobtainable.—*Nature*, *October* 10, 1942.

THE LEHIGH VALLEY SECTION of the American Chemical Society will hold its October meeting next Friday in Zion's Lutheran church social hall. DR. R. M. BURNS of the Bell Telephone Laboratories, New York, will speak on "Protective Coatings for Corrosion Prevention."—*Tamaqua (Pa.) Courier*, *October* 10, 1942.

. . . A method of printing such (oscillator) scales has recently been developed and has been described by T. SLONCZEWSKI (BELL LABORATORIES RECORD, July, 1942).—*Nature*, *October* 10, 1942.

THE VAN HORN AGENCY also sold a large residence with one acre of land in Rumson, on the Avenue of Two Rivers near the Rumson Road, to GEORGE C. SOUTHWORTH of Red Bank . . . an engineer with the Bell Telephone Laboratories—*New York Times*, *October* 11, 1942.

AN ELECTRICAL DEVICE which can talk, laugh, sing, whisper, and shout will be part of a demonstration-lecture entitled "The Electrical Synthesis of Speech," to be given by Dr. J. O. Perrine of the American Telephone and Telegraph Company, tonight at 8 o'clock in the auditorium of Alton High School.

The "Voder" was designed in the Bell Telephone Laboratories by Bell Telephone scientists. In the summer of 1940 it attracted wide attention at both the New York and San Francisco expositions.—*Alton (Ill.) Telegraph*, *October* 15, 1942.

A NEW TYPE of wipe or fillet joint is described by J. T. LOWE (BELL LABORATORIES RECORD, July, 1942) which makes it possible to meet the essential requirement for a wiped joint using far less solder.—*Nature*, *October* 17, 1942.

MISS ALEXANDRA BABCOCK, daughter of Col. and Mrs. Guilford C. Babcock of Deez House, Normandie Heights, was married in the Presbyterian Church yesterday to

George Durschmidt of the Building Shop laying out a sheet-metal detail

STATIONERY CONSERVATION

1. **Have you returned all the excess stationery and other office supplies in your desk to office stationery cabinets?**
2. **Are you removing all rubber bands, pins, clips, fasteners, etc., from papers to be discarded?**
3. **Are you conserving by refraining from scribbling on paper, bending and breaking paper clips and pins and digging holes in erasers?**
4. **Are you using rubber bands sparingly?**
5. **Are you substituting string, gummed tape or the new paper wrapping strips wherever possible for rubber bands?**

ROBERT WILSON MARSHALL, son of Mrs. Thomas Marshall of Minneapolis, Minn., and the late Mr. Marshall. . . . The bridegroom . . . is on the technical staff of Bell Telephone Laboratories, New York.—*Newark Call, October* 18, 1942.

W.P.B. ordered halted in 30 days manufacture of telephone sets and limited production during this period to 4% of total factory sales value manufactued in 1941 during the first 15 days and 2% during the next 15 days (limitation order L-204), effective October 17.—*Wall Street Journal, October* 19, 1942.

WELDING TEACHERS in one plant use throat microphones to talk with pupils. Learners listen through earphones in their welding helmets. It puts them in a world apart from the clatter of machines and crackle of welding flames.—*Wall Street Journal, October* 21, 1942.

AT THE HOTEL HOLLEY on Monday, October 19th, co-workers of the Bell Laboratories gave a luncheon in the Hudson Room with forty in attendance, in honor of E. C. EDWARDS who celebrated his twenty-fifth anniversary with the company.—*The Villager, October* 29, 1942.

MISS ALICE KEEGAN became the bride of WILLIAM J. FULLERTON, JR., of Morristown, N. J., son of Mr. and Mrs. William Fullerton, Sr., of 583 Henderson Avenue, West Brighton, at a nuptial mass Saturday morning in the Immaculate Conception Church, Stapleton. The groom is employed by the Bell Telephone Laboratories, Inc., Whippany, N. J.—*Staten Island Advance October* 26, 1942.

". . . several other special tools which are so secret that their blueprints are in invisible ink."—*Reader's Digest, November.*

MR. AND MRS. JOSEPH VAN DALE of Chapel Hill road announced the engagement of their daughter, Miss Audrey Van Dale to JOHN HUNTLEY, Jr. Mr. Huntley attended Newark College of Engineering and is now studying at New York University. He is with the Bell Laboratories, New York.—*Paterson Call, November* 3, 1942.

TWENTY-YEAR SERVICE

MEMBERS OF THE LABORATORIES who completed twenty years of service in the Bell System during the month of November were:

Research Department

T. G. Kinsley — M. L. Weber

Apparatus Development

L. P. Rannow

Commercial Relations

Martha Briegs

Plant Department

James Collins — George McDermott

Helen Maver — Eric Weil

MEMBERS OF THE LABORATORIES TO WHOM PATENTS WERE ISSUED DURING THE MONTH OF OCTOBER

A. B. Bailey
H. M. Bascom
W. M. Beaumont
B. G. Bjornson
R. R. Blair
D. G. Blattner
W. H. Boghosian
A. K. Bohren
J. H. Bollman
R. M. Bozorth
C. R. Burrows (2)
C. J. Christensen
R. E. Collis
A. M. Curtis
A. Decino
E. L. Erwin (2)
H. J. Fisher
E. W. Gent (2)
E. L. Getz
N. I. Hall (2)
R. E. Hersey
F. A. Hinshaw
W. H. T. Holden (3)
A. W. Horton, Jr. (2)
Francis A. Hubbard
L. F. Koerner
O. H. Kopp
F. R. Lamberty
H. T. Langabeer
R. F. Mallina
J. W. McRae
H. R. Moore
O. J. Murphy
E. A. Nesbitt
H. Nyquist
H. G. Och
J. R. Pierce
G. A. Pullis
R. Raymond
W. T. Rea
W. A. Rhodes
H. O. Siegmund
L. J. Sivian
A. K. Smith
P. H. Smith
E. H. Smythe
J. R. Stone
K. D. Swartzel, Jr.
R. A. Sykes
R. J. Tillman
W. C. Tinus
C. C. Towne
D. E. Trucksess
H. E. Vaughan
L. Vieth
J. R. Wilkerson
H. J. Williams
R. R. Williams
R. C. Winans

A New Frequency Divider for Obtaining Reference Frequencies

By F. R. STANSEL
Transmission Apparatus Engineering

ONE of the common characteristics of all non-linear devices, such as vacuum tubes, is the generation of harmonic frequencies. With a pure sine-wave input, the output will contain a series of multiples of the input frequency. For many purposes, of course, this harmonic generation is disadvantageous, but for others, it is very helpful. In these Laboratories, for example, reference frequencies of 1, 10, and 100 kc were obtained for many years from a 100-cycle tuning fork by harmonic generation. For more than a decade, however, piezo-electric oscillators have been used as sources of reference frequencies because of their high stability. Since it is desirable to operate these oscillators at a frequency higher than those of the standards—usually at 100 kc—a sub-multiple generator, or frequency divider, is required to secure the desired lower frequencies.

Frequency dividing circuits are not so well known as frequency multipliers. The earliest one, dating back to about the time of the First World War, is the multivibrator. This device, as shown in Figure 1, consists essentially of a two-stage, resistance-coupled amplifier with its output fed back to its input. When this circuit is oscillating, the plate current of tube No. 2 is of saw-tooth shape as shown below the schematic. Although influenced by the natural frequency of the system, the output frequency of a multivibrator is unstable when no control frequency is applied. By introducing a small amount of control current, however, either by the method indicated in Figure 1 or in any one of a number of other possible ways, the saw-tooth oscillations may be locked in step with the control frequency, which may either be the natural frequency of the system or some multiple of it. With a 1000-cycle multivibrator, for example, and a 5000-cycle control frequency, the multivibrator will lock-in on every fifth cycle, and the fundamental output frequency will thus be one-fifth of the control frequency.

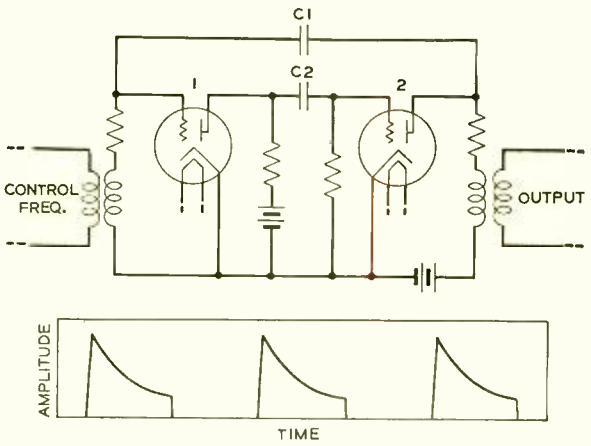


Fig. 1—Simplified schematic of a multivibrator, with the form of its output wave indicated below

Multivibrator circuits have been widely used for frequency division but they have a number of disadvantages. Inherently the multivibrator is a self-oscillating circuit whose only merit lies in the ease with which its frequency can be controlled. Once this control is lost the device becomes worse than useless since an output is obtained which is entirely unrelated to the original controlling frequency. Because of this there is always the possibility of a reference frequency generated by a multivibrator being "off frequency." The danger of "off frequency" operation is further enhanced in some cases by an occasional annoying tendency of the multivibrator to jump from one submultiple to another. Although the stability may be improved by modifications of the circuit of Figure 1, and by careful design, this likelihood is a fundamental defect which can never be entirely eliminated. This defect applies also to the multivibrator's first cousin, the controlled oscillator, another device which has been used at various times for frequency division.

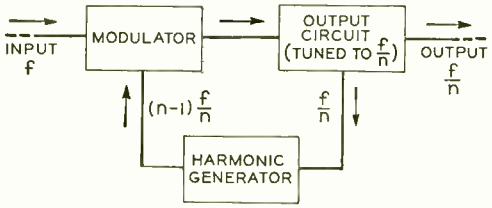


Fig. 2—Block schematic of basic circuit of a regenerative frequency divider

Another disadvantage of the multivibrator is its wave shape. For some types of work its saw-tooth wave shape with high harmonic content is a definite advantage, but for most uses in the Laboratories, particularly for frequency standardization by means of Lissajous figures, a much purer wave shape is required. Because of this, when the predecessor of the present reference frequency equipment was installed in 1931, a series of special output filters was required to clean up the output of the various multivibrators.

In recent years several new types of frequency dividing circuits have been developed. Of these probably the most successful is the regenerative frequency divider, which has today entirely replaced the multivibrator in the reference frequency system of the Laboratories. The basic form is shown in Figure 2. It consists essentially of three elements: a modulator, an output circuit tuned to the sub-multiple frequency to be produced, and a harmonic generator.

Once this circuit is in operation, its action is easy to understand. Assume, for example, that the input frequency is 100 kc, and that the output is 20 kc. Part of the output is fed back to the harmonic generator, where its fourth harmonic, 80 kc, will be selected by a tuned circuit. This 80-kc current and the 100-kc input will result in a difference frequency of 20 kc in the output of the modulator, and in a number of other frequencies as well. The 20-kc frequency, however, which is the output frequency desired, is selected by the tuned circuit. To start the oscillators, there must be some 20-kc component present in the circuit. In some regenerative frequency dividers this is supplied by a pulse applied from a starting circuit, but in more recent circuits it has been found possible to omit the starting circuit, and to depend on the transient voltages normally present in the circuit for this starting pulse.

In general, when the nth submultiple frequency is desired, the

harmonic generator is tuned to the (n-1)th harmonic. An interesting case arises when the output frequency is to be half the input frequency. Under these conditions (n-1) is equal to 1, and no harmonic generator is required. Part of the output is fed back directly to the modulator.

Unlike the multivibrator, the regenerative frequency generator cannot operate without an input frequency. Should the input frequency fail, the output drops to zero, and thus off-frequency operation does not occur. In addition, the output current of the generator is a relatively pure sine wave, and additional "clean up" filters are not required as they are with the multivibrator when a sine wave is desired.

These and other advantages led to the adoption of a circuit of this type for the reference frequency equipment recently provided for the Western Electric Company, described in the last issue of the RECORD. A schematic of the circuit is shown in Figure 3. A pentagrid-mixer tube is used for the modulator and a pentode for the harmonic generator. With a modulator tube having two shielded input grids, it is possible to eliminate the balanced modulators and transformers required for the earlier regenerative frequency dividers; and with the increased modulator gain obtained, not only is it possible to eliminate the starting circuit, but frequency division as great as 10 to 1 is obtainable in one stage. Heretofore, two dividers in tandem would have been required for a 10 to 1 division, one giving a 5 to 1 reduction and followed by a two to one reduction stage.

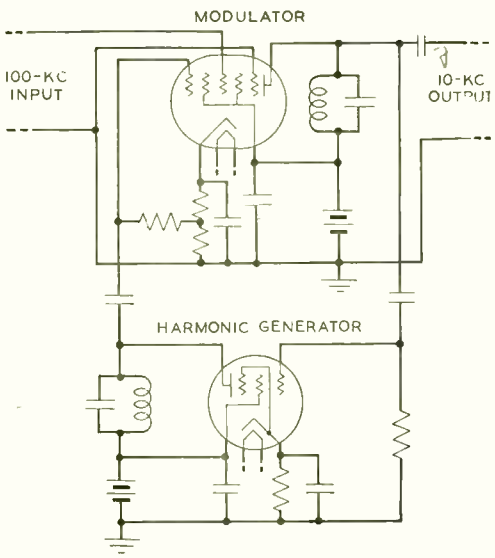
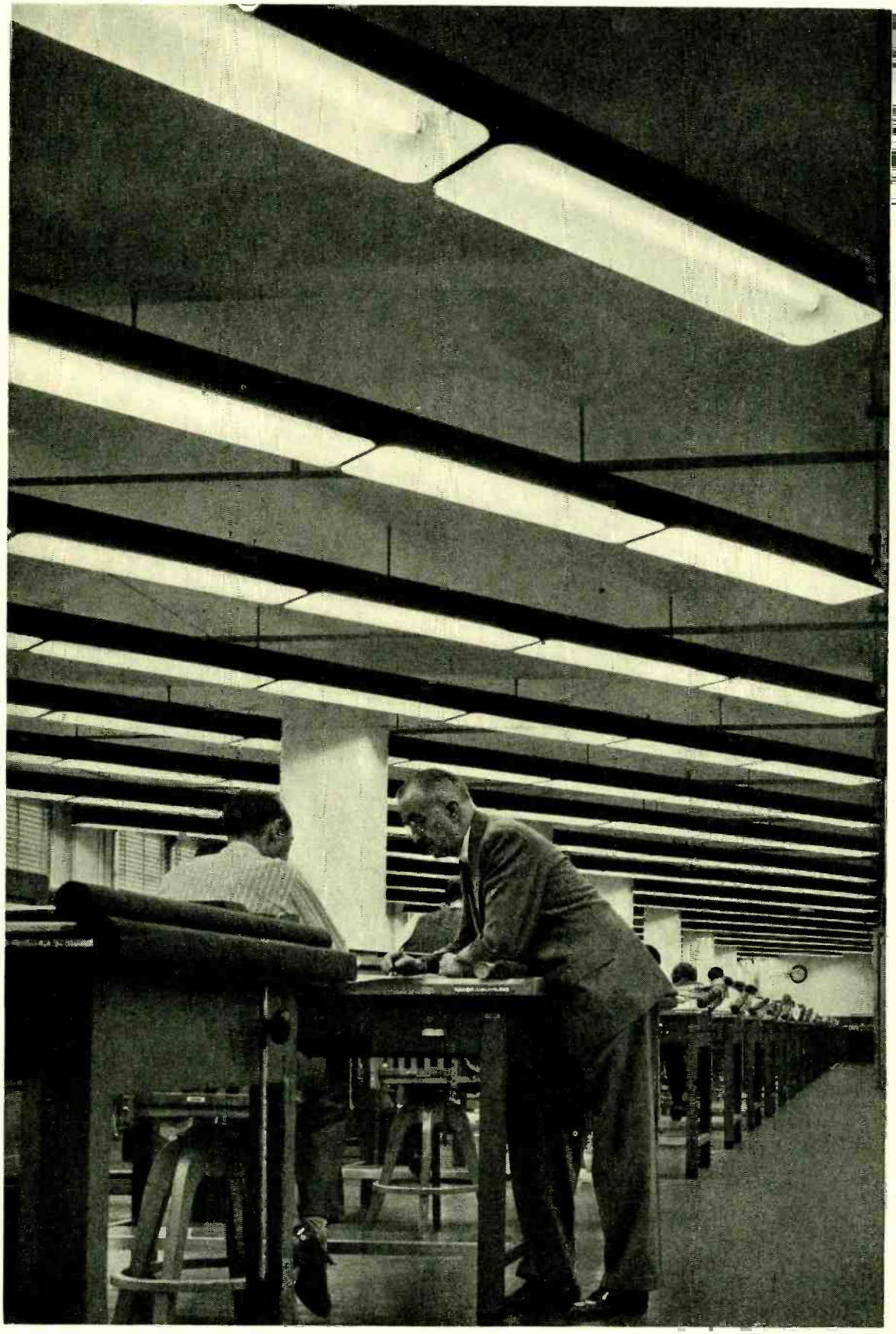
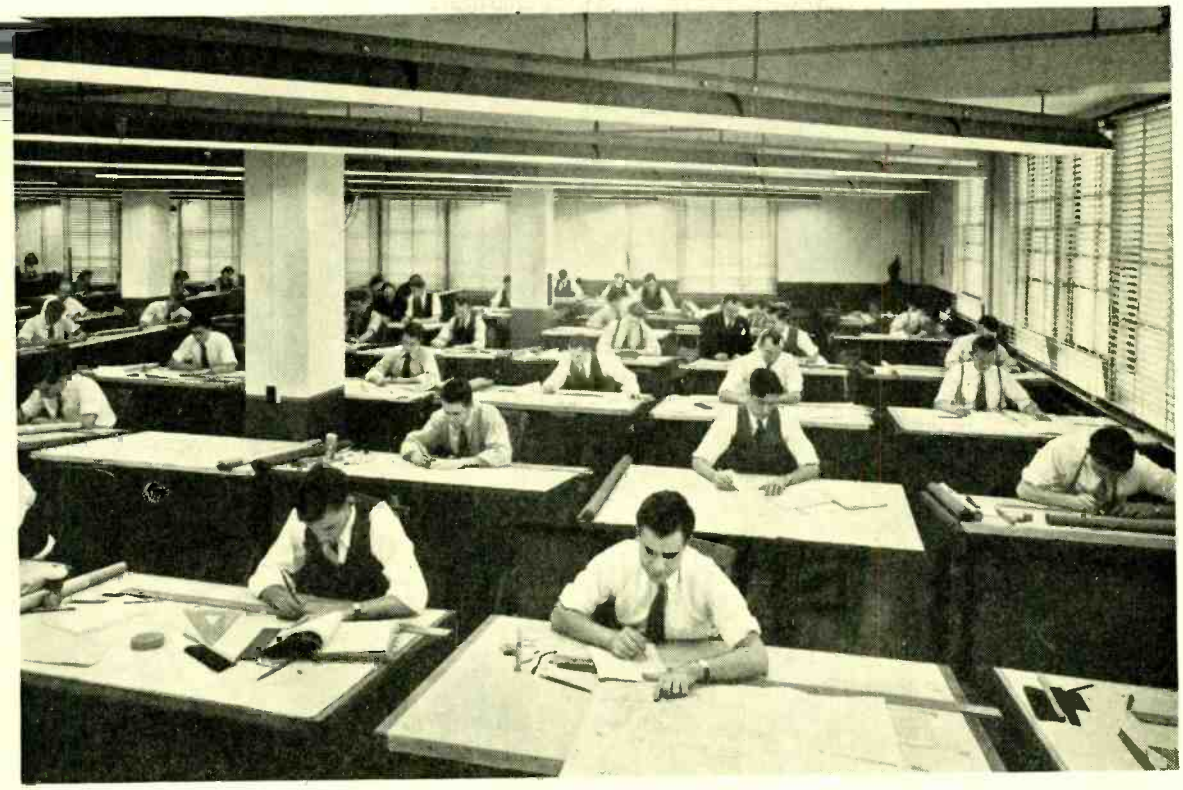


Fig. 3—Frequency divider circuit used for recently developed standard frequency equipment and used by Western Electric





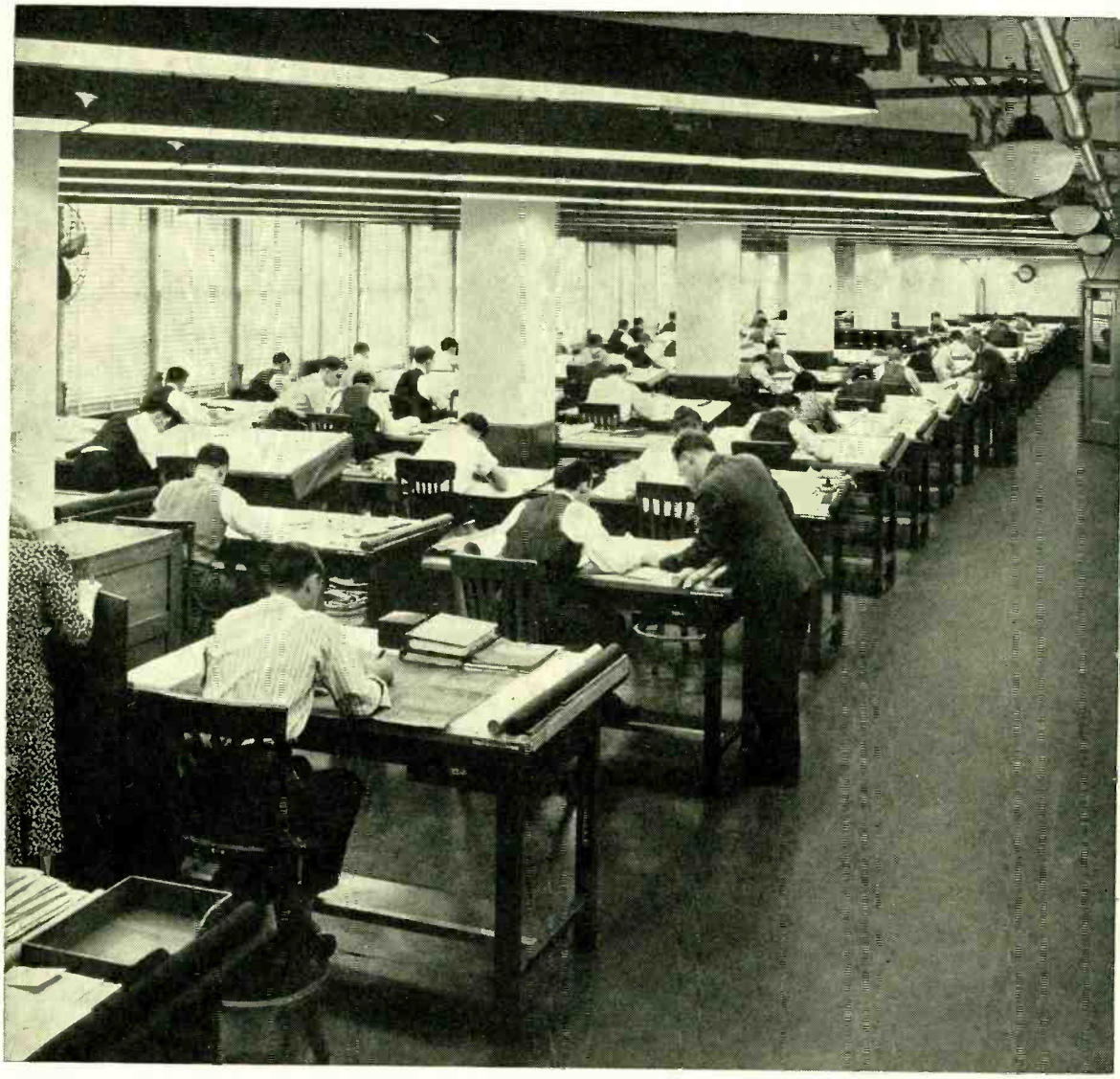
Drafting Full Speed Ahead

IN THE tremendous program of Bell Laboratories engineering and Western Electric production for the armed forces, one of the most difficult problems has been that of providing the large number of drawings required for the construction of many types of equipment. While the armament program throughout the United States has created an unprecedented demand for draftsmen, selective service has at the same time greatly decreased the number of young people who could be trained for drafting work.

Many women have been added to the drafting force to take the place of men who have entered the armed forces. The nucleus of draftswomen which began in the last war was of real benefit in the training of these new women employees. As a result, increases in effort required by the volume of war work have been effected while the number of draft-age men required has been kept at a minimum.

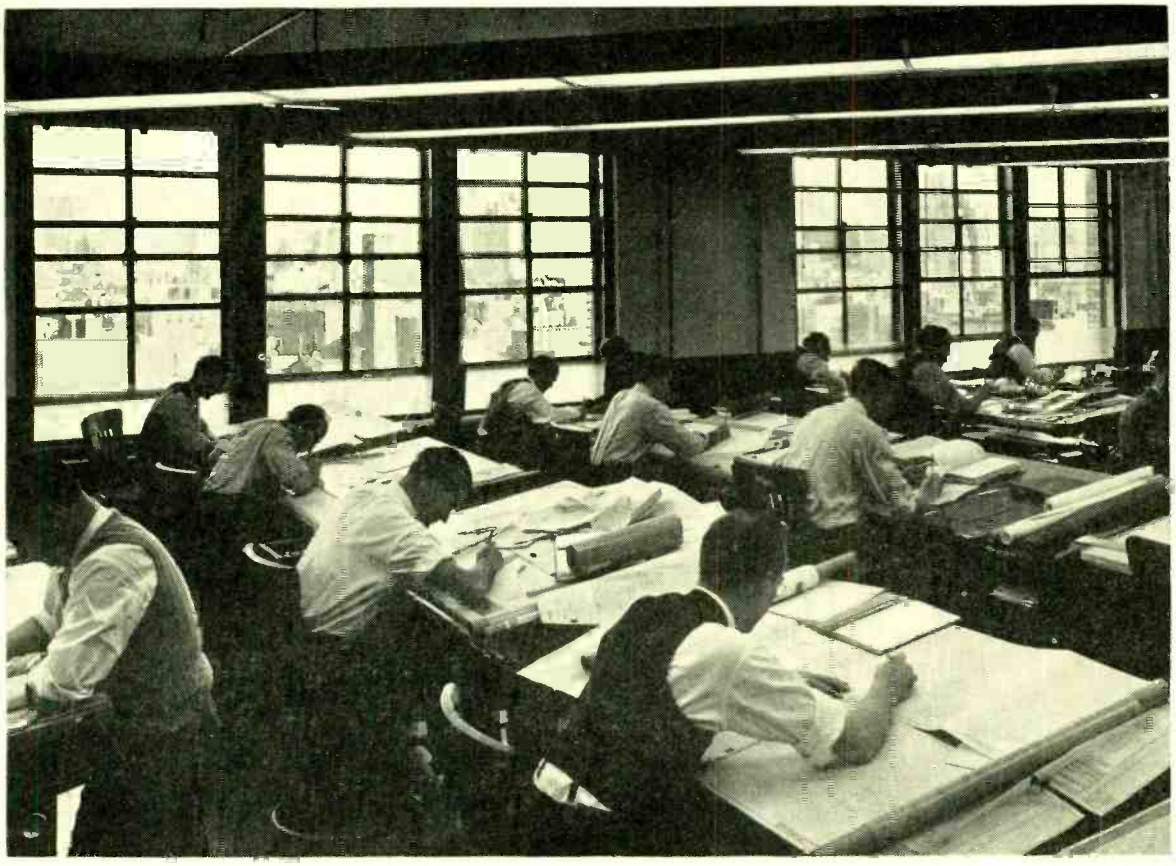
Fortunately, increasing numbers is not the only way that drafting manpower can be enlarged. Modern equipment and the best possible working conditions play an equally important part in speeding up production. With this in mind, the Systems Development Department has recently provided new quarters for its drafting personnel.

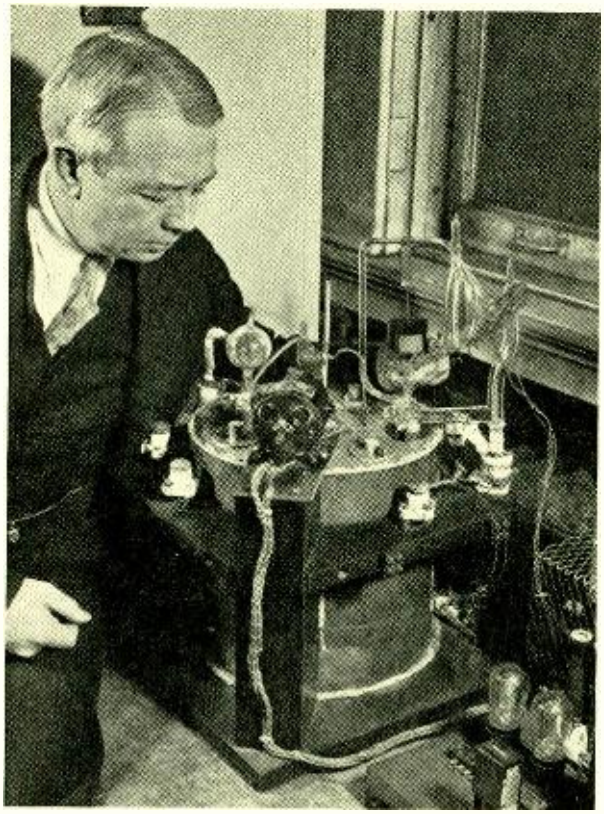
The most conspicuous and important feature of the new drafting room, as shown in the photographs, is the fluorescent lighting provided by long fixtures stretching diagonally across the ceilings. This lighting gives almost perfectly uniform illumination in the neighborhood of seventy-foot candles on the drafting tables.



The diagonal arrangement is a compromise affording a maximum of flexibility in the placement of the drafting tables. This method also combines the advantages of fixture patterns that are arranged parallel or perpendicular to the rows of tables.

The brilliant illumination obtained by the new installation is in striking contrast to the fifteen-foot candles formerly considered adequate for drafting. Its effectiveness is illustrated by the fact that the accompanying photographs were taken without the aid of any auxiliary lighting. John Mills, Jr., was the photographer.





Solubility of Metals in Mercury

By C. H. PRESCOTT, JR.
Chemical Laboratories

MERCURY is the only pure metal that is liquid at ordinary room temperature. Reasonably inert, it finds many applications in industry and in the laboratory. Among these is the making and breaking of electrical circuits, but, since the circuit terminals involve other metals, this application requires knowledge of the interactions between mercury and the metals with which it comes in contact. One such interaction is the solution of a metal in mercury.

Most metals dissolve slightly in mercury and they also react chemically with it to form intermetallic compounds. Platinum, the classical metal for contact with mercury, deteriorates slightly with age and becomes brittle with long exposure to it. Iron and tungsten seem inert, but this may be due in part to the protection of adherent surface films of oxide. Lead, tin, zinc, and cadmium are sufficiently soluble to alter the properties of the mercury which makes them unsuitable for use in contact with it in mechanical devices. Silver, copper, nickel, and platinum are but slightly soluble.

The solubilities in mercury of these last four metals and of iron and stainless steel have been recently determined by the Laboratories by a new method employing a circulating still of pyrex glass. Mercury is evaporated from a boiler, Figure 1, into a condenser. It then flows down through a bulb packed with scraps of the metal whose solubility is being determined and back into the boiler. The bulb which contains the metal sample is held in an oil thermostat at a temperature of 100 degrees C.

Since the mercury moves slowly, it becomes saturated with metal which subsequently precipitates in the boiler. After a few days, or months, depending on the solubility of the metal under test, the still is removed from the thermostat, the mercury completely evaporated from the boiler, and the residue recovered for chemical analysis. This residue is the metal dissolved, at the temperature of the

thermostat, in the total amount of mercury circulated during the experiment. The stills used in these preliminary tests are not adapted to measure the rate of circulation, but it was possible to estimate that about one kilogram of mercury circulated per day in each of these experiments since the mercury siphons intermittently through the return tube.

Due to the uncertainty of this estimate, solubilities so derived are only accurate within a factor of three, but they show very large differences in the properties of various metals. The solubility of silver was found to be 0.0018 gram per gram of mercury and that of copper was tenfold less, i.e. 0.00013 gram per gram. For silver, the most soluble metal studied, the value is in fortuitously good agreement with those in the chemical literature. The experiments on silver and copper were finished in three and thirteen days respectively, which times correspond inversely to their solubilities.

Nickel and platinum are so much

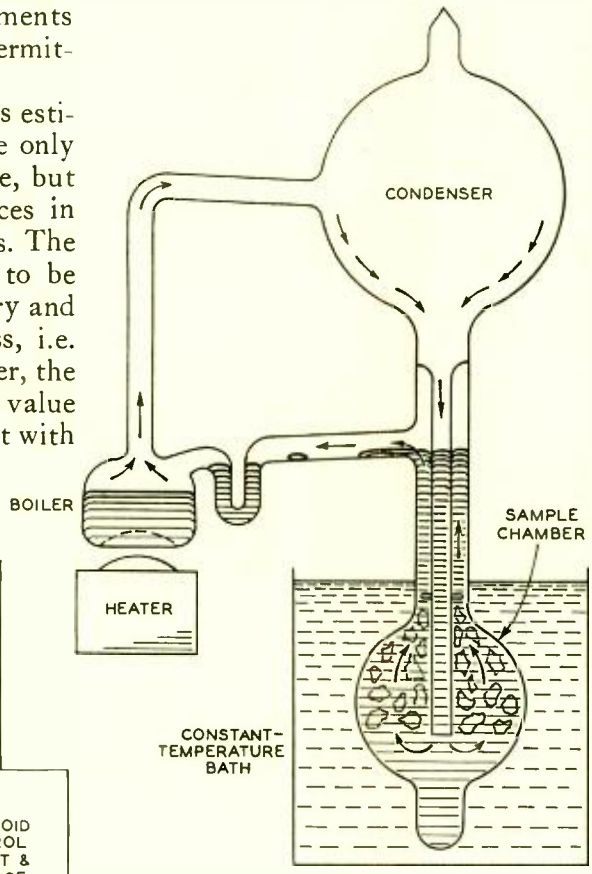


Fig. 1 (above)—Mercury evaporates from a boiler into a condenser from which it flows down through a bulb packed with scraps of the metal whose solubility is determined. The temperature of the metal is maintained constant at 100 degrees C. by an oil thermostat

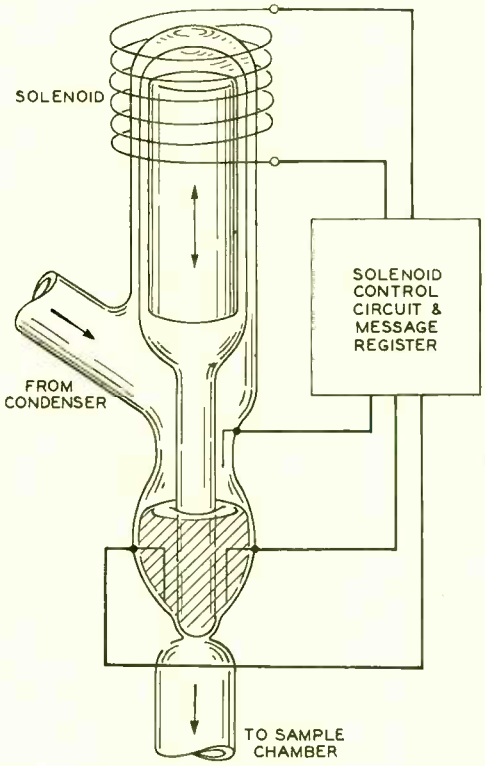


Fig. 2 (left)—To measure the flow of mercury it is accumulated in a chamber of known volume which has tungsten contacts. When the mercury closes the contacts at the right, the solenoid lifts a glass valve and empties the chamber. The valve closes again when the mercury falls below the two lower contacts and the circuit is opened

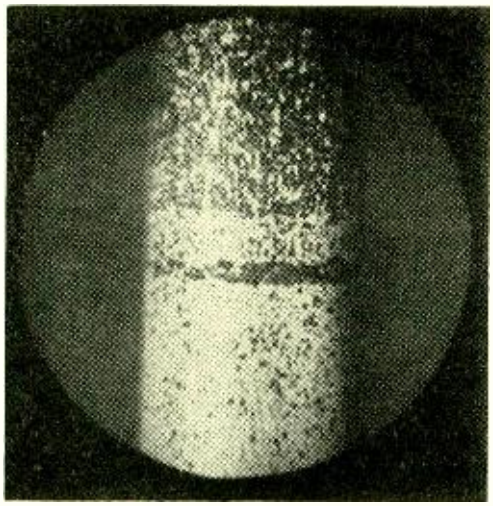


Fig. 3—Nickel cylinder partially covered with nickel black deposited by distilling the mercury from the amalgamated surface. Magnification seven diameters

less soluble that experiments on them required three and seven months respectively. The nickel residue was small, and the platinum recovered was a mere speck. The solubility of nickel was 1.4×10^{-7} gm./gm. or one part in seven million. That of platinum was thirty times less, 4.6×10^{-9} gm./gm.

With iron and stainless steel, the boilers were perfectly clean after eight months. Washings gave a spectroscopic test for iron with indicated solubilities of about 5×10^{-11} gm./gm. or one part in twenty billion. This may mean a real solubility, or it may be due to an invisible particle of scale which drifted into the boiler. More careful and extensive work would be required to decide, but the solubilities of iron and stainless steel are at least extremely small.

To gain further accuracy, a solenoid valve has been added to the still to measure the flow of mercury. The mercury accumulates in a measuring chamber, Figure 2, which has tungsten contacts. When these are closed by the mercury the solenoid is energized through a vacuum tube circuit and a relay. This lifts the iron armature with the glass valve attached to it and empties the chamber. In the improved apparatus a steam jacket surrounds the return tube from the sample bulb to prevent precipitation of metal before it reaches the boiler. So far, this still has been used only for copper; and gave a solubility in mercury at 100 degrees C. of 1.17×10^{-4} gm./gm. which is probably correct within 10 per cent.

Solubility in mercury, however, is only part of the story. The surfaces of silver, copper, nickel, and platinum are easily wet and remain covered with a fluid film of mercury. At the surface of contact there forms a layer of solid amalgam, an intermetallic compound of the metal with mercury. Silver amalgam forms readily; copper, soaked in mercury for a few months at 100 degrees C., disintegrates completely into crystals of copper amalgam. The surfaces of nickel, which has been submerged a few days and platinum, a few months, become rough and granular. When the mercury is distilled off, layers of nickel or platinum black are left behind. These are finely divided metal that are formed by the disintegration of the solid amalgam. Such a nickel surface, partially covered with nickel black, is shown in Figure 3.

It thus appears that the material in equilibrium with mercury in these solubility experiments is not the metal itself, but this layer of solid amalgam. Actually the metal must be somewhat more soluble than the amalgam. Thus, as it slowly dissolves, it is reprecipitated as an intermetallic compound which covers the surface and retards further attack. The free metal is

essentially unstable in the presence of mercury, and this change into solid amalgam is one form of disintegration suffered by silver, copper, nickel, and platinum.

The solubilities of nickel and platinum are below the limit of a spectroscopic test on the mercury in equilibrium with the metal and the quantity of metal actually in the mercury, at any instant, is negligible.

There appear to be relations, however, between the solubility and the speed of disintegrative processes which affect the service life of mercury switches. These processes include the formation of solid amalgam and, in some cases, intercrystalline attack of the metal itself.

The extreme sensitivity and theoretical simplicity of this method of measuring solubilities opens a new field of investigation on the interactions of metals and mercury. Though primarily devised for mercury, this procedure should be adaptable to a wider field in the determination of low solubilities of metals.

Contributors to this Issue

J. J. Mahoney, Jr., entered the Development and Research Department of the A T & T in 1926. About a year later he was transferred to the test station at Walker Street where he remained until 1938 in various capacities from messenger to laboratory mechanic. He attended Pratt Institute evening classes for several years. He transferred to the Protection Development Department in 1938 where he was engaged in the field maintenance of automatic oscillographs. Since October, 1939, he has been concerned with standard protection studies as a member of the technical staff. This work has included the development of instruments and techniques for natural and artificial lightning tests in the field and laboratory as well as the conduct of these tests.

C. H. Prescott, Jr., received the A.B. degree from Yale College in 1922 and his Ph.D. from the California Institute of Technology in 1926. Holding a research fellowship and a National Research Fellowship at the latter institution, he continued studies of high temperature chemical equilibria until he came to the Laboratories in the fall of 1928. Dr. Prescott

J. J. Mahoney, Jr.

C. H. Prescott, Jr.

E. A. Schramm

entered the Electronics Research Department to conduct research and development work on caesium photoelectric cells and repeater tubes with oxide-coated filaments. Following a transfer to the Chemical Laboratories in 1938, he has been engaged in research on interactions between mercury and various metals of interest in current switch developments. This includes the solubility studies discussed in this issue of the RECORD.

E. A. SCHRAMM received the degree of B.S. in Electrical Engineering from Washington University in 1928 and joined the Apparatus Development Department of the Laboratories that same year. He engaged in design of filters, chiefly for radio applications, until 1934, then spent about a year in the power transformer group before returning to the filter department for further work in connection with carrier systems. Since 1940 he has been chiefly concerned with the design of networks for equalization and regulation of type-K carrier systems.

F. R. STANSEL joined the Laboratories in 1926 after receiving the B.S. in E.E. degree from Union College that year. Until 1936 he was engaged in the design of high-power radio transmitters for broadcasting and transatlantic service at the Whippany laboratory. He then became associated with the development of oscillators and detectors for test purposes and is now with the Systems Development Department. In 1934 Mr. Stansel received the M.E.E. degree from Brooklyn Polytechnic Institute and the D.E.E. degree in 1941.

S. J. BRYMER became a technical assistant in the Systems Development Department of the Laboratories on graduating from the Brooklyn Boys' High School in 1920. He spent nine years in the drafting room and then transferred to the special equipment group to work on trial installations and current development problems. Since 1938, Mr. Brymer has been concerned with the development of common systems equipment. He received the E.E. degree from the Brooklyn Polytechnic Institute in 1933.

F. R. Stansel

S. J. Brymer