BELL LABORATORIES RECORD

OCTOBER 1945 VOLUME XXIII NUMBER X

Air-Seal Test Set for Crystal Units

By G. W. WILLARD
Crystal Research

QUARTZ crystal plate holders, used extensively for airplane radio apparatus, were originally unsealed. Under the comparatively restricted flying conditions of that time, sealing the holders did not seem essential. As planes began to fly in both arctic and tropical regions, and in the very rarified pressures at high altitudes as well as in the normal atmospheric pressures near the ground, it was found that, under certain conditions, sufficient moisture might be sucked into the holders to condense and form drops of water, which gave trouble. To avoid such conditions, the crystal holders are now sealed at atmospheric pressure.

This change in practice required that the seals be tested before the holders left the factory. Testing was originally done by placing the holders under water in a tank, and then evacuating the space above the water. Any holder showing bubbles arising from it through the water would be rejected as improperly sealed. This method proved unsatisfactory, since some of the holders that released no bubbles were found to contain water. The test was modified, therefore, by adding another step. After the evacuation, air was forced into the test chamber at a pressure of two atmospheres, thus tending to force water into the holder. Following this, the crystals were tested for activity and resistance, both of which would be affected by water. This test also did not prove to be dependable. A drop or two of water might have entered the holder, but at the moment of test might not have been in a position that would affect the activity or resistance. Later this water would redistribute and result in an entirely inoperable unit. To overcome this hazard, a test not using water was sought.

After a considerable amount of research and testing, the KS-10176 "ionic" air-seal test set was developed. It is based on the fact that, as the voltage across two electrodes is raised, a value will be reached, depending on the air pressure and on the configuration of the electrodes, at which ionization will occur and current will pass. For a voltage above the value required to initiate ionization, the current increases nearly linearly as the pressure is decreased throughout the operating range. For any given set of electrodes, the current that flows at a fixed voltage is thus a measure of the pressure. To take advantage of this method of determining leaky seals, the holders are placed in a chamber which is evacuated and held at a very low pressure for a specified period of time. During this period, air will leak out of any of the holders that have an imperfect seal. At the expiration of the leakage period, a specified high voltage is applied to the terminals of the crystals, and the current that flows is an indication of the pressure within the holder, and thus of the tightness of the seal. All holders showing more than a specified amount of current are rejected.

This air-seal test set, shown in operation at the Clifton plant of the Western Electric Company at the head of this article, consists of a vacuum pump, a test chamber for the holders, which is connected to the pump so it can be evacuated, an adjustable voltage supply together with switches to permit the voltage to be applied successively to the holders under test, and instruments for reading the pressure in the test chamber and the current flowing under the test conditions. The arrangement of the circuits is shown in Figure 1.

Two instruments are used for measuring pressure. One is an ordinary vacuum gauge that measures the pressure in inches of mercury below atmospheric pressure, and the other is a mercury manometer that will read absolute pressure up to about 10 in. of mercury, which is roughly equivalent to 20 in. on the vacuum gauge. The gauge is used only as a rough indication of pressure. Its pointer will start deflecting immediately after the pump is started, while the manometer, used

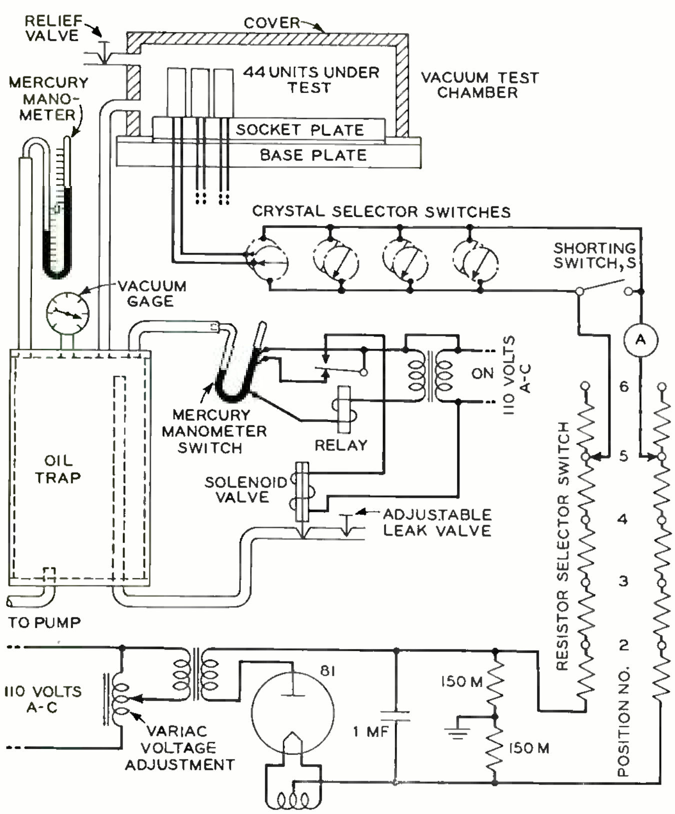


Fig. 1—Circuit arrangements of the KS-10176 air-seal test set for crystal units

during calibration, will not read until the pressure has dropped to 10 in. absolute.

For the test period, the pressure is carried down to a very low value, and to insure constancy of the test conditions, this pressure must be held within a narrow range. This control is obtained by an adjustable leak valve which allows air to leak in faster than the pump can remove it, and ahead of it a solenoid-operated valve which opens or closes the pipe to the leak valve. This solenoid valve is operated through a relay from contacts on a mercury manometer switch. It opens when the pressure drops to ½ in. and closes when it reaches ⅝ in. By this means, the pressure is readily kept between these limits.

The test voltage is obtained from a 110-volt alternating-current supply through a variac voltage adjuster, a transformer, and a rectifier. The d-c output is impressed through a five-step rheostat that inserts 20, 30, 40, 50, or 60 megohms in the circuit, depending on the position of a five-point dial switch. A microampere meter in series with the rheostat and the holders under test indicates the current being passed. To adjust the voltage to the proper value, a shorting switch between the meter and the holders is closed, and the variac is adjusted until the meter reads 30 microamperes. When the shorting switch is now opened, the voltage impressed on the holder will be thirty times the resistance inserted by the rheostat. In other words, it will be 600 volts for 20 megohms, 900 volts for 30 megohms, and so on up to 1,800 volts for 60 megohms. Usually test voltages of 1,500 or 1,800 are used.

The test chamber is arranged to take forty-four crystal holders arranged in four rows of eleven each. Four selector switches are used to select the crystals for test—each switch selecting the crystals successively in one row. A relief valve in the cover permits atmospheric pressure to be restored at the end of the test so that the cover may be lifted.

The set with the cover of the test chamber

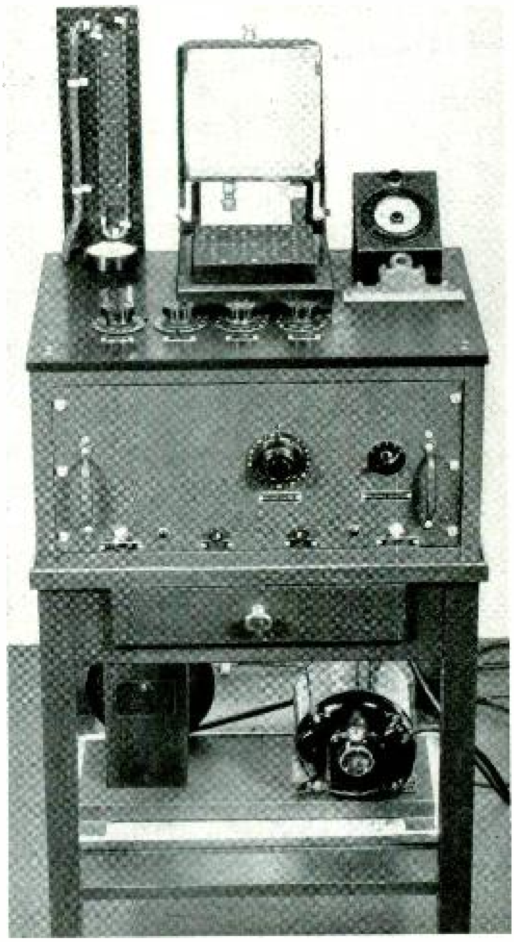
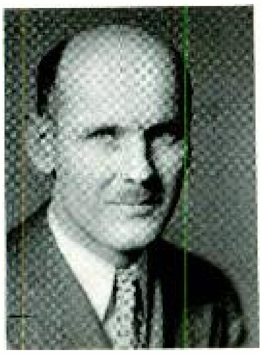


Fig. 2—Crystal test set with cover removed but without holders in place

---

THE AUTHOR: Since his entrance into the Laboratories in 1930, G. W. WILLARD has been engaged in theoretical studies of piezoelectric circuit elements. From his study of the effects introduced by changes in orientation he has been able to propose a number of new types of crystal circuit elements. As a result there have been produced the high-frequency AT and BT quartz circuit elements which are now finding such wide application in radio communication. These types are unique in that they are cut from the natural crystal with special orientation, and it is due to these orientations that they possess unusual properties. Mr. Willard holds the Bachelor's Degree (1924) and Master's Degree (1928) from the University of Minnesota, and for two years was a graduate student at the University of Chicago.



lifted but with no holders in place is shown in Figure 2. Immediately in front of the test chamber are the four selector switches for selecting the individual holders for test, while at the left are the vacuum gauge and the manometer, and at the right is the micro-ampere meter, with the shorting switch just above the dial. On the front of the case, the variac control dial is near the center and the resistance selector dial at the right. On the lower frame are the switches for the pump and the test voltage, and the circuit fuses.

After an extensive series of tests to determine the proper test requirements, the set was put in commercial use, and has proven very effective in eliminating improperly sealed containers. The use of this test is now specified in the Joint Army-Navy Specification for this type of crystal unit and the Western Electric Company has manufactured 150 of the test sets for use by the various manufacturers who furnish such crystals. Some dozen of these sets are in use in the Western Electric plant alone.

From War to Peace

. . . We honor the memory of those of our associates who will never return; in the peace they died to win, we shall work to bring about the continuous improvement of a service that can make important contributions to the well-being of America. We shall play an essential rôle in making television available on a nation-wide scale. We look forward to a record construction program of some two billion dollars to be spent as rapidly as we can get equipment manufactured and installed. We have many exciting things in mind for the future; such as dialing anyone anywhere in the United States or perhaps anywhere in the world just as simply and promptly as you dial the telephone of a neighbor in your home town. Such an idea as this is undoubtedly many years away from practical use but we promise you that the best and speediest telephone service in the world will continue to be here in our United States of America and that you will continue to get more service for your money here than anywhere else in the world. . . .

—Walter S. Gifford, "The Telephone Hour,"
September 3, 1945.

The Outlook for Radio Relaying

By RALPH BOWN
Assistant Director of Research

FOR the past two decades, telephone engineers have been searching for practical methods of radio relaying that would permit them to apply to radio the repeatered-circuit methods developed for wire transmission which have become universal in long-distance telephony. It is not surprising, therefore, to find the Bell System taking the lead toward extremely high-frequency relays by applying for and obtaining the first construction permits for a microwave radio-relay system. This project, to be built between New York and Boston, has been prosecuted as actively as possible under war conditions and the work will be accelerated as men are released from war assignments. The significance of the undertaking can be better understood by reviewing the past to see clearly how the radio art has trended toward the present situation.

A tabular analysis, such as that in Table I, below, is helpful in following the historical sweep of radio development. The chart is to a degree self-explanatory, and the following text is intended merely to supply some further detail. The first column names the basic characteristics important in a radio system that is to achieve wire-system quality of performance. The second column gives the ideal requirements for each of these characteristics. The first one is directivity. A wire system is limited to a narrow track in its occupancy of space, and in this way guides the signaling energy directly from one place to another without spreading it wastefully to other points. A comparable radio

TABLE I

TREND OF RADIO PERFORMANCE CHARACTERISTICS

	Ideal Requirements for Wire Type Performance	1915	Early 1920's	Late 1920's	1930's	1940's
		Transatlantic Radio-Telephone Demonstration	Ship-Shore Experiments Broadcasting	Transoceanic Service	F.M. Television Virginia Capes Multiplex	Radio Relays and ?
		5,000 Meters (60 KC)	500-200 Meters (.6-1.5 MC)	60-15 Meters (5-20 MC)	7-2 Meters (40-150 MC)	15-3 Centimeters (2,000-12,000 MC)
Directivity	Sharp	None	None	Some	Moderate	Sharp
Noise	Low and Steady	Severe Static Variable	High Static Variable	Moderate Static Man-Made Interference Important	Low Static Man-Made Interference Serious	None (As Yet)
Transmission Disturbances	Small and Slow	Small	Marked Rapid	Severe Rapid	Echoes Troublesome for Television	Small and Slow
Frequency Space Available	Unlimited	Picayune	Meagre	Small	Moderate (Crowded)	Large

TABLE II—CHARACTERISTICS OF A MICROWAVE CIRCUIT ASSUMING 4,000-MC TRANSMISSION WITH ANTENNA APERTURES OF 100 SQ. FT.

Facility	*Repeater Spacing Miles*	*Approximate Attenuation db/mile*	*Repeater Gain db*
Cable voice frequency..	50	.5	25
Radio relay...........	25-30	2.5-3.	70
Cable type-K carrier...	17	3-4	60
Coaxial cable (.27 inch).	5.5	9-10	
Coaxial cable (.375 inch)	8	7	55

In the "Late 1920's" the newly discovered techniques of short-wave transmission were applied to radio-telephony; trans-oceanic service was inaugurated and rapidly expanded on wavelengths of 15 to 60 meters—another step of ten to one. By this time, radio-telephony had become so important that the band width had to be more definitely recognized, and it became customary to state both the position and width of the band in terms of frequency rather than wavelengths because it makes the arithmetic much easier. In fact, use of wavelengths as a quantitative designation has now been almost wholly discarded in favor of frequency. For convenience, both frequency and wave-length figures are shown in the table. Over-land radio relaying of broadcast programs by short waves to form a network was tried by the Westinghouse Company, but the characteristics of these waves prevented practical success. As displayed in the table, some directivity can be obtained, but the fading is so bad as to distort the quality of transmission seriously.

system would have sharp narrowly directed transmission paths or beams. The second characteristic, noise, is a universal property of all transmission media, and to be satisfactory must be as low as possible and not subject to erratic variations. A third characteristic is that variability in the amplitude and waveform of signals caused by transmission disturbances which in radio is called fading. Variations small enough and slow enough to permit successful automatic correction are desirable. The fourth characteristic is the potential amount of communication that may be provided by a specific form of transmission. It is desirable that plenty of room for a large volume of traffic be available. This takes frequency space. In wire systems it can be obtained in amounts limited only by economic considerations.

When telephone engineers began to look seriously at radio, and in 1915 transmitted the voice for the first time overseas, low-frequency waves several thousand meters long were used. As is shown in column three of Table 1, the characteristics were quite unsuitable for radio relaying, there being neither directive antennas nor freedom from static, and the frequency space available was insignificant.

As shown in the column headed "Early 1920's," the next venture of telephone engineers was into ship-to-shore radio telephone experiments, and with the experience thus gained they were able to take a leading part in the early development of broadcasting. This was done at wavelengths of 200 to 500 meters, a step of ten to one from the pre-war experiments. Here the performance was quite evidently unsuited to radio relaying.

Refinements in vacuum-tube construction soon enabled the handling of waves about ten times shorter than the "short waves" and, during the 1930's, the "ultra-short waves," now called very high frequencies or v.h.f., came into use for frequency modulation and television broadcasting, and in telephony for uses supplemental to wires such, for instance, as the Virginia Capes multiplex radio link carrying the twelve channels of a type-K carrier system.* Systems of this kind can be connected end to end for true multiple-link relay operation, but the possibilities are distinctly limited by the prevalence of noise from automobile ignition and electric power systems, and the frequency space available is in heavy demand for other purposes.

Ever since the late 1920's, Laboratories' engineers have been experimenting with wave guides for transmitting and manipulating extremely high-frequency waves. It was not until the late 30's, however, that elec-

*RECORD, *May*, 1944, *page* 387.

tronic tubes began to be available that would satisfactorily generate, amplify, and modulate these microwaves, which are about a hundred times higher in frequency (or shorter in wavelength) than the v.h.f. waves just referred to. This radical step in technique has been applied with great diligence and success during the war. The leading part Laboratories' engineers have taken in the work will always be a source of pride to the Bell System and a tribute to the value of its long-range research policies.

To see why, in the 1940's, we may look forward finally to a real exploration of the possibilities of radio relaying for overland common-carrier transmission, one has to look only at the last column of the table, and to compare it with the second column. Almost any desired degree of sharpness of beam transmission seems possible using the microwaves. Beams only one degree wide are quite easily obtained. Combined with the fact that the waves do not travel along the earth much beyond seeing distances, this means that the same frequency bands can be used over and over again dozens, perhaps hundreds, of times within the United States. The frequency space available, although not unlimited or free of other claimants, s great enough so that with the aid of this multiple use of frequencies it should accommodate a large volume of communications traffic, and permit the development of such things as television circuits, which have gargantuan frequency appetites. At these extreme frequencies, there remains no trace of lightning disturbances, static, or the ordinary electrical racket produced parasitically in the ether by man-made devices. The only noises so far encountered are those of the elemental electrons moving in the conductors and the interference from intentional microwave radiations. Both of these are amenable to control by engineering design. If the distance of transmission is not stretched too far in one jump, the fading promises to be no greater than the transmission variations met with and compensated for in wire systems.

As a matter of fact, the characteristics of a microwave radio relay circuit appear likely to fall somewhere near the middle of the spread of characteristics of the other types of repeatered transmission systems used in the telephone plant. Table II gives this information estimated for an assumed radio case of 4,000-mc transmission with antenna apertures of 100 square feet.

It is seen that the hypothetical radio-relay system has a repeater spacing and an average attenuation intermediate between the voice-frequency and carrier circuits used on toll cables. On the other hand, its band width is expected to be more like that of the coaxial cable. Whether such characteristics can be realized in practice, and how much systems embodying them will cost are at present uncertain. Moreover, until low-distortion amplifiers become available for the microwave region, multiplexing will have to employ other methods than those used in conventional carrier systems.

In the light of these indications, it is not surprising that radio and telephone engineers are eager to explore this realm of science.

THE AUTHOR: RALPH BOWN, Director of Radio and Television Research of Bell Telephone Laboratories, received an M.E. degree from Cornell University in 1913, an M.M.E. degree in 1915, and a Ph.D. in 1917. He entered the Army the same year, and was commissioned as Captain in the Signal Corps. Until June, 1919, he was in charge of development of radio apparatus for the Army at the Signal Corps Radio Laboratory, Camp Alfred Vail. Dr. Bown then joined the Department of Development and Research of the American Telephone and Telegraph Company where he remained until 1934, when this department was consolidated with Bell Telephone Laboratories. At this time Dr. Bown became Associate Radio Research Director, and two years later Radio Research Director. In 1927 he received the Liebmann Memorial prize of the Institute of Radio Engineers "for his researches in wave transmission phenomena." He is a Member of the American Institute of Electrical Engineers, Fellow of the American Association for the Advancement of Science, and Fellow and Past President of the Institute of Radio Engineers.

Nation-Wide Dialing

By F. F. SHIPLEY
Switching Engineering Department

ALONG with the rapid conversion from manual to dial switching for local calls, there is a growing trend toward dial switching for toll calls. The ultimate goal is to permit the subscriber either to give his toll calls to an operator who will complete them without the aid of operators at the intermediate or terminating offices or to dial his own toll calls directly. Although the arrangements now under development are intended primarily to permit the necessary dialing to be done by an operator at the calling end, the facilities and circuits will be so planned that direct dialing by the subscriber may be readily added to whatever extent future conditions should warrant. With either operator or subscriber dialing, the time required to complete long distance calls should be very short—perhaps five seconds from the time a toll circuit is secured until the called telephone is rung. To realize such an objective, a general toll switching plan must be adopted, and the direction of future development must conform with it. Such a plan has been under discussion for some time, and agreement has been reached as to its broad outlines, although considerable work remains to be done to develop instrumentalities and to fill in the many details.

At present, most long-distance traffic is handled by manual switching methods, that is, an operator is required to establish the connection at each toll office through which the call must be switched. Before the war, some progress had been made in mechanizing toll switching. Several toll dialing networks of limited scope had been established, but except for the crossbar office installed a few years ago in Philadelphia, all of them are of the step-by-step type, and toll dialing is generally limited to direct and one switch calls. Plans are now under way to insure that the expansion of toll dialing will be guided by principles in harmony with the ultimate incorporation of all networks into an integrated network of nation-wide scope.

In formulating a plan for nation-wide dialing, the first essential is that the digits used by an operator to reach a particular subscriber must be different from those used to reach any other subscriber in the country. As long as all switching was done manually, possible conflicts in numbering could be avoided merely by seeing that no two subscribers served by the same office were assigned the same number, and that no two offices in the same city or numbering area were assigned the same name. After conversion to dial operation, however, it becomes necessary in the larger cities for the subscriber to dial a portion of the office name in addition to the numerical part of the listed number, and this leads to further restrictions. Under manual operation, one office could be named Adams, and another Beacon, but a glance at the dial, Figure 1, will show that with dial operation, where the first three letters of the office name are dialed, this is not possible because the digits would be the same for both offices.

It will also be noticed that letters useful for office names appear in only eight of the holes on the dial. The "0" position was reserved so the subscriber could dial the operator for assistance with a single pull of the dial, and the first position was avoided because of the danger that a fumble of the switchhook might produce a false pulse and result in a wrong number. With only eight positions available, the number of useful office names producing non-conflicting codes proved inadequate for New York, and to obtain relief, numerals instead of letters were assigned to the third position. When this is done, it is possible to have ADams 2 and BEacon 3 or, for that matter, ADams 2 and ADams 3 without conflict. For toll routing purposes, it is proposed to set up numbering areas on a similar basis but not to change subscribers' directory numbers or their method of dialing local calls.

Under this scheme, the theoretical number of local offices that could be included in a numbering area would be 8 x 8 x 10=640 and, since the capacity of an office is 10,000 lines, the theoretical capacity of a numbering area would be 6,400,000 subscribers. Practically, the capacity is far below this.

Fig. 1—The telephone dial has letters in only eight of the ten finger holes

Only about 500 office codes are useful for office names, and very few offices are filled to 10,000 lines. Many offices are in small towns that will never have more than a few hundred lines.

Making proper allowances for these factors, it has been estimated that between fifty and seventy-five numbering areas should be adequate for the United States and Canada with a telephone population many times the 26,000,000 of today. How the country might be divided into such numbering areas is shown by Figure 2. The final division will undoubtedly vary considerably from this.

With fewer than 100 numbering areas, and with each area on a seven-digit basis, it is obvious that by assigning a two-digit toll code to each numbering area, nine digits are sufficient to give every subscriber a toll number not conflicting with that of any other subscriber. For routing purposes, however, it is desirable that a toll code should include something to distinguish it from a local code so that only seven digits may be used for calls to points in the same numbering area without leading to confusion with codes for distant numbering areas. It has already been pointed out that neither "1" nor "0" appears in the first two places of a local office code, and it is therefore feasible to let the presence of either of these digits in the first or second position indicate a toll call outside the local numbering area. It is tentatively proposed to use a "1" in the second place as the distinguishing mark of such a call. The first three digits for a call to toll area "75" would thus be "715."

Exclusive of party letters, the number of digits required as the basis of a nation-wide dialing plan is thus ten. The full ten digits will be used, however, only when the call received at a toll office must be switched to a distant numbering area. If the originating operator is in the same numbering area as the called point, or if she can plug into a circuit that goes directly to a toll office in the desired area, she will need to dial not more than seven digits.

To provide a code structure, however, is only the first step in working out the plan. Some of the other difficulties involved may be illustrated by considering how a multi-switch toll call would be handled if all toll

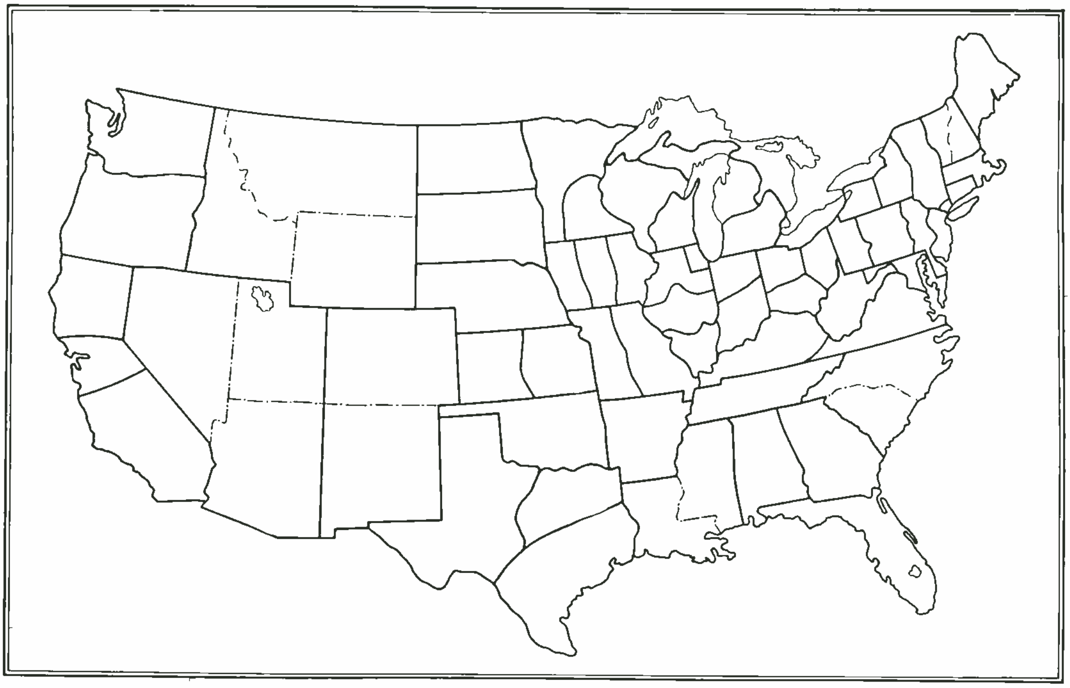


Fig. 2—One possible division of the country into toll dialing areas

offices were equipped with step-by-step switches. A step-by-step switch is driven directly by dial pulses to a level corresponding to the number of pulses in the received digit, and then hunts for an idle circuit on that level. In step-by-step toll-dialing offices, toll lines are reached from the "0" level, and two more digits are required to complete the selection of the toll circuit. Nearby tributary offices are reached from the "1" level, and two more digits are also generally required to reach them. Thus the toll code "053" would drive one switch to the "0" level, the next switch to the "5" level, and the third switch to the "3" level, where a toll line in the desired group would be found. In the process of establishing the connection through the office, however, these three code digits have been expended, and no record of them is kept to make it possible to use them again for controlling succeeding switches. When a call is dialed through a number of step-by-step offices, therefore, three digits have to be dialed for each office passed through in addition to those that are utilized in identifying the office and subscriber at the called end of the line.

This would result in a very long series of digits if step-by-step switches were used in the offices through which the call passes. Suppose, for example, that a subscriber in Portsmouth, N. H., were calling a subscriber in Vinland, Kansas, and that the routing was as shown in Figure 3, with step-by-step switches in all the toll offices. The Portsmouth operator would first have to find out the code to be used at each switching point, and then, selecting a trunk to Boston, would have to dial 053 062 078 026 138 1234. Not only would there be the delays required in finding out the proper code to dial at the various offices, but the dialing of a sequence of nineteen digits is very undesirable. This is one of the reasons why with present practice toll dialing is limited to direct and one switch calls.

How the same call would be handled under the proposed plan, with common control equipment provided where it is needed, is shown for an assumed routing in Figure 4. The Portsmouth operator instead of being required to find out the code to be used at each switching point needs only the code for Vinland, i.e., 316VI6. This code would be the same no matter where the call originated. She selects a trunk to Boston and keys 316VI61234 into a sender in Boston. The sender gives the code 316 to the marker, causing it to select a toll line to New York, and then spills the complete number into a sender in New York. This process is repeated through New York and St. Louis to Kansas City. The equipment at each switching point knows that 316 is the code for eastern Kansas, and selects the best route for getting there.

When the translator in Kansas City receives the 316 from the sender, it requires further information to enable it to select the proper route because it has direct circuits to several points in that area. It, therefore, asks the sender for the next three digits and uses them to route the call to Lawrence, telling the sender to drop the first three digits and transmit the remaining digits forward. The digits VI6 drive switches in Lawrence to the selection of a Vinland trunk, and the 1234 drive switches in Vinland to the subscriber's line. The symbol for step-by-step equipment is used at Lawrence and Vinland to indicate that senders are not required at those places since the digits received there do not have to be reused.

If the toll lines from New York to St. Louis are all busy, the call is automatically routed through Chicago, where it may be routed to Kansas City directly or, if the Chicago-Kansas City toll lines are all busy, by way of St. Louis. This is possible because, as already pointed out, no matter where the code 316VI6 is received, it always means Vinland in eastern Kansas, just as within the New York local numbering area PE6 always means the Pennsylvania 6 office no matter which local office is the originating point.

Although in the example used the call was handled by an operator, it will readily be seen that the fundamental toll switching ar-

THE AUTHOR: F. F. SHIPLEY received the B.S. in Electrical Engineering degree from Purdue University in 1925 and at once joined the Department of Development and Research of the American Telephone and Telegraph Company. Here he worked largely on general toll switching problems, but also devoted much time to certain patent studies. Transferring to the Laboratories in 1934, he continued work on toll switching problems—particularly those relating to mechanical methods that later resulted in the crossbar toll office.

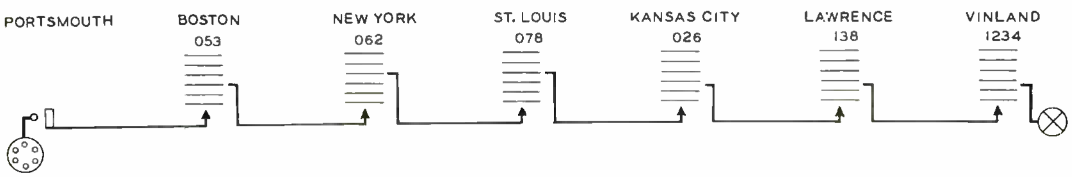


Fig. 3—Routing and codes for a toll call from Portsmouth, N. H., to Vinland, Kansas, if step-by-step switches were used at each switching point

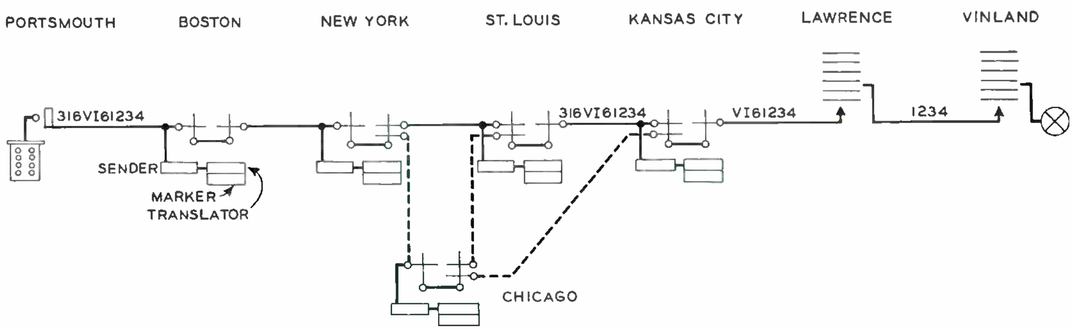


Fig. 4—Routing and codes for the call of Fig. 3 as it might be handled under the proposed nation-wide dialing plan

rangements would be no different if the subscriber had dialed his own call into a sender in Portsmouth. It is contemplated that future toll developments will follow a pattern that will place no impediment in the way of long-distance dialing by subscribers.

The essential feature of the toll switching equipment that enables any place in the country to be reached with no more than ten digits is the ability to use a code for routing purposes, and then to transmit the same code forward to be used again as often as needed. Another important feature is the ability to choose one or more alternate routes automatically. Both of these features are characteristic of common control switching equipment but not of step-by-step equipment. Successful operation of the plan thus requires that common control equipment be provided at many places where connections between toll lines are made. To accomplish this it is estimated that not more than about one hundred and fifty such installations would be required.

Adoption of the proposed toll-switching plan will result in simplification of routing instructions for operators, a considerable saving in operating labor, and an improvement in speed of service. The most notable effect on speed of service will be a reduction in the difference between the average interval now required for establishment of a multi-switched connection and that for a direct or single switched connection.

As an Editor Sees Us

The research program Bell Telephone Laboratories carried on during the war is an example of the value of well-staffed and well-equipped industrial research establishments to the Government in a period of emergency. The Bell Laboratories, largest in the country, in 1939 was spending more than $20 million a year on telephone research, only 1 per cent of which was on Government work. By 1944, through an enormous expansion in research, it was engaged in a program more than three times greater than before the war, and more than 80 per cent of the total was on Government contract. The Laboratories had cut its own research program in half, and even this work was largely war-connected. By the end of 1944, expenditures for research (including that financed by Federal funds) was at the rate of nearly $70 million per year. The subcommittee on war mobilization of the Senate Military Affairs Committee complimented the Laboratories in a recent report on the Government's wartime research and development program, adding, "a government that can increase its scientific activities ten-fold, an industrial laboratory that can increase its scientific activity three-fold in half a decade—such increases demonstrate our enormous research potential."

—*Wall Street Journal, September* 4, 1945.

Early Bell System Telegraph Services

By B. P. HAMILTON
Systems Development

ON JUNE 21, 1875, Alexander Graham Bell was carrying on some experiments in connection with a harmonic telegraph system (the forerunner of the voice-frequency carrier telegraph of today) when, quite by accident, he discovered that plucking the tuned reed of one of the harmonic telegraph receivers produced sufficient induced electrical energy to cause the corresponding tuned reed at the other end of the circuit to vibrate and to reproduce the original tone. Bell expressed the belief that by this discovery he had solved the problem of the transmission of speech by electricity, and immediately started work on the instruments which a few months later proved to be successful in accomplishing his purpose. Thus, even at this early date, telegraph was closely associated with the telephone and it has remained so ever since.

The telephone was invented in 1876, but at this time the telegraph art had already made considerable progress since Samuel F. B. Morse first demonstrated on a line between Baltimore and Washington on May 24, 1844. For ten years after the invention of the telephone, inter-city wire communication was confined entirely to telegraph service given by the telegraph companies. These telegraph companies were also furnishing some private-line telegraph service. Newspaper articles mention such a service having been established about 1873 for a New York brokerage firm for communication between its Wall Street office and its uptown branch at 23rd Street. The first inter-city private-line telegraph services furnished by the telegraph companies appear to have been placed in service between New York and Philadelphia and between New York and Boston about 1879, and between New York and Chicago about 1881.

Private-line telegraph service consisted, in these early days as it does in general today, in furnishing the requisite facilities to enable the users to communicate between specified locations during specified hours. The subscribers to this service were primarily business houses with branches in different cities. The telegraph circuits were terminated at the subscribers' offices, and telegraph operators hired by the different business concerns would send and receive the messages.

With the completion of the Bell System's line between New York and Philadelphia in 1886, the first long-distance telephone service became available between these points. Service was offered from booths installed in public places, since connecting contracts had not yet been made with the local exchanges, and few of the local exchange circuits then in service were suitable for direct connection with the inter-city lines. Efforts were made to lease inter-city telephone circuits to business firms, but there was considerable skepticism concerning the practicability of using long-distance telephone service for business communications.

To introduce the new telephone service and at the same time meet the customers' demands for telegraph service, private-line service was offered with the privilege of using either telephone or telegraph instruments as the customer desired. In this connection, Mr. Edward J. Hall, Jr., General Manager of the American Telephone and Telegraph Company, wrote to President T. N. Vail on November 23, 1886:

"Several parties are negotiating for private lines and I submit for consideration the case of Peter Wright & Sons who desire to lease a private line for both telephone and telegraph work."

On November 26 of that same year, Mr. Hall wrote Mr. A. S. Hibbard, General Superintendent:

"Referring to the application of Peter Wright & Sons for permission to use Morse instruments on a private line leased from us in connection with our telephonic apparatus, I would say, that I see no objection to granting such permission, provided the instruments are used subject to all the restrictions governing the use of telephones on such private lines, and provided that the practical operation of the instruments does not impair the efficient working of our other telephone lines on the same poles. If they are willing to make an arrangement for a private-line lease, I will endorse permission to use Morse instruments, as stated above, on their contracts."

The firm of Peter Wright & Sons, mentioned in the foregoing, does not appear to have contracted for the service about which they inquired, since there is no record of such

This method of laying field wire during World War II was in marked contrast with the Civil War method shown in the photograph at the head of this article.—Signal Corps Photo

a service having been furnished. The first actual contract of this nature was with L. H. Taylor & Company, a brokerage firm, and service was started between New York and Philadelphia on January 15, 1887. Concerning this first private line, the General Manager wrote on February 23, 1887:

"It is of interest to note that the first line leased (L. H. Taylor & Co.) was equipped with both telephones and Morse instruments, Mr. Taylor's belief being that for a broker's business the telephone was not reliable. A report of his service for February 9th shows that he transmitted 76 messages, of which 75 were by telephone and 1 by telegraph."

Following the Taylor service between New York and Philadelphia, additional services were furnished between those cities, and service was extended to other cities as rapidly as lines were completed. Some were telephone service only, while others were combined telephone and telegraph services. The first New York-Boston private-line telegraph service was started on January 2, 1888, for the Globe Newspaper Company, while the first such service between New York and Chicago was started for the brokerage firm of Hubbard, Price & Company on December 8, 1892.

For the first private-line services, a pair of wires was so terminated in the customer's office that either one telephone or two telegraph circuits could be used as desired. Early in 1888, however, this practice was changed and customers desiring private-line telegraph service contracted for the "half use" of a telephone circuit with the privilege of using Morse instruments. This was commonly known as "half-talking service" with the "Morse Down" privilege. Under this contract the customer was privileged to use telegraph service continuously during contract hours. If the customer wished to use telephone service at any time during this period, the central office was notified, the telegraph circuit was disconnected, and telephone service made available in periods not to exceed thirty minutes in any one hour. The message to the central office was sometimes sent by means of a separate telephone circuit and sometimes by attempting to communicate with a telegraph attendant there by calling on the telegraph circuit. This general scheme for handling the service was used but little after a few years. It was finally written off the books in 1918.

Concerning the private-line telephone and telegraph service in general, Mr. Hall wrote in 1888:

"We allowed our customers to use the Morse instruments, if they desired, in connection with their telephones but we hoped and expected that they would find the telephone so much more serviceable that it would always be used in preference."

As time passed, and the public became more familiar with both telephone and telegraph, it became evident that American business could make effective use of all four forms of communication—public telephone service, private telephone service, telegraph message service, and private telegraph service. Since the Bell System was organized primarily for a telephone message business, it was reluctant to allocate a circuit to a private customer if it could help speed up telephone message traffic, as witness this letter which the General Manager wrote in November 1890:

"Had we been disposed to encourage the rental of private wires to brokers with the Morse privilege we could have made a much better contract showing, a $4,000 contract of this character having been refused within the past few days. To encourage this class of business, however, would involve either tres-

THE AUTHOR: B. P. HAMILTON was graduated by Columbia University in 1913 with the E.E. degree. He taught there for two years and then joined the Engineering Department of the American Telephone and Telegraph Company in 1915 to work on equipment design and later on field tests of high-frequency and voice-frequency carrier telegraph systems. Mr. Hamilton's work has also involved development problems in connection with the Key West-Havana submarine cable and transcontinental carrier telegraph systems. Since 1930 he has been engaged in developing voice-frequency carrier telegraph systems and applications of these systems to carrier telephone channels.

passing upon the wires reserved for telephone messages or the construction of additional lines; and it has seemed better to push for the message business, leasing only such wires as were not wanted for that purpose."

Such a situation was found to continue as long as the telegraph service required the exclusive use of the line wires. It could be corrected only by developing ways of using the same wires for both telegraph and telephone, and this was one of the tasks undertaken by the Bell System as soon as the Long Lines system began to expand in the late 1880's. By the time of the first long-distance telephone service, the telegraph companies were already using the polar duplex system, which allowed simultaneous transmission in each direction over a single wire, the so-called diplex system which used simultaneous transmission in the same direction, and the quadruplex system which allowed four simultaneous transmissions, two in each direction. The Bell System was also using the polar duplex system.

The Bell System, on the other hand, was interested in devising methods of transmitting telegraph signals over telephone circuits without affecting the transmitted speech. Frequencies below about 200 cycles per second do not render any very great assistance to the understanding of speech, while very satisfactory telegraph signals may be sent with no frequencies as high as 200 cycles. Each telephone circuit is thus potentially able to carry telegraph messages without limiting its use for telephone service. The various methods that have been developed to permit telephone lines to be utilized also for leased telegraph service will be described in forthcoming articles.

General Harrison Returns

William H. Harrison, formerly vice-president of A T & T, in charge of the Department of Operation and Engineering, has been elected again to that office following his release by the United States Army. Mr. Harrison has also been elected a director of Bell Telephone Laboratories.

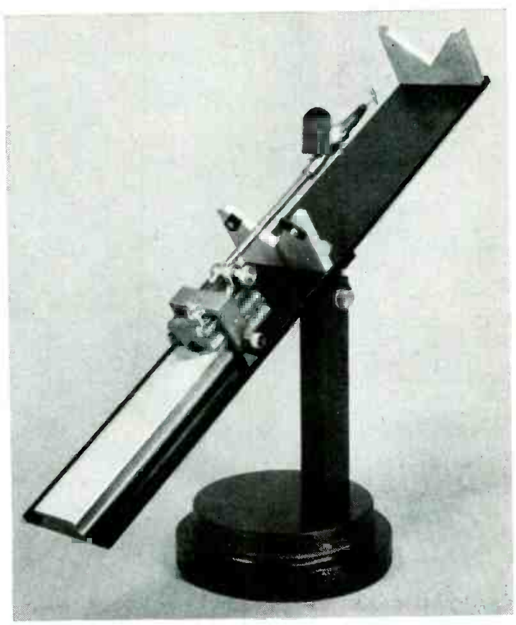
Mark R. Sullivan, who replaced Mr. Harrison in both positions during the war, has become president of the Chesapeake and Potomac group of telephone companies.

After two years as a division head in the War Production Board, Mr. Harrison became a Brigadier General, and soon was promoted to Major General in charge of the Procurement and Distribution Service of the Signal Corps. He has been awarded the Distinguished Service Medal, the citation concluding with "Faced with tremendous requirements, many of which were in the critical class, he efficiently supervised all signal supply including development of requirements, execution and modification of contracts, follow through on production, inspection, stock control and storage, and distribution of end products. The successes achieved by the Army Service Forces and the Signal Corps in procurement and supply reflect the leadership and administrative ability of General Harrison and his outstanding contribution to the war effort."

A Pit Gauge for Ceramic Tubes

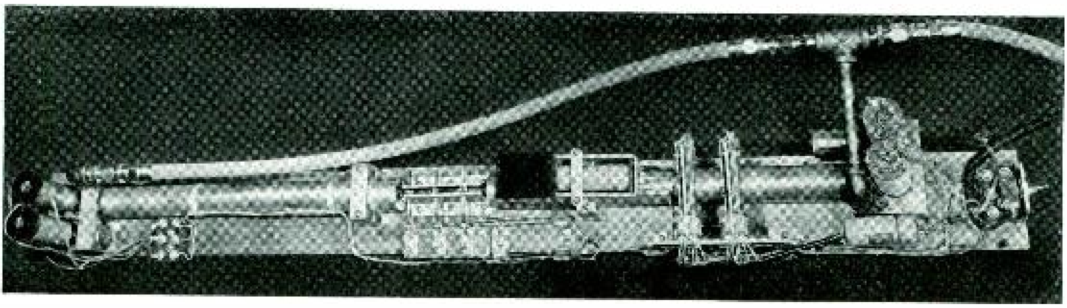
HIGH-voltage condensers are sometimes built with ceramic tubes as their dielectric. It is essential that the thickness of these tubes be uniform to a fairly high precision, since thin spots, resulting in a higher voltage gradient, might cause corona and ultimate breakdown. In the manufacture of such cylinders, however, it is difficult to avoid surface bubbles that leave small depressions, and all cylinders must be carefully inspected before they are used so that those with depressions deeper than a specified amount may be rejected. If the bubbles are in the outer surface, their detection and measurement is comparatively simple, but when they are on the inside, although they may often be seen by looking down the tube, it is difficult to determine their depths.

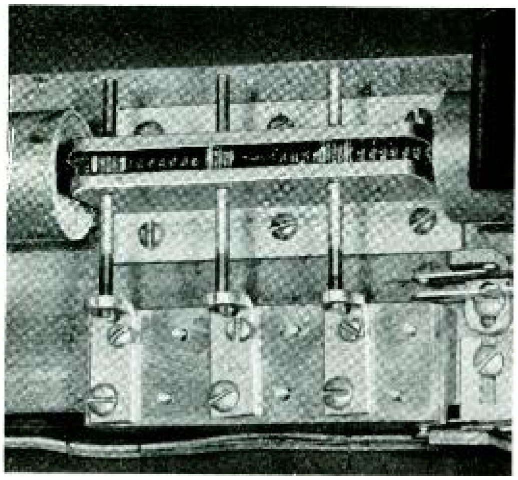
To overcome this difficulty, E. C. Erickson designed the device shown in the accompanying illustrations. A Starrett dial gauge is mounted on one end of a steel rod slightly longer than half the length of the longest of the tubes to be measured. The other end of the rod is fastened to a Starrett surface gauge which is free to slide along a flat steel plate. The lever of the dial gauge was doubled in length to double its range, and a phonograph needle, which may be readily replaced as it wears, is provided as the measuring pointer. A 45-degree mirror set over the face of the dial permits the scale of the gauge to be read by looking along the rod from the needle end. With a cylinder



placed in the two V rests as shown on page 377, the operator looks through it to locate depressions in the interior wall. Since light enters the cylinder only from the ends, its rays are nearly parallel to the cylinder, and the bottoms of the depressions will be in shadow, and thus become plainly visible. When a depression is located, the cylinder is turned to bring the depression to the bottom. The gauge is then slid into the tube until the needle is just in front of the depression, and the rod is turned down until the needle makes contact with the surface and gives a reading near the upper end of the dial. After this reading is recorded, the pointer is slid away from the operator until it rests in the depression, when another reading is made. The needle is then moved farther away from the operator until it has left the depression, and a third reading is made. The difference between the second reading and the average of the first and third is taken as the depth of the depression.

Heretofore, the depths of interior depressions have had to be estimated, which gives far from dependable results, since the apparent depths of the depressions depend on the diameter. With this new device, however, depths can be measured with considerable precision, and the rejection of satisfactory tubes or the acceptance of unsatisfactory ones is avoided.





THE LIFE of adjusting screws under the wear of intermittent turning in and out is determined by this accelerated testing apparatus. Two opposed pneumatic cylinders drive a rack back and forth that turns a pinion on each of three rods attached to the ends of the screws being tested. The tapped brackets into which the screws are turned are mounted on a plate free to move toward or away from the rack as the screws turn, and at the two ends of the desired travel, it makes contacts that reverse the motion of the rack. Each back-and-forth motion of the rack thus turns the screws in and out for the full length of their normal travel.

The Lookator

By J. T. SCHOTT
Transmission Development

IT IS NO secret that many of the most effective devices used by Uncle Sam in the recent war employ echoes as a means of obtaining information from a distance. Electrical echoes are known to occur within telephone lines wherever there are impedance irregularities, and it was upon this principle that a device known as the Lookator was developed for locating faults on telephone lines.

When connected to a telephone circuit, the Lookator shows the condition of the circuit along its length by means of a trace on a cathode-ray tube. If steady or swinging faults are present, their general nature can be at once detected, and their distance from the Lookator can be measured by a simple procedure. The device is thus a fault locator that permits the operator, in effect, to "look" out over the circuit, and it seemed appropriate to call the instrument a Lookator. The visual method of examining a telephone circuit, without making any of the usual location measurements, contributes considerable information about the circuit. It makes the device useful for examining a circuit while it is being installed, thus finding errors and faults immediately. The stability of the cathode-ray tube trace permits the use of relatively simple photographic equipment for making records of any circuit condition.

Figure 1 shows the Lookator ready for use. Operated from a 110-volt a-c power supply, the instrument is normally housed in a military-type carrying case approximately 19 x 19 x 15 inches, and complete weighs a little over 100 lbs. Two small auxiliary pieces of equipment, a terminating unit, and a hybrid unit, are used with the Lookator to make up a complete fault-finding set for use on cable such as that used with Spiral-4 carrier systems, for which purpose the present model Lookator was originally designed. Adjustable built-in networks, however, are provided in the Lookator itself for use of the instrument on open-wire and other facilities as well.

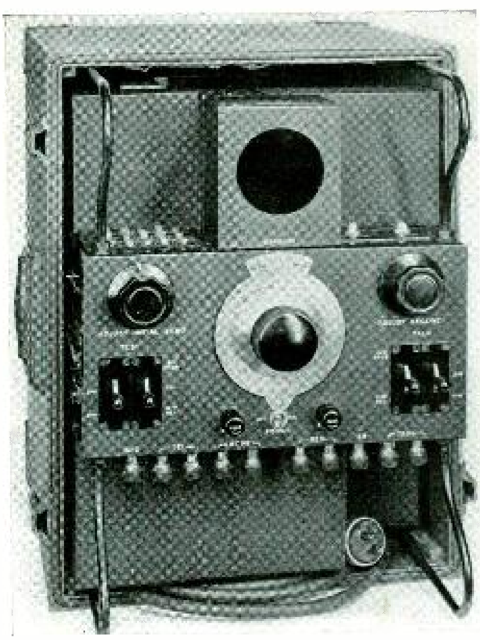


Fig. 1—Front view of Lookator with cover removed and ready for use

The principle employed for locating faults with the Lookator and its associated equipment is to measure the time for an electrical pulse to travel from some reference point of measurement out to a fault and return in the form of a reflected pulse to the reference point. Knowing the speed of transmission of the pulse over the particular facility, the distance to the fault can be obtained. In practice the time is determined automatically by the equipment. This is accomplished by properly setting a measuring dial and noting its reading. Using the reading of the dial and a previously prepared calibration curve, the location of the trouble can then be obtained.

Figure 2 illustrates in block schematic form the functional setup used in locating faults by connecting the Lookator directly to a two-conductor telephone circuit. As

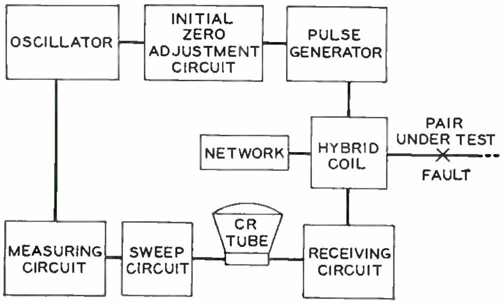


Fig. 2—Block schematic of the Lookator circuit

indicated in the diagram, the Lookator consists of an oscillator, an initial-zero adjusting circuit, a pulse generator, a hybrid coil with its associated adjustable balancing network, a receiving circuit, a measuring circuit, a sweep circuit, and a cathode-ray tube with associated control circuits. Keys are provided for testing and talking on either a two or four-wire basis. The bridge-stabilized 220-cycle oscillator feeds through the zero adjusting circuit into the pulse generator, where the oscillator frequency controls the rate at which the pulses are generated. The pulses, having individually the approximate shape of a positive lobe of a 3-kc sine wave, are delivered to the line through a hybrid coil and a set of keys. The balancing network forms part of the hybrid-coil circuit, and may be adjusted to balance any line impedances likely to be encountered.

The outgoing pulses travel along the line to the impedance irregularity caused by a fault. They are here reflected, and return along the line to the Lookator, where they enter the receiving amplifier, and appear as a vertical deflection on the screen of the cathode-ray tube. A second output of the oscillator feeds through the measuring circuit into the sweep circuit, where it controls the frequency of the horizontal sweep. The zero adjusting circuit and the measuring circuit permit the phase of the voltage supplied to the pulse generator and sweep circuits of the Lookator to be controlled individually. Consequently, the time at which functions in the sending and sweep circuits take place can be adjusted as desired with respect to each other. Since the oscillator frequency is fixed, a measure of the difference in phase between the a-c voltages controlling the electrical events in the two circuits will be a measure of the time required for the pulse to travel from the Lookator to the fault and back again. It is then possible to prepare a curve showing the relationship between time in arbitrary scale divisions and the distance out to known points on a particular facility.

The measuring procedure is simple. After the device has been turned on, but before the line to be tested has been connected, a trace appears on the cathode-ray tube screen as shown in Figure 3A. The sharp projection or "up peak" above the horizontal portion of the trace is the measuring pulse that has passed across the hybrid coil because of the poor impedance match of the network to the open-circuited line terminals. It may be set at the desired height by the ADJUST RECEIVE dial. Next the MEASURE dial is placed on zero, and then the ADJUST INITIAL ZERO dial is turned until the measuring pulse moves behind the vertical index line marked in the front of the cathode-ray tube as shown in Figure 3B, thus setting the instrument on zero in preparation for a measurement. The circuit to be tested is then connected to the Lookator by operating a TEST key. The original pulse at its normal

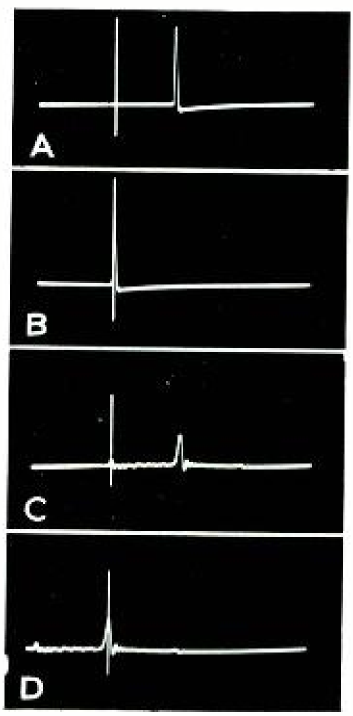


Fig. 3—Graphs on cathode ray screen during a fault location. At A *is the reflection caused by the open terminals of the hybrid coil before the line is connected. At* B, *this peak has been moved back to the index line by the adjusting dial.* C *shows the type of pulses formed by an open circuit. Distance to the fault is measured by turning the* MEASURE *dial until the pulse is brought back to the index line, as at* D

position is then greatly reduced by the increased loss across the hybrid coil resulting when the test line is connected. If a fault is present, it will appear in some characteristic fashion on the trace, and in a position along the trace that represents the distance to it. The height of the pattern produced by the fault can be adjusted for examination.

Figure 3C illustrates an open (both wires) in a Spiral-4 cable pair eleven miles from the Lookator. To measure the distance to this fault, the MEASURE dial is turned to move the trouble pattern toward the index line until the peak of the pattern aligns with the index line as shown in Figure 3D. From the reading of the MEASURE dial, the distance to the fault can be read from a calibration curve for Spiral-4 cable shown in Figure 4. Condensed instruction sheets furnished with the Lookator, which include the four foregoing photographs, make it possible for maintenance personnel to proceed actively in finding faults with a minimum of training.

The measuring dial is substantially linear with time (or distance) and therefore the calibration curves for different types of circuits will all be straight lines, but with different slopes because of different velocities of transmission. This linear measurement of time reduces the procedure of finding the distance to a fault to a matter of simple proportion. The dial readings for an artificial fault produced at a known distance on a particular type of telephone circuit and for an actual fault will be proportional to the distances to the two faults. A calibration curve, therefore, is not necessary unless it is desired for convenience. The fact that the Lookator measures actual time of transmission makes it possible also to determine the group velocity of transmission over a circuit whose length is known.

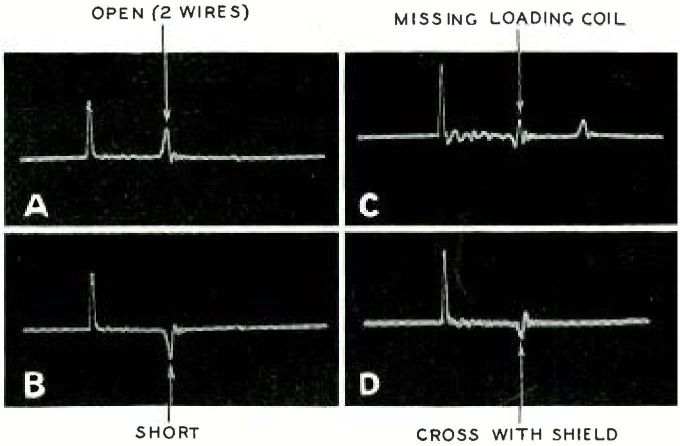


Fig. 5—Types of faults on Spiral-4 cable

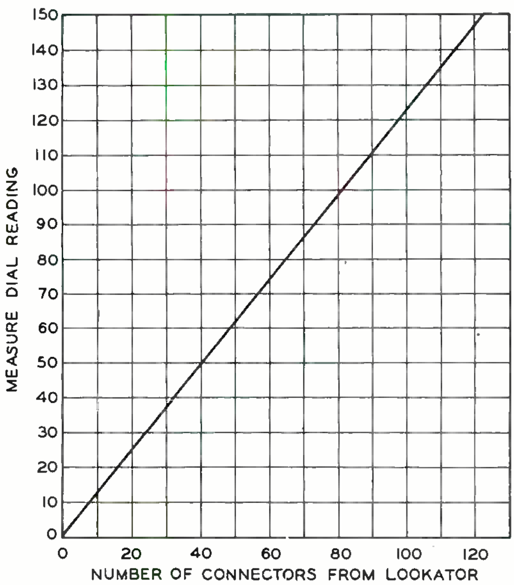


Fig. 4—Calibration chart for locating faults on Spiral-4 cable

Examples of a few types of fault patterns on Spiral-4 cable are shown in Figures 5, A to D, inclusive. For the patterns shown, the balancing network has been adjusted off balance intentionally to show the original pulse at the left of a sufficient height to indicate its position with reference to the trouble pattern. With the network properly adjusted, the original pulse becomes very small when the test line is connected. Generally speaking, any trouble that inserts an open or series resistance at a point in either conductor will show up as an "up peak." Any trouble which shorts or bridges a resistance across both circuit conductors or between either conductor and ground will show up as a "down peak." Crosses between any conductor and the braided steel wire shield, and

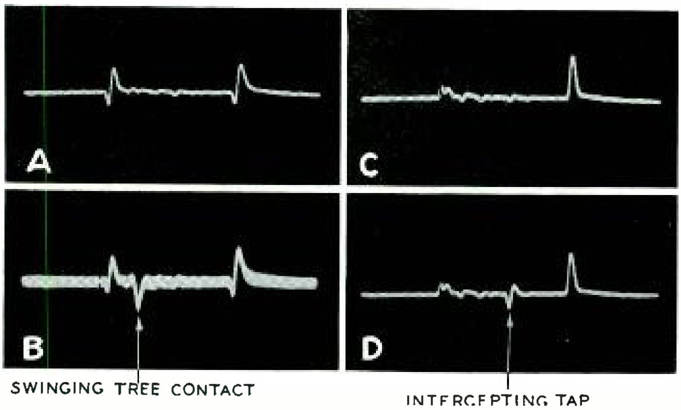


Fig. 6—Types of faults on open-wire lines. At A are pulses caused by irregularities at the entrance cable at each end of the line; B shows a swinging tree contact; C shows an open circuit at the far end; and D shows the circuit bridged with a moderately high impedance tap

at its proper location on the trace, and its position (thirty-nine miles out in the case shown) can be determined as readily as any steady trouble. The width of the trace is caused by noise, which is introduced while the tree is in contact. The noise does not interfere with the measurement. Figure 6C shows another normal open-wire circuit which is open at the far end, 179 miles away. Figure 6D shows the same circuit bridged by a typical moderately high impedance tap at a point 89 miles out along the circuit. This is a possible condition where a line is tapped for unauthorized interception purposes.

improper values of loading, are indicated by distinctive trouble patterns. In Figure 5C, for example, a missing loading coil ten miles out is indicated and, in addition, there is an "up peak" to indicate the open-circuit at the end of the particular twenty-mile circuit. This latter indication illustrates the ability of the Lookator to "look" through faults that are not gross faults and show others farther along on the circuit. The Lookator thus gives an immediate visual answer to the problem of locating more than one impedance irregularity at the same time, which when attempted by means of the classic impedance measurement method becomes rather complicated.

With open-wire lines, fault patterns for opens, series resistances, shorts, or leaks are generally the same as shown for Spiral-4 cable pair. A fairly common type of trouble on open wire, particularly during storms, arises when a branch of a tree swings so as to momentarily rub against an open-wire conductor. This is illustrated in Figures 6A and B. A normal open-wire circuit is shown in Figure 6A. The two similar patterns shown at the near and far ends of the circuit are caused by irregularities from entrance cables at each end. At the moment a swinging tree branch comes in contact with one of the conductors, the circuit appears as in Figure 6B. Each time the branch strikes, the characteristic "down peak" of a ground is indicated

The visual feature of the Lookator makes it convenient to employ a helpful method of "steering" the outside lineman to a fault. After the line crew receives instructions, and is out finding a particular location, it may not always be possible for them to know their own location because of meager circuit map details. A lineman in this case can introduce

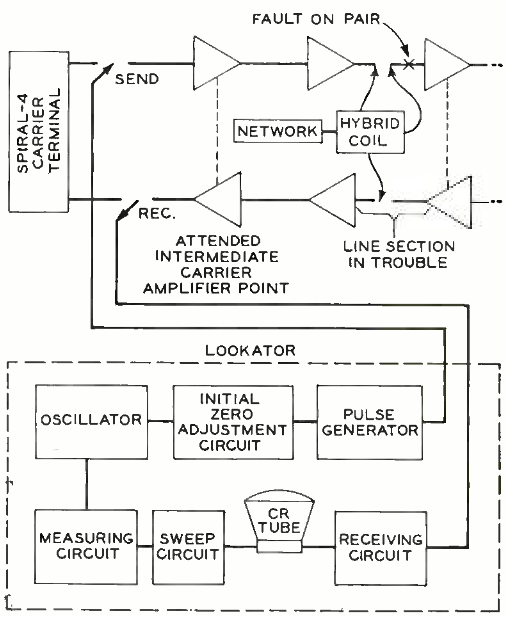


Fig. 7—Block schematic of circuit arrangement when making a test beyond the first repeater of a Spiral-4 cable

an open or short on the line, and be told immediately by the Lookator operator where he is located with reference both to the home end of the circuit and to the location of the trouble. A small terminating unit is provided for this purpose to be used by the line crew when working on Spiral-4 cables. For open wire, a short flexible conductor equipped with test clips to be used as a short across a pair is all that is required.

In all of the foregoing discussions the Lookator was assumed to be connected directly to the telephone pair in trouble. Figure 7 shows a special application for locating troubles in Spiral-4 cable beyond the first repeater section by measuring through one or more Spiral-4 carrier repeaters. The hybrid coil and network circuit in the Lookator is switched out, and a small hybrid unit containing the equivalent equipment is connected in at the intermediate repeater point preceding the cable section in trouble. The Lookator in this case is connected on a four-wire basis with the sending and receiving sides of the carrier system used as long four-wire leads to the hybrid coil circuit. The Lookator zero is set with the key of the remote hybrid unit on CALIBRATE, that is, with the circuit in trouble not connected. The circuit beyond is then added, and the result given by the Lookator is in terms of distance beyond the repeater point where the hybrid unit is being used.

The Lookator is a versatile instrument. In addition to its primary use as a fault locator, it can be used for many other purposes such as general laboratory testing, for adjusting networks properly to balance lines, for adjusting line terminations, for observing short time changes in the height of the Ionosphere, and in its present form for indicating the presence of large crosstalk coupling and showing about where the irregularity responsible for the crosstalk is located.

THE AUTHOR: After receiving the degree of B.S. in E.E. from the University of Illinois in 1921, J. T. SCHOTT joined the Department of Development and Research of the American Telephone and Telegraph Company. There his work was on circuit and equipment development of telephone repeaters, echo suppressors, and particularly on toll-circuit arrangements for furnishing of special services. This latter work included voice-frequency terminals for transatlantic radio circuits, telephoto networks, and program transmission systems of all types including switching and reversal of program lines. He became a member of the Laboratories Toll Facilities Department in 1934, and later transferred to Transmission Development, continuing the same work. Since early 1942, he has been occupied on war developments.

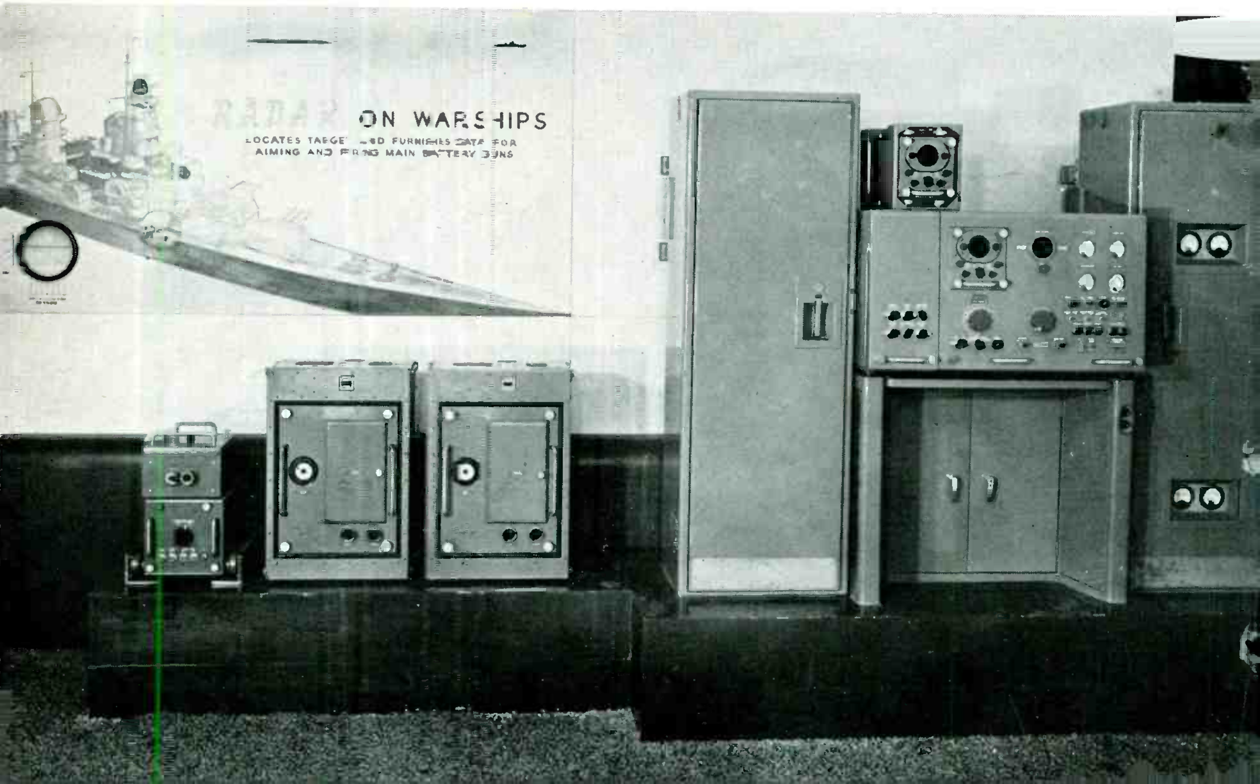
Radar antenna installed at Murray Hill

Bell Laboratories Displays Its 1944 War Projects

EARLY in August, Army and Navy equipment developed by the Laboratories during 1944 was shown and described to the Price Adjustment Board, officers of the Army and Navy, and executives of the American Telephone and Telegraph Company and Bell Telephone Laboratories. Some two thousand members of the Laboratories' technical staff also had an opportunity to see the displays and learn what their co-workers had been doing. The exhibit included complete Ground, Ship, and Airborne Radar Systems, the M-8 Gun Data Computer, Wire and Radio Telephone Communication Sets, Teletype Systems, Operational Flight Trainers, Test Sets, Rocket Warfare, Instruction Manuals, and work of the Western Electric Field Engineering Staff and Bell Telephone Laboratories' War Training School.

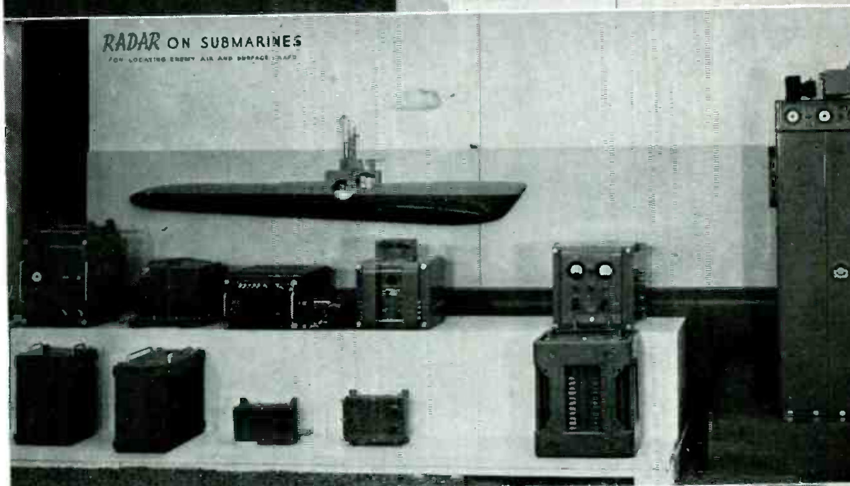
Two circus tents housed most of the displays, with some of the larger antennas set up on the lawn outside, and a few exhibits of the smaller apparatus in the auditorium of the Acoustic Building, where they could be studied before and after Dr. Kelly's talk to

Part of the display of radar for warships showing a fire control radar without its antenna

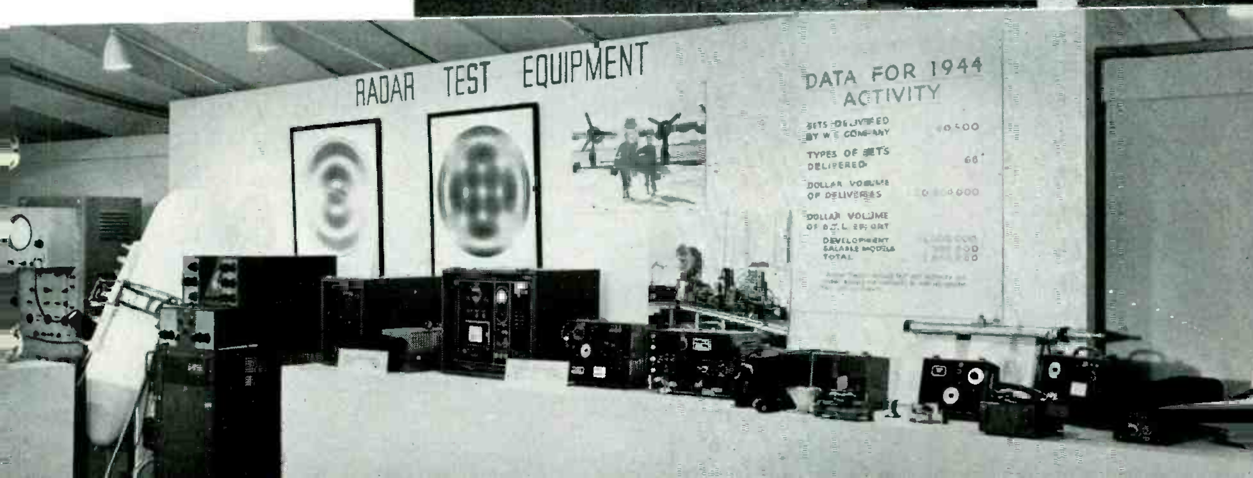


vo circus tents housed most of the :plays forming part of the ex- hit of Bell Telephone Labora- ies 1944 War Developments

ne of the aircraft radar exhibits owed a radar used on B-25 bombers



he submarine radar exhibit show- g the SJ, SV, and ST radar apparatus



f vital importance to the success radar is a wide variety of test pparatus. Some of the apparatus this type developed by the Lab- ratories in 1944 was shown in this display

Cockpit of replica of Navy Hellcat bomber used with the F6F *operational flight trainer. E. J. Fogarty at the controls*

the visitors explaining the highlights of our 1944 production. Each display was backed by large diagrams depicting its use, and a member of the Laboratories' technical staff at each exhibit explained the nature and function of the apparatus as the visitors stopped in their tour.

The entire exhibit was organized, designed, and assembled under the direction of a committee consisting of M. H. Cook, Fred Cowan and Henry Kostkos. R. C. Bertell and Company of New York built the displays, while E. V. Mace and G. W. Lees, Jr., were responsible for the Plant Department construction work.

Western Electric War Contracts Cancelled

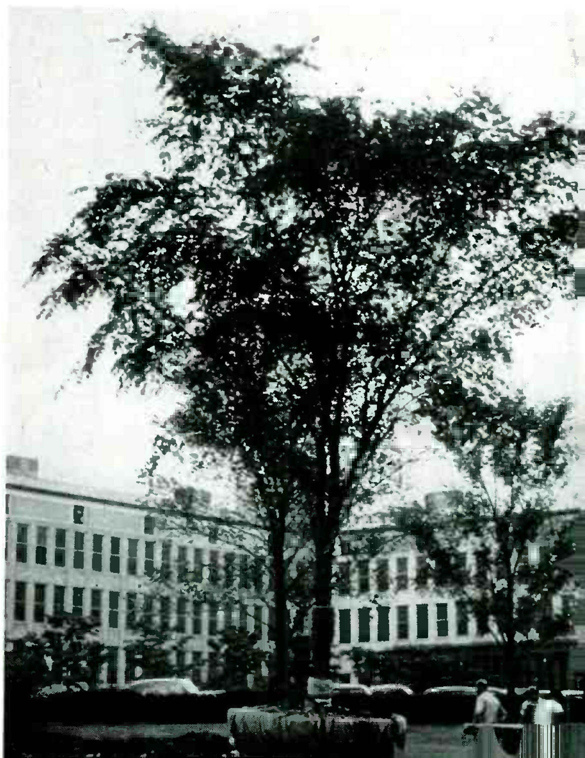
Many of Western Electric Company's war contracts for electronic and communications equipment have been cancelled outright and others have been reduced. At present the unfilled war orders are only about 40 per cent of the total on hand August 1, according to C. G. Stoll, President. Unofficial advices indicate further cancellations will be received in the near future. The company's working force as the result of terminations now numbers approximately 70,000, a reduction since August 1 of 15,000.

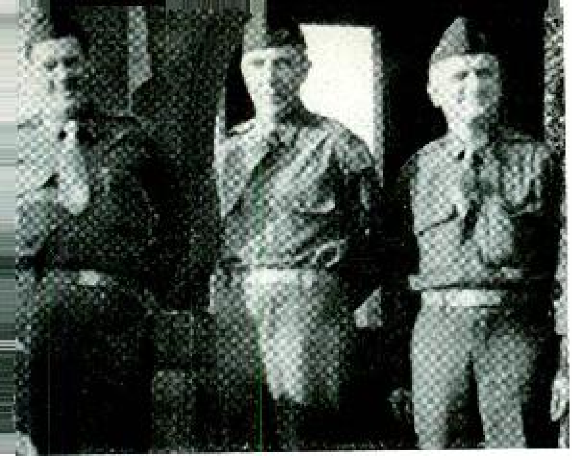
At one shop established specifically for war production in a rented building, the company's war contracts have been entirely cancelled and operations have been closed down. At other locations operations on war contracts are proceeding on a reduced scale.

Reconversion was undertaken immediately after V-J Day and involves the complete dismantling on many war shops and the reinstallation of equipment for peacetime manufacture. Every available mechanic capable of performing this kind of work is engaged on a seven-day basis in order to shorten the reconversion time, speed up the production of telephone instruments and switchboards and cables and create the maximum number of peacetime jobs.

Under the Bell System's $2,000,000,000 post-war construction program, the Western Electric Company will be called upon to furnish the major portion of the materials and equipment required. In the immediate post-war years, this will mean for Western Electric a substantially larger volume of business than was enjoyed in the years immediately preceding the war and will provide proportionately greater employment. In fact, this volume of business is expected to reach heights greater than in any peacetime year in the history of the company.

Some of the large trees at Murray Hill are being moved in connection with the construction of the new building there. This valuable elm was taken from its place near the entrance and transported to a new location





While visiting Germany on a mission to investigate technical and scientific progress in communications, radar and television, this picture of J. R. Townsend, R. H. McCarthy (W. E. Co.) and Pierre Mertz was taken at Heidelberg Castle

Laboratories New Telephone Directory

The May, 1945, permanent telephone directory is the first issue of its kind since January, 1943, when the frequency of changes of personnel made it advisable to issue only temporary telephone directories.

The preparation of the telephone directory involves considerable detail work in the compilation of names to be included in the directory and in the departmental arrangement and the selection of type set, paper and cover. The period of time required is approximately three months, beginning with the preparation of lists of names to be included in the directory and ending with receipt of completed directories from the printer. During this time the interests of the several departments are given effect through the medium of a committee comprised of representatives of each of the departments. The directory is printed at Hawthorne.

Part-Time Post-Graduate Study Plan

The Part-Time Post-Graduate Study Plan has been resumed for members of Bell Laboratories who are interested in taking undergraduate work at Columbia University and, in special cases, at other schools. Candidates eligible under the plan have been employed regularly by the Laboratories for a minimum of approximately one year and hold a bachelor's degree in arts, science or engineering. So far, a number of engineers of the Laboratories have availed themselves of the opportunities afforded under the plan.

Meritorious Civilian Awards Presented to B.T.L. Men

Gustaf W. Elmen and John F. Toomey were two of the sixty-four civilians, members of the Naval Ordnance Laboratory staff, awarded the Meritorious Civilian Service Awards as official recognition for their contributions to the war program. Dr. Elmen won the award "for notable contributions on magnetic problems and materials related to the mine program"; while Mr. Toomey's citation read "for untiring efforts and many valuable contributions to the successful mine program." Rear Admiral F. L. Reichmuth, Commandant of the Navy Yard, Washington, D. C., presented the awards.

A Fall Forewarning

Most family men take at least one day during the year for a thorough clean-up around the house, the basement and garage—and the fall is when you tackle it.

It is while doing the unusual things, those to which you are not accustomed—even the very simple operations—that you get into trouble. Forearm yourself with these forewarnings, suggested by the American Mutual Liability Insurance Company, as you do your annual housecleaning:

1. Watch for nails in cases and barrels.
2. Use step stool or step ladder for reaching.
3. Burn rubbish in a safe location.
4. Lift well within your capacity and always use leg muscles in preference to back muscles.
5. If possible, get someone to help—two persons will do it easier, faster.

Patients at the Veterans' Hospital in the Bronx take over the phone to call wives and sweethearts

Acme Photo

Holidays Restored

Members of the Laboratories will again enjoy the observance of those holidays which were suspended on February 5, 1943, in compliance with an executive order. The holidays are Washington's Birthday, Lincoln's Birthday, Columbus Day, Election Day and Armistice Day. Not only have the holidays been restored, but holiday pay practices that were in effect prior to February 5, 1943, have been reinstated.

War Fund Drive

The third and last of the National War Fund campaigns will be formally opened on October 9. Money raised in the campaign will go to support nineteen national organizations serving this Nation and its Allies.

Carl Whitmore, president of the New York Telephone Company and chairman of the New York City drive, urges contributors to remember the importance of the agencies' work toward establishment of a lasting and wholesome peace. He also points out that the goal of the national campaign remains the same as it was before V-J Day because the ending of hostilities will not end the demands on the Fund for money to maintain the USO and Seamen's Service to provide comforts, hospitalization and entertainment for servicemen who are and will be overseas for some time to come. The Fund also provides money for fifteen overseas relief groups who are obligated to provide essential food, clothing and medical supplies to the people of war-ravaged countries.

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.

News Notes

J. W. Kennard has been transferred from the Cable Development group at Point Breeze to the Murray Hill Laboratories, where he is continuing his work on cable problems.

J. H. Gray with T. C. Smith of the A T & T recently witnessed the plowing in of shield wires for lightning protection along a buried toll cable near Richmond, Virginia. Mr. Gray with D. C. Smith also conducted plowing-in and installation tests of a new design of coaxial cable in the vicinity of Washington, D. C.

H. A. Flammer visited the Patent Office in Washington during August relative to patent matters.

The Laboratories were represented in interference proceedings by J. W. Schmied at the Patent Office in Richmond.

J. F. Polhemus recently spent some time at Atlanta and Macon, Georgia, and Jacksonville, Florida, assisting in field tests of type-L equipment installed for the Atlanta-Jacksonville coaxial system.

V. J. Callahan studied engine sets for radio equipment at the Kohler Company, Sheboygan, Wisconsin.

H. H. Spencer tested changes in rectifier inverters at the L carrier station, Baldwin, Wisconsin.

"The Telephone Hour"

NBC, Monday Nights, 9:00 p.m.

October 8	*Robert and Gaby Casadesus*
October 15	*Gregor Piatigorsky*
October 22	*Marion Anderson*
October 29	*Fritz Kreisler*
November 5	*James Melton*

J. L. Dow Retires

J. L. Dow, Director of Switching Development, with over thirty-eight years of Bell System service, retired at his own request with a class A pension on August 31.

After receiving his B.E. degree from Kansas State Agricultural College in 1906, Mr. Dow started on the student course of the Western Electric Company at its Clinton Street shop in Chicago. Then, after being successively associated with the equipment engineering on central-office apparatus non-associate sales engineering, and returning to equipment engineering, he came to New York in 1916. He worked on the development of manual circuits until 1917 when he was assigned to panel dial development. Soon afterward he was placed in charge of the testing of step-by-step circuits and, later, panel circuits.

J. L. Dow

Becoming Laboratories Engineer for the Local Systems Department in 1921, Mr. Dow was in charge of laboratory analysis and testing, of the determination and compiling of apparatus requirements for central-office maintenance, and of compilation of Bell System practices. The group also investigated from the standpoints of manufacture, installation and operation, all circuits and systems proposed by the Local and Toll System's circuit design group and tested out these circuits under the most stringent conditions of actual operation.

Following the retirement of W. H. Matthies, Mr. Dow became Director of Switching Development on May 1, 1943.

F. J. Scudder

F. J. Scudder Appointed Director of Switching Development

Upon the retirement of J. L. Dow, Frederick J. Scudder was appointed Director of Switching Development. Mr. Scudder joined the New York Telephone Company in 1905 and five years later became associated with the dial telephone switching development program of the Engineering Department of the Western Electric Company. At first he had charge of the development of maintenance practices and the training of maintenance forces. More recently, as Switching Development Engineer of the Laboratories, he has been closely concerned with the development of the panel, step-by-step and crossbar switching systems for local and long-distance calls and with the automatic ticketing system for toll calls.

A. J. Busch has replaced Mr. Scudder as Switching Development Engineer in charge of local systems development and F. J. Singer has become Switching Development Engineer in charge of toll system development, a position that has been open since the retirement of R. S. Wilbur in 1943.

Other Retirements

Recent retirements with Class A pensions at their own request were: S. F. Butler with forty-five years of service and Herbert Oldham, twenty-seven years of service. Under the Retirement Age Rule there were: A. F. Gilson with thirty-seven years of service; G. H. Paelian, thirty-four years; J. C. Field, thirty-nine years; and Henry Wagner, forty years.

S. F. Butler

A. F. Gilson

Samuel F. Butler

Mr. Butler, or Sam, as he was known to all his friends and associates, was hired as a messenger by the New England Telephone Company in 1900 to work in the Engineering Department in Boston. He was a very likable and inquisitive young man, not bashful, and was prone to ask questions of his associates, with the result that before long his supervisors found he had picked up enough of the essentials of telephone work to become a subscribers' station installer, and later, when they found that he was good with a broom, he was made a central-office equipment installer. As time went on, he was advanced to maintenance man for central office and PBX and worked at this throughout the New England territory. One of Sam's most liked hobbies was deep sea fishing, but try as he might he could not get more than a few feet from the boat dock before *mal de mer* took over, so in 1910 he removed himself from this temptation and transferred to the Western Electric Company at Hawthorne. He was engaged on equipment engineering with the Western Electric Company and for several years, until coming with the Laboratories in 1919, he supervised a section of this work.

He came to West Street at the start of the panel machine switching program and was assigned to the group working on the development of equipment associated with this project, the first units of which were installed in Kansas City and Omaha. In 1921 he was placed in charge of the current development and trial installation group. Development work on dial equipment, both on panel and step-by-step, and later, crossbar, was placed under his direction in 1926. His duties as Switching Equipment Engineer included also common system engineering which takes in the development and standardization of practices and equipment common to all telephone systems.

Albert F. Gilson

Before his engagement by the Western Electric Company, Mr. Gilson had been associated with the National Meter Company in the capacity of Assistant Chief Engineer. His first connection with the Bell System was with the Western Electric Company Manufacturing Department, then located in the Clinton Street plant at Chicago, and later at Hawthorne, when this location, the nucleus of the present Hawthorne Works, was first made available to the Clinton Street organization.

Leaving the employ of the Western Electric Company in 1908, he took up work with the General Electric Company at Lynn, Mass., on meter and instrument development. Terminating this engagement after about a year and a half, he again became associated with the Western Electric Company in its engineering work at West Street.

Since that time Mr. Gilson's field of activity has widened constantly and his responsibilities have increased correspondingly. As Assistant Apparatus Development Engineer until 1941, he made substantial contributions to many of the Laboratories' developments in the telephone art and its allied by-products. Since then, as Purchasing Engineer of the Development Shops, he had been in charge of all outside shop work required during the war and was responsible for the coördination of work placement and suppliers in New York and New Jersey.

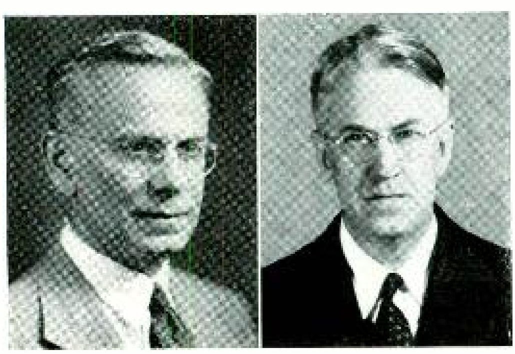
Garabed H. Paelian

After receiving the A.B. degree from Anatolia College, Asia Minor, in 1903, and the M.A. degree from Oberlin College in 1907, Mr. Paelian was an instructor in the American International College at Springfield, Massachusetts, for two years. He then attended Worcester Polytechnic Institute, from which he received the degree of B.S. in Electrical Engineering in 1911. In 1934 he received his Ph.D. degree from New York University.

He joined the Western Electric Company at Hawthorne in 1911, and two years later was transferred to the Western Electric Company at Antwerp, Belgium. Here he engaged in equipment engineering for a machine switching system involving the use of rotary switches. When World War I broke out in 1914, he was transferred to England where he was engaged in engineering and testing the machine switching equipment in the Dudley exchange near Birmingham.

Returning to the United States in 1918, Mr. Paelian engaged in sales engineering for the International Western Electric Company at 195 Broadway. Two years later he transferred to the Systems Development Department of what is now the Laboratories, concerned with the equipment engineering and trial installation projects until 1934. He then transferred to the Local Central Office Facilities Department where he was engaged in the application of probability theory to switching problems. Since 1943, in the Switching Engineering Department, he had been with the group writing instruction bulletins covering telegraph systems developed by the Laboratories for our Armed Forces.

Herbert Oldham — Henry Wagner



G. H. Paelian — J. C. Field

Joseph C. Field

Receiving a C.E. degree at Princeton in 1903 and the degree of S.B. from M.I.T. in 1905, Mr. Field joined the student course of the Western Electric Company. Later he worked in the shop on switchboard assembly and testing, and in equipment engineering on preparation of specifications for switchboards and associated equipment. Transferring to the laboratory, he engaged in general circuit work and in the development of semi-automatic switching of the panel type.

During World War I, Mr. Field was employed on deep-sea submarine detection work both in New York and at the Naval laboratory at Nahant, Massachusetts. He also worked on methods of selection control of mine systems for the Coast Artillery.

Mr. Field was primarily responsible for the ideas which resulted in the so-called A-C system of train dispatching. This includes the 60-A selector and its associated apparatus and constitute the Western Electric train dispatching system which has been standardized by the principal railroads throughout the world. Upon the completion of this type of work he transferred to what is now the Switching Apparatus Development Department where he has since been concerned with the development of dials,

Part of a Western Electric fire control system damaged by a 20-mm shell in the Pacific

crossbar switches, high-speed motors of the spinner type, variable speed control devices and, more recently, preparation of specifications and drawings on glass-sealed switches.

Henry Wagner

Mr. Wagner came to the Installation Department of the Western Electric Company in 1900 and his first work was on the installation of the first common battery telephone system used in New York. Following this he installed central-office equipment in exchanges throughout the New York district.

In 1914 he worked on the trial installation of semi-automatic panel apparatus in Newark. He later became an equipment installation foreman in charge of a group erecting both manual and dial apparatus in exchanges in New York City. Early in 1923 he transferred as an estimator to the planning and estimating group of the Installation Department, becoming a supervisor of dial system planning and estimating six months later. In 1925 he joined the group in the Apparatus Development Department working on cords, wire and switchboard cable. Through his knowledge of installation practices and field conditions he has been able to assist materially in the development of this apparatus.

Herbert Oldham

Mr. Oldham of the General Service Department joined the Engineering Department of the Western Electric Company in 1918 as a photostat operator. He became a supervisor of the group operating the photostat machines in February, 1944. Since September, 1944, he had been absent due to sickness.

Bell Laboratories Club Activities

Activity	*Chairman*	*Meeting Place*	*Time*
Archery	C. A. Bengtsen	Whippany	Noontime
Art	Fred Frampton	West Street	Tuesday 6:00
	G. P. Spindler	Murray Hill	Tuesday 5:30
	R. M. Sherman	Whippany	
Bowling	Annette Richter (West Street)	West 14th St. Bowling Center	Friday 6:00-8:30
	C. A. Fischer (Murray Hill)	Llewellyn Recreation, Orange, N. J.	Wednesday 7:00-9:00
	C. A. Bengtsen (Whippany)	O'Dowd's Bowling Alley, Pinebrook, N. J.	Friday 6:15-8:30
Bridge	Marion Gray	West Street Auditorium	Monday 6:00
Chess	H. L. Bowman	West Street Auditorium	Noontime
	Helen Benz	Whippany Auditorium	Noontime

Activity	*Chairman*	*Meeting Place*	*Time*
Choral Group	Phyllis Taylor	Summit Y.M.C.A.	Tuesday 5:30
Horseshoe Pitching		Rear of Bldg. T	Noontime
Motion Picture Camera Club	J. C. Vogel	West Street Auditorium	2nd Wednesda 5:45 p.m.
Orchestra	L. E. Melhuish	West Street Auditorium	Tuesday 6:30
Photo Forum	J. H. Waddell	West Street Auditorium	Monday 5:45
Rifle Club	J. E. Schaefer	W. E. Range Kearny	Tuesday 6:30-7:30
Stamp Club	W. S. R. Smith	West Street Conference Dining Room	2nd-4th Mondays Luncheon
Swimming	W. C. Buckland	Summit Y.M.C.A.	Wednesda 6:00-8:00

September Service Anniversaries of Members of the Laboratories

10 years

W. S. Ballantyne
A. L. Bolz
W. B. Groth
Frances Hahn
Margaret Haunfelder
M. L. Peipon

15 years

R. H. Badgley
D. M. Chapin
R. L. Dietzold
C. F. Edwards
W. B. Ellwood
R. R. Galbreath
W. H. Goodell, Jr.
B. D. Holbrook
V. L. Holdaway
J. A. Hole
A. J. Hyatt
S. B. Ingram
C. L. Luke
J. W. Mackay
C. O. Mallinckrodt
R. S. Plotz
W. T. Richards
A. L. Robinson
Thomas Smith
C. F. Spahn
G. W. Willard

20 years

E. H. Backman
W. M. Bishop
M. H. Cook
V. M. Cousins
Joseph Curran
Frank Frohner
J. E. Greene, Jr.
Edmund Ley
A. H. Lince
Doren Mitchell
L. A. Morrison
E. C. Rohr
Nellie Schultz
N. F. Schlaack
F. W. Webb
C. E. Whitney
F. T. Wood

25 years

Mary Dolan
A. A. Hansen
F. L. Hollingworth
W. A. Krueger
F. R. Lamberty
H. K. Leicht
W. G. Sawyer
H. W. Schaefer
G. T. Scheeler
G. F. Schmidt
D. M. Terry
A. E. K. Theuner
G. P. Wennemer
C. F. Young

30 years

A. R. Bonorden
C. D. Hocker
H. D. Peckham
P. W. Sheatsley

35 years

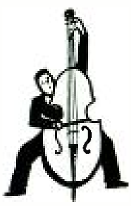
V. H. Heitzmann

40 years

G. W. Weaver

Why Not Join the Orchestra?

The Bell Laboratories Orchestra will resume rehearsals on Tuesday evenings, beginning October 16, from 6:30 to 7:30 p.m., in the auditorium on the eleventh floor at West Street. An invitation to join is extended to all instrumentalists of the Laboratories at West Street and at all other locations and it is hoped that many new members and all the former ones will be on hand on October 16 to start the season off. L. E. MELHUISH, of the Graybar building, is the conductor and J. C. Gabriel, concert master. They wish to stress the fact that, while the orchestra plays serious music, playing with the group is a pleasure and not at all hard work. The Bell Laboratories Club supplies the heavy instruments, such as bass fiddles, 'cellos and drums as well as such unusual instruments as mellophones and "A" clarinets, which are available for use at rehearsal for anyone who wishes to use them. Mr. Gabriel on extension 2132 at West Street will be glad to answer any questions you may have about the orchestra.



Heads Up!

When you hear the captain of an athletic team shout "Heads Up," that's a tip-off that the players are tiring. For one of the first evidences of weariness is relaxation into a slouched posture, with shoulders drooping and chin sagging. Like athletes, folks at desks and switchboards tend to do the same thing. What is worse, as years pass, many of us grow into that head-down, shoulders-rounded position, according to a recent health discussion by Melville H. Manson, M.D., Medical Director, A T & T.

Good posture makes for good heath, confidence, alertness and efficiency and "head and chest up" puts the organs of the body into the best position to do their work. It makes for better appearance, too. Good-looking clothes are doubly attractive on a well-built, well-poised figure. Keep "posture conscious" while sitting, reclining, standing and walking. If you cut a good figure you will feel better, look better and act better. So, heads up!

The Murray Hill Exhibit of the Laboratories 1944 War Developments gave members of the technical staff an opportunity to see what the other groups were doing. Here R. H. Gumley is at the controls of the replica of the Navy Hellcat bomber used with the flight trainer

Lt. Cmdr. Hebert

Lt. F. R. Hanlon

Victor Chirba

R. W. McMurrough

A. F. Bartin

N. A. Popp

R. C. McAdam

Lt. Fitzsimmons

In the Nation's Service

Lieut. Commander C. A. Hebert, on leave from the Equipment Development Department, returned to visit there recently. He was home on a rotation leave from the Philippines where he had been commanding officer of a PT Squadron. His ribbons bear two stars for major engagements in the Asiatic theater and one for the Philippine Liberation. He is stationed at 90 Church Street.

Lieut. Frank R. Hanlon visited the Laboratories after completing B-17 bombing missions over Germany and is now awaiting further assignment as is Victor Chirba, who called at the Labs after completing radio technician's training.

Robert W. McMurrough visited the Laboratories after his return from the European theater. Sergeant McMurrough trained at Ft. Benning, Georgia, and Ft. Jackson, South Carolina, before leaving for England, October 15, 1944. He joined Patton's Third Army at Metz and saw active service in Germany, Belgium and Luxembourg, stopping seven miles short of Czechoslovakia. Later he was assigned to the care of displaced persons on the Continent until wounded in a jeep accident in France near the Moselle River. Sergeant McMurrough wears the Purple Heart, Bronze Star, Combat Infantryman Badge, and the European-African-Middle Eastern campaign ribbon with three stars.

Andrew F. Bartinelli has been work ing in the West Street restaurant while o a 90-day furlough before reporting bac to Walter Reed Hospital for furthe medical treatment.

Nelson A. Popp reports he is unde going training for torpedo bombers a Kingsville, Texas.

Robert C. McAdam expects to be i Newport News, Virginia, for a while be fore being assigned to permanent dut and is working in the mess hall there

Lieut. Lawrence G. Fitzsimmons i teaching communications at Harvard.

Paul R. Brookman, RT 2/c, has com pleted primary and secondary schoo training in radio, receiving and trans mitting, sonar, and radar, and has beer assigned to the aircraft carrier *Kearsarge* still under construction.

On a recent visit to the Labora tories Sgt. Herbert C. DeValve saic that he was line foreman in Boogola India, for the first 200 miles of the Calcutta-Tinsukia pole line running alongside the CBI oil pipeline, the longest pipeline in the world. His unit was citec for having the least amount of trouble or the line and for efficient maintenance of communications. Sgt. DeValve, who is hospitalized at Rhoads General Hospita as a result of an old injury, expects to receive his C. D. D. (Certified Disability Discharge) the first of next year.

P. R. Brookman

H. C. DeValve

Lt. R. E. Yaeger

J. E. Cronin

W. J. Perry


J. J. Lantz


G. J. Van Delft


Lt. F. R. Hulley


Comdr. C. Unnevehr


Lt. A. R. Suneson

Lieut. (jg) Robert E. Yaeger is adar officer aboard the recently comnissioned baby flattop U.S.S. *Saidor*.

John E. Cronin and William J. Perry were both home on leaves and ad been assigned to new camps awaiting urther instructions from the Army.

John J. Lantz, who formerly worked t the Naval Research Laboratory in Vashington as a civilian, has now been issigned to active duty there with the ating of Acting Chief Petty Officer.

George J. Van Delft visited Louise Van Bergen and L. B. Eames while en route to Camp Rucker.

Lieut. Frank R. Hulley returned rom completion of bombing missions in Italy and reported to Atlantic City for reassignment after visiting the Labs.

Comdr. Clarence Unnevehr is now stationed at the Naval War College, Newport, Rhode Island, for a six-month course. Comdr. Unnevehr, who has twice been awarded the Bronze Star, has returned from sea duty after three years on a light cruiser. During that time, he participated in the capture and defense of Guadalcanal, the battle of Rennell Island, the New Georgia campaign, Bougainville campaign, Bismarck Sea actions, Western Carolines, capture of Leyte, and the Mindoro-Luzon campaign.

Lieut. Austin R. Suneson was a visitor at West Street in the late summer. He had previously seen action with both the Atlantic and Pacific Fleets and was on leave prior to picking up a new boat.

Valentine Sanchez recently visited the Laboratories after extended duty with the Merchant Marine.

Capt. Helen G. Adams is executive officer in charge of a unit of nurses now in the State of Washington awaiting shipment overseas.

Lieut. Col. Robert W. Harper made a 15,000-mile trip to thirteen different islands, six of which were in the Philippine group. One of these was Zamboanga where he went to a Moro headhunters village and was glad to get away all in one piece.

Lieut. Commander V. M. Meserve visited D. D. Haggerty and other friends at Bell Laboratories while on a leave from the Naval Air Modification Unit at Johnsville, Pa. He is responsible for the flight testing of all special radio and radar equipment there.

Thomas Kelly, after a month and a half at Sheepshead Bay, has been assigned to a five-month course at the Hoffman Island Radio School from which he expects to graduate as a Second Class Radio Operator.

Joseph A. Ceonzo, back from the South Pacific, has returned to his base. Some of the engagements in which he has participated have not yet been cleared by the Navy.

Edward A. Hake has gone to the West Coast for reassignment.

Robert W. Mortimer, a former member of the Laboratories, has reported to Camp Shelby, Mississippi.


Valentine Sanche


Capt. H. G. Adam


Lt. Col. Harper

R. W. Mortimer

E. A. Hake

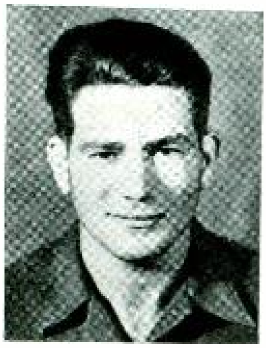
J. A. Ceonzo

Thomas Kelly

Lt. Cmdr. Meserv

F. J. Howe Awarded Bronze Star

The award of the Bronze Star Medal was made to Frank J. Howe "for heroic achievement in action, January 13, 1945, in Germany. The advance of Corporal Howe's platoon was met by heavy enemy fire and a number of casualties resulted. Realizing that the enemy fire would have to be neutralized to prevent further injury to the wounded and to permit their evacuation, Corporal Howe crawled forward alone a distance of fifty yards and opened up on the enemy with his automatic rifle. His accurate fire inflicted casualties and compelled the enemy to withdraw, thereby permitting the evacuation of the wounded as well as a further advance by the platoon." Mr. Howe, a member of the Plant Department, has a sister, Evelyn Houlihan, who is an operator on the Laboratories' PBX.



F. J. Howe

John Mosko

"Greetings from New York for a change—a nice one to be sure. Flew up from Charleston to Rhoads General Hospital where for the time I make my home. The hospitals in the ETO were very good, but here we have all of the things that were lacking—the little things that we take for granted back home but that are missed so much over there—being able to buy ice cream, potato chips and non-rationed candy in the PX and soda fountains, and then being able to pick up a phone and talk to someone.

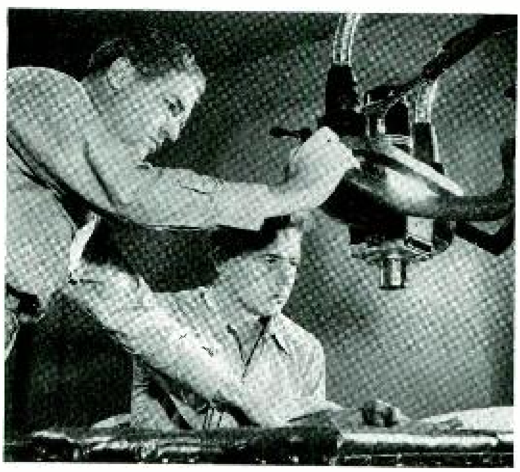
"I never did meet anyone that I knew while I was over there. One funny thing happened on the way back though. Two chaps from the 83rd were returning. It turned out that we all came over on the same trip of the Queen, got into the same outfit, one was in my platoon for awhile, we were all hit on the same day and were coming back on the same boat. We certainly caught the devil in those mountains in the closing days."

Robert F. Rennick

Robert F. Rennick, of the Equipment Development Department, was chosen by *Parade*, Magazine Section, August 19, 1945, to illustrate *Shangri-La for the Wounded*, a four-page picture article showing the ideal surroundings and treatment given to convalescing veterans. The eleven shots taken were made at one of America's most lavish resorts, the former Greenbrier Hotel in West Virginia, which was taken over by the Army and transformed into a 2,000-bed servicemen's hospital with its luxurious facilities retained. They show "Bob," a typical convalescent, receiving expert medical attention, relaxing in his room, which is a former thirty-dollar-a-day suite, enjoying sports facilities of the resort and sunning himself on the terrace with a group with whom General Eisenhower stopped to chat.

A. L. Blaha

"I have had a swell trip and now I'm on the way to Panama. We were finally allowed shore leave at a great naval base at the southern end of a string of islands and have yet to see so much construction work per square mile in my life. The Navy has strict rules for shore leave and under our first assistant engineer about twenty of us started



Robert F. Rennick is shown receiving treatment for a skin disease, known as "Jungle Rot," which he contracted while serving with the Signal Corps in the South Pacific. This is one of eleven pictures in an article "Shangri-La for the Wounded," which he demonstrated for Parade, *August* 19, 1945 for Hoover Park, a spot to swim and have refreshments. Water buffaloes, palm and coconut trees were in abundance as were good roads. The beach was narrow and shallow on a water inlet with much mud and coral around, with the ocean surf about one-half mile away where you were not allowed to swim.

"Saw movies at a seabee camp in an arena lined with coconut trees and it was very pretty. The movies were a little old but OK. Showers come and go with amazing quickness and at a show you get at least one drenching."

Pvt. William G. Schiff Killed in Action

William G. Schiff, 1911 - 1945

Private William G. Schiff was aboard an LST sailing from New Guinea to the Philippines when his ship was torpedoed by a Japanese submarine. Listed as missing in action since February 11, 1945, the War Department has now declared him killed in action. Private Schiff, formerly a porter in department 7521, was with the Laboratories eight years before entering military service on April 7, 1944. He trained with the infantry at Camp Croft, South Carolina, and left for overseas service in December, 1944. He is survived by his wife, FLORENCE D. SCHIFF, who started work with the Laboratories shortly after he was granted his military leave of absence. She continues to take care of their two children during the day and works part-time on the Blueprint Department night shift.

Isadore Bernstein

Isadore Bernstein visited the Laboratories recently. After basic training at Fort Bragg, he received special training in mountain warfare with the 604th F.A., 10th Division. After reaching Naples in January of 1944, his division proceeded to Leghorn under plane cover along the coast. They dug in at Belvedere where it was his duty to handle all incoming ammunition. His division spearheaded the big push with Germans 200 yards in front of them, 500 yards on the right, and 1,000 yards on their left. A narrow escape occurred when the fox-hole he had just left received a direct hit from shellfire. They covered 125 miles in less than five days and heard in Reva that the war in Europe was over. Pfc. Bernstein remarked that the message was carried by church bells all along the Po Valley. His division later went on to Tarcento near Trieste to keep an eye on developments there.

Lieut. Col. William H. Edwards

Lieut. Col. Edwards reverts to inactive status October 8 and returns to the Laboratories after a distinguished period of military service. He was officer-in-charge of the Wire Systems Sub-Section at the Office of the Chief Signal Officer where he reviewed all Signal Corps field training and technical manuals to provide a basis for improvements in wire and radio systems coördination. From there he went to Fort Monmouth as officer-in-charge of the Standards, Materials, and Test Section. As second in command, he frequently served as Acting Director of the Fort Monmouth Signal Laboratory.

In April, 1944, Lieut. Col. Edwards went to the European theater as commanding officer, Enemy Equipment Intelligence Service Detachment 10 (Signal) and saw combat service in Normandy, Northern France, Ardennes, Rhineland, and Central Europe. He was responsible for collecting, examining, evaluating, and studying all enemy signal equipment and documents having technical intelligence value for Military Intelligence Branch, OCSO, and Technical Liaison Division, Signal Section, Hq., ETO. Colonel Edwards issued over 21 technical reports on captured German radio and radar equipments and over 25 field reports on ground radar and radio installations, including the first captured radio components of V-2 rockets. He sent back for further study in the U. S. over 1,300 different types of desired captured signal equipment, including a trainload of mobile radar equipments not previously captured, and complete equipments of latest types from the German Air Force Experimental Radar Station at Kothen, Germany, and the Luftwaffe School for Communication Troops at Halle, Germany.

For the Signal Officer of the Fifteenth Army, he directed and organized ten field teams in an urgent preliminary physical survey of the communications industry factories in the Rhineland for the German Production Control Agency. He issued 53 detailed reports on 182 factory targets covered in a period of two weeks for which work a letter of commendation is being forwarded by the Signal Officer, Fifteenth U. S. Army.

JOSEPH M. MILLS

Joseph M. Mills

Another returned veteran of World War II is Joseph M. Mills, who has been welcomed back to the Plant Department at Murray Hill. Mr. Mills took his boot training at Newport, Rhode Island, and attended gunnery school at Chelton, Virginia. He served with a naval gun crew aboard a tanker carrying oil, gasoline, and planes, and touched at England, Ireland, Australia, India, Iran, Iraq and South America in his travels. Prior to his discharge, he was transferred to a supply unit, trained at San Bruno, California, and assigned to the Oakland Supply Depot.

Leaves of Absence

As of August 31, there had been 1,005 leaves of absence granted to members of the Laboratories. Of these, 82 have been completed. The 923 active leaves were divided as follows:

Army 513 Navy 307 Marines 28
Women's Services 75

There were also 19 members on merchant marine leaves and 16 members on personal leaves for war work.

Recent Leaves

United States Army

Raymond H. Beyer, William E. Maier
Frank B. Catalanello, W. Alfred Arny

United States Navy

Robert M. Gambon, John J. Lantz, Jr.
Frank L. Petry, Jr.

Lieut. George Bukur

Lieut. George Bukur has returned to the Laboratories after five years in military service. Starting as a private in the infantry, he was successively promoted to corporal and staff sergeant. Following Carolina maneuvers with the 71st Infantry, he was assigned to West Coast protection and later entered Officer's Candidate School where he received his commission in the Signal Corps in August, 1942. His promotion to 1st Lieutenant occurred June 7, 1943, at which time he was Plans and Training Officer at Camp Edison, N. J. In September, 1943, Lieut. Bukur attended a four-month course for the study of the Mandarin language at Yale University. Leaving for China in January, 1944, he arrived after two months by way of India "over the hump" and visited Kunming, Hengyang, Lingling, Kukonz and Kweilen from which he evacuated when it fell to the Japanese. In Southern China, Lieut. Bukur saw service along the Red River. He was Signal Officer for a Chinese Division in addition to which he did topographic work and interrogation of Japanese prisoners by means of a Japanese interpreter. Through the strain of his duties and a diet deficiency, Lieut. Bukur was hospitalized March 9, 1945, and

303 veterans of World War II have been employed by the Laboratories

evacuated to the States in May. Following his release on July 11, he enjoyed his terminal leave at home and vacationed in the Catskill Mountains and Maine before reverting to inactive status October 1.

Lieut. Emile H. Munier

Lieut. Emile H. Munier, of the 8th Air Force, visited the Laboratories while on terminal leave before reverting to inactive status, effective August 11, 1945. A pilot of a B-24, he had completed his tour of thirty missions over Germany during which they bombed Hamburg twice, Magdenburg four times, and Berlin once. His return home by Liberty ship was eventful, as his ship hit an iceberg when the convoy streamed through an ice field. Lieut. Munier plans to attend Cornell in the fall to study mechanical engineering.

Millicent M. Whitlock

Millicent M. Whitlock has returned to work in the Circuit Files after more than one year in the Waves following her discharge on V-E Day. Boot training at Hunter College was followed by a one-month course in the Hospital Corps School, Bethesda, Maryland. Transferred to the Chelsea Naval Hospital, Chelsea, Mass., as a Hospital Apprentice First Class, she did general ward duty and was given an individual course in electro-encephalography which causes even Miss Whitlock to hesitate in its pronunciation and is more popularly known as the study of "brain waves." After receipt of technician papers, she applied this training in Neuro-psychiatric Service at that location and at Sampson, N. Y.

John J. O'Shea

John J. O'Shea has returned to the Plant Department of the Laboratories after having spent three years and two months with the First Army. He was trained at Fort McClelland and at Camp Edwards before leaving for overseas duty that lasted thirty-three months. After having been stationed in Northern Ireland, England and Scotland, he fought in the invasions of Africa, Sicily and Italy and, later, the Normandy invasion. He also fought in Holland, France, Belgium and Germany and came home unscathed with six battle stars to his credit.

R. R. Stephens

Millicent Whitlock

Lt. Col. W. H. Edwards

Lt. E. H. Munier

Lt. George Bukur

J. J. O'Shea

Robert R. Stephens

Robert R. Stephens returned to Whippany from military service after continuous duty with the Marine Corps since May, 1943. He was engaged in maintenance of radio and radar on transient aircraft in Guam and Peleliu. Robert, along with several other returning veterans, is now taking advantage of the educational provision of the "GI Bill of Rights" at Iowa State College.

Ensign Bertrand H. Sommer

Ensign Bertrand H. Sommer, Jr., third mate aboard a Victory ship, has been to Suez, Aden, Karachi, Bombay, Capetown, Montevideo, and Buenos Aires where he managed to order a chocolate sundae and chocolate milk shake in Spanish. THOMAS WALSH, who used to work as a draftsman on the 4th floor, introduced himself to Ensign Sommer in Bombay after spotting his picture in the RECORD. A German U-boat surrendered just a few hours after they arrived in Buenos Aires, and Ensign Sommer said they must have passed it coming up from Montevideo.

Lieut. Fred J. Schwetje

Lieut. Fred J. Schwetje visited the Labs after his return to the States following completion of a tour of duty in the Marshalls and Gilberts. He flew his Corsair on bombing and strafing runs over the by-passed islands of Wotje, Ponape, Milli, and Jaliut, knocking out Japanese gun positions and bivouac areas, and inflicting terrific damage by the use of fire-bombs.

His only mishap overseas occurred while on an oxygen-gunnery training hop. Flying at 15,000 feet, his plane's engine "froze," forcing him to bail out. Fortunately, he was flying almost directly over a medium transport which picked him up shortly after he parachuted into the water.

Lieut. Fred J. Schwetje, 4th Marine Air Wing, gets a welcome back from R. C. Benkert (recently returned from the Army Air Corps), Clara Peschl and A. B. Kvaal

Military News

WILLIAM J. MCKEE, AERM 3/c, spent a cool summer on the Atlantic aboard a weather ship observing and reporting weather conditions for the Navy.

GEORGE BEHRINGER says he uses Western Electric equipment as a radioman on a PT boat based at Melville, Rhode Island.

HENRY G. PETZINGER, who is now a sergeant at Frankford Arsenal, visited the Murray Hill Laboratory. His wife and family are living with him in Philadelphia. Although enjoying the experience at Frankford Arsenal, he indicates that he will be very glad when he can return to his own home in Summit and his work in the Laboratories.

EDWARD H. BUEB has a new Army job in the Labor Control Office in the Philippines supplying Filipino laborers to the Army Service Group taking care of the payroll, feeding, and transporting of the men. Previously, Cpl. Bueb had been to New Caledonia, Guadalcanal, Munda, Vella Lavella, Stirling Island and Biak.

LIEUT. ARTHUR R. PARKER paid a short visit to the Laboratories on his way back to the Marine Corps Auxiliary Air Field, Eagle Mountain Lake, Texas, where he continues his training connected with the radar equipment of a Black Widow fighter.

JOSEPH O'KEEFE heard from CARMEN MARSICOVETE that the latter's group went in with the assault waves to set up communications. Mr. O'Keefe has seen some excitement himself which the censor would not then permit his telling.

JOHN P. MAHONEY has been awarded the Combat Infantryman Badge in recognition of his exemplary performance of duty in ground combat against the enemy. He participated in the Rainbow Division's 450-mile smash from the Hardt Mountains of France through the very heart of Southern Germany to the Austrian border. His division captured the center of Munich and liberated 32,000 persons at the infamous concentration camp of Dachau.

GOLDEN B. CLARK is attending Aviation Machinist's Mate School in Norman, Oklahoma, for a twenty-three-week course covering the theory of flight, flight controls, theory of hydraulics, practical work on the hydraulics in the airplane, and gunstripping. Upon completion of this course, he will go to gunnery school and from there go to operational flying at some naval air base in the States.

THE FOLLOWING MEMBERS of the Laboratories on military leave have recently been promoted: Lt. Comdr. C. A. Hebert; Capt. Helen G. Adams; Wilfred Bauer, MM 1/c; George Behringer, S 1/c (RM); Donald E. Blesse, AEM 3/c; Lt. (jg) John R. Boyle; Nicholas Brady, MM 2/c; T/4 Herbert J. Braun; 1st Lt. Edward J. Bybel; Lt. (jg) William H. Christoffers; Pfc. James DeG. Cuyler; T/Sgt. Robert W. Dawson; Franklin J. Dempsey, S 1/c; William J. Douglas, S 1/c; Charles J. Efinger, MM 1/c; Herbert J. Fischer, S 2/c; Pfc. Richard I. Forrest; Lt. (sg) Halsey A. Frederick, Jr.; Pfc. Gilbert Goodman; Edward A. Hake, RT 2/c; 1st Lt. Frank R. Hanlon; William E. Howard, AOM 3/c; Andrew M. Kurutz, Soundman 2/c; Arthur Leonhardt, S 2/c; Charles A. Liscum, ART 3/c; Sgt. Stanley P. Maschke; Joseph Mazzi, MAM 3/c; Robert C. McAdam, S 2/c; Pfc. John J. Mosko; Leon P. H. Newby, MMS 2/c; Sgt. Anthony J. Osinski; 2nd Lt. John G. Phillips; Pfc. Vincent J. Piano; T/3 Martin E. Poulsen; Ens. Ellsworth R. Rosen; T/Sgt. Warren C. Rouse; Frederick E. Schellhorn, RT 1/c; George A. Sharp, S 1/c; T/5 William J. H. Thoele; Frances V. Tracy, AerM 3/c; Comdr. Clarence Unnevehr; Richard G. Urbanek, HA 2/c; and 2nd Lt. William Wiegmann.

JAMES M. SULLIVAN, attached to Headquarters, has two battle stars from his tour of duty through Brittany, Burgundy, and Luxembourg in connection with maintaining communications for the 3rd and 12th Armies.

Lieut. Gen. Frederick E. Morgan, Deputy Chief of Staff, SHAEF, pinning the Order of the British Empire on Lt. Col. Thomas A. McCann, Frankfurt am Main, Germany. The medal is separate from the citation and both highly prized honors were awarded Lt. Col. McCann

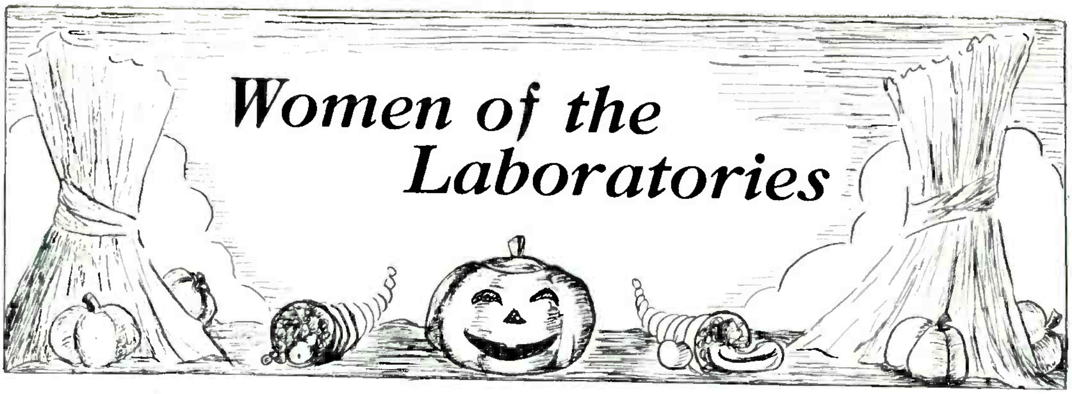
He met LEE GLEZEN in Rennes, and enjoyed the July, 1945, article concerning his work as it described conditions with which he is familiar.

THOMAS JOHNSON says that the RECORD helps him in his work of handling radios in the Navy overseas and mentions that they have been working with the Australians "who are great fighters."

JOSEPH HILL visited the Labs last month to see his friends before reporting back to Chicago to instruct classes in fundamental principles of radio. He received his training at Wright Junior College Radio School, Gulfport, Mississippi, and at the Navy Pier in Chicago where he attended an 88-hour course at the Teacher Training School.

JOHN J. COZINE wishes to say "hello" through the RECORD to all of his many friends in the Laboratories of whom he often thinks. He is in Manila where he says the people are already engaged in rebuilding, setting up businesses, and reopening their schools and universities. The city, even in its destroyed condition, looks better to him than did New Guinea and the islands "down under." The people, although small in stature, have an unbelievable power to carry heavy loads on their heads and shoulders, and he says they also have immeasurable patience for starting and finishing seemingly almost endless tasks.

Women of the Laboratories



Among the war brides who are marking time awaiting the return of their husbands is Doris Rich, whose husband, an Army engineer, has been in the Pacific for a year and a half. Doris graduated from Curtis High School, Staten Island, and attended New York University evening school where she majored in secretarial studies. She came to the Laboratories Transcription Department eight years ago and also spent a short time in the secretarial service group of the Apparatus Staff Department. Most of her Bell System service, however, has been spent in the General Accounting Department where she is secretary to J. S. McDonough, Chief Auditor and Methods Supervisor.

Doris is very fond of music, plays the piano and sings in her church choir. She is also active in many sports and especially likes horseback riding and skiing.

* * * * *

The Deisters, Dorothy and Marie, are sisters-in-law who had been busy as mothers and housewives for many years until Marie's brother, John S. Leonard, a New York Telephone man on loan to the Chambers Street Laboratories, told them of the urgency of war work at 463 West Street. Marie had at one time worked on a machine so that, while the training was different, it was not new, but Dorothy's previous business experience had been as a bookkeeper. They were hired by the Development Shops Department and were the first women to be trained to do terminating on a detail of secret equipment for B-29's. Both women have two children and are married to brothers, one of whom, Marie's husband, is Edward H. Deister of the New York Telephone Company.

Dorothy and Marie Deister

Doris C. Rich

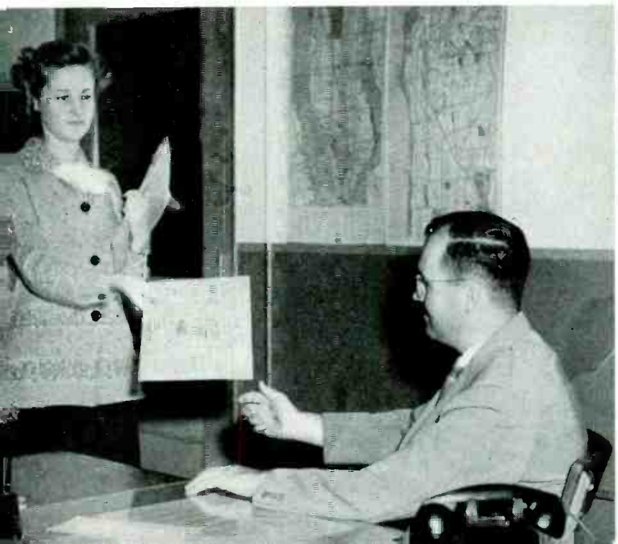
Thelma Condon

Now that we're back on a five-day week, Thelma Condon hopes to spend a lot of time out in the open trying her hand at horseback riding and tennis and learning new ones such as tobogganing and skiing, which are on her agenda, in order to help her to forget the war. Two of her three brothers served in combat with the AAF and her fiancé paid with his life in a B-24 over Germany. Miss Condon does stenography, typing and filing for the Stock Control, Special Studies and Rationing groups of the General Service Department at Fourteenth Street. She is a graduate of Walton High School in the Bronx and formerly worked with the Metropolitan Life Insurance Company. Even before Pearl Harbor, she served suppers to servicemen each Saturday from five to seven-thirty p.m. at the NCCS Canteen and then danced with them until midnight. She is a cousin of Mildred Suits also of the General Service Department.

* * * * *

Laurel Neild's one regret about Bell Laboratories is that she did not come here immediately after her graduation from Montclair State Teachers' College in August, 1943. Instead she taught high school for a year as a promise to her mother, the supervisor of music in Wayne Township, and she spent a short time as a technical assistant elsewhere before joining the Electronic Apparatus Development Department. Miss Neild plots curves and makes numerical computations translating engineering data from braille for Dr. C. M. Witcher, whose technical assistant she is, in addition to her regular work of cold-testing magnetrons, building equipment, and when necessary doing machine shop work. A math major, she has done graduate work at Columbia, and this term is studying electrical engineering there three nights a week. While she enjoys woodworking, painting and golf, Miss Neild devotes most of her free time to sailing her seventeen-foot sailboat.

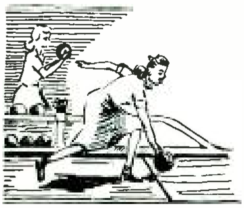
Monica Schembeck of the Mailing Department is shown on her route at the desk of E. F. O'Neill at Graybar-Varick. During vacations Monica acts as the relief dispatcher



Laurel Neild is shown recording data on tests of magnetrons at a cold-test bench with Dr. C. M. Witcher, a blind engineer, whose technical assistant she is

B.T.L. Girls Bowl Friday Nights

Fifty girls have joined the B.T.L. Women's Bowling League and are bowling on Friday nights from 6:00 to 8:30 p.m. at the West Fourteenth Street Recreation Center, 345 West 14th Street, New York City. ANNETTE RICHTER, chairman of the League, feels that many girls may now be interested in bowling who were planning on having to work overtime when the Bowling League desk-to-desk notice circulated. Those interested in joining now are asked to call Miss Richter on extension 613.



* * * * *

To MARGARET ARONOFF goes the distinction of being a third generation member of the Bell System. Her father is A. S. Hedeger of The Pacific Telephone and Telegraph Company; her grandfather, Frank Worrall, retired from the Commercial Department of the same associated company; and just to round matters out, her sister, Nancy Hedeger, is a service representative there. A science major, Peggy graduated from the

BETTY FLYNN

Margaret Aronoff, a third generation Bell System employee

University of California where she later worked in the registrar's office. She was also with the San Francisco Port of Embarkation for six months before coming East to visit her husband's family. New York took her fancy—sightseeing is still her chief hobby—and because her husband is overseas she stayed here and became a member of the Laboratories. As a technical assistant she does engineering work in connection with the fabrication of small models of telephone equipment. In addition Peggy also maintains records and charts for various projects.

* * * * *

RUNNING AN ELEVATOR at Bell Laboratories during the war was exciting as well as vital work, BETTY FLYNN thinks. The number of high ranking Army and Navy officials resplendent in gold braid; the drawings of secret equipment carried from floor to floor; and the snatches of talk on the war made her job far different from the one she had held previously for six years, nurse's aide at the Flower Hospital. Betty is the mother of three-year-old Wallace whose dad is with the army of occupation in Europe; and she is the sister of MARY and VERONICA BERNOWICH, both of the Laboratories.

Blood Donor Service Closes

The National Headquarters of the Blood Donor Service of the American Red Cross has closed the New York Center of the Blood Donor Service. The employer-employee coöperation has been outstanding, and due to this coöperation the Red Cross has been able to keep the blood flowing steadily to the European and Pacific theaters of war according to the quota set by the Army and the Navy. This knowledge will be a source of great and lasting satisfaction to all blood donors. However, the real gratitude comes from our boys whose lives have been saved by the blood donors and in their name the Red Cross says a sincere "thank you" to each and every one who has had a part in this vital war service program.

News Notes

C. A. Lovell delivered a lecture, *The Electrical Director's Conquest of the Robot Bomb*, on August 31 at Purdue University. Members of local engineering societies were present as well as students, the faculty and members of the Indiana Bell.

Life-saving classes were concluded last summer at the Summit Y.M.C.A. pool for members of the Murray Hill and Whippany Laboratories. They were under the auspices of the Red Cross with J. B. DeCoste, L. Ferguson, W. C. Buckland and Florence Mowbray as instructors. Two special outdoor sessions were held to include boating work. The photograph above shows a demonstration of a canoe rescue and the one below, members of the class

W. H. Doherty, who recently spoke at the Corpus Christi Training Station, with Commander P. A. Sugg of that station

W. A. SHEWHART has been reëlected to membership on the Advisory Council of the Department of Mathematics of Princeton University for a three-year term.

AS THE EXECUTIVE CHAIRMAN of the Communications Committee of the War Production Board, G. D. EDWARDS has been largely responsible for the selection of the investigators and of other personnel on the American side for the comprehensive survey of the German communications industry. Preliminary estimates indicate that on balance the Germans were substantially behind American industry in the communications field. J. R. TOWNSEND and PIERRE MERTZ, who went to Germany in connection with the Communications Committees investigation, are shown on page 387 of this issue.

W. H. DOHERTY addressed three thousand Navy men on August 28 at the Naval Air Technical Training Station, Corpus Christi, on *Microwaves in Radar and Communication* which was the third in a series of discussions on "The Electronics World of Tomorrow." The men at the Training Center are undergoing a course in the servicing and maintenance of airborne radio communication and radar equipment. Mr. Doherty was accompanied by C. J. Unger of the Western Electric Field Engineering Force.

N. R. FRENCH and J. C. STEINBERG presented a paper, *Factors Governing the Intelligibility of Speech Sounds*, on May 12 at the thirteenth meeting of the Acoustical Society of America in New York City. W. A. MUNSON also presented a paper, *Relation Between the Theory of Hearing and the Interpretation of Speech.*

H. E. MENDENHALL and R. K. POTTER, alumni of Whitman College, have been elected to the Phi Beta Kappa chapter at the college.

R. A. SYKES conferred on crystals with the Bureau of Ships and the Naval Research Laboratory at Washington.

I. E. FAIR visited Hawthorne in connection with quartz crystals.

W. J. KING discussed high-voltage cables and connectors at Hawthorne.

L. J. LABRIE correlated certain information for crystal oscillator test sets during a visit to the Philadelphia Distributing Shop of the Western Electric Company.

C. W. THULIN was at Haverhill in connection with tests of pulse transformers.

AT THE BUREAU OF SHIPS, Washington, D. C., A. J. CHRISTOPHER and R. S. BAIR discussed matters relative to the use of silvered mica capacitors in radio communications equipment for the Navy.

R. R. MACGREGOR visited the Standard Transformer Corporation in Chicago to study the impregnation of power coils.

Engagements

*Ernest Buehler—*Eileen Brown
*William Cunningham—*Frances Murphy
George J. Hillyer, U. S. Navy—*Yvonne Ousset
Timothy M. Monahan, U. S. Army—*Mildred A. Irwin
Anthony C. Repetti, U. S. Army—*Theresa Rimassa

Weddings

Edward W. Bozzay, U. S. Navy—*Hermina Sabo
Lt. Joseph B. Calise, U. S. Army—*Anne Colosimo
Capt. Joseph Capuano, U. S. Army—*Margaret Beazell
Joan Colcord—*R. J. Shank
Gerard R. Porter, U. S. Navy—*Ruth J. Doll
Raymond A. Tavares, U. S. Navy—
—*Marcelle M. Lesire, U. S. Navy
John J. Walsh, U. S. Army—*Beatrice A. Balbach

*Members of the Laboratories. Notices of engagements and weddings should be given to Mrs. Helen McLoughlin, Room 803C, 14th Street, Extension 296.

Obituaries

Albert L. Thuras, a member of the Physical Research Department who was on personal leave of absence at the Navy Underwater Sound Laboratory, New London, died suddenly on September 7. Mr. Thuras was graduated with a B.S. degree from the University of Minnesota in 1912 and received an E.E. degree from the University the following year. For three years he was with the National Bureau of Standards in Washington and then spent a year in the study of physics at Harvard. From 1916 to 1920 he was an oceanographer for the Coast Guard, his work consisting of the development and use of continuously recording instruments for measuring the temperature, salinity and density of the sea water in the iceberg region off the Grand Banks of Newfoundland.

In 1920 Mr. Thuras joined the Laboratories where, until 1941, he was continuously engaged in the study and development of electro-acoustic instruments. In this work he formulated many of the fundamental design principles of microphones, receivers, and loudspeakers and contributed to the development of the techniques of acoustic measurements as applied to the calibration and the laboratory study of such instruments. A noteworthy contribution in this field was his development of the self-supporting edge-wound ribbon receiving coil used in most of the Western Electric Company's moving coil instruments. He was associated in the development of sound pictures both for production and for presentation in the theaters.

In July, 1941, Mr. Thuras was granted a

J. H. Cozzens
1888-1945

Catherine Kelley
1901-1945

V. P. Thorp
1893-1945

A. L. Thuras
1888-1945

leave to join the National Defense Research Committee at the New London Naval Base. He played an important part in developing sound devices for submarines used by the Navy on hundreds of patrol missions and contributed materially in the field of submarine communication and sounding instruments and made important contributions to many devices involving hydrophones and loudspeakers. Since last March he had been continuing this type of work with the underwater sound group of the Naval Research Laboratory at the same location.

* * * * *

Vaugh P. Thorp of the Systems Development Department died suddenly on September 4. Mr. Thorp, after serving a year and a half in the U. S. Army Air Service, returned to Purdue University from which he graduated in 1919 with a B.S. degree in Electrical Engineering. He joined the Engineering Department of the New York Telephone Company where he was engaged in studies of toll fundamental plans until his transfer in 1921 to the Department of Development and Research of the American Telephone and Telegraph Company. From then and up to 1942 he had been continuously engaged in problems of development, trial, and standardization of carrier-telegraph systems. This included the first transcontinental high-frequency carrier-telegraph system, systems for the Cuba cables and the present widely used voice-frequency carrier-telegraph systems.

In 1934, when the D & R merged with the Laboratories, Mr. Thorp continued this work in the telegraph facilities group of Systems Development. Since early 1942

Mr. Thorp had been an instructor in radar courses at the School for War Training and had also assisted in the preparation of Instruction Manuals for the Armed Forces on the maintenance and operation of Laboratories-developed war equipment.

* * * * *

John H. Cozzens, a member of the Patent Staff, died on August 19 after a long illness. After he received his M.E. degree from Stevens Institute of Technology, Mr. Cozzens was with other concerns until 1919 when he joined the Apparatus Development Department of the Laboratories. After working with the special order, design, and specification groups, he transferred to the Patent Department in 1923 where he was concerned with patent phases of low-frequency signaling devices and with general equipment until 1926. Following this he was successively with the patent groups handling magnetic alloys, acoustics and carrier current wire systems; radio transmission and modulation systems; and general and carrier line transmission, amplifier and repeater circuits and loading.

In 1934, Mr. Cozzens transferred to the group handling foreign patents with some work on coin collectors, transformers and loading coils. Just prior to his illness he had been concerned with investigations of outside inventions that might be pertinent to the telephone industry.

Catherine Kelley died on August 26 after an extended illness. She had been supervisor in the Central Files of General Service Department in charge of the routing of Engineering Mail and of the Correspondence Index. Miss Kelley joined the Engineering Department of the Western Electric Company in 1918 and since early in 1919 had been in Files. At one time she had been active in interdepartmental sports at the Laboratories. She had travelled considerably and enjoyed good music, but her chief interest was in reading.

News Notes

Redesign problems on networks kept C. T. Wyman at Hawthorne for a month.

P. S. Olmstead discussed plans for service tests on textile fabrics with the Philadelphia Quartermaster Depot. Interest in improved precision in test results on textiles has been stimulated by the Walker-Olmstead paper on *A Yarn Abrasion Test* in the June issue of the *Textile Research Journal.* This paper has been presented in a formal manner before eight audiences since October, 1944, and is recognized as an important contribution to textile research.

Mr. Olmstead attended a meeting in Montclair of a special committee of the American Statistical Association. He is chairman of this committee.

AN AWARD TO

Bell Laboratories Record

in recognition of outstanding service in the publishing field in behalf of the

AMERICAN RED CROSS

and a meritorious contribution to the success of the 1945 Red Cross War Fund

Presented by the American Red Cross

May 20, 1945