BELL LABORATORIES RECORD

OCTOBER 1944 VOLUME XXII NUMBER XIV

Greystone-Stoller Corp.

FRANK BALDWIN JEWETT

Chairman of the Board of Directors of the Laboratories, a national leader in the industrial application of the methods of science, retires under the Bell System age provisions after forty years of service in its research and development work

JEWETT, FRANK BALDWIN, born, Pasadena, California, Sept. 5, 1879; son of Stanley P. and Phebe (Mead) Jewett; married Fannie C. Frisbie, Dec. 28, 1905; children: Harrison Leach and Frank Baldwin.

EDUCATION: A.B., Throop Polytechnic Institute (now California Institute of Technology), 1898; Ph.D., University of Chicago, 1902.

PROFESSIONAL SERVICE: Research assistant to Professor A. A. Michelson, University of Chicago, 1901-02; Instructor physics and electrical engineering, Massachusetts Institute of Technology, 1902-04; Transmission engineer, American Telephone and Telegraph Company, 1904-12; Assistant chief engineer, 1912-16, Chief engineer, 1916, Vice-president, 1922, Western Electric Company; Vice-president, A. T. & T. Co., in charge of development and research since 1925; President, Bell Telephone Laboratories, 1925-Oct. 1, 1940, Chairman board of directors until Sept. 30, 1944.

MILITARY SERVICE, WORLD WAR I: Major, Signal Corps, 1917; Lieutenant Colonel, Dec. 1, 1917; advisory member, Special Submarine Board of the Navy; member, State Department Special Committee on Cables; Awarded Distinguished Service Medal.

NATIONAL SERVICES: Vice-chairman, Engineering Foundation, 1919-1925; Chairman, Division of Engineering and Industrial Research, National Research Council, 1923-27, now member Committee on Scientific Aids to Learning; member, President Roosevelt's Science Advisory Board, 1933-35; member, National Defense Research Committee of Office of Scientific Research and Development; member, Coördination and Equipment Division, Signal Corps; consultant to Chief of Ordnance; President, National Academy of Sciences, 1939——; member, Committee on Post-War Research, 1944.

SOCIAL SERVICES: President and trustee, New York Museum of Science and Industry. Life member, Massachusetts Institute of Technology Corporation; President, M.I.T. Alumni Association, 1939-40; Trustee, Princeton University, Carnegie Institution of Washington, Woods Hole Oceanographic Institute, Tabor Academy.

PROFESSIONAL SOCIETY MEMBERSHIPS: Fellow, American Institute of Electrical Engineers (president, 1922-23); Institute of Radio Engineers; American Association for the Advancement of Science; American Physical Society; Acoustical Society of America; Academy of Arts and Sciences. Member, Institution of Electrical Engineers (British), New York Electrical Society, Society for the Promotion of Engineering Education, American Philosophical Society.

FRATERNITIES: Delta Upsilon, Sigma Xi, Tau Beta Pi.

HONORARY DEGREES: D.Sc., New York University, Dartmouth, 1925; Columbia, University of Wisconsin, 1927; Rutgers University, 1928; University of Chicago, 1929; Harvard, 1936; University of Pennsylvania, 1940; Dr. Eng., Case School of Applied Science, 1928; LL.D., Miami University, 1932, Rockford College, 1939.

MEDALS: Edison medal, 1928; Faraday medal, 1935; Franklin medal, 1936; Washington award, 1938; John Fritz medal, 1939.

The Career of Frank Baldwin Jewett

A CAREER, as that word is generally used, is a course of action conspicuous for nobility or success. It is a conduct in life which is meritorious and serviceable to a wide portion of society. From another aspect, it is an expression of personality—an unfolding of an idea. Sometimes, it seems, the importance resides in the idea independent of any charms of manner or person; or the idea may be inconsequential and the individual character foremost.

The ideal combination is a vivifying idea and a dominant personality. To be successful the idea must be timely; it must fit the needs of the day. And since its leader requires followers, for one assumes the other, the times must afford a reservoir of possible followers. All of which is to say: the formula for a career is a timely provocative idea in the mind of a man capable of inspiring confidence and gaining adherents.

Timeliness is of the essence: great men arise to meet great occasions, otherwise the mute inglorious Milton and the village Hampdens. Timeliness is a matter of chance, or, in other words, of luck, and it counts most where priorities are concerned as in discoveries and inventions or where the career is to culminate in an elective or appointive position which provides a niche for only one person at a time. In any field or organization there can be only one chief. Pioneer and first settler alike have a choice of hilltops ineluctably denied to late comers. It behooves one, therefore, who is destined to a career to time his entrance to fit the scene.

The entrance upon the American scene of Frank Baldwin Jewett occurred on September 5, 1879, in the pleasant town of Pasadena, California. A date more significant as to his career was 1898 when he graduated from Throop Polytechnic Institute. A bright youth, less than 19 years old, he had plenty of time for further preparation for his life work; and so turned to the Physics Department of the University of Chicago. In his mind was the tentative idea of preparing for work in electric traction, a promising field that appealed to him and to his father who had been a pioneering railroad man in Southern California. Chicago was a stopover en route to Massachusetts Institute of Technology or some Eastern center where electric traction could be studied most completely. He stayed in Chicago, however, for four years before he went to M.I.T. In that time he obtained a Ph.D. degree and also served for a year as research assistant to A. A. Michelson.

The situation at Chicago was particularly favorable for Jewett's development and he took full advantage of it. The long hours of work which he put in with Michelson on the diffraction grating engine, which the latter was then developing, were hours of pleasant association and tutelage under one of the great masters of physics who was soon to be a Nobel laureate. Michelson, a brilliant experimentalist who had developed the interferometer and echelon grating for spectrographic analysis and with Morley had made the accepted determination of the velocity of light, was one of the last of the great classical physicists before the surge of new knowledge which followed the discovery of x-rays and radioactivity. In the Physics Department at that time was a young instructor, an ingenious experimenter destined to be another Nobel prize winner. This was R. A. Millikan, with whom Jewett formed a close friendship. Millikan's interest tended towards that part of the field of physics which we would now call "electronics." Jewett, therefore, while obtaining a ground work in classical physics was exposed to the newest theories and phenomena. His doctor's thesis would have fitted in either the classical or the modern field for it had to do with a method for determining the density of metallic vapors and with its experimental application to those of sodium and mercury.

Despite his youth Jewett was one of the most mature-minded of the graduate stu-

dents at Chicago; and he associated on terms of congenial informality with professors and instructors as well as with his fellow students. A small group of the latter he organized for extra-curricular reading of mathematical physics. Not all his time, however, was spent in study and laboratory work for he was a leading spirit in a small and convivial group of graduate students whose bimonthly symposia were not entirely devoted to serious conversation. He also joined and was active in one of the national fraternities, Delta Upsilon. More importantly, he became engaged to Fannie Frisbie, a young graduate student in physics, whom he married a couple of years later.

It was in those maturing years at Chicago that Jewett began to display his amazing talent for friendship, an aptitude which has made him so rich in friends and endeared him to so many. To a character marked by frankness and sincerity, to a keen intellect with wide interests and human sympathies, to a sprightly manner and pleasant wit, nature had added a voice which expressed all those characteristics. The voice is particularly effective over the telephone, as anyone can testify who ever heard him say, "This is Frank"; from that moment on, whether the message it delivers is pleasant or not, loyalty has been aroused. While its modest possessor may have thought that what was compelling was the idea, the compulsion was always aided by the sunny tone.

Leaving scores of friends and admirers in Chicago, Jewett's next move was to the Massachusetts Institute of Technology in Boston where for two years he taught physics and electrical engineering. Here again his natural and unconscious ability to make friends rapidly enlarged his circle of influence. In a city where the formalities of social intercourse were strictly maintained and the informality of first names was something to be acquired by years of association, or to be born into, Jewett soon established many intimate friendships. The operation was essentially spontaneous—a few weeks, not months, of acquaintanceship would lead to first-name intimacy. Many of his friendships were with the high and mighty or the unapproachable—with men years older and more advanced in position and in authority than the young instructor who had just come out of the West. He never presumed nor "climbed"; his friendships always seemed the spontaneous result of natural affinity. They were just as natural with those of lower rank; and statistically more important because as he progressed the number below increased and that above decreased.

Whatever the mechanism and however deep the subconscious motivation, this capacity for friendship has been one of the greatest assets to Jewett's career. Ten years later—still young but an assistant chief engineer of a large company—he could join a brass-hatted board of military authorities, industrialists and academic leaders as an intimate associate whose ideas were respected and whose informal and sometimes jocular method of expression was always welcomed.

The vessel had been formed—the personality had matured—but the idea it was to contain had not yet evolved and much less could one descry the situation in which its enlivening draught would be poured forth. For a time Jewett considered teaching as a career; his youthful idea of electric traction had been gradually discarded. Teaching appealed because it involved ideas and men—his two major interests. While at Massa-

Dr. Jewett at the time he received his Ph.D. from the University of Chicago in 1902

chusetts Institute he received several offers to continue in that line of work. So perhaps he might have done if he had not been attracted in 1904 by an offer from the American Telephone and Telegraph Company, whose headquarters were then in Boston.

The company had a well-established engineering department concerned with the problems of transmission and switching, and of plant and traffic. Under the title "equipment division," covering development and design, it operated the Bell Telephone Laboratories of its day. Although there was some cut-and-try in its laboratory work and a considerable emphasis upon invention, the department approached its problems in a strictly scientific attitude and applied its conclusions in the best engineering manner. For its transmission problems there was requisite a facility in theoretical and mathematical physics—the sacred books were those of Rayleigh, Maxwell and Heaviside. That was then a requirement exceptional among industries. In most industries, as time has gone on, the intellectual background required for scientific work has increased but electrical communication with its electronic compeer has maintained its leadership in difficulty.

The engineering department included men like Hammond V. Hayes, Howard W. Warren, George A. Campbell and Edwin H. Colpitts, outstanding scientists and engineers who would be creative today in any research or transmission-engineering group. To Campbell, in particular, the Bell System should always be immensely grateful for basic inventions and illuminating mathematical studies. He had joined the department in 1897 after graduation by Massachusetts Institute and Harvard and after study in Europe. He had run neck-and-neck with M. I. Pupin in the invention of lumped loading, but patent interference proceedings gave priority to Pupin. It was Campbell's formulas, however, which were followed when loading was actually installed on long distance circuits. Campbell recognized the need for men well trained in science to solve telephony's highly technical problems. And it was he who discovered Jewett and in 1904 arranged his introduction to the telephone company.

Looking back on those years a historian would say that Jewett was marked for success from the beginning. He was one up on the first tee. The telephone company had started to hire a new "breed of cats"—the expression is one Jewett frequently uses but not, of course, in this connection. It had bought a Ph.D., but what it got turned out to be a broadly capable engineer. Jewett, it would seem, has generally ascribed his progress to his research training and scientific attitude of mind; all of which may be true but it has been so exceptional as to imply another cause; and that cause is Jewett *per se*.

In his West Street office in 1915, *Dr. Jewett talks over the first transcontinental line to California*

His first job assignment was the investigation of an invention which had been offered to the company. It turned out that the inventor suffered from a misconception as to the physical possibilities of his device. The report attracted favorable attention on the part of the chief executives of the company and, what was even more exceptional, similar approval by its then patent department. Written commendation on a job well done came down the line. The report was in the clear, logical and distinctly commonsense style which marks Jewett's analyses. It established him as one whose appraisal

of physical factors and whose engineering judgment could be depended upon. As the years went on, more and more frequently the question would be: "What does Jewett think of it?"

It was the quality of his engineering recommendations—his ability to see the woods despite the trees or even the trees through the woods—that marked Jewett's years in the telephone business. It was not the inventions he made, for he has a negligible number of patents. It was not experimental work carried out with his own hands, nor apparatus or circuit designs. Almost from the very start he was in a position of expert consultant and of supervisor of other experts.

Long distance transmission was the serious problem of those days and it remained so for several years, until the vacuum tube development and the techniques of carrier current, both wire and radio, had robbed it of its appalling difficulty. Loading of telephone lines was just starting; phantoming allowed three speech channels to grow where two grew before but the problem of loading phantom circuits remained to be solved; and loaded cables had to be engineered, at least along the densely populated route from Boston to Washington, to secure service against interruption by storms. In solving these problems Jewett was to play a leading part, guiding and inspiring a group of transmission engineers.

In 1907 the economic depression which was sweeping the country sideswiped the engineering department at Boston. It was a blow which moved it to New York and reduced its size, transferring its laboratory and design work to the Western Electric Company. To some it looked like bad luck, but to Jewett it proved the best of luck. He accepted it with his eyes open for he had slipped down to New York to discuss the situation and his future work with J. J. Carty, who was to be Chief Engineer. Thus there started a mutually fruitful association.

Carty was a composite of engineer and genius, of visionary and stage manager. He had come to the telephone company as a scientifically untrained youth; he made at least one very important invention and rapidly rose to a position of responsibility. He had an uncanny ability to sense lines of possible progress even when the technical background, and certainly the actual means, were not over clear to him. Jewett, who in the meantime had come to be an authority on telephone transmission, was well equipped with the scientific tools of mathematics and physics. Much that Carty foresaw of technical progress was probably predicated on a scientific base supplied by Jewett; and as time went on, in scientific matters, Carty

A familiar group in front of the small experimental wireless station which was built at Montauk Point for one-way radio transmission to an antenna in Wilmington, Delaware. In this photograph, taken in 1915, Dr. Jewett is the fifth man from the left

Dr. Jewett at a terminal of the experimental two-way television system demonstrated between 195 Broadway and 463 West Street in 1930

relied more and more on Jewett as the spearhead of the technical advance.

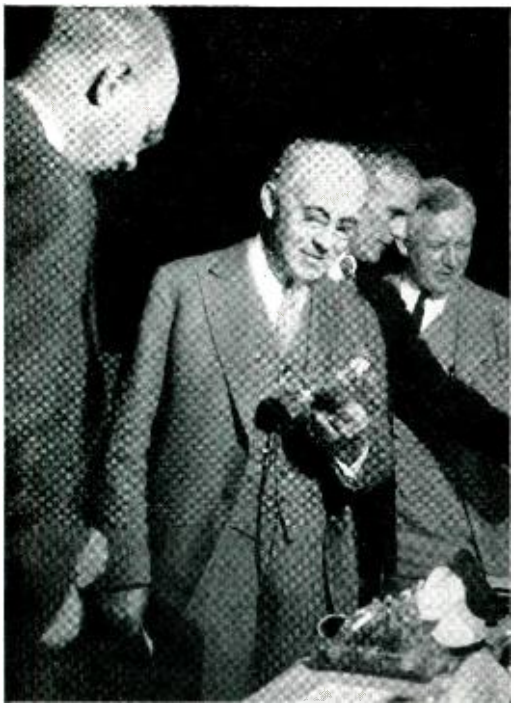
This fruitful relationship did not spring into being but developed—very gradually, at least, until luck again played a part in the early winter of 1908-09. At that time Jewett was sent on a mission to the telephonically unreachable Pacific Coast to help its engineers in their local transmission problems. He was followed later by Carty who was accompanied by Bancroft Gherardi, the intermediate on the organization chart. Gherardi, a well-educated engineer, headed up the part of the work having to do with plant as distinct from traffic and was already putting his mark on the Bell System. To him is due much of the advantage which accrues from the standardization of equipment and practices among operating companies. To these three men, in their separate ways, can justly be ascribed most of the spectacular technical progress of the telephone industry in the two following decades.

The telephonic isolation of the Pacific Coast was emphasized to Carty and Gherardi by their own remoteness from their Eastern offices and by the demands and pleas of the local telephone company. The problems and possibilities of transcontinental service were earnestly considered in conferences to which Jewett was invited. After they returned Carty wrote for H. B. Thayer, then vice-president of the company, his famous memorandum. In this, on the assumption of more men and dollars for his department, he promised notable extensions in geographical range of telephony. He foresaw not only New York-Denver service and concomitant improvement of the service over shorter distances but, through the development of a satisfactory telephone repeater, speech between San Francisco and New York. His vision went even further, it considered the impact of such a repeating mechanism upon the infant wireless art. And the impact, following in less than a decade, initiated the radio of today.

Basic to such progress was the mission which was developing for Jewett—the idea underlying his career. That idea, in a word, was the coördinated application of the methods of scientific research to the problems of telephony. Later and more broadly, application to all electrical communication; and for all industries. At the moment it was specific to the problem of an adequate telephone repeater, the solution of which, it was believed, would be found in the new physics that dealt with streams of electrical particles, whether ions of gas or electrons.

Carty envisaged the immediate accomplishment of "universal telephony throughout the United States" of which he said "its importance is so apparent that no argument is needed to demonstrate it." Gherardi envisaged throughout the country a further coördination of telephone engineers and plant executives which would insure the widest and most efficient use of the new facilities that might be developed. Jewett envisaged for the development of those instrumentalities a creative engineering group dominated by the spirit of research. All three were to see their dreams come true in the next few years.

There had, of course, always been research in the telephone company—as had been most spectacularly illustrated by Campbell's work. Individual engineers had approached individual problems in the research attitude; but never in the past had an organized group carried the aegis of "scientific research."



At the Laboratories in 1939, *Dr. Jewett looks over some new telephone equipment proposed for the Bell System Presidents' Conference. Dr. Buckley is at Dr. Jewett's right and Leo Montamat and William Wilson at his left*

Jewett got his wish for a *research department;* and it was not unaccompanied by corresponding progress on his part. In one of his memoranda to Gherardi he considered the division of the attack on the repeater problem between the engineering departments of the Western Electric and the American Telephone and Telegraph Company. "With proper handling and with proper men engaged on the various phases of the problem," he felt, he said, "very confident that fruitful results should be obtained within a reasonable time." In the work order on the "repeater study" which Carty officially approved in April, 1911, the general direction was assigned to Jewett. Incidentally, be it noted, New York-San Francisco transmission was accomplished in July, 1914, and service opened commercially the following year.

In the meantime, New York-Denver transmission had been accomplished and the circuits were ready for commercial service. Also a start had been made towards the formation of a research group in the Western Electric Company under E. H. Colpitts. Recruiting for that group Jewett had solicited Millikan's assistance, pointing out that a telephone repeater "in order to follow all the minute modulations of the human voice must obviously be practically inertialess; and I don't see how we are likely to get such an inertialess moving part except by using some of those electron streams with which you have been playing in physics." The result was the engagement of Dr. H. D. Arnold who made history by developing the structure of the DeForest audion into a high-vacuum electron tube.

For a time Jewett's responsibilities for transcontinental telephone transmission, and for the repeater which was to be basic to it, were carried out from the A. T. & T. In the spring of 1912, however, he was transferred to the Western Electric Company. There, as assistant chief engineer, he was placed in charge of the newly formed research department and also of several related departments. Informally through his association with Carty and Gherardi he retained effective supervision of the engineers at the A. T. & T. who were concerned with the field problems of transcontinental transmission.

Nothing succeeds like success, and nothing advertises itself better. Transcontinental wire communication, long distance radio telephony, carrier-current systems for wire, improvements in telephone instruments, researches into speech and hearing, electronic devices of many kinds and by-products in the phonograph and sound motion picture arts—all emerged from the research laboratory within a very few years.

The research attitude was justified and it was advertised world-wide by its products. The rapidly growing telephone research laboratory was its exemplar and Jewett its popular proponent. The idea had evolved. The personality to carry it had been developed long since. There remained only further flowering and fruiting.

Within the Bell System the research idea was rapidly ascendant; and Jewett's inspiration and leadership increasingly wider. By 1925 he had become the A. T. & T. vice-president in charge of all development and research activities and president of the recently incorporated Bell Telephone Laboratories.

Outside the Bell System, in the scientific and engineering world, the idea was quickly accepted—it was timely and in many instances overdue. It was a natural—subconsciously an inevitable idea, the adoption of which awaited only exemplification and clear enunciation. Jewett had become its evangelist. Through his many contacts with university scientists, through his activities in the National Research Council and the National Academy of Sciences, through published papers and talks, through example and precept, he advocated a wider application of the research attitude of science. He was always its welcomed exponent. Not only was he loved for himself and for the things he had accomplished, but even more for the idea for which he stood and to which he gave support.

The culmination is the research effort devoted to winning this war. To that Jewett contributed not only by his advocacy of research which had helped to prepare industry for the emergency, but also through plans and actions on the national stage and through suggestion and inspiration behind the scenes. Elected President of the National Academy of Sciences in the spring of 1939, he was in a strategic position to assist the formation of the National Defense Research Committee. As a member of that committee he has had responsibility for three lines of its activity: subsurface warfare—defense, for example, against enemy submarines and improved offense for those of the United States; communication—from secrecy devices to world-wide systems; and transportation—amphibious carriers, for example, and other non-aeronautical means. In this position Dr. Jewett is one of the managing directors of a unique scientific enterprise through which the scientists of the United States are helping to win the war.

And now, at the end of September, 1944, the age provisions for retirement in the Bell System have terminated his official connection with that organization. But the ideas he has set moving and the men he has inspired will carry on. What the Bell System loses the world at large will gain, for he will have more time to devote to the national problems of science and engineering. As President of the National Academy of Sciences, reëlected for four years, his career is far from finished. Parodying a once popular book title: Life Begins at 65. And may it be a long one!

John Mills.

The Frank B. Jewett Fellowships in the Physical Sciences

Walter S. Gifford, President of the American Telephone and Telegraph Company, has announced that the company has established a trust fund to finance post-doctorate fellowships in physical science in honor of Dr. Frank B. Jewett, its retiring Vice-President.

Five fellowships will be awarded annually, each carrying an honorarium of $3,000 *to the holder and* $1,500 *to the institution at which the recipient elects to do research. In the selection of Fellows, primary criteria will be demonstrated research ability of the applicant, the fundamental importance of the problem he proposes to attack, and the likelihood of his growth as a scientist.*

Selection for Fellowship awards will be made by a committee of seven members of the scientific staff of the Laboratories. Acceptance shall involve no implication or commitment on the part of the Laboratories or on the part of the recipient as to later employment in the Laboratories.

Senders for Automatic Ticketing in Step-by-Step Offices

By R. E. HERSEY
Switching Development

IN THE step-by-step system, senders are required only when there are operations that cannot be performed immediately under direct control of the dial. In the new toll ticketing system,* from one to three digits are dialed before the toll ticketing senders and trunk circuit are reached, and to permit these digits to be printed on the ticket, they must be identified. Knowledge of these digits is needed also so that the sender can retransmit them to route the call through the tandem switches. Besides retransmitting the digits of the called number, the sender also controls the printing of the ticket, and on two-party flat-rate lines determines which party is placing the call.

The new system provides for as many as 200 toll ticketing trunks served by a common group of senders, the number of senders in the group depending on the busy-hour traffic. Step-by-step trunk finders are used to establish connections between the trunk circuits and senders. When there are not more than 100 trunks, each sender is directly associated with one trunk finder, and all the trunks are multipled to the 100-bank terminals of each trunk finder. When more than 100 trunks are provided, each sender is provided with two trunk finders, each belonging to a separately multipled group. Half of the trunks are multipled to the banks of one group of trunk finders, and the other half to the other group. To reduce the time required for connecting a sender to a trunk circuit, the multipling between the banks of the trunk finders is shifted so that trunks appearing on the lowest level of one trunk finder appear on a second level of another, on the third level of another, and so on. In this way, each group of ten trunks appears on the lowest level of at least one trunk finder if there are ten or more senders.

A call coming in over one of a group of ten trunks normally starts the trunk finder on which that group appears on the lowest level. If this particular trunk finder and sender were busy, it would start the trunk finder on which the group appears on the second level, and so on progressively as it encounters busy senders. With this arrangement, any trunk may use any sender, but under ordinary conditions it is the one associated with the trunk finder on which this particular trunk appears on the lowest level. When a call comes in, a trunk finder steps up to the level on which that particular trunk appears, and then

*RECORD, July, 1944, p. 445.

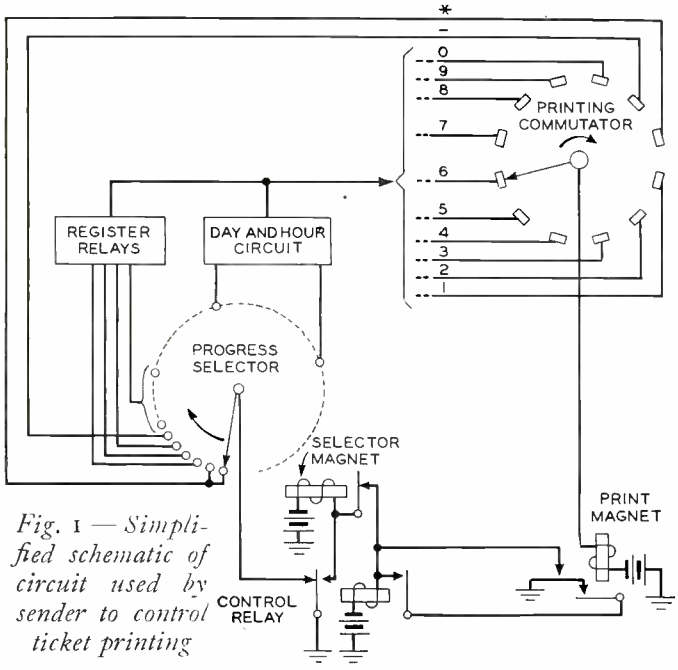


Fig. 1 — Simplified schematic of circuit used by sender to control ticket printing

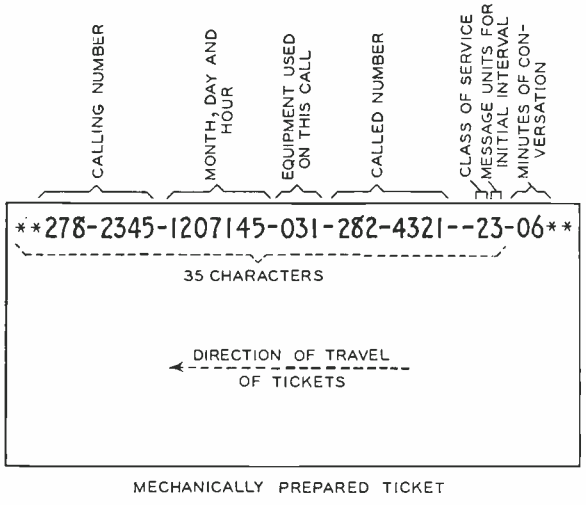


Fig. 2—Typical ticket showing the 35 characters printed under control of the sender

hunts in that level to find the calling trunk.

By the time a sender has been connected to a trunk circuit, from two to four digits will have been dialed by the subscriber. From one to three of these digits are used in reaching the trunk circuit, and one digit is dialed and recorded in the trunk circuit to allow time for the trunk finder to hunt for the calling trunk. After the sender has been connected, it records all subsequent digits dialed on register relays, but to be able to retransmit the office code, if required, and to print the complete called number on the ticket, it must also determine the digits dialed before it was connected to the trunk. To accomplish this, the sender connects itself to an identifier. This circuit determines from the selector and level reached by the calling line the digits already dialed in gaining access to the ticketing trunk circuit and the digit registered in the trunk circuit, and transfers all of these digits to the sender. To determine the number of the calling line the identifier connects itself to the thousand-number circuit, and having determined the number, transfers it also to the sender. Each subscriber who is on a two-party line in the step-by-step system has a different directory number, and the identifier can determine which number to use only it if can learn which of the two subscribers is calling. The sender, therefore, makes suitable tests to determine this for it.

As soon as the identifier has transferred to the sender the digits dialed before the sender was seized, it indicates just which

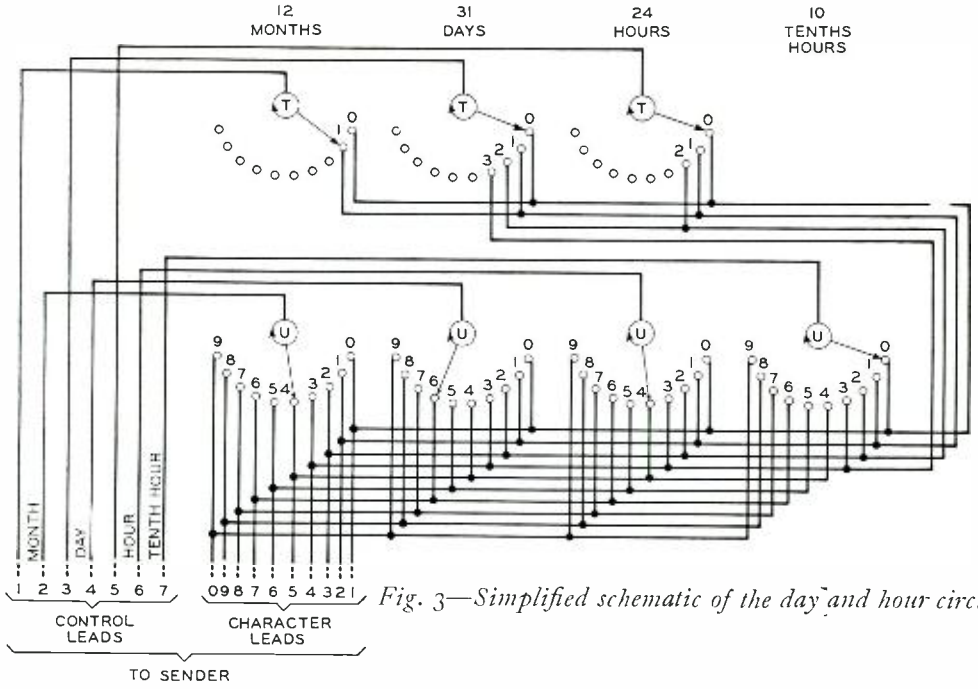


Fig. 3—Simplified schematic of the day and hour circuit

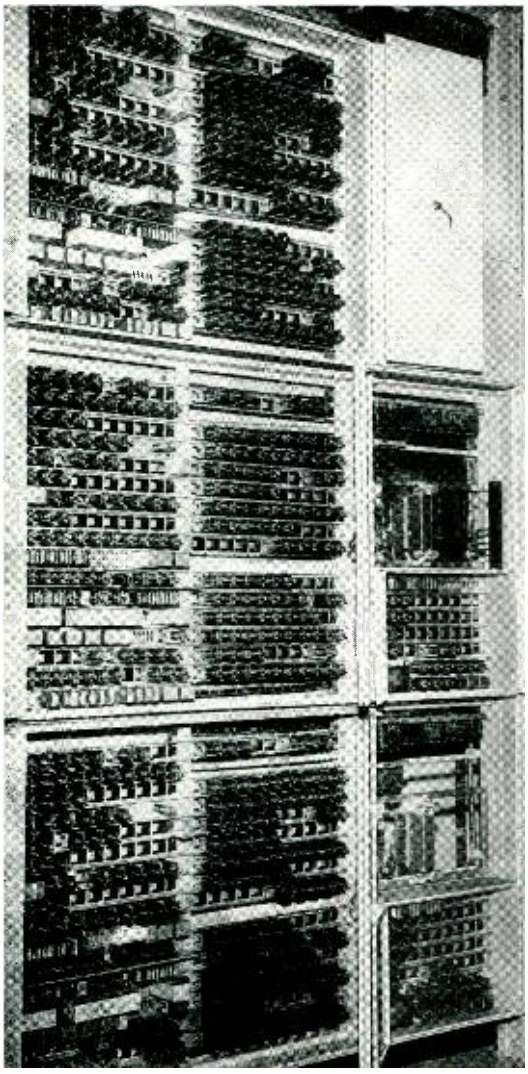


Fig. 4—A sender frame in the automatic ticketing system

digits should be sent out for setting up the tandem switches, and also may indicate, on certain calls, that one or two additional digits may be sent out for special purposes such as switching in a voice repeater. Although not included in the Culver City installation, where automatic ticketing equipment is now in commercial service, the design also provides for pulsing out a set of digits entirely different from those dialed by the subscriber. All digits the sender records are registered on sets of five relays for each digit. Two and only two of the five are operated for each digit, and consequently certain inaccuracies in registration can be readily detected.

A condenser-timed pulsing circuit is incorporated in the sender, and as soon as the office-code digits are registered, this circuit starts generating pulses for establishing the connection to the call number. Counting relays, which are switched successively to the various groups of relays by steering relays, control the number of pulses sent out to the switches for both the office code and numerical digits.

By about the time the subscriber has dialed the second digit into the sender, the identifier has transferred to it the subscriber's directory number, the subscriber's class, and the rate for the call. Having recorded all this information, the sender establishes another circuit to the trunk through preference relays and a multi-contact relay. Through this connection pass the printer-control leads and the twelve character leads. Over these leads the sender now controls the printing of the ticket in the trunk circuit. A simplified schematic of the circuit employed is shown in Figure 1. At this time 35 characters are printed, including all but those for the conversation time. The order and significance of these characters are indicated in Figure 2. A 206-type selector is employed to shift the control of printing so that the correct characters are printed for each of the 35 positions. At the beginning of printing, the selector is resting on its first position, and ground from a back contact of the control relay is carried through the selector to one of the segments on the printing commutator. During this period, the brush of the printer is continuously rotating around the twelve segments, and when it reaches this particular segment, the ground is extended to the printing magnet, which it operates. As this magnet operates, it stops the brush, prints the character, and closes the contact operating the control relay. This relay in turn opens the ground connection to the commutator segment through the selector, and immediately afterward operates the selector magnet. In the meantime, opening the ground to the commutator has released the printing magnet, allowing the brush to rotate, and has also released both the control relay and the selector magnet, which now moves the selector one step ahead. A similar cycle now begins, but with

ground extended over the second position of the selector.

The first two positions of the selector are connected to the commutator segment controlling the printing of the asterisk, and thus print the two asterisks shown at the left in Figure 2. The next three positions are connected to the relays that record the code of the calling number. These relays, as do all the groups recording digits pertaining to the call, connect to the ten numerical character segments, and pass ground to the particular lead indicated by the number they have recorded. The sixth position goes to the "dash" segment to indicate the space between the code and station number of the calling party. The next four go to relays recording the calling subscriber's number, and the following position is again connected to the "dash" segment.

The next seven characters printed record the month, day, hour, and tenth of hour. For this information the sender connects itself to a day and hour circuit. Three of these are usually sufficient for an entire central office building since they are used but a very short interval for each call. The sender selects an idle one through a relay connector which connects to the leads from the seven selector positions used for printing this information and the twelve character leads from the printer. The day and hour circuit includes seven rotary selectors whose arcs are arranged as shown in simplified form in Figure 3. One pair of these supplies the two digits to indicate the month, another pair the two digits for the day, and a third pair the two digits for the hour, which is expressed from 00 to 23, running from midnight to midnight. The seventh selector supplies the tenths of an hour indications. This latter selector is operated by a contact that is closed every six minutes by a continuously rotating synchronous motor. When the selector moves to its tenth, or 0, position, it operates the units selector of the hour pair—which is thus operated one step each time the tenth-of-an-hour selector makes a complete rotation. The units hour

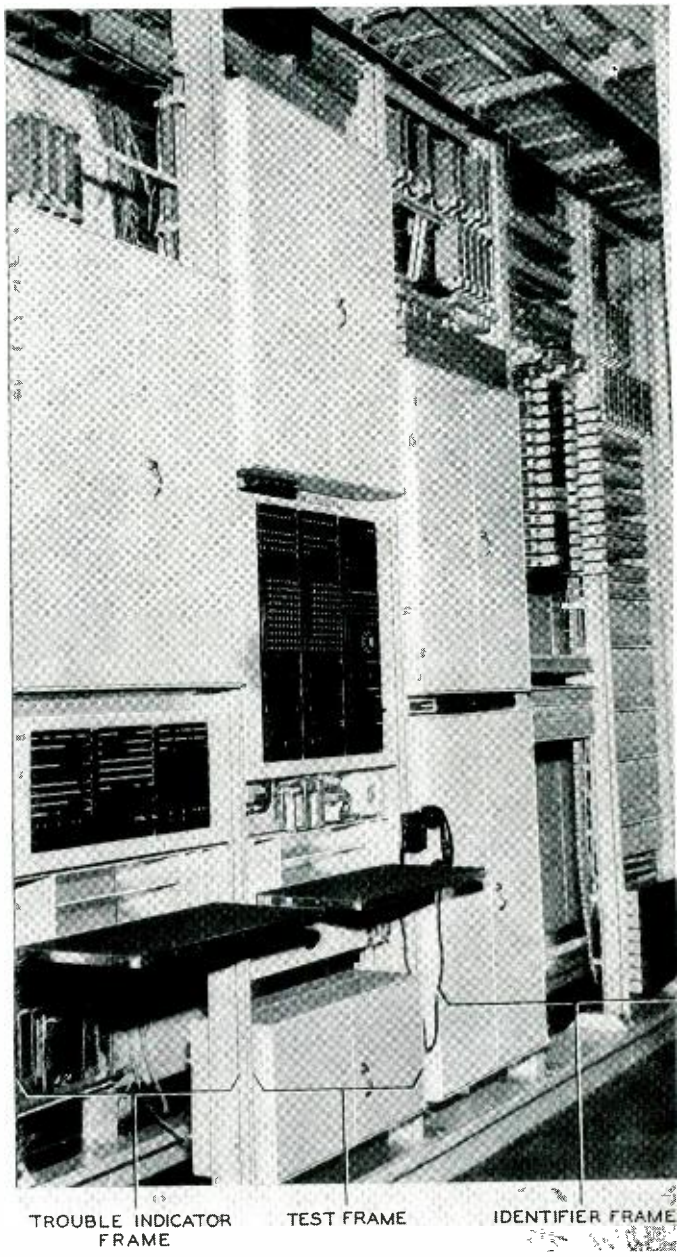


Fig. 5—Maintenance center of the automatic ticketing system to safeguard setting up the call and printing ticket

selector operates the tens hour selector when it reaches its tenth position. This type of control is carried through the entire chain of selectors with the help of circuits not shown. As a result, the various selectors are always in the proper positions to indicate the correct month, day, hour, and tenth of an hour throughout the year. As the printing selector in the sender moves from one position to the next, the ground is carried through the successive selectors of the day and hour circuit, and by them is directed to the proper character leads.

The day and hour circuit is a continuous calendar, the controls being arranged so that for months having 30 and 31 or only 28 days, the months selector is automatically advanced at midnight on the proper day. The only exception to this is on leap year, when a wiring strap must be changed in order to give twenty-nine days to the month of February. Two separate synchronous motors drive the day and hour circuits, and although all day and hour circuits may, in the case of trouble, be operated from one motor, normally some are on one motor and the others on another motor. Also there is a mutual checking path between all day and hour circuits, and should any one get out of step as much as fifteen seconds, an alarm will at once be sounded.

After finishing with the day and hour circuit, the sender prints the characters to indicate the equipment used for the call, then the office code and the numerical digits of the called line, and finally the characters indicating the class of service of the calling line and the number of message units for the initial interval. With the printing of these digits, the sender has finished its functions, and disconnects itself from the trunk circuit. The two digits indicating the conversation time as well as the two asterisks that denote the end of the ticket are printed by the trunk circuit at the termination of the call.

Three senders are mounted one above another on bays as shown in Figure 4. The usual sender features are provided, such as trunk test, connection to a monitor under abnormal conditions, timing and alarm signals, second trial, stuck sender registration, hold and make-busy jacks. An automatic sender and identifier test frame is also provided as shown in Figure 5, where it is located between the trouble indicator frame and the identifier frame. These various facilities provide adequate safeguards to assure correct set-up of the call and accurate printing of the ticket under all conditions of service.

Organization Changes

M. J. Kelly, Director of Research, was elected Executive Vice-President of the Laboratories on September 25.

A. B. Clark and R. L. Jones were elected vice-presidents. Mr. Clark is in charge of systems development and Mr. Jones is in charge of staff departments.

Elected to the board of directors of the Laboratories were M. J. Kelly and O. B. Blackwell, formerly vice-president of the Laboratories, who on October 1 became an assistant vice-president of the American Telephone and Telegraph Company.

Signal Corps Photo

American 90-mm anti-aircraft in action on June 10 on a beachhead in France

ELECTRICAL DIRECTOR HELPS BRING DOWN BUZZ-BOMBS

How the Electrical Director, having made a reputation for bringing down German planes, was called on to help overcome the menace of the buzz-bombs was the story brought back by Clarence A. Lovell of Physical Research and Richard R. Hough of Radio Development from a recent trip to England and France. American batteries in southeastern England equipped with 90-mm guns and M9 Directors were regularly bringing down 76 per cent of all the buzz-bombs which passed through their area. In Normandy, planes were brought down with anywhere from 12 to 36 shots, and in one case, three shots fired from only a single gun bagged a Nazi. The M9 was developed by Bell Laboratories and built by Western Electric.

"When I arrived in England early in July," said Dr. Lovell, "the British were in the process of revising and strengthening their anti-robot defenses. With the earlier set-up, airplanes had the first go at the robots. Only the fastest pursuit planes could overtake them, but in spite of that, the planes were bringing down about 35 per cent of all those which crossed the coast line. Heavy anti-aircraft guns took care of ten per cent, lighter guns and balloons of a few more, so that about half reached their target—London. Later the heavy guns were moved forward to the coast line, with most of the fighter planes behind them; a score of American battalions equipped with our Electrical Directors were mixed in with the British; and then the gunners went to town. On one typical day, 143 flying bombs reached the coast line. Artillery bagged 65, the R.A.F. got 35, the balloons brought down 17, and only 23 got through. Out of 7 that came across in a single flight, the guns got five. When you consider that the target is travelling at 350 to 450 miles per hour and is only 17 feet wide, and that the range was on the average as far as from the Battery to the Empire State Building, that is really some shooting. Some nights when the firing was unusually heavy, the gun barrels glowed cherry red."

The procedure, according to Dr. Lovell, was this. Almost immediately after a bomb left the launching site, its position was plotted on a big chart, much like the ones set up in the United States for aircraft

spotting. In a few seconds its course was evident and word was flashed to any aircraft offshore that might be near enough to be useful. Batteries in its path were also alerted, picked up the target on their Director telescopes and as soon as it came within range, they opened fire. Sometimes the bomb exploded on the first salvo, sometimes it got past; if so, the patrolling planes in the rear area went after it. Sometimes it was "wounded"—the control mechanism was knocked out, and the bomb circled crazily or dashed off to sea again.

In this connection there was one dramatic deed still being talked of in a British battery Dr. Lovell visited. A British pilot had winged his bird, which started on a long glide directly for that battery. The pilot sped up alongside, maneuvered his wing under the bomb's wing, tipped it up and "rode it off" to a course which carried it clear of the battery, when he let go. The bomb exploded harmlessly in a field. Said one of the British girls who was "manning" their director, "I grabbed my helmet and, as I ran, wondered where to put that helmet so it would do the most good."

To study the anti-aircraft batteries in France, Dr. Lovell and Mr. Hough crossed in a ship, landed with their bedding rolls in a barge, and rode a truck some miles inland to a headquarters. While they were bedding down, a German plane crashed and burned a few hundred yards away. Next day they were introduced to an officer—a former entomologist—whose assignment was to investigate and catalog every enemy plane brought down.

From this officer they learned that from D-day to the end of June the heavy A.A. artillery brought down a quarter of all the planes they engaged. The score for July, while incomplete, was practically as good. All of this shooting was at night since the Allied air cover was so complete that the Germans did no daytime flying. Usually the target was hit in anywhere from 12 to 36 shots, although in one classic example, when the battery was not alerted in time, only one gun fired, and in three rounds brought down the target. All of this heavy artillery was equipped with Electrical Directors developed by the Laboratories.

While in France, Dr. Lovell had an opportunity to see a robot launching site. It had been badly mauled by our air force but it was quite evident that a launching was quite an event. The flying bomb was brought into a non-magnetic room where the compass was set for the course to be flown. It was then rolled out on a car and placed on the launching ways—rails about 8 feet apart and 60 feet long. Some sort of rocket was used to bring the car and bomb up to a speed where the bomb would take off under its own power. A stabilizing device would make it climb to a predetermined altitude and the compass would direct it on its course. The heavy concrete protection for personnel with narrow slots covered by heavy glass, and blast marks here and there, showed that launching was attended by real danger to the launchers.

C. A. Lovell (left) and R. R. Hough in the uniforms they wore in Europe. Dr. Lovell holds a souvenir of the trip—a German mine field marker

Flying across the Greenland ice cap and getting beyond the front lines in Normandy were among the personal experiences of Dr. Lovell and Mr.

Hough. Leaving New York on July 7, on only a few hours' notice, their plane took the northern route, flying up a winding, ice-filled fjord and passing over the desolate snowfields inland. Arriving in London in the evening of the 8th, they were assigned to their billets and then Mr. Hough walked out on a bridge to watch the robots. One of them hit a gas holder a couple of miles away; it went up in a puff of flame hot enough to be felt. The buzz-bombs often passed over or near their hotel so they were glad to get out of London into the comparative safety of Normandy. Every facility was given them by Americans and British to circulate wherever they felt information could be gathered.

In Normandy, they were assigned a car and driver, and an officer to act as liaison. Since most of the firing was at night, that was the time for them to be at an A.A. battery, as might be expected. Jerry usually picked out another area, so that their loss of sleep was often for nothing. Their most exciting experience came when they decided to combine souvenir-hunting with a visit to an A.A. battery. Now souvenirs are found in greatest profusion in an area just vacated by the enemy and before the Salvage Corps—or too many GI Joes—have gotten a chance at it. So they picked a route which would take them into a forward area. Unfortunately, the enemy had driven a salient the night before, and the AEF was busy cleaning it out. They heard field artillery fire ahead, then alongside, and finally heard the shells passing overhead. After going through a still smoking village they passed an infantry platoon lying by the roadside, and then they noticed, from fallen leaves and branches, that the road hadn't been travelled recently. That was a signal to turn back; later they found that the enemy was only about a quarter mile ahead of their most forward point. Eventually they reached the anti-aircraft battery, but without souvenirs.

Acme Photo

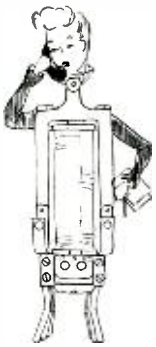
Spotting its prey, an RAF fighter plane zooms down on a buzz-bomb making its way to Southern England. A few moments later it was exploded by the fighter's guns

Returning to England, the engineers revisited the anti-robot batteries, and visited certain military laboratories. They saw a mechanical director captured from the Germans which impressed them as of competent design and workmanship. They were told it gave "excellent "results under certain conditions, but lacked the flexibility of the M9 Director. On August 24 they left London by plane and early the next morning they were back in New York.

Senders for Automatic Ticketing

R. E. Hersey, author of the article on page 550, showed an early draft to his wife to discover whether he was making himself clear. Her reaction follows:

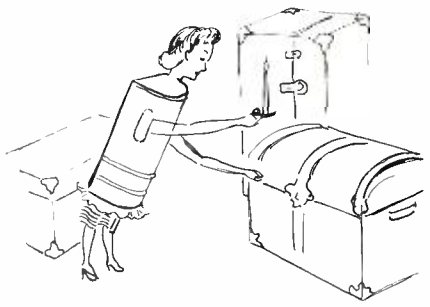
SOMETHING new has been added at Culver City to the old step-by-step system. These "senders" do the work of a very agile secretary with a very excellent memory. Figures 1, 2, and 3 may leave Varga-girl addicts unmoved, but such a camera conscious crew of connoisseurs needs no bird or bell to tell them that the secretary pictured in Figure 4 is a Ducky Jenny (seductively photogenic to you)! Now let me tell you about the extra services:



Ducky Jenny

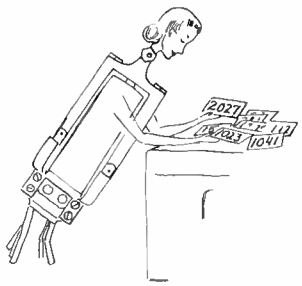
DSA boards are overloaded. AB toll calls are increasing. Try to dial a call. Often your first three digits are already consumed in the case in the local office. There you are, getting nothing, like old Mother Hubbard's dog. Telephone people don't like to wait. One company installed operators to plug into large common trunks to tandem locations. That cost. But this new "sender" can not only register the digits dialed by the subscriber, it can automatically repeat them again to a tandem point, or actually without human aid substitute other arbitrary digits. *You still get the number you're dialing!* Isn't that versatile? Or don't you like speed and economy?

Not a number lost around the office where this super secretary works. There used to be a game of missing digits while the "stepmother" selector hunted in the attic for an idle trunk. But this "sender" has a pet called the "Identifier" which digs up all might-be missing numbers, and dashes to the thousand-number circuit for the directory number of the calling line, and politely gives them both to a relay for registering.



"Stepmother" selector hunting for idle trunk

Nothing deaf about this super "sender." You can't even stump her with such a confusing pair of twins as a two-party line. She knows the tip party from the ring party by her 209-Type Relay Test which she uses twice each party-call just for luck. No melodramatics unless ground trouble develops. That's like a mouse in the office. The "sender" climbs up on her stool and yells for the maintenance crew.

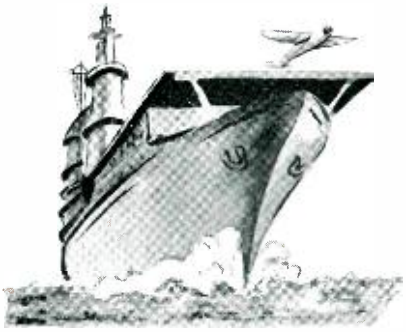


"Identifier"

The "sender" puts numbers on a ticket as spontaneously as the usual secretary applies make-up. Her work generates the type pulses on a battery and ground loop basis. Counting relays and steering relays switch the control from one set of register relays to the next. And when this dame comes out with her calling card, it surely leaves nothing to the imagination: month, day, hour, even tenth of an hour, conversation time, calling subscriber's directory number, class of subscriber, and rate of charge. You may even see stars, although the wise call them asterisks.

With a "sender" like this in your office, you're only in for a disappointment if you anticipate trouble. Everything is double-checked, preshrunk and Sanforized. By the way, how many shall we send you?

And don't forget to listen in, same station, future date, for a complete exposé of how the "identifier" determines the calling subscriber's number, or "Dunninger Done It but We Can Dood It Too!"



IN OUR NATION'S SERVICE

Lieut. Walter S. Gifford, Jr., Killed in Action

Walter S. Gifford, president of the American Telephone and Telegraph Company, has received word from the Navy Department that his son, Lieut. Walter Sherman Gifford, Jr., had been killed in a plane crash in the Southwest Pacific war theater.

The telegram stated: "Your son is now known to have been killed in a plane crash while in the performance of his duty and in the service of his country."

Raymond P. Chapman

"I was slightly wounded at Anzio during the big push, but I have completely recovered and feel fine. The Italian summer is really swell with moderate weather and very little rain. This mountainous country has none of the resources which one observes in the States and very few factories. The people in North Italy are more modern and the houses much better than they were in the south.

"I am now an 'old fogey' in Army slang, having served three years. There sure has been a vast improvement since Tunisia. Our supply situation is better and we now even get good American beer once in a while."

August Uhl

"Greetings from the island of Guam. Our division participated in the invasion here and made a creditable showing. It took just twenty-one days to take the island and communications played a big part. Saw a lot of Western Electric wire and handled quite a bit of it. The natives here speak good English, especially the younger folks who have attended American schools. We have been on the island one month and have developed it as much as the Japs have in three years. I guess that's the good old American way of getting things done in a hurry."

C. W. Fleischer

"So far since I've been overseas my work for the most part has been the maintenance and repair of local battery telephone equipment. Since ours is a service group, we're considerably removed from the combat scene. About the only thing we've been subjected to is an occasional 'nuisance' raid from the air. Life in this particular place is not very difficult although I have been in several camps where the mud was ankle deep and nothing I owned would dry out. Our chief sources of diversion are the outdoor motion pictures and an occasional sup-

Major Emil Alisch (right) sent this picture from the Aleutians of "one crab—they are so big that you need a G.I. can to cook them"

ply of books from Special Service. Lately many of the men have gone on night fishing expeditions and have thereby added a little more variety to our mess.

"Right now we're in the middle of the winter or dry season and the heat, while still very high, is not so intense as during the rainy summer months."

Lieut. Edward J. Bybel

"I've been chasing all over the South Pacific. Finally, upon our arrival here, we did get mail—the first in over nine weeks! I had forty-two letters and spent a swell afternoon reading them. The American G.I. is a funny Joe—he creates a bit of America wherever he goes. Therefore we have outdoor theaters and baseball diamonds carved out of thickest jungle."

Major H. T. King

"We are living well here in Italy, supplementing a ration which has lately been more than satisfactory. We have had corn on the cob several times and quantities of tomatoes, and, to a minor extent, peaches, pears, plums, apricots and apples. Our regular ration has been bountiful lately although at a moment's notice it may become canned hash and chili.

"I had a little experience the other day which to me was quite a thrill. I went up to the OP (Observation Post) and after having had a look around and watched the adjustment of some artillery and some mortar fire, I went with a member of the OP detail and our communications officer to a nearby house to look at a Jerry dud that had arrived the day before. The shell had hit the roof and had gone clear down through three concrete floors in addition to the roof and was now reposing in the cellar.

"We were approaching the door of the house, when we all became interested in a low moaning sigh that was something like a current of air rushing through a hole in a wall. It became louder and at about the same time we all decided the sound was a forerunner of another 'token' from Jerry. We made a mass attack on the door of the house and having successfully negotiated it in a body, darted around convenient corners from the door and assumed poses calculated to convey to the oncoming shell that we were part of the house and that we really weren't there at all. About this time 'it' hit, jarring us nicely and sent portions, fortunately small, of the house tumbling down upon us. The other two insisted rather sulphurically that it had hit the house but I held out for the house across the street.

"At any rate we went on about our business, and truly it is our business to learn as much as we can about what Jerry is tossing at us. The house across the street had been struck on the roof. We were headed for that house to see what was coming in that

Laboratories men who recently attended the School for War Training. Kneeling, left to right—Charles A. Haas, Warren C. Rouse and John Scharf. Standing, left to right—Frank W. Garland, James B. Kennedy, George E. Linehan and Martin C. Nielsen

Leaves of Absence

As of August 31, there had been 899 military leaves of absence granted to members of the Laboratories. Of these, 32 leaves have been completed. The 867 active leaves were divided as follows:

Army 504 Navy 270 Marines 29

Women's Services 64

There were also 18 members on merchant marine leaves and 30 members on personal leaves for war work.

Recent Leaves

United States Army

Robert J. Cameron	Vincent J. Piano
William Dimella	Robert Schuster
Eleanor J. McConnell	Shirley Siegel
Herbert K. Meyer	Charles S. Simko

United States Navy

Gilbert A. Beck	Richard F. Heinrich
Wesley Bender	Eugene A. Kleiner
Clayton B. Brown	Kenneth F. McKenna
Lt. Cmdr. C. E. Clutts	Thaddeus E. Rybka
Raymond G. Engel	William H. Schwartau
Robert F. Graham	Daniel F. Walsh

Merchant Marine

Leonard Kromnick	Ralph X. Van Buren

day, when we were all frozen momentarily by a repetition of that unearthly sigh. The 'freeze' was temporary only, for we all broke into a run—and the direction we chose was around the corner away from the deadly 'sigh.' Captain Truax and the lad with us threw themselves down on the sidewalk up against the house, and I—running a very poor third, I must admit—dove for a hallway that appeared to loom invitingly. I was about two steps inside when a giant hand reached out and struck me across the broad of my back, tossing me ignominiously on my snoot. Both of the others were still lying motionless upon the sidewalk. Slowly, ever so slowly, it seemed to me, Captain Truax gathered himself and rolled over so so that he could look in my direction and said: 'I don't want any to come any closer than that one.' We decided that it was an infantry problem and got out of there."

Flight Officer Stanley W. Erickson

"The 'Pubs' are quite an experience to an American, they are more like a neighborhood club than a drinking establishment. It's not uncommon to see entire families enjoying a pint of mild or bitters. The English use the fork in the left hand when eating, and use the knife in the right hand as a 'pusher.' I had the pleasure of having dinner with an English family and they pointed out the difference in our eating habits. Incidentally we have to be careful to eat very little as they are rationed very severely, and it is a problem in diplomacy not to insult their hospitality. The country is similar to our state, gently rolling country, and plenty green, but I sure wish I were home. Thanks a million for the RECORD."

John H. McConnell

"I am now stationed in Bermuda. It is very pretty, and the color of the sea and sky never ceases to amaze me. I do a lot of swimming and fishing and have a jeep in which to do my sightseeing.

"I am responsible for the technical aspects of all radio equipment used on this base. Everywhere I turn I see equipment developed by the Labs and when I speak to the operators and technicians and learn the regard they have for the apparatus, it makes me feel very proud indeed."

Lieut. George Bukur

"For those that think it is a hot summer in New York, let me inform you that ninety degrees is considered air-conditioning here in China. I have been having a wild time moving around the country just one breath ahead of the Japs.

"We had a real treat today—I found three little watermelons and they sure tasted good. I also received some dehydrated soup from Pete and we had a little ritual over that meal. The melons cost me five dollars (gold).

"The war news here has been good of late, but I hope that the people back home don't get too optimistic because there is still a long hard pull ahead of us."

Thomas Calvani

From an 8th Air Force Service Command Station in England the following report has been received: "Thomas Calvani is now

serving at this large strategic air depot as an airplane mechanic. Essential duties are efficiently accomplished by Private First Class Calvani, who puts his civilian aptitude to work with the Army in the swift reconditioning of battle-damaged Lightning, Mustang, and Thunderbolt fighter planes here."

Walter J. Bittman

"We're now located somewhere in France. We left England in an American LST and landed on the American beachhead. At present things over here are pretty muddy—the rain hasn't helped matters at all."

Lawrence B. Jones

"I would like to tell you of some of the things that the civilians here in Denver do to make servicemen feel they are really welcomed and appreciated. Although there are three other camps located near Denver, causing the town to overflow with Army men on week-ends, families are always ready with invitations for the boys to Sunday dinner or a trip to the mountains. One family invited servicemen to swim in their private swimming pool on Sunday afternoons. The attitude taken by the people here really makes you feel at home and appreciate Western hospitality, and one doesn't mind quite so much being away from New York."

William F. Bodtmann received his wings as a pilot in the Army Air Forces on June 27. He visited the Laboratories at Deal while home on his first furlough in sixteen months

George W. Galbavy

"I have now seen a little of the world and realize how large it is and what a tremendous undertaking it is to ship men and supplies. You would be amazed at the sight and the size of New Guinea. It is becoming civilized since Hon. Tojo's scoundrels have been almost wiped out. Although we have practically made the place civilized, we still haven't arrived at the point where we established the well-known corner drugstore, and newspaper stand, but I think maybe we will get around to that some day.

"Right now I am in the main exchange, incidentally the largest hereabouts, and three of us man it. We have a three-position multiple switchboard and it is sport shooting trouble on it. All long lines and long distance teletype lines go through our main distributing frame. Really means staying on the beam all day long and well into the evening. Fortunately I am working 8 to 5 but it is the calm before the storm.

"This New Guinea Telephone Company is not an old institution by any means and it is growing by leaps and bounds every day. Since my stay in this out-of-the-way so-called beautiful South Sea island, I have learned a lot about basic and fundamental communications. They are both interesting and heartbreaking to maintain, especially the cable projects fanning out from the central office. The cable itself is strung aerially for obvious reasons; it is easier to run and maintain. The most trouble encountered in cable is the method by which it is run. At the time of running it the cable is strung fairly tight within spans and in time it buckles right at the messenger. Speaking of lead cable buckling, that reminds me that I read an article in the RECORD which explained that particular subject and the field studies that are being made at the Chester Lab. You would be surprised at the number of things that you run into in the way of equipment trouble due to rugged atmospheric conditions.

"On the type of equipment we are using here the ring-down relays are equipped with a zinc non-freezing disc. The location of the exchange is within a hundred yards of the beach and you know what's coming. The salt air seems to hit this non-freezing disc and a chemical reaction results, leaving a powdery white coating on both the relay

core and the disc. The coating itself looks like pulverized sodium hydroxide and smells a lot like it. With these little unorthodox things maintenance is a little more exacting and more frequent. The plugs are plagued with a similar curse of corrosion. If we didn't have these little things to contend with I believe life here would be very boring.

"We have all types, WE-550's, Kelloggs, the portable TC-1 which can be installed to nine positions and even had a WE605-A with six positions at my last assignment. That was a pretty sight to see at peak traffic periods, with busy lights flashing on all trunk lines. There were red lamps, green lamps and white lamps, depending on what sort of lamp caps we had available. It is interesting work with one exception. A phone is apt to ring any time during the night for emergency repair work. That is not any picnic during a visit from the Jap bombers, but all has been peaceful lately.

"We have a jeep at our disposal and no amount of praise can do the vehicle any justice. The Army calls these first-class roads. I would hate to see some of the worse type. Seriously speaking, the Army Engineers and the Navy Seabees have accomplished near miracles in constructing roads, air strips, and bridges out of the dense jungle and coral foundations. If it were not the fact that one has to be here, you could almost appreciate the scenic beauty and nature's pranks in the form of animal life. Orchids grow here in diameters of a foot or more, a veritable debutante's paradise, but no debutantes—what a calamity!

"Still being somewhat scientifically minded, I'll divulge some of the things we have run into. In the first place B.S.M.P.'s are okay but they were not drawn up for this particular climate. Relays are adjusted by judgment mostly until they operate satisfactorily. One day it will be hot and muggy, rains very frequently and not the drizzle type. Ants get into these TP-6 instruments (Signal Corps nomenclature) but we know them as combined handsets. A cluster of them get into the switchhook contacts and short the instrument. Get a brush and clean them out. The ants here are pesky. Lead cable does not stop them and if they ever find a break in the cable it is all over but the shouting. It means a pretty fair splice.

With the Murray Hill Laboratory as background, A. R. Kemp is shown photographed beside his son, Lieut. Warren R. Kemp, who had just received his wings and commission as a pursuit pilot. Lieut. Kemp is now attending the Central Instructors' School at Randolph Field, Texas, to prepare him to become an active instructor in the Advanced School of Flying

"Use a lot of rubber cable here suspended on poles but teletype circuits put a crimp in them and break down the pairs. Lead cable is O.K. except that in this rainy climate it is acting as a submarine cable and I am pretty sure it was not designed or manufactured for that use. Some smart G.I.'s have even gone so far as shooting 30 calibres through rubber cable suspended from the poles. There was quite a fuss made down in Australia when members of our Army as well as the Australian Army riding on the train from Brisbane to Townsville took great delight in showing off their ability as marksmen by shattering a lot of the glass insulators on their long distance lines.

"My only beef, and it is the consensus of all beefs here, and that is the chow. People back home think we are getting the best but most of it is canned and dehydrated. Believe me when I get home I am going to gorge myself with steaks and drown them with beer.

"There is a compensating feature these days in the S.W.P.A. First came the cigars as part of our tobacco ration and the day

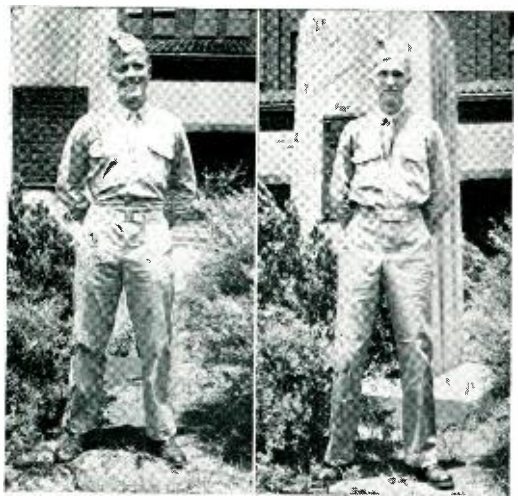
after tomorrow introduces the beer ration. To add to the home-appearing advantages the Wacs will be here in a couple of weeks.

"Jack Benny and his troupe including Carole Landis are scheduled to appear at an outdoor show. It is scheduled to come off at 7:30 P.M. and at the time I am writing this letter, which is 2:00 P.M., the bowl is filled with G.I.'s. I don't think it is even worth the effort to go down to see it. It is not laziness but the utter futility of it all.

"Angau (Australian-New Guinea Administrative Unit), the governing body of the natives, takes care of the hiring of natives for various labor details, such as unloading trucks, ships, mosquito control and even erecting buildings for supply purposes. They have proved invaluable to both the Yanks and Aussies in all their pack-carrying problems in the dense jungles. At any rate, Angau pays them, in some areas with money, in others by any agreed medium of exchange. The natives like to smoke cigarettes, especially if they can manage to beg or bribe one from our boys. If they don't get one, Angau supplies them with a tobacco ration every week. In one area here Angau used to pay the natives off with some newspapers which they used to wrap around the tobacco and make a cigarette 6 to 8 inches long. A Yank outfit was unloading an unlimited supply of newspaper which was wrapped around the equipment to cushion it in the crates. A group of natives helped to unpack the equipment and naturally they were goggle-eyed at the amount of newspaper that was going to be burned. Here was untold wealth to them. The group kept jabbering and the result was they finally elected a member to make a request for some of the wealth they had been handling. The elected one stepped forward timidly and asked one of the Yanks if he could have some of the paper. 'Sure,' said the Yank, 'take it all.' What a mob scene followed. They picked up every piece they could get their hands on and lit out for the jungle. Net result a medium of exchange ruined. Something more enticing had to be offered in order to get them to work again, and so it has been all along. Yanks have spoiled them. At first you could purchase a cocoanut for a bob, now it is two bob. They make all sorts of wood carvings of animals and sell them for two pounds and up.

"The natives that are in the army as a separate unit under the jurisdiction of the Australian Army are really proud boys and are envied by those natives who are not so fortunate. Down below they are used to patrol a pipe line used for fuel that was pumped directly from tankers to the various tanks they had dispersed over a large area. I have seen them on a number of occasions go through a guard mount in platoon formation armed with rifles. They really were sharp, precise and took immense pride in their ability to soldier. To be frank, they put some of the guard mounts our G.I.'s have performed to shame. Their platoon sergeant had 56 Jap scalps to his credit."

James W. Cunningham in a Photo Reconnaissance Squadron at Muskogee, Oklahoma



Aviation Cadet Alexander E. Gerbore (left) has completed his pre-flight training at Maxwell Field, Ala., and is awaiting assignment to gunnery or advanced navigation, and Albert B. Watrous is stationed at Fort McClellan, Ala.

Military News

W. B. Snow, who has been on leave of absence to the Underwater Sound Laboratory at New London since the middle of 1941, has been appointed as assistant director of that laboratory. Writing to Dr. Buckley of the appointment, T. E. Shea, director of research, said: "Mr. Snow has been the backbone of that laboratory's acoustical measurements program, and his thoroughly accurate, imaginative, and conscientious work has achieved for him universal respect in the Navy and NDRC."

Sidney Darlington has been given a personal leave of absence in order to work for the Office of Scientific Research and Development.

Major S. H. Lovering is Chief of the Communications Equipment Section on the Staff of the Maintenance Division, Army Service Forces, located in Washington. He recently visited the Signal Corps Ground Signal Agency Headquarters, Bradley Beach, N. J., for the purpose of ascertaining the status of various new developments and the overall laboratory picture of the moisture and fungi proofing of communications equipment. Examination of Signal equipment now in process of development indicated that A.S.F. policy of simplifying maintenance and reducing the number of types and models is being effectively pursued.

Robert F. Logan of the Marine Corps writes, "In our first mail call since arriving on Guam was my issue of the Record. It's great to know how everyone is doing."

Lieut. V. M. Meserve is now at the Naval Air Station, Willow Grove, Pa.

Lieut. Robert T. Rooney is in the Valley Forge General Hospital in Phoenixville, Pa.

Joseph J. Rosato is stationed at Camp Swift, Texas. "After two years in the Anti-Aircraft it looks like they're going to make an engineer out of me."

Recent promotions to rank of: Lieut. (sg) William B. Callaway; Catherine Covert, Sp "Q" 3/c; Walter Burkhart, Radioman 3/c; Edward Gempler, RT 1/c; Ens. Cedric W. Sheppard; Lieut. L. A. Hopper; Catherine Lennon, Clarence Anderson, A. A. Hauth, and R. Rafferty, Tech. 5th grade; G. B. Taylor, F.M. 2/c; Sgt. Walter Sokolosky; E. L. Chinnock, Chief Radioman.

W. J. Douglas of the Coast Guard visited West Street recently. He has been on active duty and had just returned from a trip to Bizerte in North Africa.

James Larimer is on active duty in the Pacific; W. P. Harnack has graduated from school as a "Communications Specialist" and is now an instructor; Edward A. Hake has completed boot training and is now stationed in Chicago.

William T. Reck is an aviation cadet at Moody Field, Georgia; Ensign Robert C. Shopland won his wings at Corpus Christi, Texas, and is now taking operational training in Florida; Harold W. Collier is in Officer's Training School at Ft. Benning.

Upon his return from the South Pacific, Lieut. Martin P. Hughes visited West Street. Lieut. Hughes spent two months in Hawaii, and eleven months in the South Pacific around Bougainville, New Britain, and Rabaul. He carried on rescue work there as a pilot in the Naval Air Corps.

Frank Majorossy (left) of the Photostat Department recently visited the Laboratories with his brother William

Frank A. Braun is on active sea duty in the Pacific theater.

Lieut. Col. W. F. Smith, Jr., is engaged in organizing and training an engineering and technical group at Camp Crowder, Missouri.

Lieut. Col. W. J. Galbraith is assigned to Headquarters of the U. S. Armed Forces in the China-Burma-India theater at Delhi.

Lieut. Col. R. O. Ford has been in France since a few days after the invasion.

S. M. Wojtaszek
Fort Sill, Okla.

Henry Henkel
Fort Hodges, W. Va.

"I haven't had any particularly exciting experiences, and am in good health. I have travelled extensively over the roads of Normandy and know them almost as well as those of New Jersey."

John R. Merchant is in Pre-Flight School at Maxwell Field, Alabama; Wayne Wilson has been transferred to the Medical Corps at Camp Ellis, Illinois.

Edward J. Schaum stopped at West Street recently while en route to San Luis Obispo from a camp in Florida.

Flight Officer William R. Spenninger visited the Laboratories while on leave from Ellington Field, Texas.

On a recent furlough from Fort Hodges, West Virginia, Aviation Cadet Henry Henkel visited West Street.

John C. Pfaff is teaching a new course on Tropicalization of Signal Corps equipment at the Post School at Ft. Monmouth.

Lieut. J. C. Young won his wings and commission last June in Texas. He is now flying P-47's prior to being sent overseas.

Louis Kramer is with a Malaria Survey Unit in the Pacific theater; Ensign Robert Light is stationed in Boston attending M.I.T. Electronics School.

Edward Downes is attending Radio School at the Naval Training Center in Sampson, N. Y.; Marcae Bitowf is attending *** School in preparation for instructing pilots and mechanics on the maintenance and operation of all Navy *** sets.

As a most ardent reader of the BELL LABORATORIES RECORD I want to express my gratitude to you and your staff on the fine job you are doing to make the RECORD an interesting magazine. In my opinion it is very well illustrated and the variety of articles covers the interesting goings on in the Laboratories which the serviceman likes to read about.

After being over in this uncivilized country of Northern New Guinea I welcome the pleasure to sit down and read the RECORD.

(*Lt.*) *Herman E. Manke.*

W. R. Spenninger
Ellington Field, Tex.

E. J. Schaum
San Luis Obispo, Fla.

Henry Widmann has been transferred to a submarine after spending six months in the relief crew.

L. Charles Brown is "having a wonderful time visiting all the places I've heard about—Naples, Rome, and the Vatican."

Lieut. Emile H. Munier has received his pilot's wings and is now awaiting an overseas assignment.

From somewhere in the Pacific Robert Flinn writes, "Swimming here is excellent, the days hot, the nights perfect if one can ignore the mosquitoes. We use some Western Electric equipment here. Occasionally I see some items that were still experiments when I was back at West Street."

James Campbell is stationed at Ft. Leonard Wood, Missouri; John J. Barrett is attending Radio Technician School in Chicago, Illinois.

J. M. Hayward, Chief of the Technical Data Laboratory, Engineering Division, A.A.F., at Wright Field, has been promoted to the rank of Colonel.

Lieut. H. E. Manke writes, "I can safely say I have had my share of travelling. San Francisco to Guadalcanal, through the Solo-

mons to Southern New Guinea, and now up to Northern New Guinea. Pitching tents and digging foxholes are my specialties. I enjoy flying at night, and it is a pretty sight to see all those tracers light up the sky."

LIEUT. ROBERT I. NOLAN visited West Street recently while en route from Camp Robinson, Arkanas, to Ft. Meade, Maryland. He has been transferred from Anti-Aircraft Artillery to the Infantry.

FRANK A. KODITEK is on active sea duty aboard an LST. "In the tank deck of this LST we have a basketball court, volley ball court, and ping-pong tables. We can go swimming every day by just opening the bow doors and lowering the ramp. After working hours we have recordings played over the public address system."

CHARLES W. MUCCIO writes, "Am in France and thought you would like to know that my battalion was the first to enter Cherbourg. Am feeling fine."

WALTER A. FARNHAM is overseas in the Pacific area. "I've seen quite a few good baseball games down here. Several of the former Yankee players are down here in the islands."

THOMAS MUSCA
Patuxent, Md.

C. C. MARSICOVETE
Miami U., Ohio

VINCENT DECKER writes: "After weeks of drill, swimming, commando courses, classes, and swabbing the barracks floor I still think the Navy is a swell place. We are fast becoming a bunch of salty sailors."

ROLAND M. SCHELLER writes, "Here I am in New Guinea, where it is hot and rainy. This is the winter season, but it seems more like summer back home."

R. C. LOCKWOOD is on active duty in the Pacific, but hopes to be back in the States for a furlough by Christmas.

LIEUT. EDWARD G. SHIELDS is stationed at Walnut Ridge, Arkansas. "I am doing Malaria Control work around the Army Air Field here. The main problem in this section of the country is trying to control mosquito breeding in the rice fields. Airplane dusting is used effectively. Once a week the airplane dusts the fields with a mixture of Paris green and soapstone."

"I AM NOW stationed at Buckingham Army Air Field in Florida," writes THOMAS COMPARETTA. "I have just started Aerial Gunnery School and it is very interesting, especially the electrical sighting. Some of our classrooms down here look like the large laboratory on the tenth floor of the Graybar-Varick building."

ALBERT H. DIEGLER is now attending special school after six weeks of "tough infantry basic." He is studying to be a Signal Corps draftsman.

GEORGE J. THIERGARTNER is on an island in the South Pacific which was once held by the Japs. "Living conditions are far superior to what I had anticipated, and the heat isn't bad as long as one stays out of the sun."

WILLIAM J. ROSOFF in the Maritime Service is now in New London, Connecticut; ELLSWORTH ROSEN is in the Naval Research Laboratory in Washington; LIEUT. THOMAS M. PEPE and LIEUT. FRED SCHWETJE are both at the Marine Base in Santa Ana.

LIEUT. CHARLES J. MCDONALD writes from New Guinea: "After eleven months in this Tropical Paradise of ants, flies, cocoanuts, jungles, and, of course, Nips, I am quite ready for some civilization. Tojo's boys are still bewildered and joining their ancestors, with our help."

V. D. WIPPERMANN
Merchant Marine

R. J. NIELSEN
Fort Benning, Ga.

News Notes

MORE THAN a hundred of the Western Electric Fastax cameras are now in use, nearly all of them on important investigations for the benefit of the Armed Forces. Fastax, a development of the Laboratories (RECORD, *Sept.*, 1943, *page* 1), is made in a 16-mm size, which will take pictures up to 4,000 a second, and an 8-mm size which will take 8,000 a second. Among the larger users are Aberdeen and Dahlgren Proving Grounds, Edgewood Arsenal, the Navy Bureau of Aeronautics, Naval Research Laboratory, Princeton, University of California and Wright Field.

RATES FOR OVERSEAS radio telephone service from most parts of the United States to Costa Rica, Guatemala, Honduras, Nicaragua and Panama as well as to Curaçao in the Caribbean and Surinam on the mainland of South America were reduced on September 1. The lower charges apply to service from most states and the reductions range from $1.50 to $6.75 for a three-minute weekday call. Charges for service to seven other countries in the South American and Caribbean areas were reduced during the first part of August.

E. E. HINRICHSEN, who retired from the Laboratories in 1933, in a recent letter to the Benefit Department wrote: "I have been on the sick list for the last two years, and have not been able to do much of anything. It started with a streptococcus infection which had me laid up for about two months and left me very weak and shaky. I am much better by this time, but still under the doctor's care. Up to then my principal activity was travel. We used to go frequently to most places within a day's round trip, and about once a month to some more distant point. The longest one was up to Yellowstone, which we enjoyed very much. I used to attend the meetings of the Life Member Club of the Pioneers in Los Angeles regularly, and enjoyed them, often meeting old friends, mostly Western Electric, but since my illness I had to give it up."

IN A LETTER to a group of Bell Laboratories men at Fort Dix who are on military leave of absence, the Burlington County Chapter of the American Red Cross thanked them for a contribution made to the Fort Dix Air Base Canteen.

H. W. BODE spoke on *The Stability of Dynamical Systems* before the Mathematical Association of America, at Wellesley, Mass., on August 12. This meeting was in conjunc-

Your Copy of the RECORD

Please put your RECORD in the "Correspondence-Out" box when you are through with it so that it can be sent to a Serviceman's family.

September Service Anniversaries of Members of the Laboratories

10 years

Josephine Holohan
John MacKay
J. A. Watters

15 years

A. J. Ahearn
Ernest Babcock
Robert Black, Jr.
J. R. Boettler
G. R. Brady
M. S. Burgess
Vincent Burns
L. P. Carter
J. P. Cherney
T. R. D. Collins
Michael Conzani
W. J. Darlington
F. P. Drechsler
Hilma Edin
D. J. Fefee
R. K. Freeman
Kathryn Gough
Thelma Gradwell
Shirley Grimm
Priscilla Grutzner
O. C. Haas
W. F. Halloran
M. S. Hawley
C. H. Heller
Eleanor Hill
F. S. Hird, Jr.
J. F. Hurley
C. W. Irby
O. H. Kimmel
W. J. Lally
Florence Larkey
G. W. Lees, Jr.
G. L. Martin
H. C. Montgomery
R. J. Morris, Jr.
James Murray
J. W. Nalencz
Thomas Nally
Richard Olsen
Patrick O'Neill
W. K. Oser
N. J. Pierce
H. J. Reinwald
R. O. Rippere
R. W. Sears
W. F. Sefcik
J. J. Seiler
P. J. Sheehan
J. O. Smethurst
B. F. Stoddard
R. L. Towne
L. M. Towsley
A. W. Treptow
A. H. Van Bree
G. H. Williams, Jr.

20 years

David Anderson
J. A. Becker
C. F. Bischoff
C. G. Graf
J. J. Heil
A. F. Kane
Walter Koenig, Jr.
Mary Maxwell
J. K. McDuffee
A. A. Noel
R. L. Peek, Jr.
Frank Steiner

25 years

H. B. Arnold
J. W. Corwin
G. J. V. Faley
Howard Flammer
N. R. French
J. J. Gilbert
H. E. Ives
E. K. Jaycox
J. L. Mathison
H. S. Price
G. A. Roberts
E. L. Schwartz
B. S. Swezey
R. R. Williams
E. S. Wolek

30 years

R. B. Simon

35 years

W. C. Dorgan
J. J. Kuhn

45 years

Mary Douglas

tion with the summer meeting and colloquium of the American Mathematical Society and the meeting of the Institute of Mathematical Statistics.

L. H. GERMER, F. E. HAWORTH, K. H. STORKS and MISS E. J. ARMSTRONG attended the Gibson Island, Md., conference devoted to *X-Ray and Electron Diffraction* sponsored by the A.A.A.S. Mr. Germer was chairman of the conference.

G. W. WILLARD's article, *Inspecting and Determining the Axis Orientation of Quartz Crystals*, published in the March RECORD, was abstracted in the July 29 issue of *Nature* (*London*).

AT THE REQUEST of the Rubber Director's Office, R. W. WALKER visited most of the synthetic rubber plants in the southwestern and northeastern areas of the United States to assist with the introduction of special control methods.

M. D. RIGTERINK and C. J. CHRISTENSEN were at Hawthorne and at the Stupakoff Ceramic and Manufacturing Company, Latrobe, Pa., on ceramic production problems. S. O. MORGAN was at Point Breeze on similar problems.

RUBBER MANUFACTURING PROBLEMS were discussed by B. S. BIGGS at the Goodrich Rubber Company, Akron, and by G. G. WINSPEAR at the American Brass Company, Waterbury.

A. C. PETERSON, on August 11 and 12, attended State Department conferences with industry to decide and map out the government's policies on radio allocations and international cable and radio communications for the post-war International Telecommunications Conference.

W. L. BETTS has been elected a member of the Executive Committee of the Metropolitan Section of the American Society of Mechanical Engineers.

P. S. DARNELL spent two weeks at Hawthorne in connection with manufacturing problems on resistors.

G. V. LAGO visited the Line Material Company at Zanesville, Ohio, with J. D. Burlie of Hawthorne in connection with the manufacture of power transformers.

L. W. MORGAN, at the American Transformer Company, Newark, discussed the manufacture of transformers.

H. A. STONE spent two days at the Haverhill plant of the Western Electric Company to discuss coil winding machines.

H. T. WILHELM visited Leeds & Northrup Company in Philadelphia to inspect testing equipment being built for the Laboratories.

B. E. STEVENS was at Line Material Company, Zanesville, Ohio, on power transformer problems.

A. W. ZIEGLER conferred with engineers of the Ucinite Company in Newtonville, Mass., on parts for sealed containers.

H. H. STAEBNER, at Baltimore and Washington, discussed cord development.

C. A. WEBBER was at the Hawthorne plant of the Western Electric Company on matters pertaining to pulse cables.

F. V. HASKELL is now engaged in making measurements on experimental coaxial cable near Princeton.

G. Q. LUMSDEN has been in Canada on

Tom Melahn, one of the Graybar-Varick messengers, was quite impressed with the Ordnance Show in Bethune Street last winter so he set to work to make models of some of the devices. Here, he is pictured with the 40-mm anti-aircraft gun and, in front, the computer and tracker of the M-9 Director, the last two being made from pictures in the RECORD

Blood Donors

W. J. Albersheim
J. P. Coggins
T. B. Grant
J. F. Hurley
K. H. Lloyd
Jane Luckey
Elizabeth Meyers
Janet Mysel
Madeline Roché
L. J. Ryan
Verna Toepfer

the seasoning of red pine poles and experimental use of northern pine crossarms.

R. H. COLLEY conferred with members of the Forest Products Laboratory at Madison, Wisc., on current problems in timber production and preservation.

W. FORSCY, at the Heywood Wakefield Company, Gardner, Mass., discussed the manufacture of special equipment.

R. E. WEBSTER was in Waterbury to discuss manufacturing problems with the American Brass Company.

J. F. POLHEMUS, B. DYSART, W. R. LUNDRY, S. A. LEVIN and MISS M. V. KUMMER participated in a trial of new office equalizers on the Minneapolis-Stevens Point type-LI carrier system.

F. G. COLBATH took a trip to Clinton, Tenn., in connection with a PBX installation at that point.

W. S. Ross conferred with engineers of the Bell of Pa. in Philadelphia on various telephone problems.

A. J. WIER visited Haverhill and Watertown, Mass., in connection with the manufacture of crosstalk balancing coils.

J. H. SHEPARD and C. L. DEELWATER were at the Torrington Manufacturing Company, the Haydon Manufacturing Company and the L-R Manufacturing Company in connection with motor and blower problems.

R. C. FREMON of the Personnel Department has received the M.S. degree from Columbia University.

Research in Peace and War is the title of an article by JOHN MILLS in the Westsider magazine of the West Side Association of Commerce. Illustrations are photographs of Laboratories activities.

Leo C. Tyler, 1907-1944

LEO C. TYLER of the Development Shop Department died suddenly on September 9. He joined the Laboratories in April, 1943, and since then had been a mechanic and calibrator on the night shift at Whippany.

"THE TELEPHONE HOUR"

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

OCTOBER 9, 1944

Overture to "The Bartered Bride" — *Smetana*
Orchestra

Concerto No. 1 in G Minor — *Bruch*
First and Second Movements
Fritz Kreisler and Orchestra

Londonderry Air — *Traditional-arr. Kreisler*

Schön Rosmarin — *Kreisler*
Fritz Kreisler

OCTOBER 16, 1944

Overture to Orpheus in the Underworld — *Offenbach*
Orchestra

Habañera from "Carmen" — *Bizet*

Kiss Me Again — *Herbert*
Jennie Tourel

Allegro Appassionato — *Saint-Saëns*

The Swan — *Saint-Saëns*
Gregor Piatigorsky

Élégie — *Massenet*
Jennie Tourel and Gregor Piatigorsky

OCTOBER 23, 1944

Maxims from "The Merry Widow" — *Lehár*

Kashmiri Song — *Woodforde-Finden*
Nelson Eddy

Waltz from "The Swan Lake" — *Tschaikowsky*
Orchestra

Evening Star from "Tannhäuser" — *Wagner*
Nelson Eddy

Overture to "The Tsar's Bride" — *Rimsky-Korsakoff*
Orchestra

The Wreck of the Julie Plante — *O'Hara*
Nelson Eddy

OCTOBER 30, 1944

Furiant from "Schwanda" — *Weinberger*
Orchestra

Think on Me — *Scott*
Bidu Sayão

Valse Bluette — *Drigo*
Orchestra

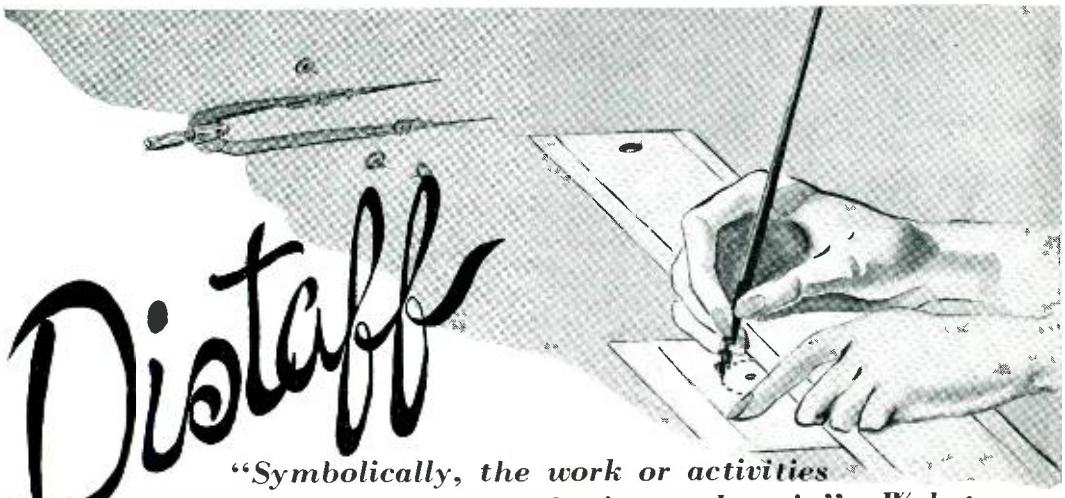
El Merção de les Esclavas — *Sandoval*

The Rats — *Bené*
Bidu Sayão

Introduction to "Khovanstchina" — *Moussorgsky*
Orchestra

Variations on a Theme of Mozart — *Adams*
Bidu Sayão

Bell Laboratories' Club has no more tickets for these programs because its limited supply has already been distributed to applicants.



Distaff

"Symbolically, the work or activities of women, or woman's authority or domain"—Webster

COMPILING PARTS and spare-parts tables detailing the multitude of individual pieces which go into the manufacture of special radio equipment is the war work which DOROTHY TURNQUIST has been doing for the past two years at Whippany, where she is associated with the spare parts group. The spare-parts tables furnish the information for the Western Electric Shops to procure and ship parts for the repair and maintenance of the equipment in the field. These tables, which are included in instruction books for the Army and Navy, serve to identify each part by name, number and function to aid the operator when he finds the equipment sputtering following enemy action in the field.

Mrs. Turnquist was graduated from Barnard College, took her Master's Degree in Psychology at Columbia University in 1937 and has completed courses for a Doctor's degree in sociology. Before coming to the Laboratories she had been Information and Radio Editor of *Popular Science Monthly* and spent several years working with juvenile delinquents.

Mrs. Turnquist lives on a farm near Whippany where she raises chickens, turkeys, pigs, sheep and has several collies and a Siamese cat. Her two-hundred-year-old farmhouse has been visited by Rudyard Kipling. She has learned to spin and weave wool from her own sheep for her dresses and her husband's suits. Music interests her too—she plays the piano. Her son is in the Army Air Corps, while her husband has devoted considerable time to duties in the Signal Corps in Washington.

DOROTHY TURNQUIST

New Picture Passes

New photographic identification cards are being prepared for all members of the Laboratories. This complete reissuing of passes is being handled by HELEN LEONARD, PEGGY GRILLO, and MADELINE ROCHÉ. In addition to this work, they make up all badges, resident visitor passes, and special purpose passes issued in the Laboratories.

Although the process of making up the passes entails many steps, each girl can handle any one of them. There are three basic steps in the mechanical end which are pictured here.

Peggy Grillo is shown cutting out each picture to the proper size to be pasted on the pass by striking the die with a wooden mallet. Helen Leonard operates the laminating machine where the passes, between layers of double acetate, asbestos and steel plates, are heated, subjected to 11,500 pounds of

Making up the picture passes are Peggy Grillo (above left), Helen Leonard (right) and Madeline Roché (below)

pressure, and then cooled. This process seals the pass within the acetate case and so makes it impossible to open the case without damaging the pass. Madeline Roché is cutting the acetate-covered passes to size on the kick-press machine. The cutter was designed for this use by the Development Shop. Later the corners are rounded with the corner cutter.

Service for the Servicemen

Many humorous and serious incidents highlight the average day of the pay station attendants who place calls for servicemen. In an article in the *Wisconsin Telephone News*, Miss A. M. Warren describes some of them.

"Attendants are called upon to put through emergency calls in cases of sickness, to find the correct party when the information may be meager or incorrect, and to solve other servicemen's problems.

"There was a young sailor who came to the girl on duty at a railway station saying, 'You don't remember me, but I sure remember you and I've been looking for you to thank you for that call you got through for me when my Dad was sick.' It seems that about six weeks previous to this, she had put a call through for the sailor at the Milwaukee USO. Delays were encountered so she told the operator of the call's emergency nature and got through.

"A young soldier arrived at the Milwaukee USO on his second visit to the city and told the attendant that he wanted to call a girl named Jane whose number was, for example, 4750. The operator explained to him that the number was incomplete without the central office prefix. At this he was crestfallen. He came from a small town where nobody had prefixes on their telephone numbers and he thought he had all the information necessary — the girl's first name and the number. The attendant, feeling slightly like Dorothy Dix, put in calls for all listings carrying the four numbers at various central offices. The soldier was delighted when she finally located his 'Jane' for him.

"Two incidents stand out in one attendant's experiences. A sailor from Great Lakes said he had been trying to call his home at intervals for two months, but every time he tried to place a call the circuits were busy. This time she was able to get through and he praised the service highly. At the USO last Christmas Eve, a young soldier on his way home from overseas put in a call to his parents. She worked on the call for two hours but finally got it through."

ELEANOR GUERCI

ELEANOR GUERCI's work in the Apparatus Files demands alertness and unfailing accuracy. She handles special requests from the various branches of the Western Electric Company for specifications and blueprints put out by the Apparatus Development Department. Originally the ordering, collating, and distributing of this material was done by Mrs. Guerci, but with the increase in confidential material, and in the needs of sub-contractors for additional copies of "specs," three more girls were needed to carry out this work.

Eleanor's husband, Major Harold B. Guerci, is on military leave of absence from the Laboratories. Her two brothers are on active duty in the Pacific. She has her own apartment in Manhattan, and is especially interested in interior decorating which she took up in an evening course at Traphagen School of Fashion.

* * * * *

ELIZABETH MEYERS of the Commercial Relations Department at Whippany is secretary to J. F. Kearns. She came to the Laboratories at West Street in 1941, and early in 1942 was sent to Whippany—one of

A Call Distributing System has been installed in the Apparatus Files at West Street. The use of this type of service has been suggested by the telephone company to provide efficient centralized contact with the Files. The number of incoming calls requesting file information in the department has increased from 7,000 *calls in* 1940 *to* 20,000 *calls in* 1943.

Four girls were trained by a telephone company supervisor to operate the system. They are Polly Pavelich, pictured here, Mary Carini, Dorothy Thompson, and Mildred Lanzetta

Elizabeth Meyers with her fiancé, Fred Engelman, who is on military leave from the Laboratories

the first fourteen girls to work there then.

Elizabeth, better known as "Liz," takes part in many of our Laboratories activities. She is now the Whippany representative on the Executive Committee of the Bell Laboratories Club. She was the first Women's Athletic Director at Whippany, and has completed the Advanced First Aid Course of the American Red Cross.

She is an accomplished and enthusiastic sportswoman, with tennis, baseball, skiing, archery, swimming and riding on her list of favorites. Besides sports, Liz finds time to make many of her own clothes (she just turned out a gabardine suit) and to collect popular and classical records.

Her fiancé, Fred H. Engelman, on military leave from the Laboratories, is an aviation cadet in the Army Air Corps at Napier, Field, Ala.

Victory Vacations

"Farm life is rough, but if you have a willingness to work and a desire for something different, you will return from a victory vacation richer in friends, experience, and health." This was the opinion expressed by Beatrice Levin of the Apparatus Development Department who spent her vacation working on a farm. She considers the time spent helping

to harvest crops was definitely educational—it gave her a better understanding of the problems faced by the farmer.

Harvesting of apples, grapes and other fruits and vegetables is at its peak in October. It is not too late to take a part in this vital work.

In a recent editorial the *New York Herald Tribune* says, "every community, each organization should do its part in supplying every possible pair of hands for full or part-time work. For every volunteer orchard worker there is the satisfaction of patriotic service in preventing food waste."

Engagements

*Walter L. Filmer—*Harriet Barnett
Harry Anderson—*Mary Castiglio
Clarence P. Smith—*Elizabeth Glander
Hugo Luoni, U. S. Navy—*Pauline Pavelich
Peter Turcic—*Mary Volarich
*James N. Walter—Vianna Wasson

Weddings

*Edward Dall—Mary Cooley
*William Duschaneck—Edna Dall
Lt. A. S. Kazmierski, U. S. Army—*Jean Matalavage
Gilbert Spillman, U. S. Army—*Evelyn Meyer
*Henry L. Messerschmidt—Anne Meysing
Dale Fergusen, U.S.M.S.—*Anne Willoughby

*Members of the Laboratories. Notices of engagements and weddings should be given to Miss Mary Ellen Wertz, Room 1103, Extension 296.

National War Fund Campaign for $115,000,000

The National War Fund offers members of the Laboratories the opportunity to give our fighting men a lift and to lend a helping hand to the unfortunate victims of tyranny in other lands.

The Fund, administered through thirty-one agencies, makes possible the USO—a home away from home for members of the

USO workers provide call service which enables men on furlough to sleep until train time. More than 3,000 USO units, from Newfoundland to Hawaii and from Alaska to Brazil, are supported by the National War Fund

Armed Forces in their off-duty hours; USO Camp Shows which keep them laughing; United Seamen's Service, which provides recreation and serves the needs of our seamen in ports all over the world; War Prisoners' Aid for thousands of Americans who languish in the prison camps of the enemy; and, in addition, many other organizations for the relief of the needy among the civilian population of our Allies.

These relief societies provide care and rehabilitation for child war victims, food for persons of all ages in Axis-stripped lands, medical aid for the sick and undernourished, shelter for the many victims of ruin and pillage, clothing for those whose homes and belongings have been swept away by war, and assistance in starting life anew for thousands who have escaped from the terrors of Axis occupation of their homelands.

Contributions made through the Laboratories Club will be sent to local community committees with credit by name to the individual contributors. Where contributions are on a deferred basis and collected through payroll allotments, the local committees will be informed at once as to the total commitments that have been made.

Standardization of Paper Capacitors for Armed Forces

A new American War Standard, C75.16-1944, has recently been issued covering paper capacitors for the Armed Forces. Preparation of this specification was carried out by a committee consisting of representatives of Army, Navy, and industry. Among the latter were F. J. Given and A. J. Christopher of these Laboratories and F. E. Dillon and J. P. O'Donnell of the Western Electric

Prize-winning Victory Garden. Ludwig Evers of the Murray Hill Shop Department won the contest this year for the best garden in Summit

Soft Ball at Whippany

The Whippany team won the 1944 championship of the Morristown Recreation Soft Ball League. Above, standing: E. I. Bulman, manager, F. E. De Motte, J. H. Durrett, R. C. Carlton, H. Z. Hardaway, Anthony Kulaszewski, F. L. Langhammer, A. Doornheim, H. T. Casey, F. F. Gruber, S. E. Hardaway and W. Jacob. Kneeling: W. S. Ballantyne, K. H. Lloyd, J. McGee, A. S. Allocco, and Casimir Glazar. At left: F. E. De Motte, E. I. Bulman and R. L. Coutts, Police Commissioner of Morristown

Company. The new standard has been adopted by the Army and Navy, and steps are now under way to convert it into a joint Army-Navy specification under the designation of JAN-C-25.

This is one of a series of war standards issued by the American Standards Association to provide a single set of specifications that can be used jointly by Army, Navy, and industry. It covers all the more common sizes and types of fixed paper capacitors in hermetically sealed metal cans, and gives complete information on sizes, shapes, and terminal arrangement, as well as on capacitances, voltage and temperature ratings, and requirements for tests.

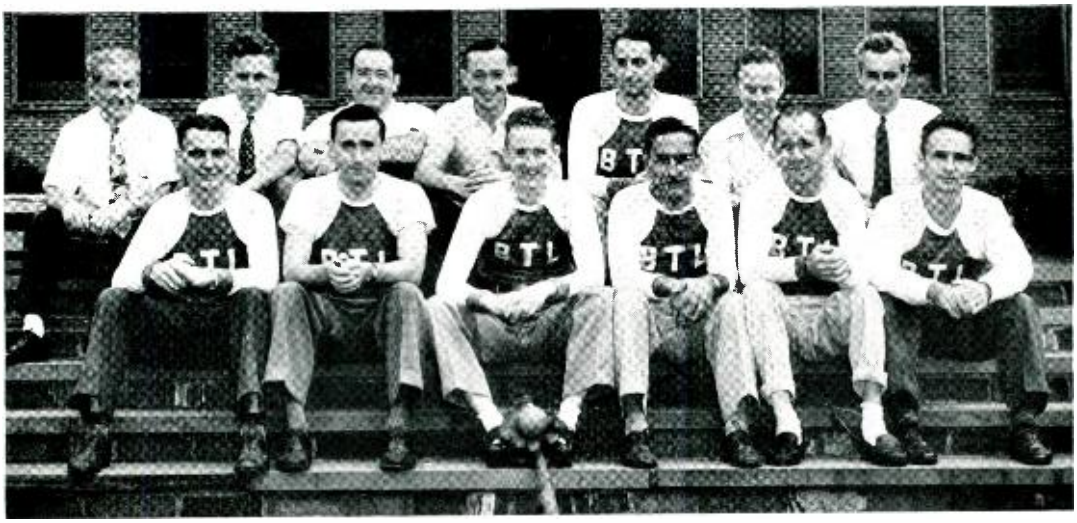
One of the unsatisfactory features of the previous situation with paper condensers has been the matter of d-c voltage rating. Paper condensers have generally been rated for operation at 40 degrees C. (104 degrees F.), and the safe operating voltages that could

be applied under the wide range of temperatures required by present wartime conditions have not been generally known. The Laboratories, however, have carried out investigations on the effects of temperature on the characteristics and life of condensers, and the results were made available to the committee. A table is included giving the operating voltages permissible at various temperatures as a percentage of the normal 40-degree rating for all types and sizes.

This new specification should be of considerable assistance to designers of electronic equipment, since it provides essentially complete information on capabilities and limitations for the various classes of capacitors. This permits the equipment engineer to select more readily paper capacitors best suited for his particular needs. It should also facilitate problems of procurement, interchangeability, and replacements through standardization in tests and size.

Soft Ball at Murray Hill

Two soft ball teams of the Murray Hill Laboratories played this year in the Summit League. The No. 1 team has been a member for the past eight years but this was the first season for the Blue Jays. No. 1 Team, front row, left to right: J. Leutritz, J. J. Oestreicher, B. S. Biggs, N. F. Marinaro and T. J. Crowe, manager. Rear row, left to right: J. T. Smith, W. G. Pfann, L. H. Osborn and N. R. Pape

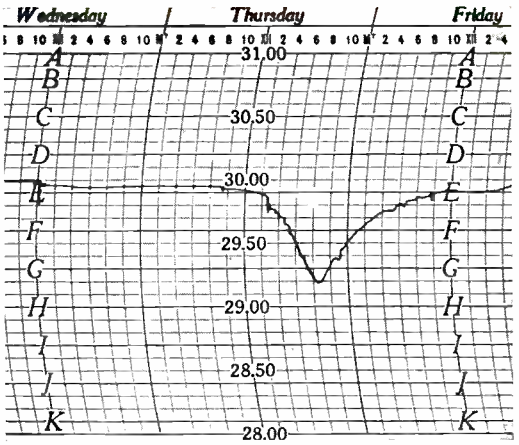


Blue Jays, front row, left to right: R. T. Smith, T. Z. Tackacs, W. L. Whinn, L. W. Bellevue, L. H. Osborn and M. Konash. Rear: C. A. Grant, business manager, A. W. Koenig, F. J. Shiel, assistant manager, E. Hannigan, J. A. Pecca, J. M. Meehan and H. J. Brennan, manager

H. W. MacDougall Retires

HARRY W. MACDOUGALL, a member of the Patent Staff, retired on August 31 at his own request with a Class A pension following forty-two years of Bell System service. Mr. MacDougall joined the Western Electric Company in Chicago and worked successively in the switchboard cable shop, the drafting room and the equipment engineering group. In 1915 he came to New York and engaged in circuit design for both manual and toll systems. From 1919 to 1922 he handled circuit designs for panel systems and then he transferred to the Patent Department to carry on the patent phases of this work. In 1929 he transferred to patent work on sound picture developments. From 1937 to the time of his retirement Mr. MacDougall carried on similar work in connection with automatic telephone systems, principally with the toll crossbar system.

H. W. MACDOUGALL



Record of Laboratories' barograph during recent hurricane

When the Hurricane Struck

The record from the Laboratories' barograph shows the rapid fall and rise of atmospheric pressure on September 14-15. Damage to Laboratories' property was inconsequential; trees at the New Jersey locations were the principal sufferers. Power failed at Holmdel and Atlantic Highlands; it was restored at Holmdel by a portable gasoline-driven alternator borrowed from the Signal Corps at Camp Evans.

Serious damage was done to the telephone plant; 414,500 telephones were affected—of which 100,000 were on Long Island. A thousand plant men were brought in from distant points to help the 11,000 local men.

Thirty Bell System Cable Splicers Flown to Europe

A new and dramatic experience has come to thirty Bell System cable splicers who volunteered in August for 90 days' emergency

During the Months of July and August the United States Patent Office Issued Patents on Applications Previously Filed by the Following Members of the Laboratories

H. M. Bascom
H. H. Benning
F. E. Blount
M. E. Campbell
J. E. Clark
K. H. Davis
J. W. Dehn (2)
R. W. De Monte
E. Dickten, Jr.
J. V. Domaleski
H. L. Downing
K. S. Dunlap
M. S. Glass
M. C. Goddard
R. E. Graham
L. N. Hampton
R. V. L. Hartley
B. D. Holbrook
F. A. Hubbard (2)
J. C. Irwin
R. C. Jones
R. J. Kent
C. C. Kingsley
F. A. Kuntz
W. V. K. Large
C. A. Lovell
A. A. Lundstrom
R. F. Mallina (2)
T. A. Marshall
J. W. McRae
Virginia Merrill
O. S. A. Mesch
S. T. Meyers (2)
L. E. Milarta
E. E. Mott
A. C. Norwine
H. T. O'Neil
E. L. Owens
J. A. Potter
V. L. Ronci
R. O. Soffel
N. R. Stryker
Stanly Terry
E. A. Thurber
J. G. Walsh
E. C. Wente
J. W. West (2)
L. A. Wooten
M. K. Zinn

duty in Europe to help build communications lines in the territories from which the beaten Nazis have been driven. The men were prepared for three months of what the U. S. Army Signal Corps called "arduous duty." They were to work side by side with Signal Corps personnel.

Flown across the Atlantic in Army planes, the men arrived in Europe early in September and went to work. The flying trip was the culmination of a hurry-up telephone call to the A T & T on August 29. Immediately the wheels were set in motion among plant men of the companies nearest the East Coast, and the response was such that quotas had to be set for each of the seven companies participating. Arrangements were expedited all along the line, and within a few days the volunteers had been granted leaves of absence from their companies and they reported to the Army in Washington.

"They say he got his first patent last week!"

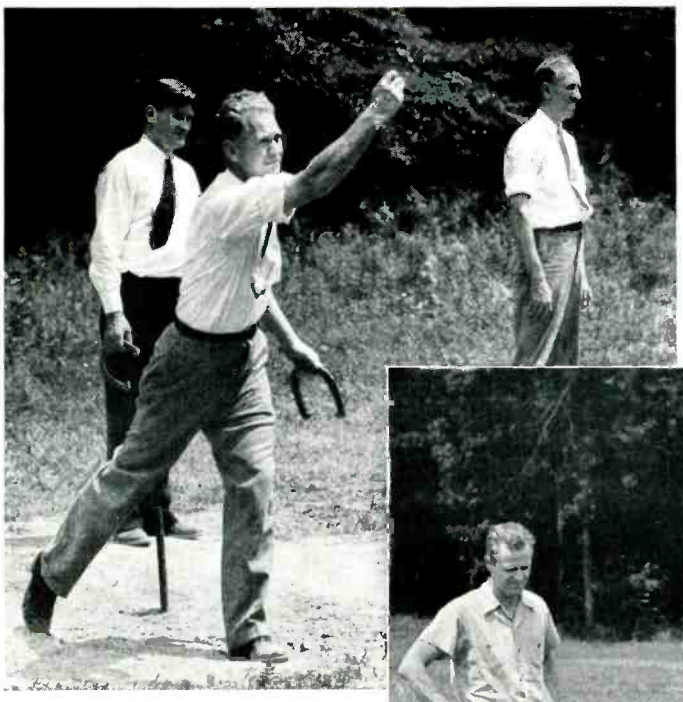
In the capital they were given rigorous physical examinations by the Army, passports were provided and other necessary arrangements made. Then they were off and winging their way across the ocean. The men wore uniforms provided by the Army, with arm bands to distinguish them from regular Army personnel.

Companies represented in the volunteer group are New England Telephone and Telegraph Company, The Southern New England Telephone Company, New York Telephone Company, New Jersey Bell Telephone Company, The Bell Telephone Company of Pennsylvania, The Chesapeake & Potomac Telephone Company and Southern Bell Telephone and Telegraph Company.

J. M. Campbell (right) and S. E. E. Sundstom on the staging, and T. A. Coffey, below, changing a partition at Murray Hill. Photograph by Andreas Feininger for Life *magazine*

Life Magazine Pictures Building Facilities at Murray Hill

An illustrated article that emphasizes the speed and convenience of changing laboratory space and equipment at Murray Hill, made possible by the removable metal partitions and the piping arrangements, appeared in the September 18 issue of *Life* magazine. The photograph shown here is one of many others taken by the *Life* photographer, Andreas Feininger, last November in preparation for this article. There are no fixed room partitions within the buildings. All are built of steel panels, described in the September, 1942, issue of the RECORD, which are easily installed with screwdriver and hammer as shown in the illustration.



Pitching horseshoes is a popular noon-day sport at Murray Hill. T. F. Osmer is at the stake while O. L. Walter holds his horseshoe ready for the next pitch. Sam King watches the progress of the game

Lunchtime at Murray Hill finds enthusiastic golfers practicing their hobby on the wide stretches of lawn between the buildings and the main road. H. A. Sauer watches B. C. Gaughran make an iron shot

Laboratories Men Rescue Drowning Man

To the life-saving skill and promptness of two members of the Laboratories a bather owes his life. On August 5 Edgar A. Jones of the Commercial Relations Department was diving near a small dock in the Manasquan River at West Point Pleasant, N. J., to recover a piece of jewelry. While so engaged, a man on the dock called Mr. Jones' attention to another man apparently in trouble out about 150 to 200 feet on the opposite side of the dock.

Recognizing this man as one with whom he had previously been swimming and who was 74 years old, Mr. Jones hurried through the water until it reached his shoulders and then swam the remaining distance. He found the man face down and unconscious. He placed his right hand under the man's chin to raise his nose and mouth out of the water and swam directly towards shore until he could touch bottom.

Then, aided by a 17-year-old boy, he carried him to the beach and immediately started artificial respiration. After 15 minutes Mr. Jones became quite exhausted and asked for relief, and R. L. Shepherd, of the Bureau of Publication, who had just arrived at the scene from his nearby cottage, re-

sponded. (It wasn't until September 6 that Mr. Jones and Mr. Shepherd realized that both were members of the Laboratories.)

Mr. Shepherd then continued artificial respiration for about 10 minutes. In 7 or 8 minutes the man started to breathe very slowly and Mr. Shepherd synchronized his motions to the man's breathing until the arrival of the Point Pleasant First Aid Squad and the setting up of their inhalator. After using the inhalator for nearly an hour, the Squad took the rescued man to the hospital. He was released six days later.

Mr. Jones came to the Laboratories from the New York Telephone Company last December where for the past three years he had been a qualified American Red Cross First Aid Instructor. Mr. Shepherd holds an American Red Cross Standard First Aid Certificate. This was Mr. Jones' second experience in applying artificial respiration, the first time being several years ago when he assisted in reviving a person after another person had started him breathing.

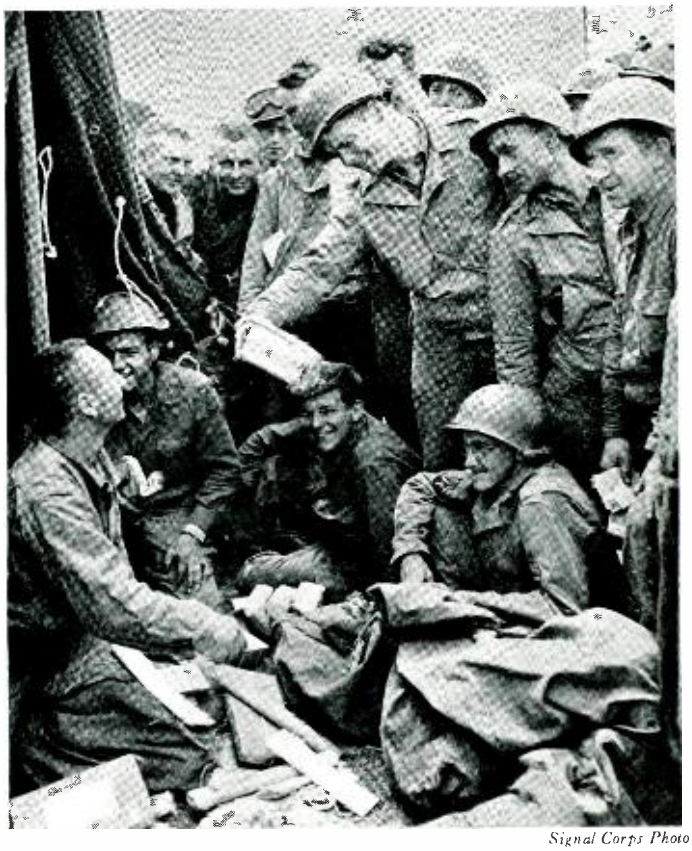
E. A. Jones, who rescued a man from drowning in the Manasquan River

Christmas Gifts to Servicemen

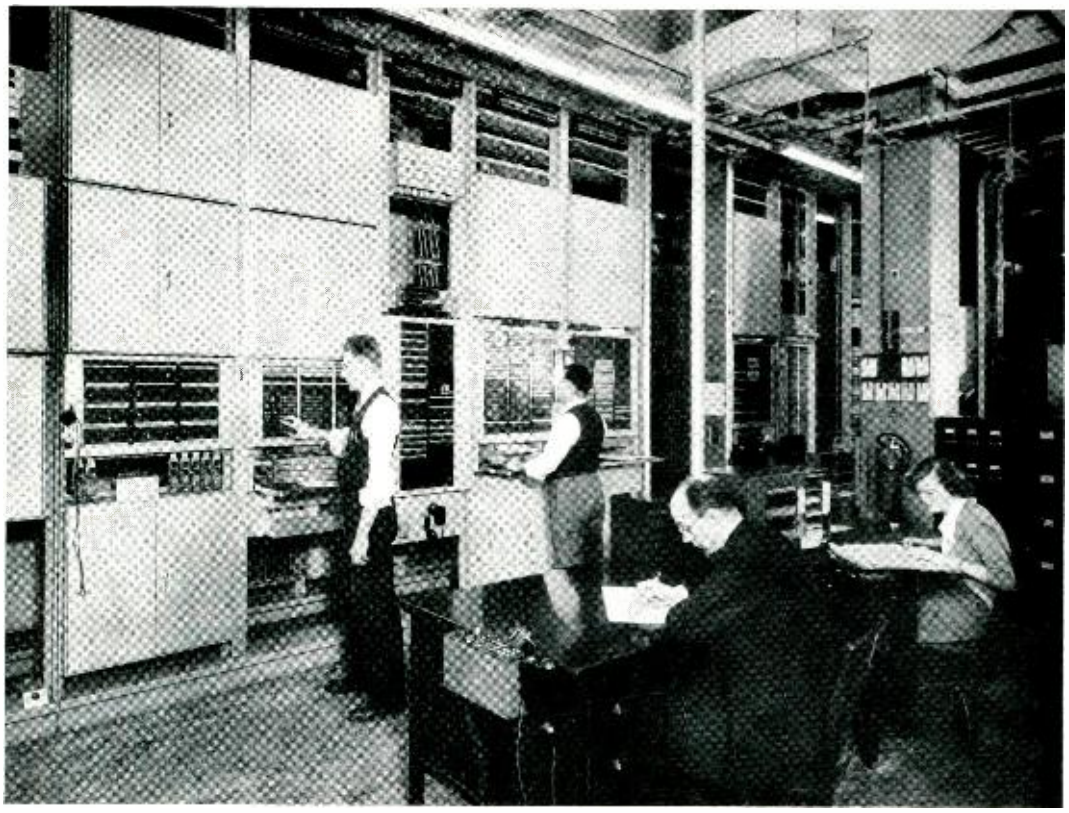
In this photograph we see a group of combat engineers on the beachhead in Normandy receiving their regular mail. For Christmas boxes the deadline is October 14 to make sure that they are received by December 25. Gifts should be packed in boxes of metal, wood, solid fiberboard or strong, double-faced corrugated paper with strong gummed paper or tied with twine, or both.

Christmas parcels destined for overseas must not exceed the present limits of five pounds in weight or fifteen inches in length, or thirty-six inches in length and girth combined.

Addresses should include name, rank, serial number, branch of service, organization and APO number, and the post-office through which the package should be routed. The name and address of the sender should be written on the package.



Signal Corps Photo



Maintenance Center for the Crossbar Toll System

By C. V. TAPLIN
Switching Development

ALARMS and other indications of trouble in the automatic switching equipment of the crossbar toll system are received at the maintenance center shown in the photograph at the head of this article. Here is the major testing equipment and here also are the facilities for removing the more important circuits from service. From this point, the maintenance of the switching equipment is directed. The testing and operation of the toll lines are directed from a different point.

The need of a maintenance center for automatic switching equipment has developed with the increase in the use of relatively small groups of high usage common circuits, such as senders and markers. In offices of the step-by-step type, each switch has, in general, the same importance as every other switch, and there is relatively small need for concentrating the alarm indications, testing equipment, or the direction of maintenance activity. With the advent of panel-type central offices employing senders, the automatic sender test frame, facilities for taking senders out of service, and a floor alarm frame were usually located near the chief switchman's or wire chief's desk. This point thus became to a large degree a maintenance center, although it was not recognized as such, since generally other automatic testing equipment and facilities for removing equipment from service were not located at this point.

In crossbar offices, the introduction of markers, and the provision of terminating senders have, of course, increased the use and importance of high-usage common circuits. The markers, which do the actual work of setting up the connections, are required to operate with many other circuits, and consequently a fault in any of these circuits may cause failures of markers to complete their functions. Under such conditions, the circuits cannot be held while the cause of the failure is determined, since this procedure would in most cases interfere with service. To provide promptly as much information as possible concerning a failure and to release the circuits involved, the markers were arranged to call in a trouble indicator whenever their work could not be completed in a prescribed interval of time. Upon being attached to a marker, the trouble indicator displays on lamps pertinent information which the maintenance people can use in locating the difficulty.

Since a condition causing marker failure could occur in any of several circuits, an analysis of one or more trouble indicator displays might indicate the desirability of making tests of senders, markers, or other circuits, or of removing such circuits from service. To carry on the maintenance work efficiently, therefore, it was found necessary to locate at one point all test frames, trouble indicators, facilities for removing the common circuits from service, communication facilities, and maintenance information.

At Philadelphia maintenance facilities consist of a sender test frame, a sender make-busy frame, a trouble indicator frame, an outgoing-trunk test frame and an outgoing-trunk make-busy frame, all located in one line. In front of these frames is the chief switchman's desk; and at one side are filing cabinets containing circuit schematic and wiring drawings, circuit descriptions, Bell System Practices applying to the circuits and apparatus used in the office, and various records that are needed.

The sender test frame requires three bays of apparatus. It has a large job to do, since it is used to test both incoming and outgoing senders. It tests and progresses automatically from sender to sender until all senders of a particular type have been tested. Provision is made for controlling the operation of the test frame in various ways by features similar to those used for sender test frames in local crossbar offices.

To the right of the sender test frame is the single bay comprising the sender make-busy frame. Its main function is to provide a location for the jacks used for removing senders from service, and for the keys used to control the feature that automatically releases the sender if it fails to complete its functions within a certain time.

To enable the maintenance people to communicate with other points within the building, and also with other central offices, communication trunks and official telephone lines are provided on the sender make-busy frame together with a telephone circuit and a dial. These facilities also appear at the outgoing-trunk test frame and the chief switchman's desk. Some additional lamps and keys, and also registers for recording the number of certain types of failures such as stuck senders, are grouped together and are located on the sender make-busy frame.

The two-bay structure next to the right is the trouble indicator frame, which accommodates the apparatus of two trouble indicator circuits: the marker trouble indicator and the controller trouble indicator. These facilities are similar, except for details, to the corresponding trouble indicators in local crossbar offices.

Jacks for taking the markers out of service are located on the trouble indicator frame. With them, the markers can be either completely removed from service or made busy to certain marker connectors. Lamps are also provided to indicate the particular marker and the circuits used by it in setting up each connection. These light only while the connection is being established.

The outgoing-trunk test frame requires only a single bay, and is used principally for testing the outgoing toll-switching trunks. This frame is somewhat similar to the incoming-trunk test frame used in crossbar offices in that it can automatically select trunks one after another and test them by directing a test call to a suitable test number in the terminating central office. The test frame is operated manually for some of its tests of toll-switching trunks and also when testing some other trunks such as those that are used by the operators.

Last in the line is the outgoing-trunk make-busy frame, which is provided as a concentrating point for the jacks used to take the toll-switching and miscellaneous trunks out of service.

The work at the maintenance center covers too large a number of details to be completely described here, but most of it falls into three classes: responding to alarms, making tests, and following up trouble reports or requests for assistance.

The activity involved in responding to alarms includes chiefly investigating trouble-indicator indications, alarms caused by stuck senders and by various other circuits whenever they do not perform their functions in a prescribed time interval, and alarms indicating blown fuses.

Trouble indicator indications are extremely important. The marker trouble indicator, for example, can be called in by trouble conditions in different circuits such as senders, marker connectors, incoming-frame circuits, and outgoing-frame circuits. Whenever the trouble indicator is called in, lamps indicate the circuits involved in the connection, the point at which the progress of the connection was stopped, and in some instances the actual trouble. In many cases, however, a single indication does not provide sufficient information, since, as pointed out previously, any one of several circuits may be responsible. As each indication appears, therefore, a record is made of the lamp display on a form provided for the purpose, after which the trouble indicator is restored to wait for the next failure. If the trouble persists, an analysis of a number of records will indicate its most likely location. These records may be kept for a considerable period, since many trouble conditions that are encountered do not cause frequent failures.

A sender which is unable to complete its functions will either release automatically or cause an alarm and light the associated lamp at the sender make-busy frame. The action of the sender in this respect is determined by the position of the key associated with the sender. If the traffic is heavy, so that all senders are required for handling calls, or if the maintenance force is very busy, the sender keys are set so as to cause the senders to be released. At other times, however, the keys can be set so as to hold senders that fail. Assuming that a stuck sender condition is to be investigated, the sender circuit is first examined to determine where the progress is stopped. If the sender does not appear to be at fault, the connection is traced to identify the circuits involved and, if possible, to locate the cause for the blocking of the call.

Alarms such as those indicating that other circuits have failed to complete their functions, or that a fuse has blown, are also followed up from the maintenance center.

Although the testing equipment at the maintenance center is often used for locating trouble conditions known to have caused circuit failures, a major function of this equipment is to make routine tests on a scheduled basis. It is for this purpose that the sender and outgoing-trunk test frame are arranged to test the circuits automatically one after another without attention until a trouble condition is encountered. The schedules for these tests are so arranged that all features of the circuits will be tested periodically, the high usage features receiving, in general, the most frequent tests. By making tests on a routine basis, irregular conditions are uncovered and corrected before they can seriously affect service, and thus the circuits can be kept in good condition for the work they have to do.

Tests actually carried out at the maintenance center cover only the senders, markers, and outgoing toll-switching trunks. Tests

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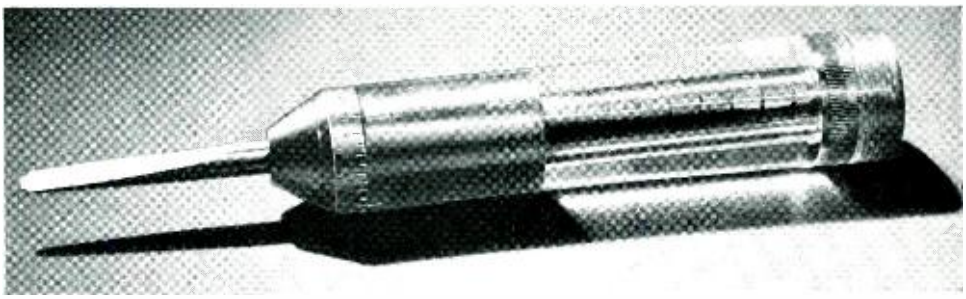
THE AUTHOR: C. V. TAPLIN graduated from the University of Vermont in 1916 with a B.S. degree in Electrical Engineering. After a year with the General Electric Company and two years as an instructor at the University of Vermont, he joined the Department of Development and Research of the A T & T Company and transferred to the Laboratories in 1934. Since joining the Bell System he has been concerned principally with the development of testing equipment and maintenance methods for panel and crossbar central offices.

and inspections of various other parts of the equipment are, of course, also necessary, and these are scheduled as required and directed from the maintenance center.

In addition to the irregularities disclosed by the trouble indicators and alarms, and by the various tests, reports of trouble are received from other sources such as the Traffic Department, the toll test board, and other local and toll offices. An investigation is made of these reports, and the trouble is cleared if it is in the crossbar toll office. If it appears to be caused outside of the crossbar toll office, the trunks to other offices will be tested, but the removal of the trouble will be handled by other groups. When failures occur on trunk cables, or when a rearrangement of trunking facilities is made, frequent requests for making trunks busy and for restoring trunks to service are handled at the outgoing-trunk test frame.

Administration of the maintenance of the equipment is carried on to a large extent by the chief switchman. In addition to the general supervision of the work, he frequently takes an active part in the analysis of trouble indications, and in directing the correction of such conditions.

Torque Gauge of Screwdriver Type



In connection with certain developments for the Armed Forces, a study was made of the holding power of small screws and nuts with and without various forms of lock washers. To secure consistent results from tests of the holding power of fastenings, it is necessary to know the torque applied to the fastening prior to the test. Available torque measuring apparatus was not suitable for measuring the relatively small forces applied to light screws and nuts, and so A. C. Millard undertook the development of a small torque gauge of the screwdriver type. The resulting instrument is shown above.

A calibrated spring has its upper end attached to the cylindrical body of the tool, and its lower end to the cone that clamps the screwdriver. A removable collar on the upper rim of the cone carries a torque scale, which is read opposite a line on the lower rim of the main cylinder. Three springs and two graduated collars are supplied. The springs cover the torque range from 0 to 20 inch-pounds, while one of the collars is graduated in inch-ounces and the other in inch-pounds. Two sizes of screwdriver tips are provided, and also a mandrel with a square end that can be used with various sizes of socket wrenches. The various tips, springs, and scales for this torque-measuring instrument are readily changed by removing the ends of the main cylinder.

Emergency Reporting Systems

By P. V. WELCH
Switching Engineering

G. I. Joe, in this war as in other wars, must learn to walk his post in a military manner when on sentry duty, and to call out lustily for the Corporal of the Guard should anything unusual or suspicious occur within sight or hearing. The call, identifying the nature and the location of the incident, is relayed from sentry to sentry to the guard house, where the Corporal of the Guard summons aid of the Military Police or other military organization, and dispatches a detail to the scene.

This phase of the duties of a sentry has been speeded up and made easier in the present war by the telephone. Emergency reporting systems, a development of the Laboratories, provide at or within easy reach of each sentry's post, telephones that are reserved specifically for use in reporting directly to a superior officer. These systems also alert the personnel on duty at the ambulance garage or firehouse, and indicate by means of lamp annunciators the location of the source of the call.

Emergency reporting switchboards are of two types: one, a cord-type board with a capacity for 100 lines, and the other, a key turret of 20-line capacity. The cord switchboard is used widely at camps requiring from 40 to 100 lines. Where more than 100 lines are to be served, several sections are installed side by side. One large Eastern camp has a three-position board serving over 400 emergency reporting telephones. The small key turret is used at the smaller camps requiring up to 20 lines, and occasionally two cabinets are employed side by side to provide capacity for 40 lines.

Adjuncts to the emergency reporting switchboards consist of a large vibrating

Emergency reporting switchboard of the turret type with twenty-line capacity

alarm bell and an annunciator lamp cabinet. Each lamp in the cabinet is covered by a large cap of glass or, more recently, of translucent plastic with an opaque numeral designating the number of the associated emergency reporting telephone. The annunciator cabinets are usually located in the camp's fire station.

The emergency reporting telephones scattered about the camp area may be mounted on poles outdoors, or in sentry booths, gate houses, or at building entrances. For outdoor locations, modified outdoor-type telephones of metal or wood are used. The indoor telephones are of the common combined set type.

Because the emergency reporting telephones may remain unused for long periods of time, the emergency reporting switchboards embody test facilities which constantly keep the line conductors between the switchboard and the emergency telephones under electrical test. The lines are different from ordinary telephone circuits in that a closed circuit is maintained by means of special facilities in the telephone instruments. These provide a path for the flow of test current over the line to operate an appropriate alarm when the circuit breaks, or for some other reason the current fails to follow its proper path. Each line has two lamps, one red and one white. The white lamp lights when a ground fault or a break occurs in the line conductors and indicates an out-of-order condition to the emergency switchboard attendant. The emergency reporting telephone instrument is arranged so that a line out-of-order alarm results also in case of malicious removal of the handset or of damage to or sabotage of the handset cord. This out-of-order feature enables the attendant to report immediately to the maintenance forces for corrective action any damage of the emergency reporting lines and telephones which might otherwise go unnoticed for a considerable time.

The red lamp associated with each line lights when the handset is removed from its mounting at the emergency reporting station, indicating to the attendant that an emergency call is being made. The attendant answers the call by plugging an answering cord into the line jack, or by operating the talking key lever toward the lighted red lamp when the small turret is used. Conversation proceeds between the person making the call and the attendant at the switchboard during which the attendant is informed of the nature of the incident causing the call. The attendant, usually a member of the fire, guard, or other emergency force, initiates whatever action is required to dispatch the necessary forces to the scene.

The circuit which lights the red line lamp is arranged so that the lamp remains lighted

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THE AUTHOR: After receiving the degree of B.S. in E.E. from Pennsylvania State College early in 1918, P. V. WELCH reported for active duty with the U. S. Army at the Signal Corps Officers' School at College Park, Ind. Upon his return from France in the spring of 1919 he joined the Engineering Department of the A T & T where he engaged in the development of private branch exchange systems. He came to the Laboratories during the 1934 consolidation, and since then has been in the switching engineering group of the Systems Development Department. He is now engaged on war projects, specifically private-branch exchange and allied facilities for Army, Navy, and other war establishments.

until answered by the switchboard attendant, even though the person making the call hangs up immediately because of nervousness or to avoid danger. The lamp in the annunciator cabinet at the fire station bearing the number of the telephone at which the call originates lights at the same time as the red line lamp in the switchboard, and the alarm bell rings. It stops when the call is answered at the switchboard, but the annunciator lamp will continue to burn until a release key located in the annunciator cabinet is pushed. This arrangement is employed to insure the receipt of the alarm at the fire station and indicate its point of origin in the event that telephonic communication is not established with the person making the call. Several minor miscellaneous features are also incorporated in the emergency reporting switchboards. A buzzer is associated with the out-of-order lamps as an audible alarm. Facilities for terminating incoming lines from the post telephone switchboard are provided so that alarm calls originating at other than emergency reporting telephone stations may be received. Arrangements are also provided to permit the switchboard attendant to call any of the emergency reporting stations by plugging in in the usual way on the cord board and ringing the line, or on the key turret by operating the line key and ringing from a master ringing key in the section. Each switchboard is equipped with a neon lamp that lights when any ringing key is operated, and serves as a telltale to indicate to the attendant when the regular source of ringing power fails. Hand generators are employed in both switchboards for emergency ringing.

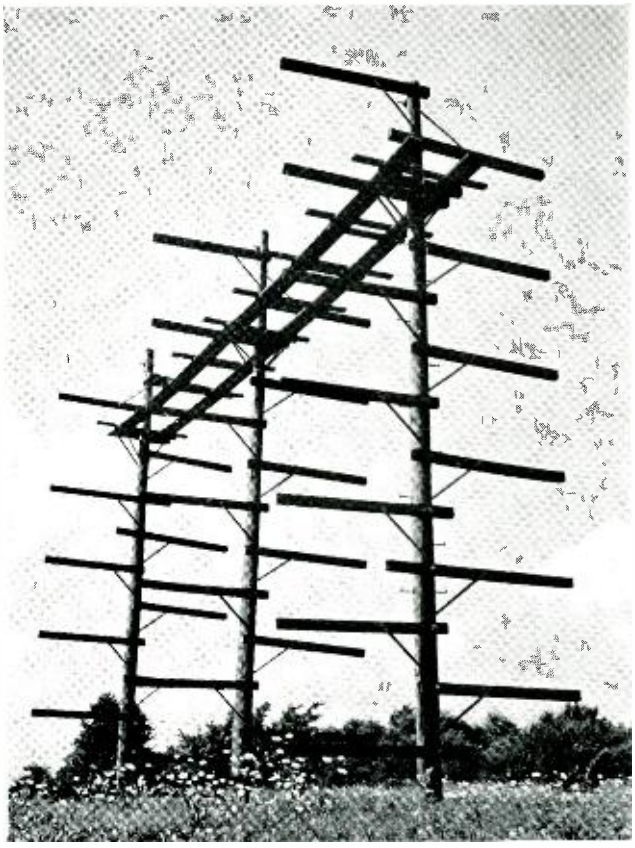
At very small camps, requiring only a few emergency reporting stations, and where the use of a separate switchboard is not justified, arrangements have been developed for terminating emergency reporting lines in the post telephone switchboard. These arrangements provide the line-test feature, locked-in line lamp, and locked-in annunciator lamp of the emergency reporting boards. When a call is made from one of these lines the switchboard attendant completes the call to the responsible officer by way of a line reserved especially for the purpose.

In a recent letter to C. G. Stoll, President of the Western Electric Company, Major General O. P. Echols, Assistant Chief of Air Staff, said:

"The Army Air Forces desires to express its appreciation to your company for the services rendered by your field service representatives assigned to training installations in this country and in combat theaters overseas. . . . These technicians have not only trained thousands of members of Army Air Forces ground crews in the proper maintenance of equipment made by your company, but, through their observation of combat performance, have also been instrumental in indicating improved methods of manufacture and maintenance. Many of them have performed this essential service at great personal risk to themselves. . . ."

New Woods for Crossarms and Their Preservation

By G. Q. LUMSDEN
Outside Plant Development



Portions of crossarms remaining after the break test have been installed in square-rigged fashion on poles at the field laboratory located at Chester, New Jersey, where they are examined periodically

SINCE the turn of the century the open-wire lines of the Bell System have been supported almost exclusively by Douglas fir and southern pine crossarms, of which over twenty million are now in service. War emergency demands for these timbers have become so great, however, that it became necessary to seek substitutes. The woods most readily available were red and jack pine from the Lake States and the inland type of Douglas fir from the Northwest.

Following successful preliminary tests at the field laboratory at Chester, N. J., the matter of treatment in full-size commercial equipment came up. In the Lake States region, where one of the Bell System's cedar pole suppliers expressed a willingness to coöperate in tests, open tank non-pressure equipment is generally available. It was decided to apply a preservative treatment to these new arms by an improved hot-and-cold bath process, instead of using the standard pressure processes that are regularly employed for southern pine arms. The plans called for the use of a solution of pentachlorphenol in petroleum instead of creosote for the cold bath. Pentachlorphenol is a comparatively new wood preservative; it is practically insoluble in water and leaves the surface of the wood clean.

The crossarm blanks, as received from the saw mill, were large enough to make arms 3¼ inches by 4¼ inches by ten feet after planing and sawing to length. The planed blanks were examined with a template to exclude those which contained too many knots or had excessively large ones located so that they would seriously affect the strength of finished crossarms. Blanks showing too much slant grain or excessive insect damage were also discarded. The top and bottom of the blanks were chosen so that major defects would be located in the bottom or compression side of the crossarms. Then the blanks were passed on a roller table to the boring machine, Figure 1, and to a shaper to form a curved roofing on the arms. Belt conveyors carried the arms to the treating tank.

About 1100 crossarms were treated at a time. These were laid in the tank, Figure 2, and kept from floating by steel rails secured to the tank's sides. Heavy lids were put on to hold the heat, prevent excessive evaporation and keep out rain. The hot-and-cold bath non-pressure treatment was then applied. Creosote, heated to above 220 de-

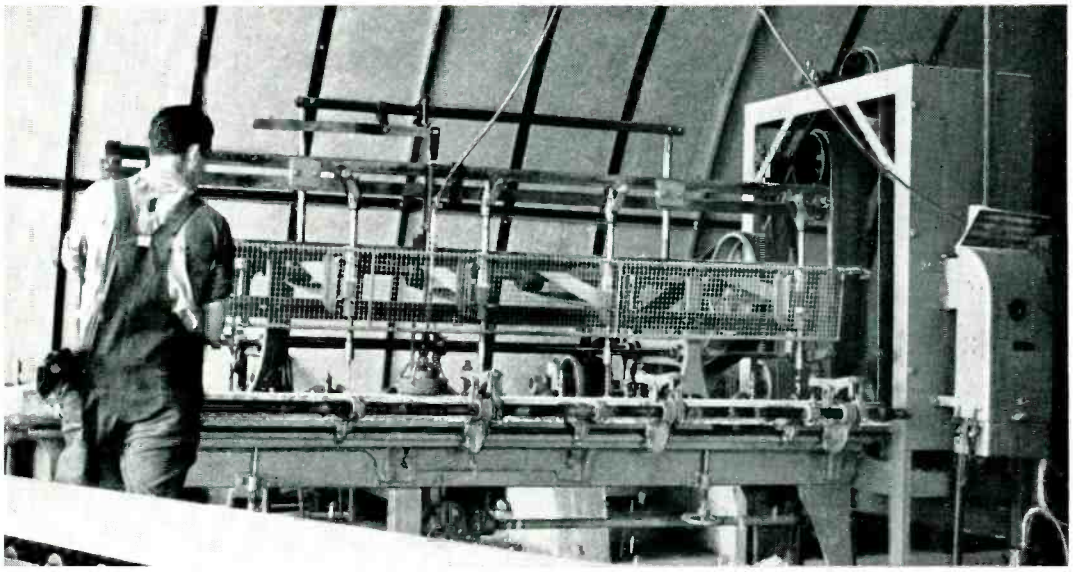


Fig. 1—Ten pinholes and three bolt holes are bored in one operation

Fig. 2—Steel rails are used to counteract the buoyancy of the arms in the preservative. R. H. Colley supervises the stacking of the crossarms in the treating tank at St. Paul

grees F., was pumped in to fill the tank. From two to four hours later, depending on the condition of the timber treated and the outside temperature, this creosote was pumped off. As soon as possible, and while the crossarms were still hot, the tank was filled with a 5 per cent solution of pentachlorphenol in an aromatic petroleum at 90-125 degrees F. After allowing another two to four hours for this solution to be absorbed, the tank was again drained and the crossarms removed for stacking.

At the end of the cold-bath treatment, the sapwood was completely penetrated and the heartwood was penetrated around the pinholes. Retention of preservative solution varied with the amount of sapwood present.

It averaged about 8.5, 6.4, 0.6 pounds of solution per cubic foot of wood for red pine, jack pine and heartwood inland fir, respectively, in the sections between pinholes.

THE AUTHOR: GEORGE Q. LUMSDEN received the degree of Master in Forestry at Cornell University in 1923, a year after he was graduated there with the B.S. degree. The same year he joined the Engineering Inspection Department of the Western Electric Company to engage in studies of timber products. He transferred to the Laboratories in 1927 when the Outside Plant Development Department was established. Since that time studies of timber products and their preservation, especially of new preservatives and their trial in the field, have occupied Mr. Lumsden's time.

Fig. 3—In a new method of stacking crossarms for curing, the overlapping of the alternate tiers protects their ends and prevents warping and twisting during drying

These retentions were considered high enough to keep crossarms of the different species free from the attack of wood-destroying fungi during their expected service life.

The treated arms were stacked for curing by a method recently devised by the Laboratories to keep end checking, splitting and warping to a practical minimum. They were laid on a sturdy foundation of 8-inch by 8-inch timbers with their ends well protected by overlapping alternate tiers, as shown in Figure 3. After curing, part of the arms were X-piled, as shown in Figure 4, to determine their tendencies, if any, to bleed, warp and split.

The treated arms were shipped to the Associated Telephone Companies, where about 8000 have been installed for periodic observation in line. Breaking tests* on sample arms sent to Chester indicated that inland fir is practically as strong as the current standard coast-type fir and southern pine arms, and that red and jack pine are about eighty per cent as strong. The new arms are generally considered strong enough, however, for all line purposes except in extra long spans under heavy loading conditions. It is of historic interest that red pine crossarms were used in some of the very early telephone lines and that the 3¼-inch by

*RECORD, *Sept.*, 1943, *p.* 12.

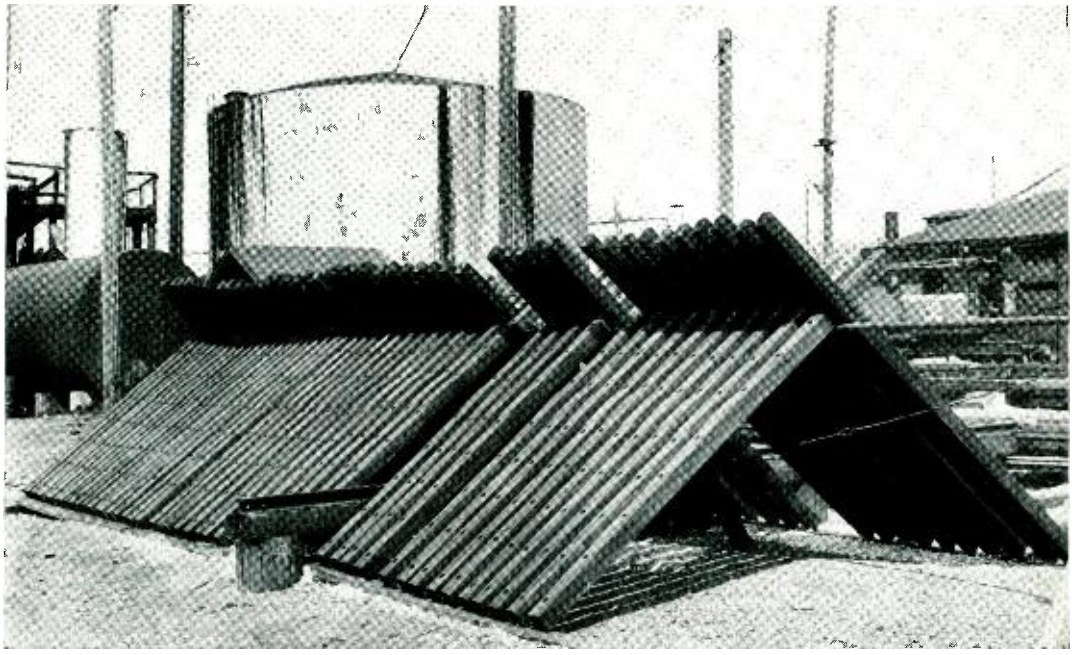


Fig. 4—Testing crossarms for tendency to bleed, check, twist and warp by X-piling on a rail

4¼-inch cross section for ten-foot arms was made standard at that time.

These preliminary studies of new species were of interest to the Bell Telephone Company of Canada. Arrangements were made with a wood products concern in Canada to manufacture and treat an initial lot of one thousand red and jack pine crossarms from timber cut in the Laurentians. The blanks were about 12 feet long when received from the woods. This gave more leeway than in the previous test for boring pinholes and bolt holes to avoid locations near knots. The treatments followed the same general procedure as in the States except that the hot and cold baths were carried out in separate tanks. One hundred arms, stacked in a heavy steel crib, were treated at one time. The crib and arms were withdrawn from the hot creosote and swung into the cold pentachlorphenol-petroleum by crane.

Results were as promising as those in this country. Complete sapwood penetration was obtained and the retentions averaged about three pounds of solution per cubic foot of wood. About ten per cent of the volume of these arms was sapwood. In the curing stacks the arms remained clean, and there was no appreciable amount of warping.

Successful non-pressure treatment of red pine, jack pine and inland fir crossarms with hot creosote, followed by cold pentachlorphenol dissolved in a suitable petroleum, opens new avenues of relief in a restricted lumber field. Other woods may be used provided they are strong enough and will take preservative treatment. For example, ponderosa pine, western hemlock and larch are all worth considering, if the supply situation warrants it. On the basis of work already done, the Laboratories is in a position to recommend the more promising substitute woods for crossarms; and standard specifications have already been revised to include red pine, jack pine, lodgepole pine and inland fir.