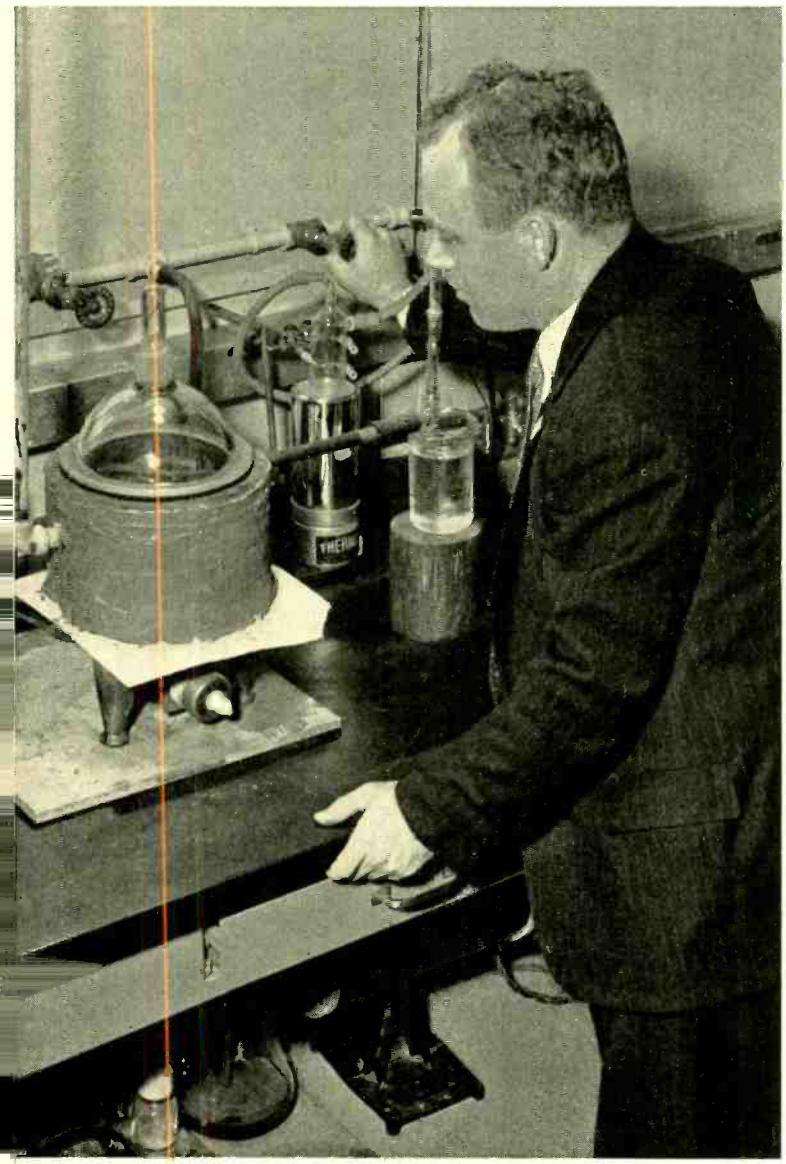
ELL LABORATORIES RECORD



AUGUST
1942

VOLUME XX

NUMBER XII

Determining the plasticizer content of plastics
(*see page 294*)

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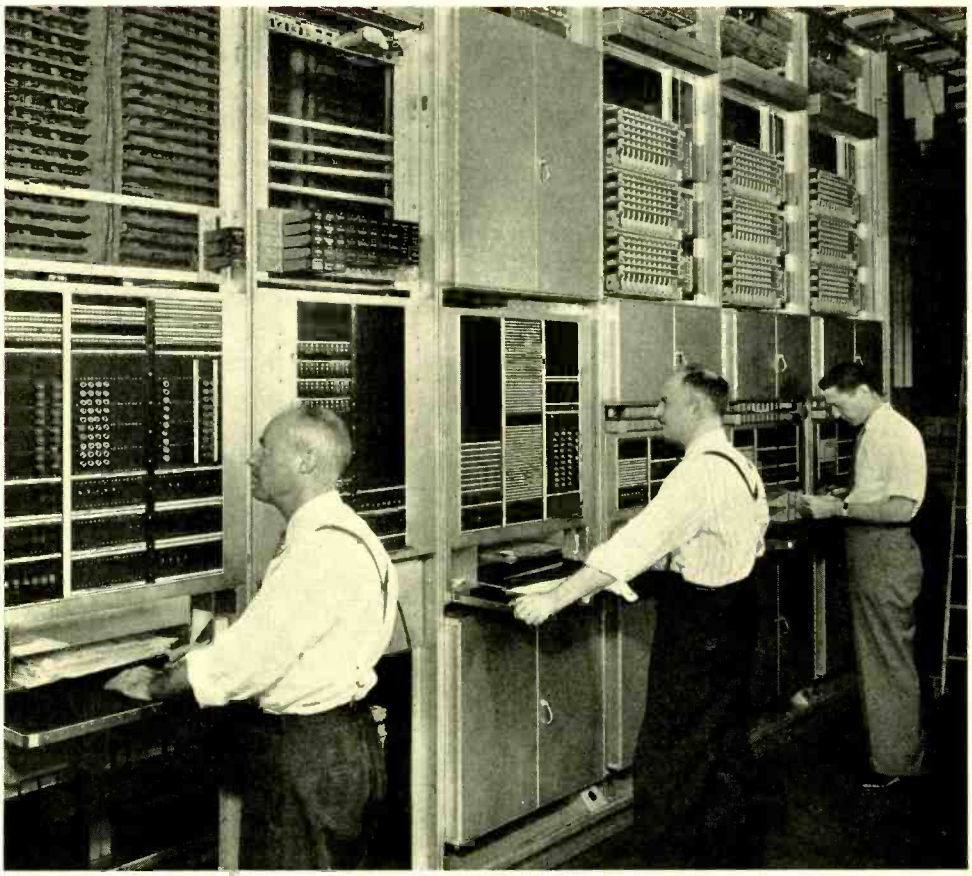

A Crossbar Tandem Office

By F. A. KORN
Switching Development

A TANDEM office* is an interconnecting center for a large group of central offices, much as a central office is for a large group of subscribers. It promotes economy in the use of trunks by making it unnecessary to run trunks between each pair of central offices in the group. A suburban office, for example, instead of having a separate group of trunks to each office in New York City, would have trunks to a tandem office, and through it would be able to reach any of the metropolitan offices. In this way a single group of trunks from each outlying office to the tandem office makes unnecessary the large number of trunk groups that would otherwise be required. Not only will the total number of trunk groups be reduced, but the efficiency of use of the trunks provided will be increased.

Until recently there have been two standard types of full-mechanical tandem offices available for large cities

*RECORD, *January*, 1930, *page* 233.

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served by panel and crossbar offices. These are known as the "office selector tandem" and the "sender tandem" office, and both use panel-type switching equipment. The former, which is the simpler of the two, is designed only for full-selector calls in panel and crossbar areas; that is, the control of the call must originate in panel or crossbar senders. At the tandem office the call is handled by a panel-type selector frame—the brush and group selection on this frame being guided by two groups of signals transmitted from the sender at the calling office. Since the latter sender can control only a single set of office brush and group selections, only one tandem office selector can be used for a call, and the total number of outgoing trunks which it can reach is limited to 450. Since there is a maximum of fifty groups of trunks per frame, this tandem cannot give access to more than fifty groups of trunks, and there will be less than fifty if any of the groups require more than a ten-terminal assignment on the multiple.

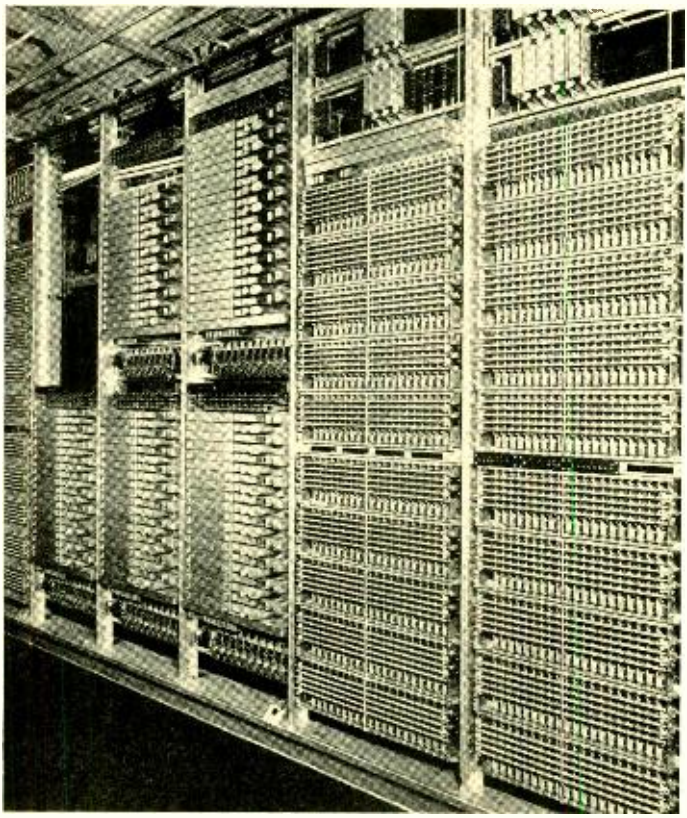

Fig. 2—Tandem trunk and trunk-link frames in the new crossbar tandem office

This limitation is avoided in the panel sender tandem office by employing a sender at the tandem office to receive all three digits of the office code transmitted by the originating sender, and to translate them into the proper signals to control a district and one or two office selectors. With two or three frames in tandem, the number of trunk groups and the num-

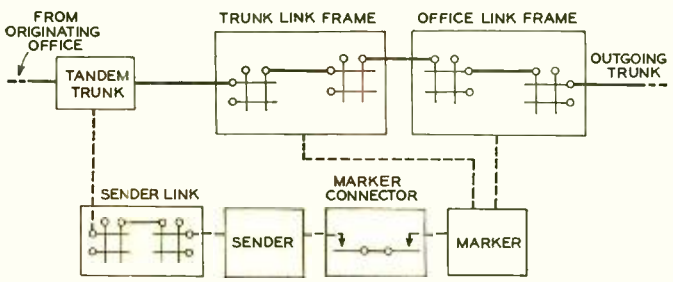

Fig. 1—Fundamental switching plan of the crossbar tandem office now installed in New York City and Detroit

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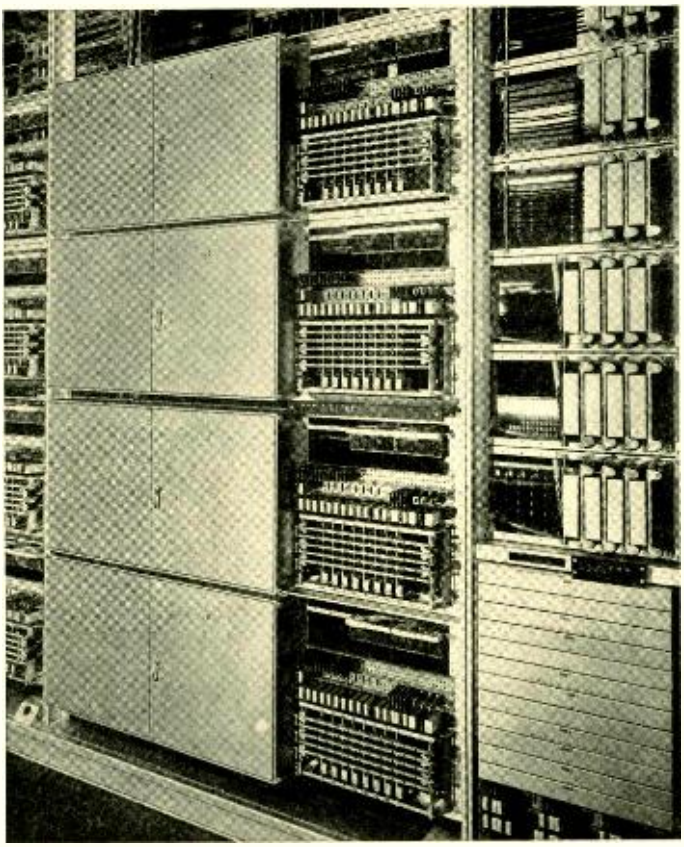

Fig. 3—Sender frames with marker connectors at the right

ber of trunks per group may both be greatly increased. This sender tandem office also provides means for making connections to an operator for setting up calls received from A operators via straightforward trunks and will handle calls to manual offices on either a straightforward or call-announcer basis. It is, however, considerably more expensive than the office selector tandem, and introduces greater delays in the completion of calls.

With the development of the crossbar central office system,* studies were made to determine methods of obtaining the many advantages of crossbar switching in a tandem office in respect to both reliability and trunking efficiencies. As a result of these studies, a crossbar tandem office has been developed, and initial installations have just been made in New York City and Detroit. The new crossbar tandem will handle all types of service that the panel office selector tandem will, and it can readily be arranged to handle all the types of service available with the panel sender tandem office. It will more adequately and dependably handle the future requirements for tandem equipment for all panel and crossbar areas and serve as an interconnector between panel or crossbar and step-by-step equipment on either an operator dialing or subscriber dialing basis.

The system is simple and flexible and one that can be economically maintained. Precious metal twin contacts insure better and more reliable contacts, and the all-relay construction reduces wear and maintenance.

The fundamental switching plan of the crossbar tandem is indicated in Figure 1, and the appearance of the various frames may be seen in the accompanying photographs. It includes trunk-link, office-link, and sender-link crossbar frames, together with senders, marker connectors, and markers. Solid lines are used to indicate the talking or "built-up" connection path, and dotted lines indicate the elements used in building up

*RECORD, *February*, 1939, *page* 173.

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the connection. Circuits from the calling offices are terminated on tandem trunk relay circuits, and several such trunk circuits are provided to take care of the various types of connecting offices. Calls are handled much as with the district and office frames of a local crossbar office, and access is provided to as many as one hundred groups of trunks with practically any number of trunks in each group. An incoming call is connected to an idle sender through a sender-link frame, and the digits are recorded. A connection is then secured to a marker, which selects and closes a path through the crossbar switches to a trunk to the desired office.

Each tandem trunk circuit is cabled to a trunk-link frame and also to a sender-link frame. Trunk-link frames are arranged for a maximum of 160 tandem trunks, like the new incoming-link frame already described in the RECORD.* Each sender-link frame can accommodate one hundred tandem trunks and in this respect is similar to the terminating sender-link frame of the local crossbar system. It is capable of connecting a trunk to any of a maximum of forty senders. Under some conditions two types of senders are required. Revertive senders are used for calls from panel and crossbar offices, while dial-pulse senders are used when connections must be made from step-by-step offices or manual boards equipped with dials. When two types of senders are required, forty of each type may be connected to each sender-link frame by splitting the horizontals of the secondary switches. This provision for two classes of senders improves the efficiency of the sender-link frame, since without it separate link frames would be required for each class of sender. Each trunk is connected to two primary sender-link switches, and should it fail to establish a connection to a sender through the first, an attempt will be made over the second. This provides a substan-

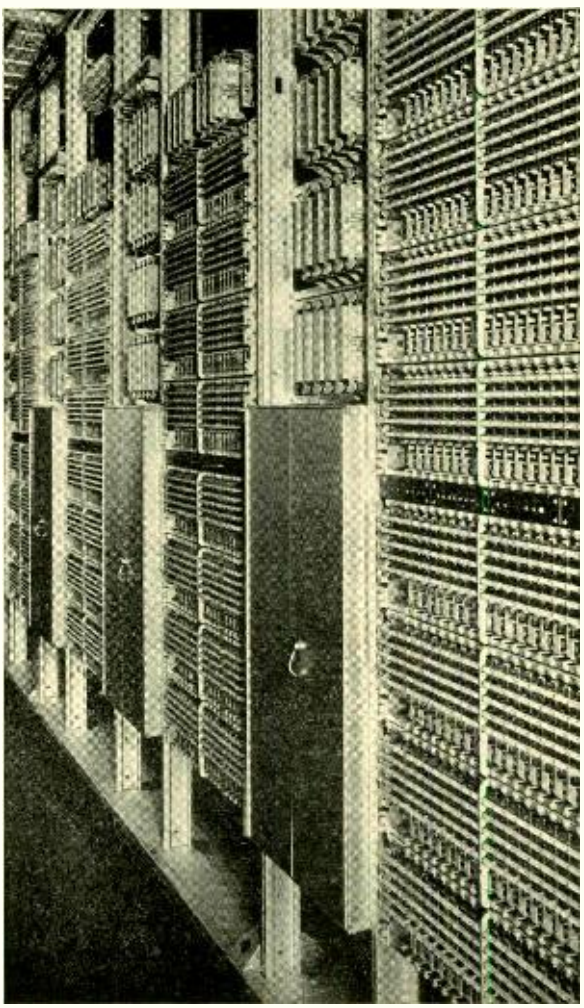

Fig. 4—Sender-link frames in the new crossbar tandem office in New York City

*RECORD, *January*, 1942, *page* 114.

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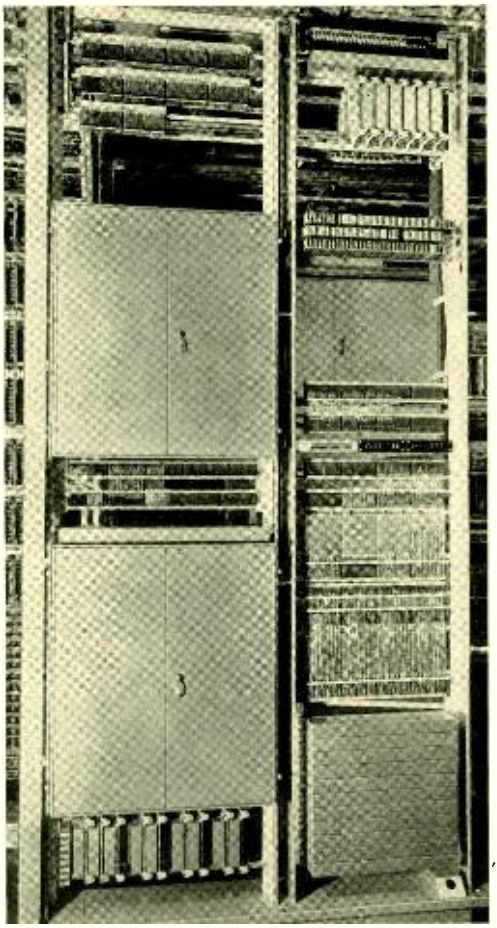

Fig. 5—One marker in the New York crossbar tandem office

tial safeguard to service when trouble exists on a sender-link frame.

The revertive sender, used for calls from panel or crossbar offices, is arranged to receive revertive* type pulses. The dial-pulse sender, on the other hand, is designed to receive dial pulses, and under normal conditions is proposed only for areas where connections are required from step-by-step offices or switchboards equipped with dials. On calls for a panel or crossbar office, the revertive sender receives all digits, and after the connection through the tandem switches has been set up, it sends out those needed to establish the connection at the called office. This feature, whereby the tandem sender repeats revertive pulses to the terminating office, permits much longer or higher resistance trunk loops between the originating and terminating offices than would be possible if the switches at the terminating office were controlled directly by the originating senders. The dial-pulse sender will also send revertive pulses, and, like the revertive sender, is arranged to send out pulses for completing calls to step-by-step offices.

For calls to manual offices equipped with call indicators, the revertive sender receives only the pulses required for establishing the tandem connections; the pulses for operating the call indicator at the distance office are sent by the originating sender after the tandem connection has been established. This arrangement, which makes it unnecessary to provide equipment in the tandem revertive senders for storing and sending out panel call indicator pulses, was adopted for reasons of economy. Any possible advantages which might result from the use of call indicator repeating equipment in the tandem revertive sender would be overcome by its cost and because it would be used less and less in future years due to the decrease in the number of manual offices. The dial-pulse sender, however, is arranged to send out panel call-indicator pulses, since on such connections there are no originating senders capable of sending these pulses to the manual offices.

The markers used with the crossbar tandem office are similar in function and general operating procedures to the originating markers used in the local crossbar system.

*RECORD, June, 1929, page 395.

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With these various facilities the crossbar tandem system is now arranged to establish connections from and to the various types of trunks indicated in Figure 6.

An important feature introduced with the crossbar tandem office is the concentration of remote-control charging and timing circuits for panel offices. The use of timing and multiple-charging control equipment in panel offices for interzone calls is relatively expensive, since it requires that considerable equipment be added to each district-selector circuit. With the new crossbar tandem office, certain of the tandem trunk circuits are provided with the necessary equipment for timing calls and for transmitting charge-control pulses to the panel office. Since only a small fraction of the originating traffic is interzone, the provision of this equipment in the tandem trunks is more efficient than the use of control equipment for each individual district. The pulses are received at the district selector by a simple circuit using a cold-cathode tube and relay which operates the subscriber-line register directly. In this way the costly timing and zone charging equipment is limited to a relatively few tandem trunk circuits instead of being required in all of the district circuits of the panel offices. These trunks can be arranged for either one or two rates. When two are provided the rate used is controlled by the marker which determines it from the zones of the originating and called offices.

This plan obviously forces the routing of the zone calls through the interzone crossbar tandem, part of which

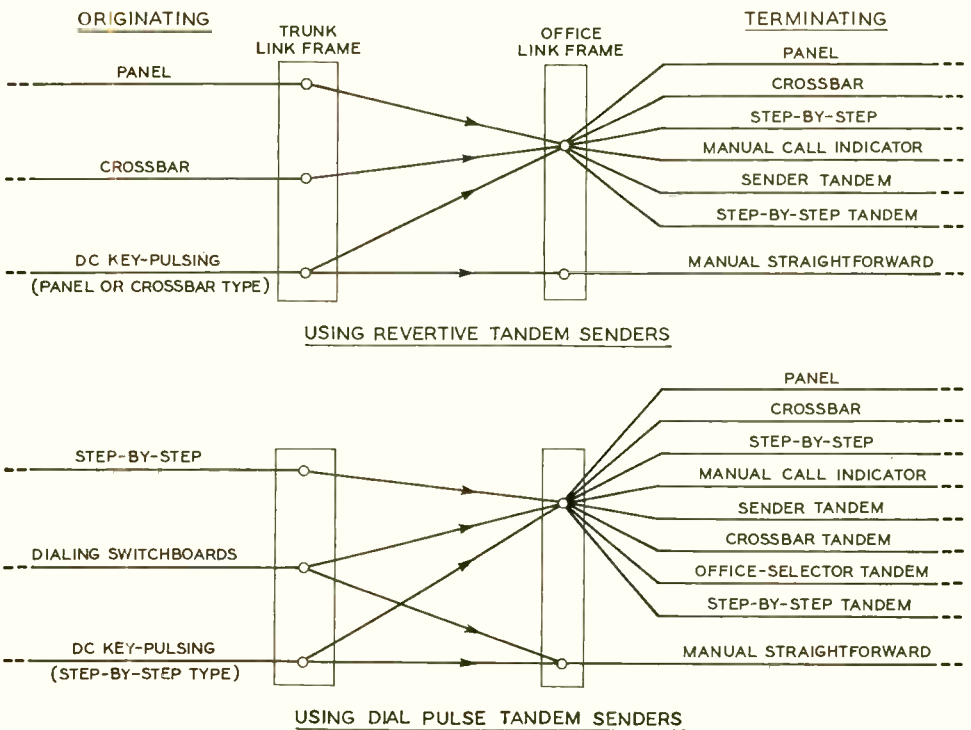

Fig. 6—Types of trunks between which the facilities of a crossbar tandem office can establish connections

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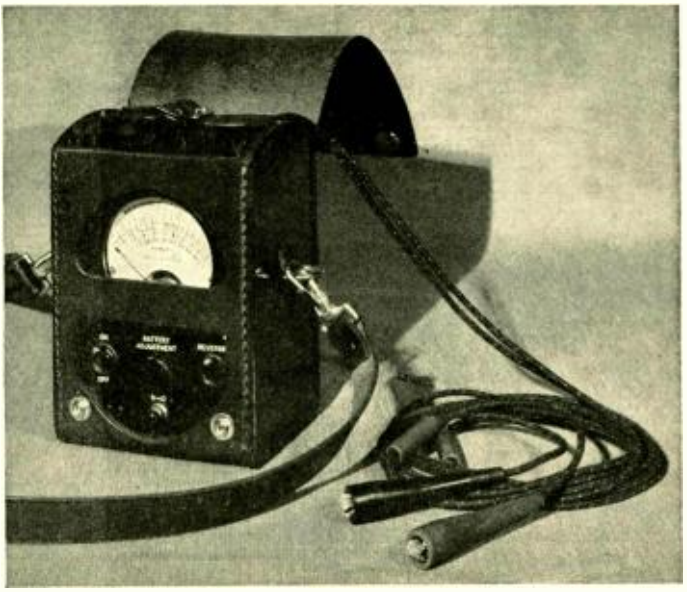
might otherwise be routed by way of direct trunks or other existing types of tandem offices. This disadvantage is more than offset by the concentration of the costly zone registration and control equipment in the tandem office. In the local crossbar system this disadvantage does not exist because the originating marker makes it economically possible to provide zone timing and registration circuits in the originating crossbar offices in proportion to the traffic.

The crossbar tandem office is also equipped with a substantial number of maintenance circuits, such as a trunk test, sender test, outgoing-trunk test, and trouble indicator. A photograph of the maintenance center at the New York crossbar tandem office is shown at the head of this article. The bays from left to right are sender test, sender make-busy, trouble indicator, and three bays of trunk test circuits. Like the similar equipment in local crossbar offices, these circuits impose routine tests on the equipment, and detect incipient trouble so that it may be corrected before it interferes with normal telephone service.



To improve service in community dial areas, a portable test set, coded KS-8455, has been developed for repairmen's use, primarily as an aid in locating trouble on subscribers' lines. It is a volt-ohmmeter of 100,000 ohms resistance, with a 45-volt battery, and cords for making connections. Housed in its bakelite box and including a leather carrying case, it weighs about two and a half pounds. The set supplements present equipment and is used for measuring the insulation resistance of a line, for localizing line faults such as grounds and opens, for detecting the presence of bridged condensers, and for measuring line potential. Its use reduces considerably the time required to restore faulty lines to service.

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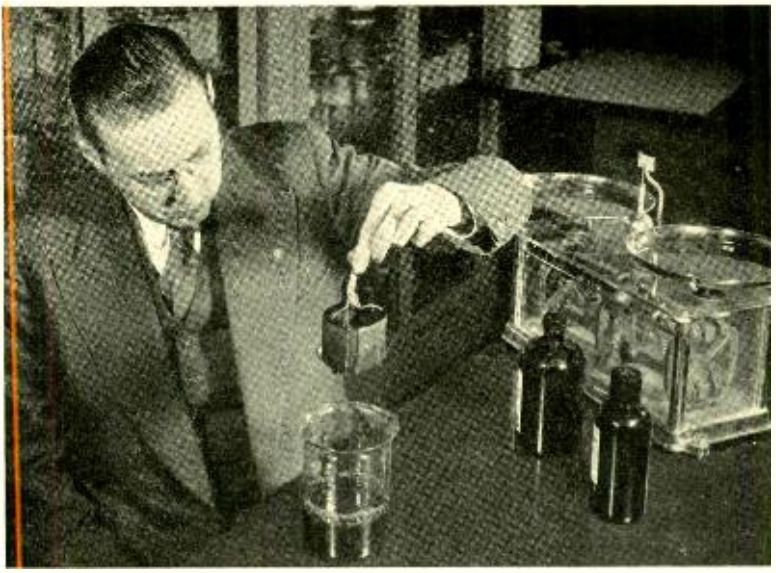
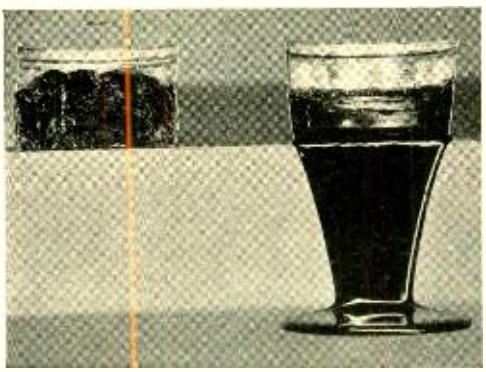


Impregnating Varnishes

By W. J. KIERNAN
Chemical Laboratories

UNTIL the recent development of synthetic resins and drying oils, the impregnants applied to coils contained linseed or china-wood oils and natural resins. Those materials would "set" by oxidation on the surface, leaving the interior in a semi-fluid state. In the unset portion, fatty acids were usually present, sometimes in sufficient strength to corrode copper. These drawbacks may sometimes be avoided by using wax and resin compounds, but the low melting points of these materials may require potting containers and large safety factors in coil design to prevent the impregnating medium from liquifying under ordinary conditions.



Synthetic resin varnishes, left, solidify throughout by polymerization. Varnishes made from natural oils and resins, right, harden on the surface by oxidation, leaving the interior in a semi-fluid state. This is illustrated by cutting a small can of each kind in halves after baking the contents

Varnishes made with synthetic resins of the phenol-aldehyde type avoid most of these limitations. They polymerize on drying rather than oxidize, and produce a solid state throughout their mass. Corrosive tendencies are negligible or entirely absent because of their complete setting and low acid content. When thoroughly dried by baking at elevated temperatures they

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are no longer thermoplastic. This feature is an advantage because it allows coils to operate at higher temperatures without softening the impregnating material and permits substantial savings by reducing the size of the coils. For certain types of apparatus potting containers may be eliminated.

The penetrating power of these synthetic resins, which leaves few voids in the coils, and their high dielectric strength make them particularly valuable for high-voltage circuits where corona discharges might occur. These must be minimized because corona in voids filled with air oxidizes the nitrogen and produces nitric acid which breaks down the insulation.

Retardation coils and power transformers of several types, designed for telephone apparatus, are now being impregnated on a production basis with synthetic resin varnishes. The results indicate advantageous possibilities for their wider use.

Determining the Plasticizer Content of Plastics

Cellulose plastics find many telephone applications, notably in the handset housing. To make them tough and more easily handled in molding, a plasticizer is added. Its amount has to be carefully controlled to assure that the finished article is hard enough to resist marring and able to hold its exact shape indefinitely. R. H. Erickson is shown in the Frontispiece, page 285, determining the plasticizer content of cellulose acetate and cellulose acetate-butyrate plastics.

The arrangement is much like that of the familiar double boiler used in the kitchen. Weighed samples of plastic in glass dishes are set under the glass dome on a plate which is maintained at a constant temperature of 256 degrees C. by a boiling liquid in another chamber below it. The space above the samples is evacuated to a pressure of one mm of mercury; and the plasticizer, which is ordinarily considered essentially nonvolatile, distills out of the plastic into the ice-cooled trap on the right. Any volatile matter which escapes the ice trap is caught by the dry-ice trap behind it and thus can not damage the vacuum pump. At the end of a specified period the distillation is stopped by releasing the vacuum and the dishes are cooled and reweighed. The loss in weight represents the amount of plasticizer in the sample.

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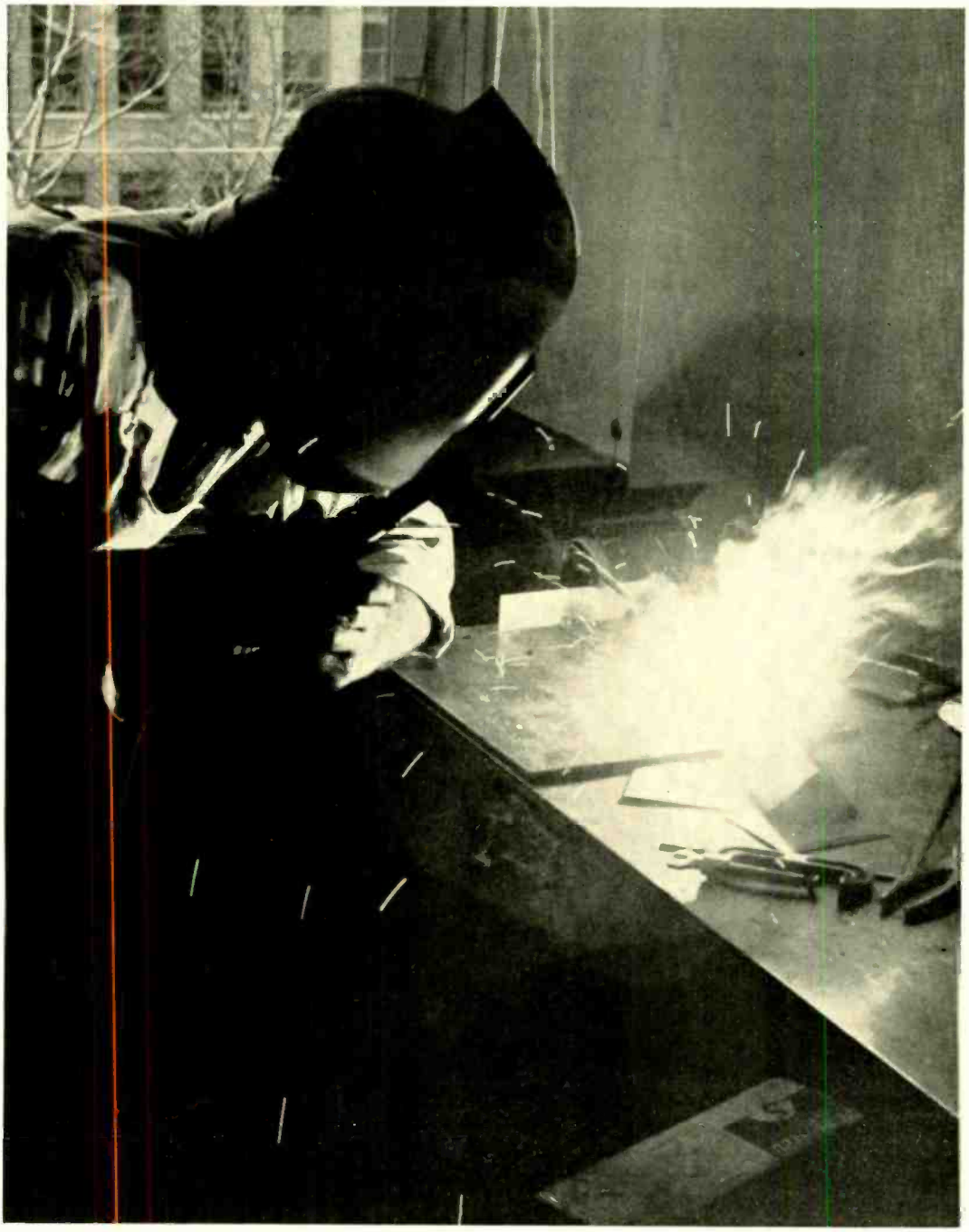
NEWS AND PICTURES



Welding parts of an angle-iron frame in the Development Shop at Murray Hill

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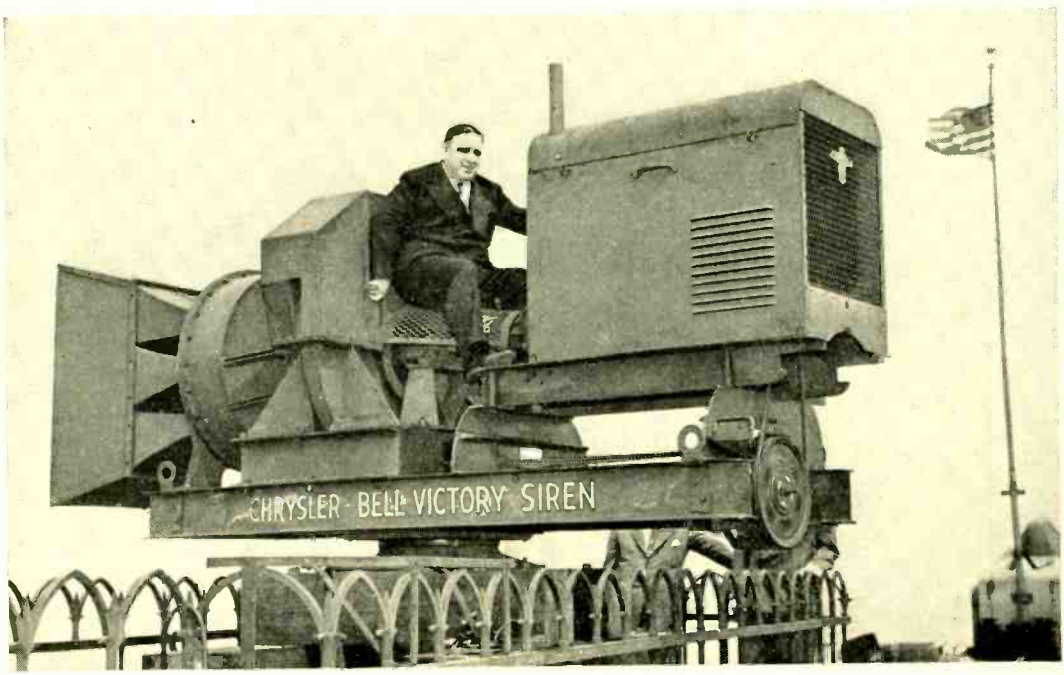
News of the Month

New Siren Has Successful Trial in New York City

Installed on the roof of the RCA Building, tallest of the Rockefeller Center group, an air raid signal designed by the Laboratories and built by the Chrysler Corporation has had a number of successful tests on July 4 and subsequent Saturdays.

Following the demonstration on Manhattan Bridge early in March, an experimental model of the siren, together with manufacturing information, was turned over to Chrysler engineers at the direction of the Office of Civilian Defense. The first production sample was shipped to New York. As installed here, the complete outfit of 140-hp automobile engine, blower, "chopper," and horns is mounted on a turntable driven by the engine. In that manner the entire sound output, concentrated into a beam, is swung continuously around the circle. For the July 4 tests a steady note of about 440 cycles was sounded, but on July 11 the frequency was warbled between 300 and 420 cycles, for the first test, and the steady note was sounded later. The warble note will be used as an "alert" signal and the steady note for the "all clear." Reports from police observers and the public were generally favorable; the signal was audible for roughly three and a half miles, depending on the directness of the path and the noise level. It is understood that orders have been placed by the city for a number of additional outfits.

During the tests, sound meter readings were made by Laboratories' engineers at a number of points. J. B. Kelly was on the 59th floor of the Salmon Tower at 5th Avenue and 42nd Street; he observed 114 db. J. B. Little and T. L. Dowey were on the 79th floor of the Empire State Building, 5th Avenue and 34th Street, and observed



The Mayor of New York inspects the new siren

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105 db. J. A. LEHANS in Central Park opposite 66th Street observed 100 db. In all cases the background noises were 35 to 50 db below the signal.

INVENTIONS AND WAR NEEDS

THE GOVERNMENT, through the National Inventors' Council, has suggested that all inventions or discoveries of the employees of research and development organizations be reviewed from the standpoint of their application to Military, Naval or other Governmental needs.

If any member of the Laboratories sees any application to Military, Naval or other Governmental needs of any work, or has any ideas, whether or not associated with his own work, which he thinks might be of use to the Government, the Laboratories will be glad to have them reviewed by appropriate persons and called to the attention of the Government through this Council or through other proper channels.

Anyone wishing such a review of his ideas should forward them to G. M. CAMPBELL, in writing and accompanied by drawings or sketches if capable of illustration.

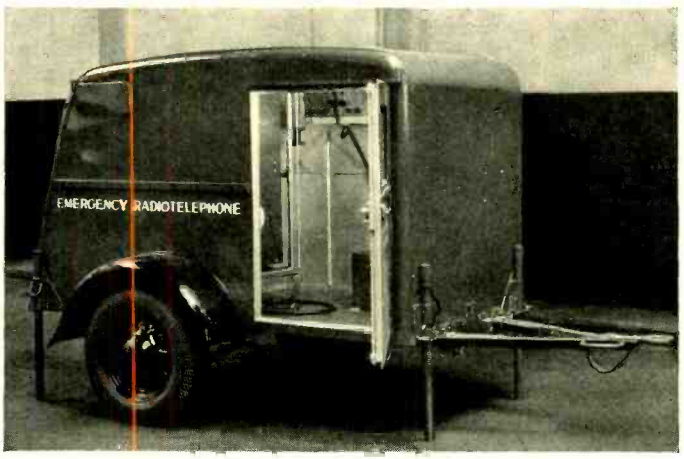
This procedure, of course, does not apply to any confidential work which the Laboratories is doing for departments of the Government. The ideas of any of the men associated with such work should be handled in the group responsible for the work.

ROLLING RADIO STATION

TO PROVIDE in mobility for the Bell System emergency radio telephone sets, engineers of the A T & T have developed the

140-RT radio telephone trailer. As shown by the accompanying pictures, this is a two-wheel vehicle designed to house the 221B equipment and to shelter the operator. When fully loaded with radio and other equipment the trailer weighs about 2000 pounds. Fittings on the trailer permit towing by passenger car or truck.

It takes only a few minutes after the trailer is uncoupled to establish an operating radio terminal. At its location the trailer is steadied by adjustable pipe supports at its four corners; and its doors are thrown open. Using the materials it carries, a fifty-foot mast is quickly erected and the proper connections are made to the radio equipment. Following this the normal ground connections are made and the gasoline engine-driven generator, which is located in the rear compartment of the trailer, is started to provide the necessary power supply. Immediately the radio operator calls the distant station and makes known the availability of the radio terminal. Connections from the trailer station to the nearest telephone line are made and the central office is advised that communication over the emergency radio channel is available for service.



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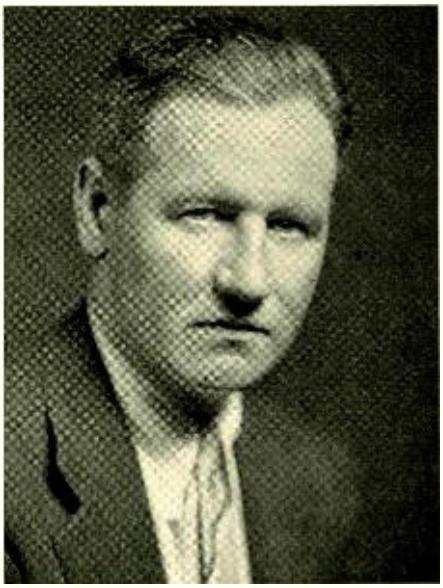
CHARLES E. MARTIN, M.D., became Medical Director of the Laboratories on July 13, succeeding DR. MELVILLE H. MANSON who has been appointed Medical Director of the New York Telephone Company where he will be responsible for the Medical Departments at 140 West Street, and in Brooklyn, Albany and Buffalo. DR. JOHN H. BOGLE, who has been associated with our Medical Department for the past three years, principally on periodic and preplacement examinations, enlisted and was then called into service during the latter part of June. Dr. Bogle is now a Captain in the Station Hospital at Fort Snelling, Minnesota.



Dr. Charles E. Martin was appointed Medical Director of the Laboratories on July 13

At the Murray Hill Laboratory, DR. GORDON A. STEPHENSON takes the place of DR. ORRIN F. CRANKSHAW who enlisted and was ordered to active duty at Camp Edwards, Massachusetts, where he is a Captain with the Yale Medical Unit (39th General Hospital). Dr. Stephenson is on duty at Murray Hill from 10:30 to 12:30 and available on call at other times.

Dr. Martin comes to the Laboratories from the Albany Hospital where he had been Medical Director for the past seven years. After taking the pre-medical course at Union College from 1918 to 1920, he received his M.D. degree four years later from the Albany Medical College. He remained at the college for the next three years, the first year being spent on special work on pathology and the other two as Resident Surgeon. From 1927 to 1935 Dr. Martin practiced surgery and also taught in the Department of Surgery at his alma mater. In addition, he was examining physician for the New York Telephone Company from 1929 to 1932 and from 1932 to 1935 was Medical Officer of the company for its Eastern and Central Divisions. In 1935 he became Medical Director of the Albany Hospital and early this year had been appointed Assistant to the Dean. Dr. Martin is a member of Phi Sigma Kappa, the American Medical Association and the American Hospital Association. He has written a number of papers for scientific and medical journals.

Dr. Stephenson received his M.D. degree in 1929 from the Arts and Medical School of the University of Buffalo. He served his interneship in the Orange Memorial Hospital and from 1932 to 1934 was Resident in Surgery at the Jersey City Medical Center. Since that time he has practiced medicine in Summit where he is also Associate in General and Gynecological Surgery in Overlook Hospital.

Eat it up
Wear it out
Make it do
Do without

When asked what made New England great, Calvin Coolidge responded with these four maxims. Our practice of them today will help to win World War II.

VAIL MEDAL AWARDS

FOR OUTSTANDING ACTS OF SERVICE in 1941, Mrs. Mary E. Cusick of the Illinois Bell, William Webb Grantham of the Southern Bell and Hazel Belle Grobert of the Indiana Bell have been awarded Theodore N. Vail medals of silver, each one accompanied with a cash award of $500.

Mrs. Cusick, who is a central-office in-

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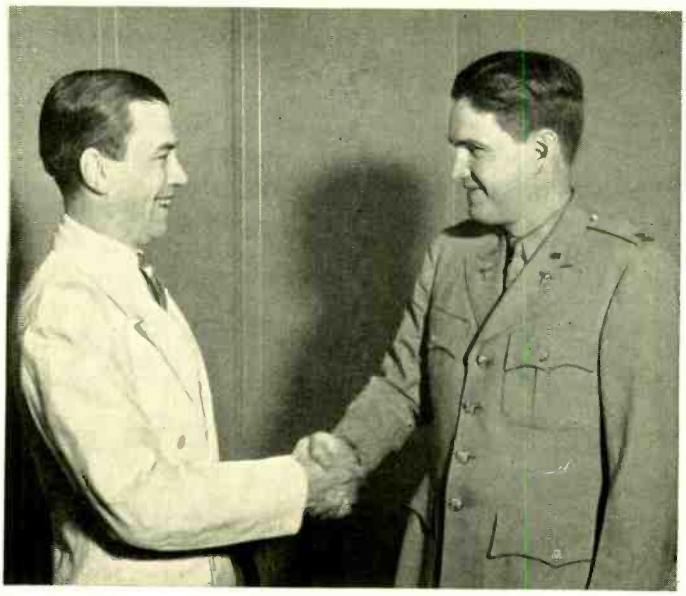
structor in Chicago, rendered extraordinary service to help save the life of a four-year-old girl who had swallowed acid and was dying in a hospital. While on duty one Sunday night last November she received a call asking for help in finding officials of the company which had made the acid. It was imperative, the caller stated, for the doctor to know the acid formula in order to prepare the right antidote. Acting with great resourcefulness and perseverance, Mrs. Cusick through persistent effort and much ingenuity located the chemical company officials and connected them with the hospital.



Dr. Gordon A. Stephenson (left) succeeds Dr. Orrin F. Crankshaw at Murray Hill. Dr. Crankshaw is now a Captain with the Yale Medical Unit at Camp Edwards, Massachusetts

Mr. Grantham, installer-repairman at Gulfport, Mississippi, rescued a power company lineman who had been badly burned by a high-voltage line and was hanging helpless in his safety strap. Climbing a pole, near which dangled a broken end of the hot wire, Mr. Grantham worked very close to the dangerous line and lowered the injured man to the ground. He then rushed the patient to the hospital in the telephone company truck and continued to assist in every way that he could. His prompt, intelligent and courageous action undoubtedly saved a life.

Dr. Melville H. Manson (left), recently appointed Medical Director of the New York Telephone Company, and Dr. John H. Bogle, now a Captain in the Army and who was ordered to the Station Hospital at Fort Snelling, Minnesota

Hazel Belle Grobert, operator at Kendallville, Indiana, won her medal by conspicuous devotion to duty during a tornado which swept the town on the night of May 15, 1941. The storm disrupted all electric service and put more than half the telephones out of commission. Bricks and timber crashed through the roof of the central office and it seemed that the

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building itself might collapse. Despite great danger Miss Grobert stayed at her post, maintaining all possible telephone service, protecting the switchboard from rain which came in through the ceiling, and summoning help. Her action prevented extensive damage to telephone equipment and made possible prompt restoration of service.

In determining the national awards, the National Committee reviewed reports of 17 cases in which 21 bronze medals were awarded by committees of the various companies. The Vail Memorial Fund was established in 1920 in memory of Theodore N. Vail, former President and Chairman of the Board of the A T & T, and for 22 years the Vail medal awards have given recognition to acts of noteworthy public service which demonstrate the traditional Bell System spirit.

One thousand and fifty members of the Laboratories have received the sticker illustrated above, which the Treasury Department of the U. S. designed for display by those regularly investing ten or more per cent of income in War Bonds. Actually those who are subscribing for War Bonds to this extent are more than this number. Several persons had no interest in obtaining the sticker and so did not return to the Bond Committee a signed statement as to the per cent of their subscriptions. There is no way of determining just how many more there are without imposing on the Payroll Department the serious load involved in checking percentages for each employee.

For the Laboratories as a whole during June there went into bonds 7.2 per cent of the June payroll, including overtime payments. An accounting made July 20 showed only 209 persons, or 3.6 percent of the then personnel, as not subscribing at all. This figure is not as bad as it sounds since the Laboratories increased its personnel by two or three hundred persons during the last month; and many only got on the payroll just in time to be counted. They may be expected to subscribe in the near future. Several more of those who are not subscribing have long been absent because of serious illness; but they must be counted in the percentage since reports to the U. S. Treasury and other authorities do not take such absences into account.

During the month of June, 2267 members of the Laboratories increased their bond allotments; and 211 more did so during the first fifteen days of July. Now that the flurry of the June 15 income tax payments is well past, it is expected that still more will increase their subscriptions and the total per cent of the Laboratories' payroll which goes into bonds will be appreciably increased.

Telephone Pioneers

James W. Farrell was elected president and William H. Matthies a member of the Executive Committee of the Edward J. Hall Chapter, Telephone Pioneers of America, at the annual meeting held on June 17.

During the second quarter of 1942, the following have enrolled as Pioneers:

Ernest L. Baulch	Warren A. Marrison
Homer W. Dudley	George S. Mueller
Lester H. Germer	Joseph C. Rile
Estill I. Green	Milo O. Schrum
Arnold A. Hansen	Thomas A. Spencer

John Zoller

The Executive Committee of the Telephone Pioneers of America has voted that as a matter of patriotic necessity the meeting of the General Assembly scheduled for September 25 and 26 in Detroit be cancelled. This action is in line with the recent recommendation of Joseph B. Eastman, director of the Office of Defense Transportation, that all meetings and conventions not closely related to the war effort be called off in view of increased demands on railroad facilities.

Air Raid Wardens

The photograph at the top of the next page shows a group of the key men in the Laboratories' Air Raid Warden Service of which W. A. Tracy, zone warden, is in

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Key men in the Air Raid Warden organization of the Laboratories. Left to right: E. H. Backman, Harry Schreiber, E. A. Wieland, W. W. Andrews, W. A. Tracy, J. P. Greene, Patrick Monahan, E. J. Reilly, Patrick McLaughlin, Patrick Doorly, Walter Connick, Edward Bulman and George Wismar

charge. Reporting to him as sector wardens are EDWARD BULMAN, WALTER CONNICK, JOHN LEONARD and DANIEL O'NEILL. Thirteen senior post wardens, who supervise ten posts consisting of ninety wardens at the West Street buildings, two posts of twenty-three wardens at the Graybar-Varick building and one post of twelve wardens at the Davis building report to these sector wardens. At West Street the senior post wardens are W. W. ANDREWS, E. H. BACKMAN, J. P. GREENE, PATRICK MCLAUGHLIN, AINSLEY MEGRAW, PATRICK MONAHAN, E. J. REILLY, HENRY SCHAEFFER, HARRY SCHREIBER and DENNIS TYRRELL. At the Graybar-Varick building they are PATRICK DOORLY and E. A. WIELAND and at the Davis building GEORGE WISMAR. There are also four building control directors—MILTON ELLIS, JOHN MURRAY, PATRICK O'NEILL and WILLIAM WISSEL.

NEWS FROM MEN IN SERVICE

CORPORAL RAY P. CHAPMAN writes:

I am now stationed in northern Ireland as part of the American forces. It is a beautiful country of rolling hills and neat farms. The foliage is bright green in color probably due to the large amount of rain and all the land is utilized for farming or cattle grazing.

The people are quite friendly and have gained most of their knowledge about America from the "Cinema" which shows the latest Hollywood productions. Tennis and golf seem to be the most popular sports—I have seen some courses which are really tough even for an expert.

I am pleased to say that I have been receiving the RECORD regularly and it sure is a pleasure to read it.

HUBERT A. SHEPPARD was commissioned a Major in the Air Corps on June 15. He writes:

My active duty orders ordered me to duty in the Office of the Chief Signal Officer. However, when the Army was reorganized into its present three branches that section of the Signal Corps to which I was assigned was transferred to the Air Corps. So now I am in the Air Corps and my Major's commission is an Air Corps promotion. Since February, 1942, I have been an Engineer Officer (the branch in which I held my Reserve Commission), a Signal Corps Officer and now an Air Corps Officer. Sometimes I wonder if I am "fish, fowl or just plain red herring." However, in spite of all this shifting around my work has remained the same—that is Aircraft Warning Service.

LIEUTENANT COLONEL ALBERT M. ELLIOTT writes from Jacksonville:

During the Carolina Maneuvers I met many Bell System men in the service and regardless of the branch they had started in, nearly all were by then in communications work. And all were

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While on leave A. J. Leimer had his photograph taken with a familiar background. He is now an Aviation Ordnanceman in San Juan, Puerto Rico

doing a good job, too. I was assistant to the Signal Officer, First Army, so was in a position to observe.

On conclusion of maneuvers I had expected to return to my regiment in Virginia, but in December was assigned to First Army Staff. By February my family and furniture had arrived in New York and were settled; then in May I was transferred to Jacksonville, Florida. It was only a few days ago we again "got settled." My duties here are Signal Officer, Southern Sector, which is one of the four sectors of this Eastern Defense Command. It comprises the states of North Carolina, South Carolina, Georgia and Florida. The telephone facilities in this area are comparatively limited and distances are great so communications problems are real "problems." Much radio is used. I find the work very interesting and consider that I have been very fortunate all along in my assignments.

During recent trips through Washington I have never failed to see less than a half dozen Laboratories men in the offices of the Chief Signal Officer, as well as many A T & T and several New York Telephone men.

LIEUT. SHERMAN T. BREWER writes from the Signal Corps School at Fort Monmouth:

I have been going to school for the past three months. It seems as though there is no place like the Army for schools. Even the generals find that they are not immune. . . .

These are difficult days. We are all called upon to sacrifice things which were taken for granted yesterday, or to accomplish things which were impossible the day before. Nevertheless, because of the nature of the American people, these new demands will act to challenge rather than discourage their indomitable spirit and will. It is fortunate for us today that the "summer soldiers" and the "sunshine patriots" are few and far between. And so each of us can face the future unafraid, with renewed determination to perform the task at hand, however small it may seem, to the best of his ability. For we know that all of our little individual efforts are a vital part of the great effort which lies ahead.

EMIL ALISCH has graduated from the Command and General Staff School at Fort Leavenworth, Kansas, and has returned to his former organization at Fort Lewis, Washington. On June 3 he was promoted to Major and his present assignment is Plans and Training Officer.

ALBERT J. ENGELBERG, who transferred from the Air Corps to the Signal Corps last April, was promoted to Lieutenant Colonel on June 16. He is now in the Office of the Chief Signal Officer in Washington.

F. A. HINSHAW has been commissioned a First Lieutenant in the Signal Corps. He is now at Camp Evans, New Jersey.

AMONG OTHER recent promotions are: DICK S. BARLOW to First Lieutenant; JOSEPH F. DALY, Staff Sergeant; RICHARD A. DEVERAUX, Lieutenant Colonel; FRANCIS M. HODGE, Sergeant; WILLIAM H. LICHTENBERGER, First Lieutenant; GEORGE M. RICHARDS, Second Lieutenant; and SAMUEL C. TALLMAN, First Lieutenant.

L. J. SIVIAN, who has been on leave of absence with the National Defense Research Committee since June 23, 1941, returned to the Laboratories on July 6.

CAPT. ALBERT G. KOBYLARZ is at Wright Field with the Signal Section of the Air Service Command.

GEORGE BICKARD is now at Fort George Wright where he is with the Headquarters group which records changes in personnel of the Second Air Force.

MEMBERS OF THE LABORATORIES who have been granted leaves of absence to enter military service since those noted in the last issue of the RECORD are CLEMENT BOSCH, CAPT. ORRIN F. CRANKSHAW, M.D., GEORGE W. GALBAVY, MARTIN P. HUGHES, LIEUT. WILLIAM M. KNOTT, LIEUT. JAMES H. MILLER, ROBERT T. ROONEY, DANIEL F. SKELTON, MAJOR MORTON SULTZER, JAMES J. VIGGERS and KENNETH E. WATERS; and to enter naval service, JACK I. PICARD.

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News Notes

William H. Harrison, a former director of the Laboratories, became a Brigadier General on June 26 and since July 1 has been in charge of the production, procurement and distribution activities of the Services of Supply of the Army.

Harvey Fletcher's paper, *Hearing, the Determining Factor for High-Fidelity Transmission*, presented before the Broadcast Engineering Conference in Columbus, Ohio, was published in the June issue of the *Proceedings of the I.R.E.*

Members of the Laboratories presenting papers at the summer convention of the A.I.E.E., held in Chicago from June 22 to 26, were D. E. Trucksess, *Regulated Tube Rectifiers in Telephone Offices;* R. H. Colley, *Poles and Pole Treatments;* and R. I. Wilkinson, *The Combination of Probability Curves in Engineering.*

L. H. Germer presented a paper on *Stray Magnetic Fields from Cobalt* and A. M. Skellett one on *The Use of Secondary Electron Emission to Obtain Trigger or Relay Action* at a meeting of the American Physical Society held at Pennsylvania State College.

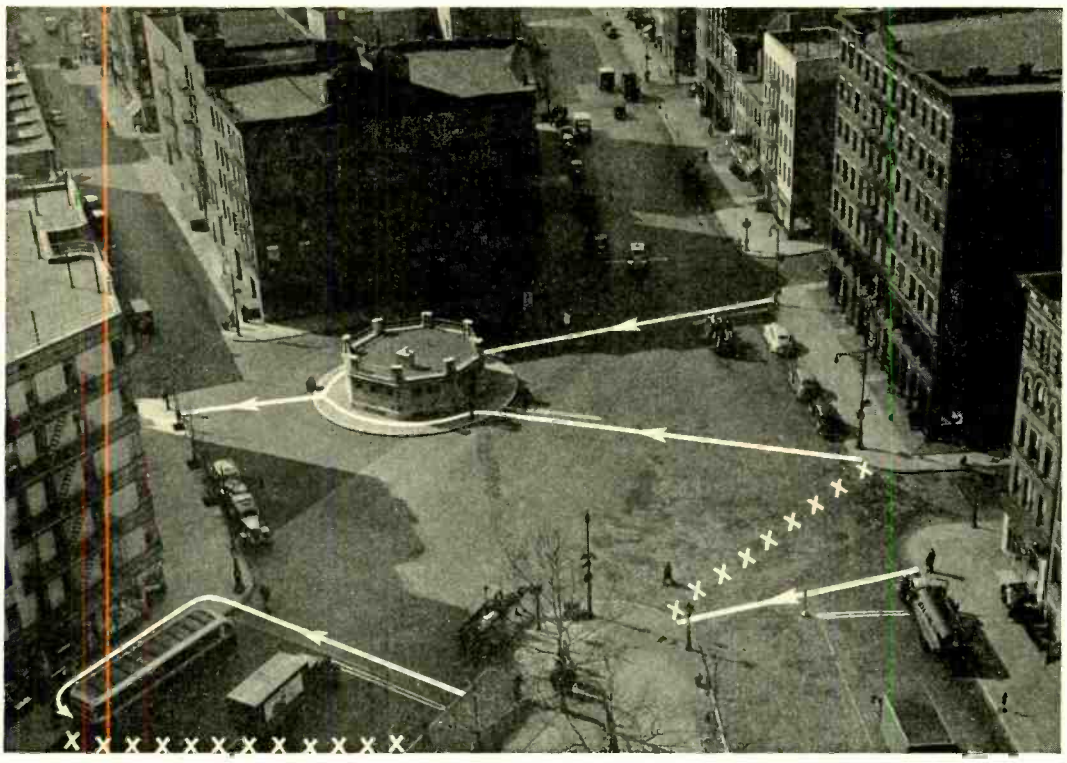
R. T. Staples went to the Whitney Blake Company's plant in New Haven and to the Point Breeze plant to confer on cord development problems.

C. A. Webber, W. V. Thompson and W. J. King were in Hawthorne in connection with the design of cords and cables.

C. A. Webber visited the Okonite Company at Passaic to discuss cable problems.

C. O. Mallinckrodt is making field tests and modifications on the type-K2 carrier systems at Pittsburgh, Altoona, Harrisburg and Allentown.

R. M. Burns, K. G. Compton and C. H. Sample visited Wilmington, North Carolina, to observe marine corrosion studies carried on by the International Nickel Company. Mr. Burns, at a meeting of the American Coördinating Committee on Corrosion held at Atlantic City, was elected to chairmanship of this committee.



X *marks the spots where a pedestrian might meet with an accident. Solid lines show safe paths across Abington Square. Also, "Watch the Traffic Lights"*

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Some Members of the Laboratories

THIS MONTH the RECORD presents the following biographies of members of the Laboratories chosen by lot.

* * * * *

TO HIS SHOP teacher in grammar school, JOE KOCAN gives the credit for his bent toward instrument making. Some credit should go to his father, too, who is a mechanic himself. At any rate, after graduating from Central High School in Paterson, Joe signed up in July, 1937, for the Laboratories' apprentice course. Three years later he was a junior mechanic and was assigned to work under one of the engineers at Graybar-Varick. Realizing that his advancement will come from what he knows, Joe is taking physics, calculus and drawing in Newark Technical School, looking toward a bachelor's degree in electrical engineering.

With his parents, a brother, and three sisters, Joe Kocan lives in Singac. When time permits, he golfs—a game which he learned years ago.

JOSEPH KOCAN

* * * * *

THE SAILORS who go rowing in Central Park are kin spirits to GUS KOENIG (AUGUST W., JR., on the records) who after a day making gadgets for the engineers at Graybar-Varick goes home and builds a little engine for a model airplane. He builds the planes, too, and flies them at a nearby "airport." Just to make his home look like the Development Shop (or is it vice versa?) he has a drill press, lathe and grinder. Gus' mechanical aptitude stems from his grandfather, uncle and father; all of them machinists. He graduated from the Mechanical Arts course at Bryant High School, Long Island City, in 1935, and entered the Laboratories' apprentice course the next year. For the last six months he has been in the Development Shop at the Graybar-Varick building. Drill

AUGUST W. KOENIG, JR.

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ELENA TIGHE

press and lathe now have a rival, for Gus married about a year ago. His wife likes music and dancing, and is reported to be keeping an eye on the "Shop Equipment Wanted" advertisements. Photography — her husband's other hobby—is more to her taste.

* * *

ELENA TIGHE is a girl everybody likes—particularly the engineers at Graybar-Varick from whom she takes dictation. One of her arts—stenotypy—she acquired at business school after she graduated from St. Angela Hall in Brooklyn. Her other art—that of being liked—she learned by instinct.

Elena entered the Laboratories in 1934, in Transcription; a year later she went to Graybar-Varick. Born in Richmond Hill, she now lives in Brooklyn, where her mother and two sisters make something of a pet of her while she makes a pet of "Penny," a beagle hound. An ardent horsewoman, she rides every week in the year, even spending her vacations at a nearby "dude ranch." No information is available, however, as to why this summer's vacation trip was in Florida.

* * * * *

COMMUNICATIONS RUNS IN "BURT" SIMONS' family. His father was commercial manager for Western Union and Burton began to build radio receivers at an early age. He still builds them—the Western Electric police receiver was one of his projects.

After completing high school in Worcester, where he was born, young Simons went through the Polytechnic Institute there, specializing in electronics and getting an M.S. degree in 1937. Then entering the Laboratories, he was for a short time with the Electrical Measurements group and transferred to the Receiver group in Radio Development. He says: "After getting the requirements to be met by a receiver, such as frequency band, gain, selectivity and power supply, I work out a likely looking circuit, make a bread-board model if necessary, and then go into a huddle with the Mechanical Design people Their job is to get the elements into the allowable space; my job is to see that the assembly works."

The Simons family—father, mother and

BURTON H. SIMONS

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Burton—live in Jackson Heights. Burt swims and plays tennis in summer; the family generally go together to their old home town for vacation.

* * * * *

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

Research Department

H. T. Budenbom
L. A. Elmer
P. B. Flanders
Joseph Nedelka
N. D. Newby
R. S. Ohl

Apparatus Development Department

L. G. Bostwick
L. J. Cobb
Ada Corcoran
F. J. Daniels
A. E. Dietz
W. J. Farmer
R. A. Hecht
R. J. Nossaman
W. W. Werring

Systems Development Department

F. B. Blake
R. G. Bowen
Mildred Brosnan
V. T. Callahan
H. T. Douglass
J. M. Duguid
George Garbacz
D. M. Hannum
R. E. Hersey
Frank Huebsch
D. F. Johnston
R. A. Leconte
John Meszar

Patent Department

J. E. Cassidy
Kathryn McGaughin
Margaret Shea

Murray Hill Project Department

A. F. Leyden

Personnel

I. W. Whiteside

Financial

Adelaide Sweeney

General Service Department

H. W. Salch

Plant Department

D. P. Barry
F. W. Brunnengraber

K. G. COMPTON attended meetings of the Electroplaters' Society, held in Grand Rapids, Michigan, from June 8 to 11.

J. M. FINCH, at the A.S.T.M. convention held at Atlantic City, discussed questions concerning insulating papers and insulating sheet materials. B. L. CLARKE and C. J. FROSCH also attended this convention.

H. W. HERMANCE visited central offices in Evanston, Ill., and in Pittsburgh in connection with contact performance studies. Mr. Hermance gave talks before telephone engineers in Chicago and Pittsburgh describing recent work on causes of contact noise.

B. L. CLARKE and MR. HERMANCE visited the Davison Chemical Company in Baltimore on silica gel dehumidification studies.

C. S. FULLER and B. S. BIGGS visited the Resinous Products & Chemical Co., Philadelphia, on matters pertaining to plastics.

W. FONDILLER, D. E. TRUCKSESS and N. Y. PRIESSMAN visited the General Electric Company at Lynn on problems relating to the supply of selenium rectifiers.

E. HABIT of the Transmission Apparatus Development Department received a degree of M.S. in Mechanical Engineering from New York University last June.

E. R. MORTON visited the John Oster Manufacturing Company, Genoa, Illinois, to collaborate in the design of special motors.

D. D. MILLER visited the Leeds and Northrup Company, Philadelphia, to discuss special telephone apparatus.

C. D. HOCKER attended the annual meeting of the A.S.T.M. at Atlantic City.

R. H. COLLEY attended a meeting of the Executive Committee of the American Wood-Preservers' Association at Cincinnati.

OBITUARIES

LYLE W. WICKERSHEIM, a former member of the Systems Development Department who retired in 1938, died on June 27. Mr. Wickersheim graduated from the University of Southern California in 1916 with a degree of B.S. in Electrical Engineering. He received, from the same university, a degree of A.M. in Physics in 1928 and an E.E. degree in 1929. He was with the Engineering Department of the Western Electric Company from 1916 to 1922, except for a year during

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ERNEST VAUPEL
1881-1942

L. W. WICKERSHEIM
1894-1942

World War I when he was in the Signal Corps. During this time he was concerned with laboratory work in connection with carrier telegraph developments. In 1922 he left the company and for the next two years was with the Wickersheim Implement Company in California. He then joined the Engineering Department of the Southern California Telephone Company where he was concerned with equipment layout and central-office engineering. In 1929 Mr. Wickersheim transferred to the Telegraph Development Department of the Laboratories where he was engaged in the development of carrier telegraph systems, both high frequency and voice frequency, until his retirement in 1938.

* * * * *

ERNEST VAUPEL, formerly an instrument maker in the Development Shop who had retired in 1938 after twenty-six years of service, died on July 5. After graduating from the public school in Long Island City in 1896, Mr. Vaupel took evening courses in mechanical drawing at Cooper Union, while working as a mechanic during the day. Later he became a toolmaker with the Neptune Meter Company and then an instrument maker with the Splitdorff Magneto Company. In 1912 he came to the Western Electric Company as an instrument maker in the Development Shop. At this time, machine-switching equipment was in its infancy and coin collectors not as readily available as now and he spent many years working on this type of equipment. For several years he had charge of "short order" work and later supervised a group of instrument makers engaged in the construction of sound-picture apparatus and telephotograph transmitters and receivers.

* * * * *

C. C. LAWSON visited the Point Breeze Works of Western Electric Company in connection with production of special cables.

J. M. HARDESTY was in Bedford, Pa., to discuss corrosion protection work on the Harrisburg-Pittsburgh A and B cables.

APPLICATION of new cleaning methods to panel-bank terminals were discussed with

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

L. G. Abraham
H. G. Arlt
M. W. Baldwin, Jr.
H. L. Barney (2)
G. M. Beardow
W. M. Bishop
B. O. Browne
E. Bruce (2)
C. J. Christensen
R. C. Davis
J. W. Dehn
R. W. DeMonte
H. W. Dudley
W. H. Edwards
L. Egerton
E. B. Ferrell
A. G. Ganz
J. J. Harley
H. C. Harrison (2)
C. A. Hebert
R. A. Heising
W. Herriott
C. N. Hickman
W. H. T. Holden (4)
F. A. Hoyt
Francis A. Hubbard
K. S. Johnson
W. F. Kannenberg
J. A. Kater
L. W. Kelsay
G. V. King
F. R. Lamberty
B. F. Lewis
M. A. Logan
W. H. Martin
W. P. Mason
A. E. Melhose
J. M. Melick
P. B. Murphy
E. H. Perkins
G. M. Phillips
A. F. Pomeroy
S. A. Schelkunoff
W. G. Shepherd
L. J. Sivian
R. J. Tillman
E. C. Wente
J. M. West
A. J. Wier
G. W. Willard
M. K. Zinn

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FRANCIS F. LUCAS
of the Chemical Laboratories completed forty years of service in the Bell System on the first of July

WILBUR E. MOUGEY
of the Outside Plant Development Department completed thirty-five years of service in the Bell System on July 8

engineers of the New York Telephone Company at Buffalo by W. E. VIOL, A. TRADUP and H. W. HERMANCE.

AT THE HAWTHORNE plant of the Western Electric Company, G. E. BAILEY and A. J. WIER discussed production problems on type-K2 carrier equipment; W. W. BROWN, operators' chairs constructed of substitute materials; C. H. ACHENBACH and G. W. MESZAROS, power equipment; and D. E. TRUCKSESS, manufacture of power rectifiers.

A. E. JOEL, JR., of the Switching Development Department received an M.S. degree from the Massachusetts Institute of Technology last June.

F. A. KORN conferred with engineers of The Bell Telephone Company of Pennsylvania on problems relating to the No. 4 toll crossbar office.

H. T. LANGABEER observed tests on the type-L carrier systems at Eau Claire and Baldwin, Wisconsin, and on the 110-A central-office power plant at Gary, Indiana.

A. E. PETRIE and W. T. BRECKENRIDGE attended a conference with the General Electric Company engineers at Schenectady.

V. T. CALLAHAN, at Lansing and Muskegon, Michigan, discussed engine development problems.

C. E. BOMAN visited the Lyon Metal Products Company, Inc., located at Aurora, Illinois.

F. W. WHITE of the Equipment Development Department received a B.E.E. degree from Cooper Union last May.

E. D. SUNDE, J. J. MAHONEY, D. G. NEUMAN and MISS E. M. BALDWIN have been in New England making surge tests on aerial cables.

L. S. INSKIP, accompanied by E. B. King of the O & E, recently discussed exchange cable protection with engineers of the New England Telephone and Telegraph Company at Boston.

E. GUZMICH of the Switching Development Department received a B.E.E. from the Polytechnic Institute of Brooklyn last June.

WILLIAM A. RHODES
of the Switching Engineering Department completed thirty years of service in the Bell System on July 1

DELBERT C. MEYER
of the Equipment Development Department completed thirty years of service in the Bell System on July 8

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ARTHUR A. CATLIN
of the Transmission Apparatus Development Department completed thirty years of service on July 29

E. LYNN RUDD
of the Equipment Development Department completed thirty years of service in the Bell System on July 29

THEODORE MUHLENBECK
of the Switching Apparatus Development Department completed thirty years of Bell System service on July 3

D. W. BODLE has been in New England on matters relating to exchange-cable lightning studies.

A. H. SCHIRMER and D. W. BODLE visited Forked River in connection with natural lightning studies on buried cables.

L. K. SWART discussed bonded neutral cable protection investigations with engineers of The Bell Telephone Company of Pennsylvania at Philadelphia.

L. L. GLEZEN was in Minneapolis and Stevens Point on coaxial system tests. He also visited Chicago and Pittsburgh on matters relating to performance studies of the type-K carrier systems.

THE 1942 ROSTER of officers and committee members of the Institute of Radio Engineers includes the following members of the Laboratories: *Board of Directors*, H. T. FRIIS and F. B. LLEWELLYN; *Executive*, F. B. LLEWELLYN; *Board of Editors*, F. B. LLEWELLYN, E. L. NELSON, L. J. SIVIAN and WILLIAM WILSON; *Admissions*, F. W. CUNNINGHAM and LLOYD ESPENSCHIED; *Awards*, RALPH BOWN, chairman, and F. B. LLEWELLYN; *Constitution and Laws*, R. A. HEISING; *Membership*, F. W. CUNNINGHAM and J. G. KREER, JR.

Nominations, RALPH BOWN; *Papers*, WILLIAM WILSON, chairman, F. B. LLEWELLYN, vice-chairman, H. A. AFFEL, F. W. CUNNINGHAN, E. B. FERRELL, J. G. KREER, JR., D. K. MARTIN, G. G. MULLER and S. A. SCHELKUNOFF; *Papers Procurement*, A. A. OSWALD; *Public Relations*, G. W. GILMAN; *Registration of Engineers*, E. L. NELSON; *Sections*, R. A. HEISING, chairman, and F. A. POLKINGHORN; *Electroacoustics*, G. G. MULLER, chairman, and L. J. SIVIAN.

Electronics, S. B. INGRAM and J. R. WILSON; *Piezoelectric Crystals*, W. L. BOND and W. P. MASON; *Radio Receivers*, H. B. FISCHER; *Radio Wave Propagation*, C. R. BURROWS; *Symbols*, C. R. BURROWS; *Television*, A. G. JENSEN; and *Transmitters and Antennas*, J. F. MORRISON and J. C. SCHELLENG.

Institute representatives on other bodies are WILLIAM WILSON, *Committee on Applied Physics;* LLOYD ESPENSCHIED, *Committee on Engineering Developments of the National Advisory Council on Radio in Education;* and E. L. NELSON, *Planning Committee, National Conference on Educational Broadcasting, American Council on Education.*

Don't repeat rumors

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E. S. Wilcox, C. H. Gorman and C. O. Cross have been in Tulsa making crosstalk balancing tests at type-K carrier frequencies.

M. A. Weaver, with L. B. Bogan of the O & E, was in Tulsa to investigate proposed balancing and crosstalk poling methods.

F. A. Brooks, H. H. Benning, F. B. Anderson and O. D. Grismore visited Baltimore and unattended stations of the 0.8-megacycle coaxial trial between Baltimore and Washington.

For their paper, *Television Transmission Over Wire Lines*, M. E. Strieby, formerly of the Laboratories and now with Long Lines, and J. F. Wentz received honorable mention in the 1941 A.I.E.E. national prize award for the best paper on engineering practice.

H. A. Affel, H. H. Benning, J. H. Bollman and B. Dysart visited the Minneapolis-Stevens Point coaxial system points in connection with rectifier-inverter and new switching unit tests.

W. C. Kiesel attended a hearing before the Examiner of Interferences at the Patent Office in Richmond.

Members of the Personnel Department who attended sessions of the annual meeting of the Society for the Promotion of Engineering Education, held at Columbia University from June 27 to 29, were G. B. Thomas, R. J. Heffner, R. A. Deller, M. S. Mason and H. P. Smith.

William C. F. Farnell, curator of the Bell System Historical Museum and a member of the Bureau of Publication, receives his eight-star service emblem from O. B. Blackwell as L. S. O'Roark and John Mills look on

Twenty-Five-Year Service Anniversaries

George B. Thomas, Personnel Director of the Laboratories, graduated from Ohio State University in 1907 with the degree of M.E. in E.E. He taught electrical engineering at M.I.T. from 1907 to 1910 and then at Colorado College from 1910 to 1917, where he was professor and head of the Electrical Engineering and Physics Departments. From 1910 to 1916 he also conducted a summer program for engineering teachers at the Westinghouse Electric and Manufacturing Company. When war started in 1917 Mr. Thomas left teaching and came to West Street to work on submarine detection.

At this time personnel work in the Engineering Department had been handled for the most part individually by department heads and supervisors. Records and other routine matters were cared for by a small service group. With the growth of the Engineering Department, largely due to the rapid expansion of its research work, there was need for a coördinated development of personnel work along broader lines. In addition to the problem of selecting suitable men and women for employment there was that of giving them an introductory training and particularly opportunities for subsequent study, for arranging interdepartmental transfers, and also for correlating medical and other assistance. To meet this situation the Personnel Department was formed in 1918; and Mr. Thomas was placed in charge of its work of technical training. Later, in 1925, he was appointed Personnel Director. Unique training programs were initiated under his direction. These included part-time post-gradu-

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GEORGE B. THOMAS

JOHN B. IRWIN

SEWELL W. ALLISON

ate study, out-of-hour courses given by members of the Technical Staff, and courses for junior mechanics, bench hands and drafting assistants.

For many years Mr. Thomas has been active in the affairs of the Society for the Promotion of Engineering Education, the Committee on Student Selection and Guidance of the Engineers' Council for Professional Development and the American Management Association.

Residents of the Wyoming section of Millburn, Mr. and Mrs. Thomas have two sons and a daughter. The oldest boy, George, Jr., is now a member of the Transmission Development Department. The daughter, a Wellesley graduate, is married. Mr. Thomas was a member of the Millburn Board of Education for a number of years; is the present chairman of the Millburn Safety Council and of the District Cubbing Committee of the Boy Scouts of America. He enjoys fresh-water fishing and taking color movies and is a Telephone Pioneer.

* * * * *

J. B. IRWIN joined the Transmission Branch of the Western Electric Company following his graduation by Penn State in 1917 with a degree of B.S. in Electrical Engineering. His work consisted of voice-testing transmission instruments and circuits and the determination of circuit losses by computation. About five years later he transferred to the group demonstrating, installing and servicing public address systems. He then spent a year installing power-line carrier systems followed by a period on the design and development of radio speech input equipment.

Mr. Irwin's next step was in the sound picture field. He aided in the development of the film method of sound reproduction and in the commercial application of this system of recording. In 1927 he was loaned to Fox Movietone News and was sent to Europe as the sound man with the first news unit in France, Italy and Germany. On his return he spent a few months assisting the late S. P. Grace in his lecture work. Then he transferred to Electrical Research Products where he was engaged in general engineering on theater sound systems. He returned to the Laboratories in 1938 and since has been with the Transmission Development Department working on various phases of toll transmission problems, principally on voice-frequency repeaters and associated equipment. More recently he has been concerned with the development of equipment for the Signal Corps.

Mr. and Mrs. Irwin live in Bronxville with their nine-year-old daughter. He enjoys golf and is a member of the Edward J. Hall Chapter of the Telephone Pioneers of America.

* * * * *

S. W. ALLISON received his Sc.B. degree from Brown University where he then spent

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two years as a laboratory assistant. He then joined the Engineering Department of the Western Electric Company, his first work involving an investigation of relay contacts to determine the size and type of metal to provide satisfactory life. Late in 1917 he joined the Ordnance Department of the U. S. Army in which he was later commissioned Second Lieutenant. Upon his return to West Street he was concerned with the analysis and determination of power requirements for circuits in the panel step-by-step, manual and other telephone systems. These current drain data formed the basis on which power plants were furnished.

JOHN B. JOHNSON

Mr. Allison transferred to the Panel Laboratory in 1928 and for the next two years analyzed and tested circuits for the panel system, with particular reference to their use in connection with multiple registration on party lines and as test circuits to maintain panel-type senders. Since 1930, in the Switching Development Department, he has been concerned with the design of circuits for use in toll switchboards and for test circuits for maintaining these switchboard and associated toll and trunk circuits. More recently Mr. Allison has been engaged with the development of emergency toll systems.

The Allisons, who live in West Orange, have one son who graduated from Rutgers in May and is now in officers' training at Fort Benning, Georgia. Mr. Allison, while having no particular hobby, is interested in all types of sports.

* * * * *

BORN IN Gothenburg, Sweden, J. B. JOHNSON came to the United States in 1904. He attended the University of North Dakota from which he received the B.S. degree in 1913 and the M.S. degree a year later. He was then awarded a Fellowship in Physics at Yale University, the degree of Ph.D. being conferred on him in 1917. Coming immediately to the Research Department, he engaged in the development of vacuum tubes for Army and Navy use. Following the war he took up the development of cathode-ray oscillograph tubes. By using a new electron gun and gas focusing as the source of electrons, he developed a tube that operated on from 300 to 400 volts. This cathode-ray tube was the first manufactured on a commercial basis.

Dr. Johnson then began his investigations on noise in vacuum tube circuits. He analyzed and explained more completely the noise produced in vacuum tube circuits by the random thermionic emission of electrons called "shot noise." He discovered and obtained the experimental proof of the thermal motion of electric charge in conductors. This is known as "resistance noise" and is commonly called the "Johnson effect."

During the early development of sound pictures Dr. Johnson developed a flashing lamp (D-95954) for sound recording. From 1928 to 1936 he spent much of his time on patent cases, principally as an expert witness on vacuum tube circuits, amplifiers and recording lamps. He then took up the development of thermistors and was responsible for much of the preliminary research in this connection. Concurrently, he was engaged in the development of cathode-ray tubes used in television equipment for experimental purposes and demonstrations over coaxial cables. More recently he has been concerned with the development of vacuum tubes for special purposes and with projects associated with war work.

In his home community, the Wyoming section of Millburn, New Jersey, Dr. Johnson has served for several years on the council of the Wyoming Association and was its president for two years. For a number of years he has been active in Boy Scout work and is now chairman of a local troop committee. He is interested in gardening and belongs to the Telephone Pioneers of America. The Johnsons have two sons, the older one has just completed his junior year at Cornell University and the other is now in Millburn High School.

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G. O. Smith came to West Street immediately after he was graduated by the University of Vermont in 1917 with a degree of B.S. in Chemistry. During the war period he was engaged in the development of air-damped transmitters and sensitive devices for the detection of aircraft and submarines. Since the war he has been successively concerned with fundamental investigations on carbon to develop higher sensitivity in transmitters; on the behavior of metals and alloys for relay contacts; on materials for filaments; on alloys for lead cable sheaths; and on materials for oilless bearings.

For the past thirteen years Mr. Smith, in the metallurgical group of the Chemical Laboratories, has been associated with the development of copper-oxide varistors now used so extensively for modulators and demodulators, power rectifiers, low-voltage protective devices, polarized relays and in other apparatus. The ten patents issued in his name cover phases of each undertaking with which he has been concerned although most of them refer to varistors.

The Smiths live in Maplewood with their son who is now in fifth grade. Mr. Smith is an American Red Cross instructor and in addition to teaching classes in his community is the leader in First Aid of a Medical Unit and Casualty Station. At the Murray Hill Laboratory he is also in charge of the First Aid rooms and area squads in the Air Raid Precaution Plan. He is a Pioneer.

George F. Heuerman joined the Engineering Department of the Western Electric Company during World War I and his first work concerned the manufacture of vacuum tubes for war purposes. After the war he transferred to the Research Department where he was engaged in experimental vacuum tube investigations under Dr. Davisson. Later he joined the acoustics research group testing the quality of sound reproduction of various instruments when inserted into communication circuits. He also was associated with the development of audiphones for the hard of hearing. During this time he took the Laboratories' Student Assistant Course and was in the first class to graduate. Following this he took evening courses at Brooklyn Poly.

Mr. Heuerman transferred to the Patent Department in 1925 and since that time has been primarily concerned with the preparation and prosecution of patent applications relating to electro-optics, television and picture transmission. More recently he has also covered voltage regulation systems.

The Heuermans live in Great Neck with their two children, a son who has just completed Junior High and a daughter in grade school. Mr. Heuerman is interested in golf and photography and is a Pioneer. Up to a few years ago their vacations were spent in Canada. Last year they made a trip through Yellowstone and Glacier Parks while the year before they went to Denver.

George O. Smith

George F. Heuerman

Joseph Jakubiak

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JOSEPH JAKUBIAK completed a quarter century of service in the Western Electric Company and the Laboratories on the twelfth of June. He joined the building service group of the Western Electric Company in 1917 after spending five years with the Dehstil Steel Works in Philadelphia and five years in New York City with the National Biscuit Company and Liggett, Riker and Hegeman Drug Company. As a general utility hand in the plant operation group of the Plant Department he acts as a day cleaner on the first four floors at West Street, does a certain amount of porter service and operates freight elevators in various parts of the building.

Mr. and Mrs. Jakubiak live in Manhattan. For diversion he spends some of his spare time at the local Democratic Club or at the National Polish Club.

Your Telephone in Wartime

"In wartime first things must come first. And in wartime war comes first. This is true in the telephone business just as it is in all other businesses.

"Shell cases are made of copper. So are telephone wires. The shell cases come first. That means that many people who want telephones may not be able to get them.

"It also means the service on long distance calls cannot always be up to standard.

"Three weeks ago we told you of the tremendous increase in the telephone system in one city—the nation's capital—how hundreds of operators have been added—how the long distance switchboards and circuits have been doubled. In spite of this and in spite of the best efforts of an army of loyal, trained telephone people, the facilities are not now adequate to give Washington the kind of service it had been used to. The circuits in and out of Washington are jammed with war calls—so please don't call Washington unless the call is vital.

"There are also congested circuits to many other points in this country where America's expanding war effort is mounting to ever higher peaks. Many long distance routes are overloaded. Naturally there are bound to be delays and disappointments in the service. When you find the circuits busy in these war and munitions towns, please restrict your calls to the real necessities.

"You can be of great assistance in helping to keep the wires clear for essential war calls if you will keep the following suggestions in mind:

"1. Make only really necessary long distance and toll calls during the business day.

"2. Avoid the morning and afternoon hours. Make calls between noon and 2 p.m.; 5 and 7 p.m.; and after 9 p.m.

"3. Make only necessary local calls and keep conversations as brief as possible.

"We know you are anxious and willing to do your part in speeding up America's march to Victory. It will help a lot if you will always keep this thought in mind—War Calls Come First."

Announcement, July 6, 1942, on "The Telephone Hour" program.

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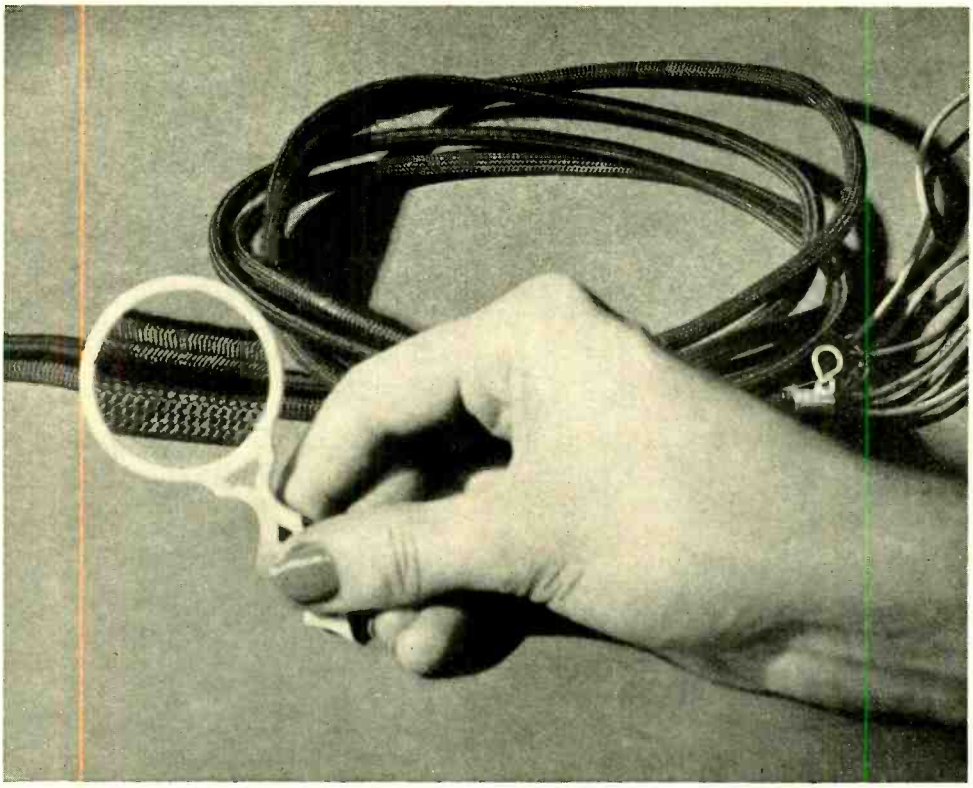

Basket-Weave Telephone Cords

FOR some time engineers of the Cord Development Groups in the Laboratories and the Western Electric Company have been investigating various types of braid weaves in an effort to obtain a textile covering which would increase the service life of telephone cords. As a result of these studies, a change was made to the basket weave which is superior in wearing qualities and offers the added advantage of doubling the output of the braiding machines. This basket weave (lower cord, above) harmonizes with the former type of braid, so that cords of both types may be used on the same telephone.

The greatly increased demands for communication equipment created by the national defense program placed an unprecedented load on the manufacturing facilities for the associated braided cords and wires. To fill these needs, Western Electric would have required additional braiding machines and floor space which could not have been obtained without considerable delay. The new basket weave which has been adopted has made it possible to release braiders for war projects.

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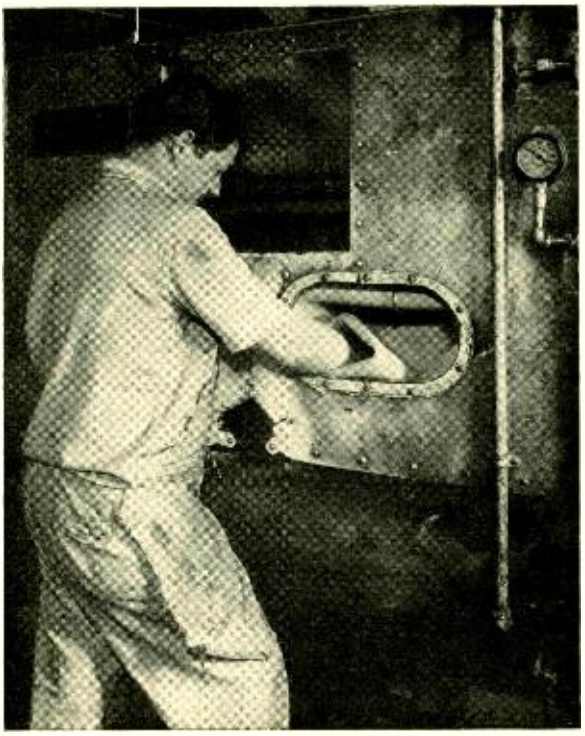


Rubber Economy in Typewriter Cylinders

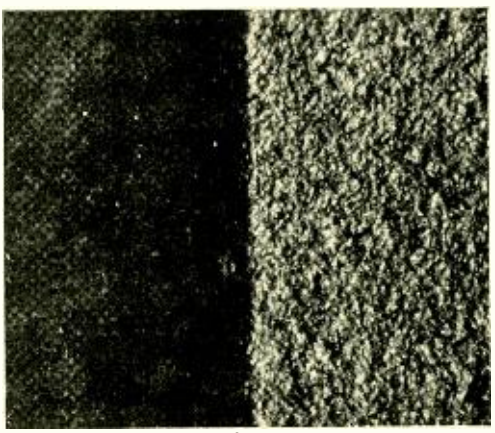
By A. R. KEMP
Organic Research Chemist

SAVINGS in the rubber used for typewriter cylinders, and reduced maintenance costs, are now possible as a a result of experiments recently carried on in the Chemical Laboratories. These cylinders consist of an arbor of steel or wood over which is slipped a sleeve of rubber. The rubber is vulcanized on the arbor, and then ground to bring it to the proper size and to roughen its surface so that it will grip the paper firmly.

With extensive use, the cylinders become hard and glazed, and no longer hold the paper securely. When this occurs, it has been customary to return them to the factory to have the old rubber removed and new rubber put in its place. It has been estimated that from fifty to one hundred thousand cylinders need to be renewed each month.

It happens that Bell Telephone Laboratories itself has nearly a thousand cylinders that must be maintained, and in an effort to reduce the demand for rubber, A. E. Pattinson, in charge of office machine maintenance, asked the rubber research group if there were not some way of avoiding this loss of rubber.

It would probably be possible to use some other plastic than rubber for these cylinders, but since most plastics also come under the head of war materials, it seemed preferable to develop some satisfactory way of resurfacing existing cylinders. Since the rubber compound used on them is not



A typewriter cylinder as glazed by long use, at the left, and after sand-blasting, at right—14 times actual size

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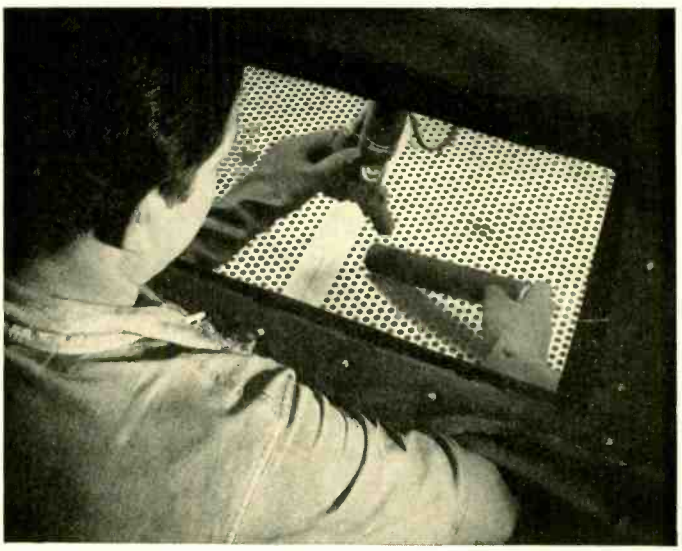
suitable for reclaiming, a satisfactory resurfacing process would have the advantage of economy as well as of saving material. As a result of tests carried out largely under the direction of F. S. Malm, it was found that by sand-blasting the glazed cylinders for two or three minutes, using No. 90 steel grit and an air pressure between fifteen and twenty pounds, a surface was formed that in many ways was superior to the original. The reduction in the diameter due to this resurfacing is less than two-thousandths of an inch. Cylinders treated in this manner have had hard service in Bell Laboratories for more than six months without showing need for further treatment.

Cylinders that have been ground have a grooved structure, while sand-blasted cylinders have an irregular pattern of minute projections that grips the paper firmly in all directions. The sand-blasting, moreover, knocks out the fine particles of filler compound that otherwise would reduce the friction between paper and cylinder, much as talcum powder would.

Typewriter cylinders vary considerably in size but on the ordinary letter-page machine the rubber weighs in the neighborhood of a pound, and with over a million replacements a year, sand-blasting promises to save a million pounds of rubber compound a year.

Complete information was given by the Laboratories to the Office of Price Administration in Washington, and through that office is available to the interested public.



In the sand-blasting of typewriter cylinders, the operator, standing outside the blast chamber with his hands projecting into it through long-sleeve gloves, turns the cylinder with one hand and directs the stream of steel grit with the other

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Radiation Pattern of the Human Voice

By D. W. FARNSWORTH
Physical Research

RADIO antennas, microphones, loudspeakers, or any apparatus that either emits or receives radiations has a directional characteristic or radiation pattern, and the determination of these patterns is one of the routine procedures in radio and acoustical work. If the device is to receive radiation, the directional characteristic expresses the sensitivity of the device to radiation coming from various directions in space. If the device is to emit radiation, on the other hand, the directional characteristic expresses the power radiated in various directions. In both cases the sensitivity and power in each measured direction may be subdivided into frequencies or frequency bands. In acoustics, the basic radiator of voice sounds is the human mouth, but strange as it may seem there are no known records of any complete determination of the directional characteristic of speech as it is affected by the shape of the mouth, head, and body. This situation has now been partially remedied by an extensive study recently made in these Laboratories by H. K. Dunn and the writer.

Fig. 1—Arrangement of speaker and microphone for distribution measurements

Perhaps one of the reasons that such a study has not been made before is that it is inherently a much more laborious task than determining the directional characteristics of a loudspeaker or microphone. With a loudspeaker, for example, the characteristic is usually determined for a number of single frequencies, and these are supplied to the loudspeaker from an oscillator giving a continuous tone at constant frequency and volume. There are no other variables but the position of the pick-up microphone, and thus the procedure is comparatively simple. The human voice, however, is a complex assembly of dif-

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ferent frequencies at different levels, and in ordinary speech both level and frequency composition vary continuously. Moreover, the source is a human throat, which suffers fatigue; it cannot be turned on like an oscillator and run continuously without variation. Determining the distributional pattern of the voice is thus far more laborious and complicated than any of the more usual determinations of directional characteristics.

In securing the spatial distribution pattern of speech, it seemed desirable to average the speech pressures over an interval long enough to insure that the average was typical, and to use as the source of sound a set of words that would be typical of ordinary speech both in the basic sounds employed and in their distribution into syllables. To meet this requirement, J. C. Steinberg devised the following sentences:

"The different speech sounds have been moulded into *sentences, such that the consonants and usual compounds occur in the vowel combinations which are met with very frequently in English. For lack of time, it was not possible to get every group included; although, as is shown quite clearly in the figure, upward of eighty per cent* are accounted for. I think nothing else need be said in this place on the subject."

Sound pressure was averaged over a fifteen-second period, which was controlled automatically, and the actual measurement covered usually about the italicized portion of the quotation. The tests were made in an acoustically treated room so that reflections from the walls would not result in readings that did not truly represent the direct radiation from the mouth. Because of these precautions, the results are essentially the same as would have been obtained in an open outdoor space entirely free from extraneous sounds.

Besides determining the distributional pattern for whole speech, it was desired also to determine it for various bands of frequencies. In some ways, the narrower these bands, the more satisfactory would be the results, but it was finally decided, largely because of the availability of filters, to divide the range of speech frequencies into twelve bands. The lowest three were each one octave

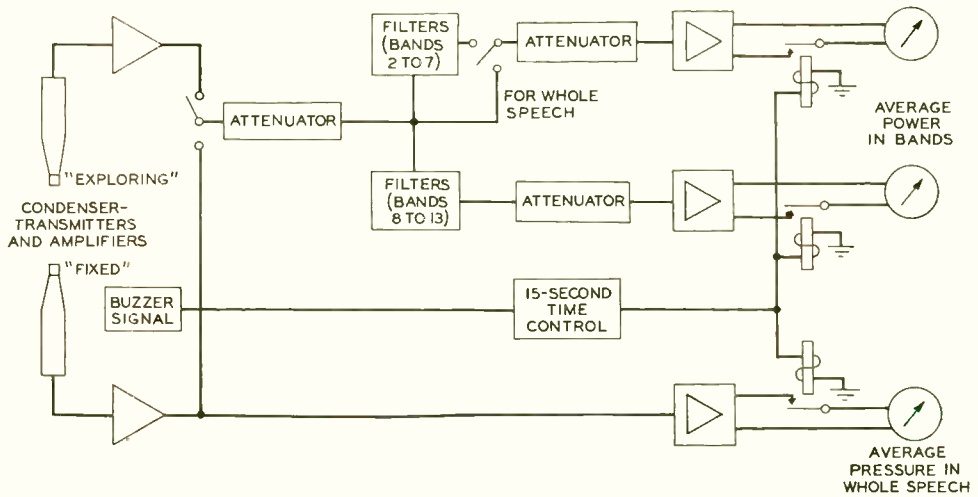

Fig. 2—Block schematic of measuring circuit

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wide, and ran from 62.5 to 500 cycles; above 500 cycles, the filters were each one-half octave wide except the twelfth, which was a high-pass filter

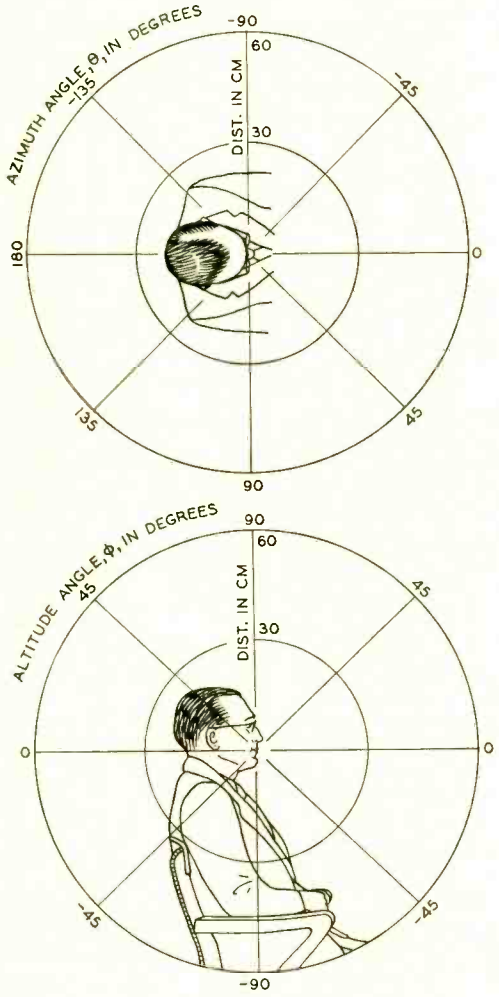

Fig. 3—Positions in space were indicated by three coördinates: r *for radial distance from the lips;* θ *for horizontal angles; and* ϕ *for vertical angles*

cutting off at 8,000 cycles. The upper frequency is really set by speech itself, which has practically no components above 12,000 cycles.

Limitation of apparatus and of personnel made it necessary to take readings at only one position in space at a time, and of only two frequency bands. This meant, of course, that measurements would have to be carried on over a considerable period of time, since for each of some eighty positions in space, seven readings were required to cover all the frequency bands and eight readings were taken for each pair of bands to insure that the value used was representative. Including preliminary and trial readings, a total of 5,000 readings was taken altogether.

With such a protracted study, there would be bound to be variations in the test sentences in volume, not only from day to day but for different sets of readings taken on the same day. It was necessary, therefore, to set some reference volume at some fixed position, and to correct each set of readings for departures from the basic value. To make this possible two pick-up microphones were used for each reading; one was an exploring microphone, which could be moved to various positions, and the other was fixed. This latter microphone was fastened to the arm of the chair in which the speaker sat, with the diaphragm at one side and slightly below the speaker's lips, and thirty-two centimeters away. An attached bracket carried a small loop of wire at the end, and the speaker always sat so that this loop just touched his upper lip. The arrangement is shown in Figure 1.

Both of the microphones were of the condenser type with self-contained amplifiers. They are small microphones with diaphragms only 1.8 centimeters in diameter, but for positions very close to the speaker's mouth, a "search tube" five centimeters long and only three millimeters outside diameter was used. A block schematic of the testing circuit

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is shown in Figure 2. For each position of the exploring microphone, four readings would be taken for each frequency band and for whole speech. Four for each band were also taken using the fixed transmitter.

Positions at which readings were taken are designated by three coördinates, as indicated in Figure 3. One of these, designated "r," is the radial distance in centimeters from the front of the lips; another is the horizontal angle "θ" measured from directly in front of the speaker in either direction around to 180 degrees, directly behind him. Readings were taken only around one side, since is seemed reasonable to assume that because of bodily symmetry, readings on the other side would be the same. The third coördinate is the vertical angle ϕ, measured from zero in the horizontal plane to +90 degrees directly overhead, and to −90 degrees directly beneath the lips of the speaker.

With data distributed over three-dimensional space and over twelve frequency bands, it is difficult to present them in a way to make the distribution of sound pressures evident over the entire volume. The general form of distribution may be indicated, however, by plotting the pressures at some one constant radial distance for each frequency band and for speech as a whole at vertical angle o degree as the angle θ varies from o to 180 degrees, and in a vertical plane at horizontal angle o degree as the vertical angle varies. This is done in Figure 4.

Considering first the variation with horizontal angle, it will be noticed that whole speech remains about constant up to 90 degrees, and then falls off. Frequencies from 62.5 to 175 cycles, however, remain practically constant all the way around. For the higher frequency bands there seems to be a progressively increasing reduction in level after 45 degrees is reached. This becomes particularly pronounced for frequencies above 2800 cycles. Pressures at frequencies from 700 to 1400 cycles seem to behave in a rather anomalous manner, for which there is no ready explanation. It has been known, of course, that in general the high frequencies are more directional than the low, but this is the first time that actual detailed results have been secured of their directivity when emitted as speech.

Distribution in the vertical plane,

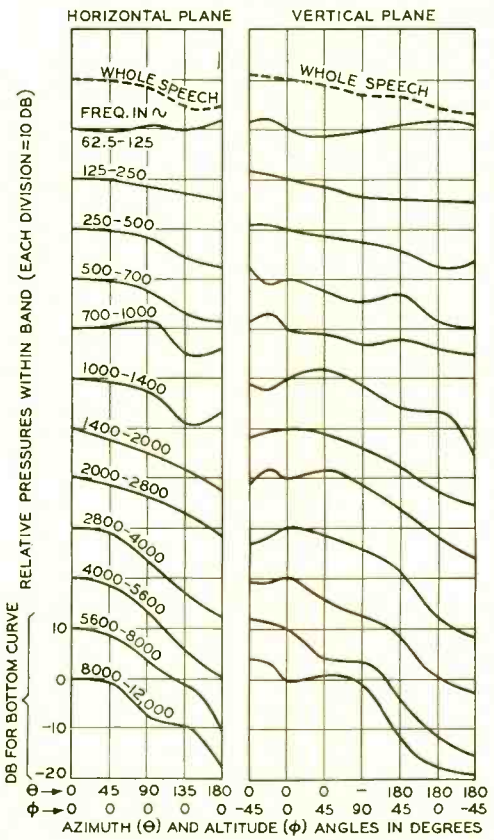

Fig. 4—Relative speech pressures at 60 cm from the lips as θ varies, at the left, and as ϕ changes, at the right

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shown at the right of Figure 4, evidences more unexpected characteristics. For whole speech, for all frequency bands below 1000 cycles and also for those above 5600 cycles, the pressures are greater 45 degrees below the horizontal than they are in the horizontal plane. At a distance of 15 centimeters where readings may be taken at −90 degrees, that is, directly below the lips, the pressures straight downward are greater than either at −45 degree or 0 degree for all frequencies below 1000 cycles.

Data of this sort are very useful in guiding the placing of microphones, since they show the region over which all frequencies are present in about their true relative proportions, and the amount of equalization that would be required in other locations. A study of these curves shows that a microphone could be placed at any horizontal angle up to about 75 degrees and at any vertical angle from −45 degrees to +90 degrees without the necessity of equalization.

To confirm these conclusions, listening tests were made in which two other positions were compared with a position in front of the speaker. One of these was 60 centimeters directly above the lips, the forward transmitter being at the same distance, and listeners in another room could switch between the two transmitters. After equalizing the two circuits for loudness, the listeners could not distinguish between the two transmitters. When one of the transmitters was placed directly behind the speaker, however, there was a marked loss of the higher frequencies.

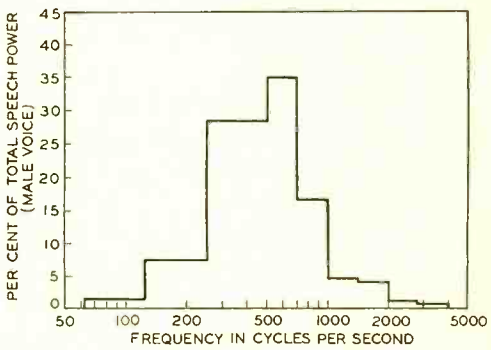

Fig. 5—Spectrum of male speech power obtained from an integration of the test results

Another advantage of these data is that they may be used for calculating the total voice power, and also the total power in each frequency band. It is possible to integrate speech pressures over the entire surface of a sphere having its center at the speaker's mouth by assuming that the pressure in each direction represents the average pressure extending halfway to the next position line in both directions in both horizontal and vertical planes, and by using a suitable constant to calculate the total emitted power. The error in this basic assumption is probably within the accuracy of the test data. The results of these calculations are plotted in Figure 5 in per cent of

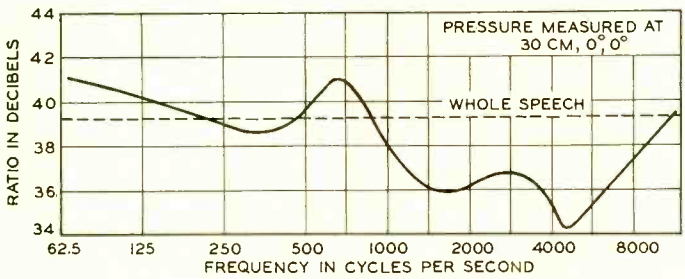

Fig. 6—Ratio of average speech power in total field to the power per square centimeter at a single point

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the total power. This curve shows that for the male voice tested, 80 per cent of the total speech power is in the frequency band from 250 to 1000 cycles; that 96 per cent is in the band from 125 to 2000, and that only 0.4 per cent is above 4000 cycles.

Previous to these tests, a common method of estimating total speech power was to assume that the pressure directly in front of the speaker was constant over a hemisphere. A similar calculation made from data taken on these tests gives a result 2 db lower than that obtained from the more complete integration. Although the total speech power will vary with the person talking, this difference for the two methods of calculation should remain constant, and so it is safe to assume that calculations made on the basis of a single reading in front of the speaker have been about 2 db too low.

This ratio of total speech power to the power per square centimeter at one point was calculated for all the frequency bands as well as for whole speech. A curve expressing this ratio for a point 30 centimeters directly in front of the speaker's mouth is given in Figure 6. Such a curve may be drawn for any of the points at which measurements were made, but the shape of the curve would vary with the point taken. With such curves available, the total speech power may be determined from measurements made at a single point.

Contributors to this Issue

A. R. KEMP was graduated by California Institute of Technology in 1917, obtained his M.S. degree in Chemistry from the same institution in 1918, and entered the Laboratories the same year. Following two years as a supervisor in the Analytical Laboratory, he directed research in the field of submarine cable insulation for several years. He is now directing the work of the group in organic research dealing mainly with rubber and other types of insulations. In 1922 he was responsible for the development of the pressure equalizing material required for the successful operation of the first permalloy loaded submarine telegraph cable. The development of paragutta was another of his many contributions.

A. R. Kemp

D. W. FARNSWORTH received his B.A. degree from Lehigh University in 1929, following which he spent a year with the Radio Corporation of America. He has been a member of the Acoustical Research Department since joining the Laboratories in 1930. He was at first concerned with hearing studies, including investigations of the acoustical properties of telephone bells and other signaling devices, and studies of telephone noise. More recently he has been concerned with fundamental speech investigations, especially measurement of the distribution of speech power around the talker's head, and most recently, studies of the mechanism of speech production, particularly of the action of the vocal cords.

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D. W. Farnsworth

F. A. Korn

W. J. Kiernan

F. A. KORN joined the Laboratories in 1920 and took the course for technical assistants, spending six months in the field with the Western Electric Installation Department. Subsequently he was in the circuit laboratory, and since 1924 has been engaged in the design of switching systems for manual and dial central offices. In 1933 he became a member of the group responsible for the fundamental planning of crossbar switching systems. From early 1937 to June, 1941, he supervised a group engaged in the development of crossbar switch and trunk circuits for local, toll and tandem offices. He was then placed in charge of a group engaged in the development of senders and marker circuits used in crossbar and panel-dial systems. Later that year he transferred to the Equipment Development Department to supervise the group handling equipment features of crossbar, panel and step-by-step offices and private branch exchanges.

W. J. KIERNAN joined the Laboratories as a technical assistant in 1925 to work on paper, textiles and other insulating materials. These developments concerned the substitution of Kraft-condenser paper for linen in condensers, of rayon for silk on wire and of sheet cellulose acetate for paper as interleaving in coils. In 1935 Mr. Kiernan received the A.B. degree in chemistry from New York University. In 1940 he transferred to the finishes group to work on protective coatings including those described in this issue of the RECORD.

The motif of the cover design of the RECORD *is wave motion. If each of the vertical lines represents a layer of particles in a homogeneous medium, the entire pattern represents a compressional wave train (alternate compressions and rarefactions) with a wave length of about one and three-quarter inches. This characteristic pattern was chosen for the cover of the Laboratories' magazine since so much of its work has to do with waves in air or along wires or through space.*

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University of California
Division of War Research
at the U. S. Navy Radio and Sound Labo
San Diego, California

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