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W. K. OSER
Outside Plant Development

A general purpose tree wire

Bell System open-wire lines contribute about 25 per cent of the total circuit miles devoted to long-distance telephone traffic. As yet, there is no economical substitute for such lines where traffic requirements are light or slow in growth, since circuits can be increased as needed simply by adding pairs of wires to an existing line or by applying carrier systems to existing pairs. Because of the exposed locations in which they are strung, open-wire lines must be protected from foreign contacts, particularly trees. For use where such contacts are likely, an insulated line wire, known as tree wire, is supplied.

Occasionally, tree wire finds uncommon uses. Along the New Jersey shore, it furnishes protection from insistent fish hawks which find the cross-arms convenient nesting places. On the Florida coast, tree wire prevents short circuits that might result from rising or settling ducks, or from the errant tackle of causeway fishermen.

In its principal use, tree wire is found in situations like that illustrated. Since such severe conditions impose difficult problems

Tree wire must be resistant to abrasion and must be able to withstand the deteriorating action of the weather.

for the field forces who string the wire and maintain the circuits, trees are avoided whenever possible by using appropriate private rights-of-way on cross-country routes. Tree trimming is sometimes resorted to, but it is not entirely satisfactory since it is temporary and relatively expensive. At large tree limbs where contacts are localized and heavy, plastic guards have proved practicable. But in ordinary circumstances tree wire is the best expedient, particularly for lines having carrier-frequency assignments. The two long-haul, open-wire carrier systems are the type C, employing frequencies up to about 32 kc, and the type J, whose frequency range extends to about 140 kc.

An insulating cover for tree wire must not only be resistant to abrasion to prevent contact of the conductor against the tree branches but it also must be able to withstand the deteriorating action of the weather. This asks a great deal of any organic material and, until recently, the best wire covering has been only moderately satisfactory.

Originally, tree wire consisted of standard copper line wire in four different sizes insulated with a layer of rubber compound and protected by a heavy abrasion-resistant cotton cover. The cotton was weatherproofed with asphalt-like materials, but their relative impermanence resulted in deterioration of the cotton and eventual failure of the insulation.

Electrically, the cotton-covered tree wire had no shortcomings until objectionable crosstalk was encountered on the type-J carrier system. The difference in the circuit impedances of the tree wire and of the bare line wire proved to be the significant factor at the higher frequencies employed by the type-J system. A new, general purpose tree wire can be used almost unrestrictedly in type-J carrier lines without incurring the transmission penalties resulting from use of the earlier type. This wire comprises a copper-steel conductor with GR-S insulation and a neoprene jacket.

Insertion in any two-wire transmission line of a length of a different type of wire, having a different characteristic impedance, produces reflections at the ends of the inserted length and results in reflection crosstalk. This is proportional to the product of a crosstalk coupling and a reflection coefficient. The crosstalk coupling is roughly proportional to frequency so that the reflection coefficient which can be tolerated is in inverse ratio to frequency. The quantity determining the proportion of the electrical energy reflected at the junction of two infinite transmission lines having different impedances is called the junction reflection coefficient and is represented by the difference of the two impedances divided by their sum. The impedances in question are called the characteristic impedances and at the higher frequencies they approach the surge impedance, defined by the square root of L/C, a pure resistance. Copper open-wire pairs at type-J carrier frequencies have characteristic impedances of about 500 to 600 ohms, depending on wire size and whether the spacing is 6 or 8 inches.

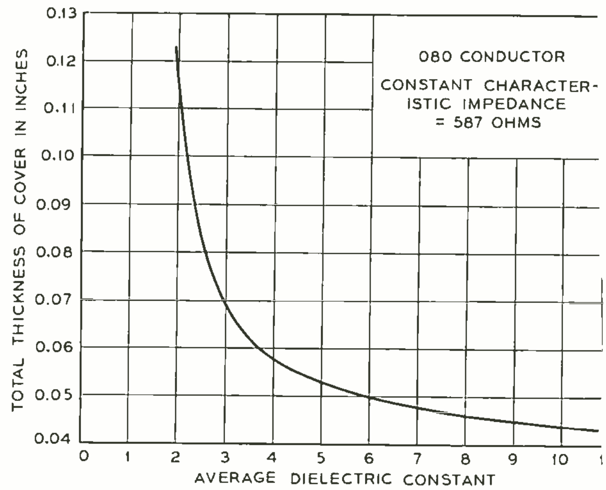

Fig. 1—Cover thickness versus dielectric constant for constant characteristic impedance in a tree wire.

With tree wire, however, finite lengths, each consisting usually of a few span lengths, are installed where required in the open-wire line. The total reflection in a repeater section is a function of the number, length and separation of all the installations which are a matter of chance. To provide for cumulative effects, therefore, the reflection allowed at a single junction should be less than the over-all allowance

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for the whole repeater section. A junction reflection coefficient of not more than about 2 per cent at 140 kc with 8-inch spacing was the requirement which had to be met in designing the new tree wire. Since the line impedance-frequency curve is flat in the carrier range, an impedance match satisfactory at 140 kc will remain so at the lower frequencies.

Due to the higher capacitance resulting from the insulation on the conductors, the impedance of the earlier tree wire was considerably lower than that of the corresponding size of bare copper wire and junction reflection coefficients of about 5 to 6 per cent resulted. This explains the objection to the earlier wire on the type-J carrier system where it was necessary to restrict the lengths installed to keep the crosstalk at tolerable levels.

By increasing the conductor separation, it is of course possible to compensate for the higher capacitance of the tree wire but this would require about double the common 8-inch spacing. To maintain the same separation between pairs, also necessary for crosstalk reasons, pole-head configurations about twice the sizes of those used in the bare wire portion of the line would be needed, an obviously cumbersome and expensive arrangement. A better solution was to decrease the diameter of the tree wire conductor to the extent that the ensuing increased inductance balanced the higher capacitance produced by the insulation.

The design problem was therefore one of correlating the wire dimensions with the dielectric properties of the insulating cover in such a way as to match the impedances of the bare wire pairs. The obvious requirement that the strength of the tree wire conductor be equal to that of the largest size of bare line wire was met through the use of extra-high-strength copper-steel wire. Of the available cover materials, neoprene compound is considered most satisfactory from the combined standpoints of abrasion resistance and weather durability. This is the material employed as a jacket for NP drop wire and B and C block wires, now standard throughout the Bell System. Neoprene, however, is suitable only as a jacket, because its electrical insulating properties are poor. Some type of insulation must therefore be placed under the jacket directly over the conductor.

In Figure 1 the curve illustrates the inverse relationship between total cover thickness and average dielectric constant with the data applying to tree wire having size 080 conductor (0.080 inch in diameter) and a constant characteristic impedance of 587 ohms. This impedance value is the mean of those of 104 and 128 copper open-wire pairs with 8-inch spacing, the reflection limit being liberal enough to allow a single size of tree wire to be used in conjunction with those two sizes of bare line wire.

To enhance abrasion resistance, a thick jacket and thin insulation are desirable. But when the total cover is thick, a low value of average dielectric constant is required, as the curve shows. This calls for thick insulation and thin jacket because the dielectric constant of the jacket material is much higher than that of the insulation.

Such conflicts are not uncommon and a compromise was reached in the final design for which a 30-mil thickness of GR-S insulating compound followed by a 50-mil thickness of neoprene jacket compound were selected as the cover for the conductor.

For use in toll lines only two sizes of the tree wire conductor are sufficient, contrasted with the four sizes formerly required. The smaller size, 080, is for use with both 104 and 128 bare copper. For 8-inch spaced wires the computed values of junction reflection coefficient are 1.9 and 0.3 per cent respectively. The larger size, 104, is for use only with 165 bare copper and here the reflection coefficient is 0.9 per cent. The 080 size is also intended for use in exchange lines where tree wire installations are not troublesome to transmission. Values of junction reflection coefficient given here are within the limit imposed by transmission requirements. They were calculated at 140 kc for 8-inch spaced pairs in dry weather. The effect of variations in wire spacing are small and wet weather coefficients are substantially the same as the dry weather values.

The new wire, designated B copper-steel tree wire, may be used without restriction in high-grade carrier circuits, save in rare instances when the lengths installed may be so great that their higher attenuation would have to be taken into account. Because of its smaller size, as compared with the older variety, the new wire is less expensive and the greater durability of the neoprene jacket is expected to result in longer life, particularly in those parts of the country where weatherproofed cotton braids have proved especially vulnerable.

A crystal weed

It's not a stick of candy that "Pat" Reilly of Analytical Chemistry is examining in the illustration at the left—but a sort of crystalline "weed" that grew in an idle solution of EDT. In case you don't know it, there are two kinds of EDT crystals—the kind that is used in electric wave filters, and is grown with great care in long single crystals; and another kind which has extra molecules of water and is of no value for filters. Careful control of temperature is necessary to be sure the solution lays down the useful crystals and not an irregular mass like this.

L. T. ANDERSON
Switching Development

Senders for No. 5 crossbar

One of the features of the No. 5 crossbar system that distinguishes it from other common control switching systems is that intraoffice calls—calls originated by and completed to subscribers within the office—are established without the use of senders. Neither are senders required on incoming calls. All calls outgoing, however, except those requiring operator assistance, require a sender. Where the called and calling offices are in the same building but are served by different marker groups, inter-marker-group senders may be used, but for all other calls outgoing senders are used.

The chief function of the outgoing sender is to transmit the number to the called office, and since No. 5 crossbar is designed to connect to all existing types of offices, provisions must be made for multi-frequency pulsing, dial pulsing, revertive pulsing, and call-indicator pulsing. This could have been done by providing a single design with a multiplicity of classes, but to reduce the complexity of the design, four general types of outgoing senders are provided, and are designated according to the method used for transmitting the number. Thus there are multi-frequency, dial pulse, revertive pulse, and call-indicator pulse senders.

Unlike the No. 1 crossbar senders, the senders of the No. 5 office do not receive and record the digits one at a time as dialed by the subscriber, but receive them all simultaneously through the marker from either the originating or incoming registers. While the number is being recorded, the sender also records, under control of the marker, class marks denoting any special handling of the call such as fast dial speed or compensation to be added to the loop. The sender also receives from the marker information for the initial entry on the automatic message accounting tape in offices where this system is used. It records this information at the same time it receives the called number and class information, and transmits it to the automatic message accounting circuits as soon as it receives a "go ahead" signal from the marker. This latter signal indicates that the marker has connected the calling line to a suitable outgoing trunk, and that the sender should proceed with its part in completing the connection.

A set of five relays is provided in the sender for recording each digit of the called number, but two, and only two, relays of each set are used to record any one digit. For some types of calls, only four digits are included in the called number, while for nation-wide dialing, eleven digits may be required. The senders may thus include from four to eleven sets of recording relays. The five relays of each set are marked 0, 1, 2, 4 and 7. For digit 0, relays 4 and 7 are operated, but for all other digits, the sum of the two operated relays indicates the digit. Thus 0 and 1 are operated for digit 1, 0 and 2 for digit 2, 1 and 2 for digit 3, and so on. This 2-out-of-5 method of recording provides a check on correct operation, since if fewer or more than two relays are operated, it is evident that an error exists, and a trouble record will be made.

In the registers, digits are also recorded on 2-out-of-5 sets of relays and in the same order in which they are dialed. A particular set of recording relays, therefore, does not always record digits of the same significance. For a call to a local office in an area with only two-digit office codes, for example, the fourth set of relays would record the second digit of the number in the office called. In an area with three-digit office codes, the fourth set of relays would record the first digit of the number in the called office, while with nation-wide dialing systems, the fourth set of relays would record the first digit of the office code. Because of this lack of functional identity, the sets of recording relays are designated A, B, C, and so on, up to L, but excluding I, when the full eleven sets are required.

These digits are transferred from the register to the marker and from the marker to the sender in the same order in which they were dialed, and in both marker and sender are recorded on similarly designated sets of relays. In general, however, the sender does not transmit all the digits it records. To an office in the same area reached over a direct group of trunks, for example, only the subscriber's number is transmitted, even though the office code had been recorded, since the marker has selected a trunk to that office. Although the markers could have been designed to transfer to the will begin with the B digit; while if the No. 3 delete relay is operated, it will begin with the D digit, and so on. Thus, if the number CH3-2468 has been transferred to the sender, the marker, after selecting a trunk to the CH3 office, would operate the No. 3 delete relay in the sender. When the sender is given the "go ahead" signal, therefore, it will begin its transmission with the fourth digit, 2. When automatic message accounting is not provided, however, and when there are no routes to a toll or tandem office, the senders are not equipped to record the digits for the office code.

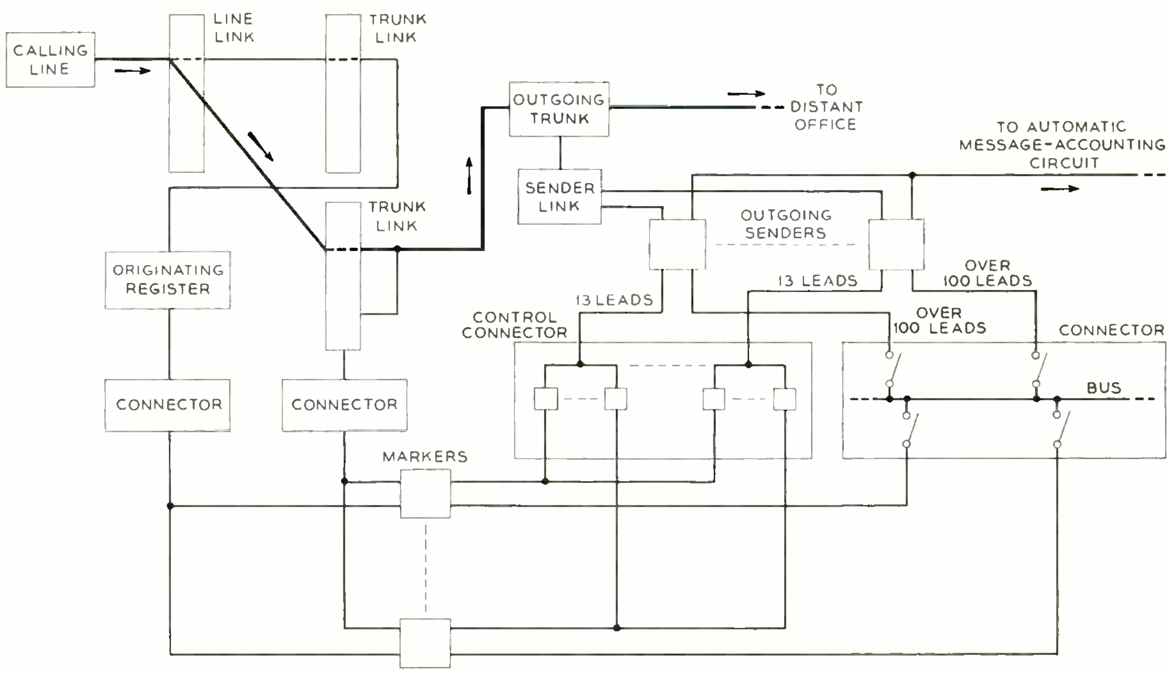

Fig. 1—A block diagram showing lines of association of the sender with other units of a No. 5 office.

sender only the digits it required, or to shift the order in which it transferred them so that in the above example the called station-number digits would have come first, it was found simpler to allow the marker to transfer the complete set of digits it received and in the same order, and then to indicate to the sender the point in the recorded chain of digits at which it should begin sending. This is accomplished by delete relays, of which there may be as many as six in the sender. If the marker operates the No. 1 delete relay, the sender

The first three delete relays are commonly used, but the higher numbered ones are employed chiefly to take care of situations that may occasionally arise with nation-wide or extended-area dialing. The marker can also order the sender to add one arbitrary digit or to prefix "one-one" as special codes under certain conditions.

The lines of association of the sender with other units of the system are indicated in Figure 1. When a subscriber lifts his handset, a marker is seized and connects the calling line through the line-link and trunk-link frames to an idle originating register, which returns dial tone and then records the number dialed. The register then seizes a marker, transfers the digits to it, together with certain other information, such as the equipment location of the calling line. The path through the link frames, over which the register was connected to the calling line, is broken down after the trunk has been selected. The marker, knowing from the office code digits the type of sender that will be needed, seizes an idle sender of this type, and transfers the digits to it. Communication between the marker and sender is established over two sets of channels, a connector, and a control circuit. The connector, when fully equipped, includes more than 100 leads and is common to all senders and to all markers. Over these leads all the digits and certain other information, such as the class and automatic message accounting information, are transferred simultaneously. Only a fraction of a second is required for the transference of this information and for checking the recording, and then the channel is released for use by other markers and senders.

The control channel between the marker and the sender, when fully equipped, includes thirteen leads. It is individual to each sender and each marker and is held until the marker is satisfied that the proper connections have been made to the sender. This channel is also used for passing certain class information pertaining to the trunk which the marker obtains from the trunk-link frame on which the trunk appears and which may not be obtained in time for passage through the common channel.

The marker, at the same time it records the number in the sender, selects an idle outgoing trunk to the called office and causes the trunk to be connected to the selected sender through the outgoing sender link. This connection places the sender under control of supervision in the outgoing trunk, and when the marker has connected the calling line to the outgoing trunk over the line-link and trunk-link frames, it gives

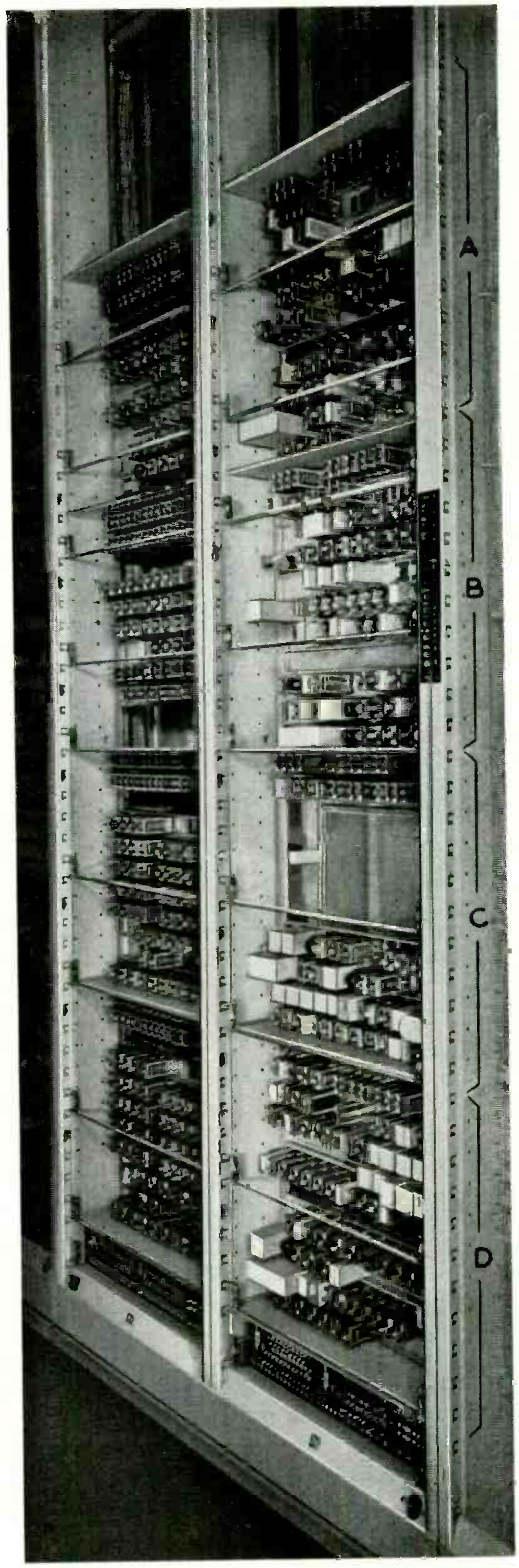

Fig. 2—A sender frame of the Laboratories' installation of No. 5 crossbar: A—call-indicator sender; B—revertive sender; C—multi-frequency sender; and D—dial-pulse sender.

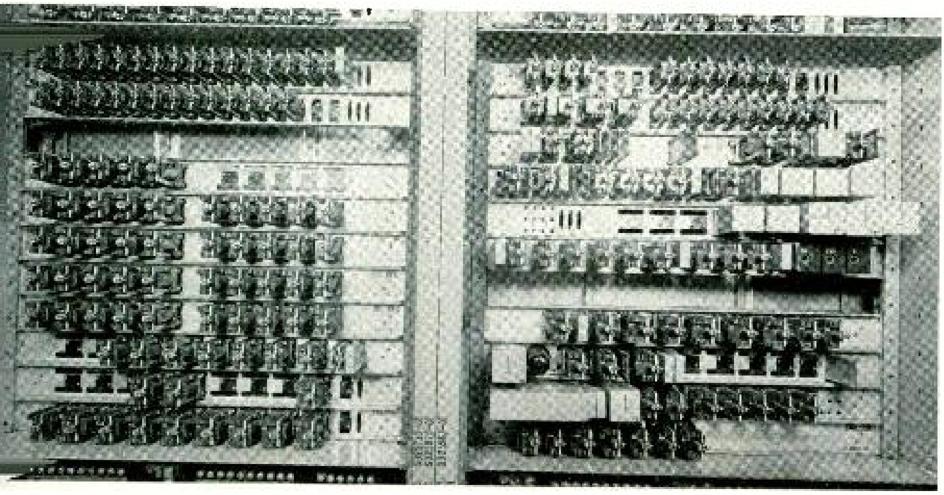

Fig. 3—A dial-pulse sender with the front covers of transparent plastic removed.

the sender a "go ahead" signal, and releases. At this time, the sender starts an AMA initial entry, if one is required, and starts timing an interval for allowing the distant end of the trunk to become normal. This is necessary since the trunk may have been seized immediately on appearing idle. The time between selection of a trunk by the marker after being released from one call, and the connection to a sender for another call, is insufficient to allow the complete release of the trunk supervisory relays at the called office, and the sender allows approximately one-half second before closing the trunk tip and ring conductors as a seizure signal. When this interval has elapsed, the sender connects the tip and ring leads to its supervisory circuit, and when this circuit detects the proper polarity, the number is transmitted and the sender released.

Outgoing senders are arranged so that when an AMA record is required for the call, the transmission of the number will not be completed until the initial entry is completed. This is done on all except the call-indicator sender by delaying the transmission of the last digit, but on call-indicator senders by delaying the transmission of entire number. Usually, except for the call-indicator sender, the initial entry is completed in sufficient time so that it causes no delay in the call's completion.

The multi-frequency sender offers the fastest means for transmission of the number and, consequently, this sender is used whenever the called office is provided with means of receiving the multi-frequency pulses. At present, such services are available for crossbar No. 1 and No. 5, crossbar toll, and crossbar tandem offices. Transmission of multi-frequency pulses is at the rate of approximately seven digits per second.

Dial-pulse senders are used for completing calls to step-by-step offices, and can be used for completion to No. 5 crossbar and to crossbar toll and crossbar tandem offices. Transmission of dialed digits is at an average of either one or two per second, depending on the capability of the terminating office to receive them.

Revertive-pulse senders are used for completing calls to panel offices and to No. 1 crossbar offices that are not equipped to receive multi-frequency pulses. The revertive-pulse sender is arranged to transmit only the four numerical digits of the number, but this is transmitted in five selections of the type required for guiding the panel selectors to the proper terminal. Revertive-pulse senders are arranged for operation in areas having office codes of two digits, three digits, or combinations of two and three digits.

Call-indicator senders are used for completing calls to manual offices equipped with call-indicator equipment, and to panel-tandem offices, which are similarly equipped. These senders are arranged for operation in areas having office codes of two digits or three digits, and the marker informs the sender whether to delete or to transmit the office-code digits.

A close-up view of the dial-pulse sender is shown in Figure 3, and of the multi-fre-

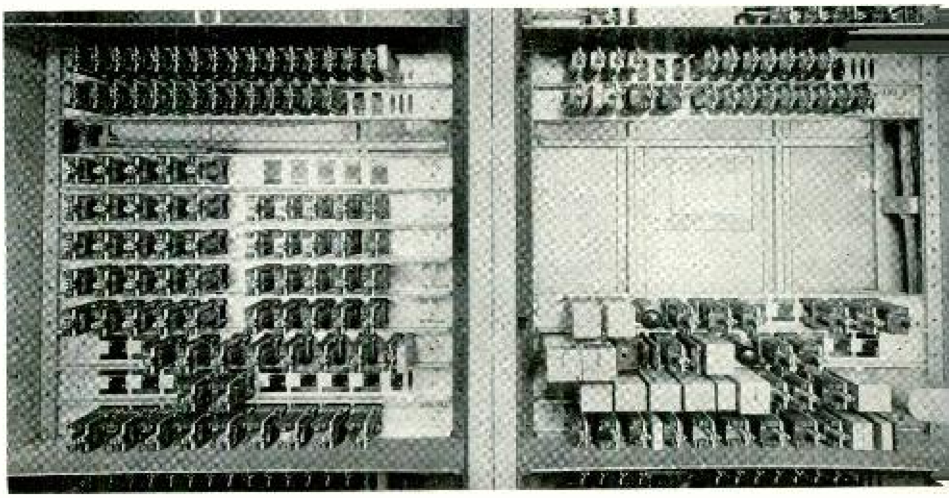

Fig. 4—A multi-frequency sender with the front covers of transparent plastic removed.

quency sender in Figure 4. The two rows of relays across the top of both bays of each sender are those used for the automatic message accounting system. In the left-hand bay section of each sender, the five rows of relays beneath the AMA are the digit register relays, while the delete relays are in the row next lower, and the steering relays that control the digit register are in the bottom two rows. In the right-hand bay section of the dial-pulse sender, the first row beneath the AMA relays includes the class relays; the next three rows include the dial-pulse generator, counting, and control relays; and beneath these are the general control relays. For the multi-frequency sender, the frequencies are generated in a separate circuit. Means for connecting these frequencies for each digit are included with the general control relays in the four lower rows.

The holding time of an outgoing sender on a normal call is only a few seconds, and as few as ten multi-frequency and ten dial-pulse senders are usually capable of handling the outgoing traffic for a 10,000-line office. To prevent a sender from being held for a long period, in case a trouble condition is encountered that prevents completion of the call, each sender has a timing circuit which allows each call sufficient time for normal completion. If the call is not completed within this interval, the timing circuit functions to give the calling party an overflow signal and then to release the sender. Under certain conditions, the sender can be held for maintenance attention after a timeout. All senders are equipped with make busy jacks and trouble lamps, and these are located at the maintenance center. All outgoing senders have provisions for connections to the automatic monitor, register, and sender-test circuit for automatic monitoring of service calls and for testing to insure that their respective functions are performed satisfactorily.

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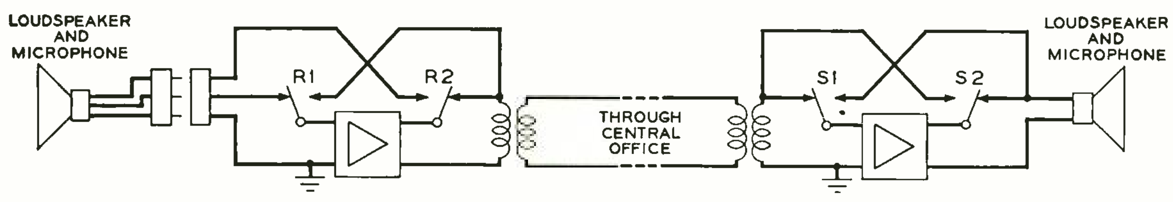
Schooling by telephone

Prior to the war, the Laboratories had undertaken development of a telephone system that would permit students confined to their homes to carry on classroom schooling by telephone. Although this project was interrupted by the war, interest in it was recently revived, and the Laboratories coöperated with the Executone Company of New York City in adapting the design of their terminal apparatus for this type of service.

The system provides an amplifier and a combination loudspeaker-microphone, both in the school and at the bedside of the student. The circuit employed is shown below. Speech can flow in only one direction at a time, which is normally from the school to the student. By operating a listen-talk switch on his loudspeaker set to the nonlocking talk position, however, the student can reverse the direction of the speech flow to permit his recitations or comments to be heard in the schoolroom. As soon as the student is through talking, he releases his switch, which returns to the normal listening position. Contacts on this listen-talk switch reverses the amplifier in the student's set, and over the telephone line operates a relay at the school that reverses the amplifier there.



The Executone unit for the student's home is a 7″ x 7″ x 5″ walnut-finished cabinet weighing under five pounds, and is installed near enough to the student to permit him easily to operate the listen-talk switch. It is equipped with a cord and plug for connection to the power supply.

The classroom pick-up and reproducer unit, in a metal housing, 6″ x 6″ x 3¾″, weighs about four pounds, and terminates in a cord and plug to permit its connection to a receptacle wired to the school amplifier unit which may be in any convenient location. No commercial power is required for this unit. Such an arrangement permits the unit to be moved from one classroom to another, as occasion requires, each room being equipped permanently only with the receptacle wired to the amplifier. In both the home and classroom sets, a single unit serves both as microphone and loudspeaker.

The school amplifier unit is somewhat larger than the other units, since it includes a relay that reverses the direction of the amplifier under control of the switch at the student's station, and derives 50 volts d-c from the commercial power supply for operating the control circuit. It is designed for mounting at any convenient place in the school and is wired to receptacles in various classrooms.

Use of this system is not limited to a single student. Where more than one homebound student is to take part in the class work, the students' private telephone lines are multipled at the central office. Under these conditions, all homebound students hear what goes on in the classroom and also are able to hear the other homebound students speak.

Arrangements have been made for the Western Electric Company to supply this Executone apparatus to the Operating Companies as they have calls for this type of service. The various Operating Telephone Companies have been informed by the American Telephone and Telegraph Company of the availability of apparatus for this service and as to its capabilities and field of use. Schooling by telephone is thus now one of the many auxiliary services made available by the Bell System.

H. C. FLEMING
Transmission Development

Transmitting amplifier for the K2 carrier system

The line amplifiers for the K2 carrier system* have thermistor control that holds their output to an approximately constant value. To make such a system of regulation possible, the amplifier at the transmitting terminal must have a constant output regardless of how many of the twelve channels of the band are in use and of the talking volume of each speaker. It meets this requirement by serving as a 60-kc oscillator as well as an amplifier. Its 60-kc output is varied complementarily to the voice component of the output. When the voice input is small, the 60-kc output will be large and thus the combined output—voice sidebands +60 kc—remains nearly constant. In its function as an amplifier, the circuit has three stages of gain: two voltage amplifiers coupled by interstage network No. 1, and a power amplifier coupled to the second tube by interstage network No. 2, as shown in Figure 1. All tubes are filamentary type pentodes heated by alternating current. Signals enter the circuit through the input transformer and are delivered to the cable through the output transformer.

Negative feedback is applied to the circuit to stabilize the gain, to smooth out the frequency characteristic, and to minimize non-linear distortion. As shown by the heavy lines of Figure 2, a portion of the output voltage is taken from tap 5 of the output transformer and carried to the input transformer, where it is added out of phase with the incoming signals. Resistance G may be strapped to vary the amount of voltage fed back, and thus to control the over-all amplifier gain. A number of elements in this path provide phase margin against singing at undesired frequencies outside the band. The gain without feedback is about 110 db. With feedback, it is reduced to from 61 to 67 db.

The circuit is made to oscillate at 60 kc by another feedback path shown principally by the lightweight lines on the same diagram. Voltage is carried from terminal 6 of the output transformer to another transformer A, where it is stepped down,

*Record, *April,* 1949, *page* 141.

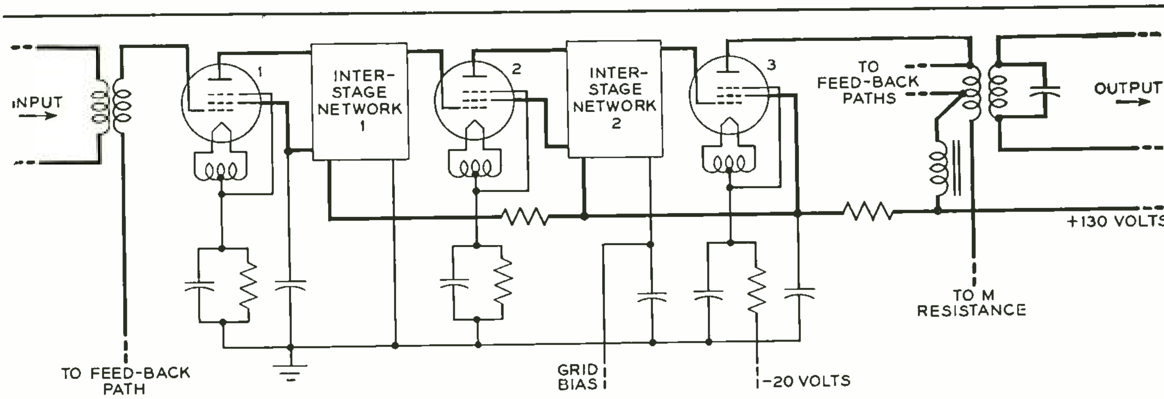


Fig. 1—Simplified schematic of the transmitting amplifier for the K2 carrier system with the feedback paths omitted.

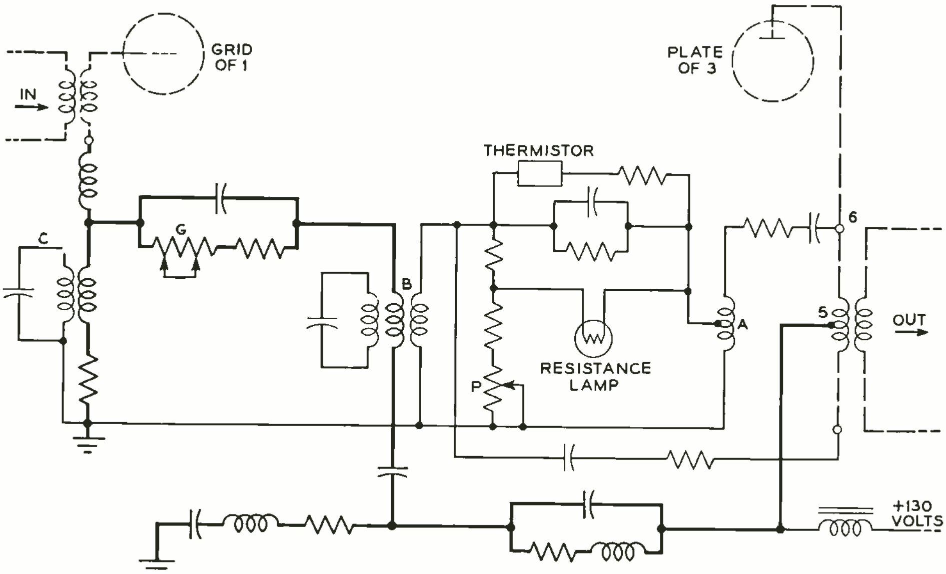


Fig. 2—Feedback paths for the amplifier of Fig. 1. The main path of the negative feedback is shown by heavy lines, and that for the positive feedback in light lines. Some of the lines are common to both paths as brought out in the accompanying description.

and a portion is transmitted through three paths to transformer B, which is sharply tuned to 60 kc. A second winding of this transformer is in series with the negative feedback path described above, and thus carries the voltage to the input transformer. The phase relations are such that the 60-kc component arrives at the input in phase with the 60-kc component at the input, and with sufficient amplitude to cause the circuit to oscillate at this frequency.

The three paths by which positive feedback currents reach transformer B from transformer A provide means for controlling the 60-kc output level. A resistance lamp in the lower path provides the automatic adjustment of the 60-kc level to a value that assures an approximately constant total output. The lamp is heated by both the 60-kc oscillations and the signals derived from speech, and as it is heated, its resistance increases. If no speech is present, the lamp is heated entirely by 60 kc, and reaches a critical resistance that reduces the positive feedback to a point where no excess gain at 60 kc exists around the oscillator loop, and thus limits the 60-kc output to the desired value—usually +15 dbm. When speech is present, it also heats the lamp, increases its resistance, and decreases the 60-kc output. Thus, in the ideal case, the total output would remain constant. The actual circuit constants are such that when speech sidebands are present in sufficient volume to give an output of +15 dbm by itself, the total output is about 15.8 dbm. Beyond this point, the total power approaches the speech power, and the 60-kc output disappears. With normal use of the circuit, however, the signal power seldom reaches a level sufficient to stop the 60-kc oscillations. An output-input characteristic of the amplifier is shown in Figure 3.

The resistance lamp has sufficient thermal delay so that instantaneous peaks of speech do not cause the 60-kc oscillations to cease; instead, the lamp operates to give a relatively constant output averaged over a period of several milliseconds. The response of the lamp is rapid enough, however, to follow speech syllables.

Adjustment of potentiometer P permits the 60-kc output to be set at the desired level. The upper feedback path, including a thermistor in series with a resistance, provides correction for the effects on the lamp of variations in the ambient temperature that are encountered.

The tuned transformer B passes a narrow band of frequencies centered at about 60 kc. Frequencies above 60 kc have little effect, since the K carrier band extends to only 60 kc. To prevent the gain from rising at the frequencies below 60 kc, the 60-kc equalizer network, marked C in Figure 2, is added to provide additional negative feedback at these frequencies. When one of these K2 transmitting amplifiers is to be used with a K1 system, both this equalizer C and the tuning coil of transformer B are short-circuited to stop the 60-kc oscillations, which are then not required. Other elements provide the desired transient response of oscillations, and permit control of the output impedance.

The constant output, independent of speech power, delivered by the transmitting amplifier, makes it possible to use the simple regulating system in the line amplifiers described in the article referred to on page 391, and thus compensate for the major portion of the variations in the cable loss with temperature.

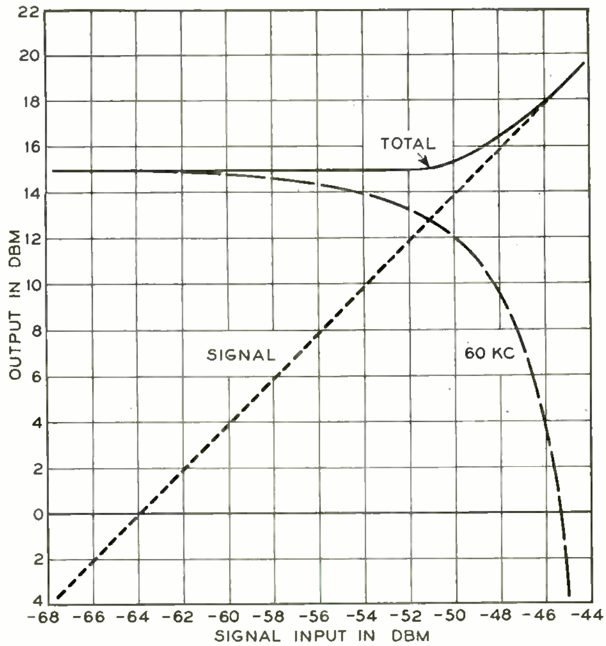


Fig. 3—Output-input characteristics of the transmitting amplifier for the K2 carrier system.

THE AUTHOR: H. C. FLEMING received the B.S. in E.E. degree in 1932 and the M.S. degree in 1936 from New York University, after teaching electrical engineering subjects there in the interim. In 1937 he joined the Laboratories and was assigned to the Personnel Department, where he taught various subjects in training courses for drafting assistants and junior mechanics. Since 1941, with the Transmission Development Department, he has been concerned with various carrier telephone system problems. During the war he was occupied with the development of underwater sound detection devices. The development of 5-kc and 15-kc carrier program circuits was his most recent assignment.

The 111A key equipment for air traffic control

W. O. ARNOLD
Switching Engineering

One of the largest of the private line networks operated by the Bell System is the Civil Aeronautics Administration Air Traffic Control Network, which consists of approximately 100,000 miles of private telephone lines. This network, which interconnects the Regional Air Traffic Control Centers, the Interstate Airways Communications Stations (INSACS), and the Airport Control Towers located throughout the United States, closely parallels the Federal Airways established by the C.A.A. To permit this network to be controlled effectively, the country is divided into twenty-six air-traffic control regions, each with a regional headquarters known as an Air Traffic Con-

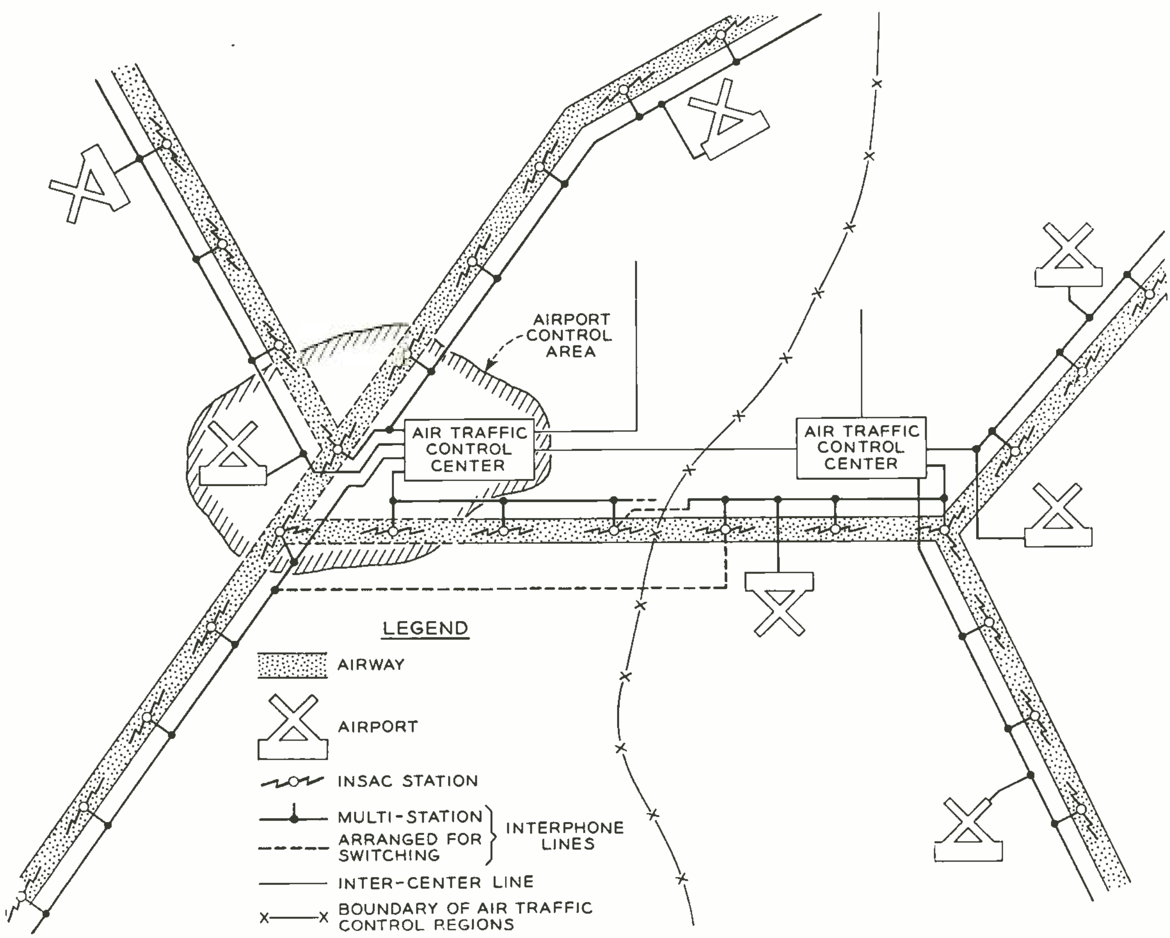


Fig. 1—Typical layout for two air traffic control centers.

trol Center. A typical layout, including two control centers, is shown in Figure 1. It is the responsibility of the Air Traffic Control Center to see that all aircraft in the air above the area contained within the regional boundaries are safely conducted into and out of the region or to a destination within the region.

Around each airport in the region, there is an area designated as the airport control area. This area is generally limited by line of sight considerations to a radius of approximately five miles from the control tower. Aircraft within this area are under the direct control of the control tower operator. He issues all instructions relative to landings, takeoffs, assignment of runways, altimeter check settings, surface winds, etc. This control is generally exercised over the air-ground radio on the airport control channel.

After a particular flight has become airborne, and has progressed to the boundary of the airport control area, the control of the aircraft passes to the jurisdiction of the Air Traffic Controller at the Air Traffic Control Center. The controller then directs the flight to the airport control area of its destination, and relinquishes direct jurisdiction, thereby causing the aircraft to come under the surveillance of the local control tower, which provides the necessary landing instructions.

The primary purpose of the Air Traffic Control Network is to provide the means for directing aircraft while they are en route to a destination. To facilitate this control, the C.A.A. provides what are known as Interstate Airways Communications Stations, or INSACS, as they are commonly called. These stations, which are located at strategic points along the established airways, furnish links between the Air Traffic Control Network and the en route aircraft. They do this by relaying messages over the air-ground radio channels. In addition to their other functions, the INSACS also provide periodic reports to the aircraft concerning weather and winds aloft, and transmit the signals of the radio ranges by which the pilots identify the airways and their locations. To enable the INSAC stations to fulfill their mission speedily, the private telephone lines of the

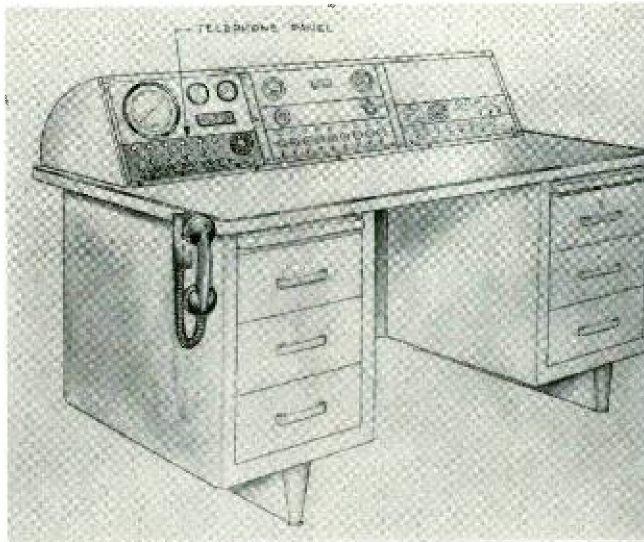


Fig. 2—The air-ground operating console.

traffic control network are required: first, to relay position reports received from each flight as it passes over an INSAC station to the Air Traffic Controller; and second, to pass on to the aircraft all instructions received from the Air Traffic Controller directing that flight toward its destination.

Since modern aircraft move with great speed, they must be controlled by an efficient communication system. The INSAC stations and Airport Control Towers are therefore connected to long multistation telephone lines which terminate at the Air Traffic Control Centers. With as many as ten or twelve INSACS or Airport Control Towers connected to one private line, all of these stations may keep abreast of the reports on a particular flight by listening to loudspeakers connected to the line at the respective stations. Reports may therefore be received by one INSAC station, and instructions relayed to a flight by another INSAC station, with all parties to the transaction fully informed.

In addition to the multistation lines, the Air Traffic Control Network also includes many two-station private telephone lines, which are known as intercenter lines. These lines, as their name implies, are for passing information from one Air Traffic Control Center to another. In this manner, the Air Traffic Controller in each control area is able to determine the time of arrival and departure of all aircraft in his region, and is therefore able to inform any aircraft of possible hazards it may encounter while in his region.

To secure maximum flexibility in the use of the Air Traffic Control Network, especially under emergency conditions, the network is arranged to permit INSAC stations, located near regional boundaries, to be connected to the multistation lines serving adjacent control regions. Since the telephone facilities at the INSAC station are arranged to permit switching together of multistation lines, alternate connections between Air Traffic Control Centers may be established, when desired, by merely requesting the INSACS operator, who controls the switch, to establish the connection.

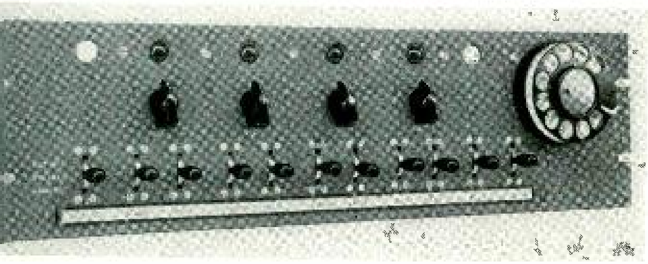


Fig. 3—The telephone panel for the 111A *key equipment.*

In 1947, the C.A.A. undertook a program for modernizing its communications facilities at the INSAC stations. At that time, the Bell System was requested to provide new telephone facilities to be installed in a new Air-Ground Operating Console that the C.A.A. was currently developing. Two broad requirements were stipulated: all Bell System telephone lines serving the INSAC station were to be terminated in the console, and all telephone facilities were to be integrated into the structure of the console. On the basis of these requirements, the 111A key equipment was developed by the Bell Laboratories.

The Air-Ground Operating Console, which the C.A.A. developed, is shown in Figure 2. It consists of a sloping front cabinet mounted on a modern steel desk. The inclined portion of the cabinet facing the console operator, who is known as a Communicator, contains a number of panels bearing the operating controls and signal indicators of the various radio receivers, transmitters, radio range, and telephone facilities which the Communicator is required to manipulate. The telephone panel, in the lower left-hand corner of the operating console, is shown in greater detail in Figure 3. Telephone relay equipment,

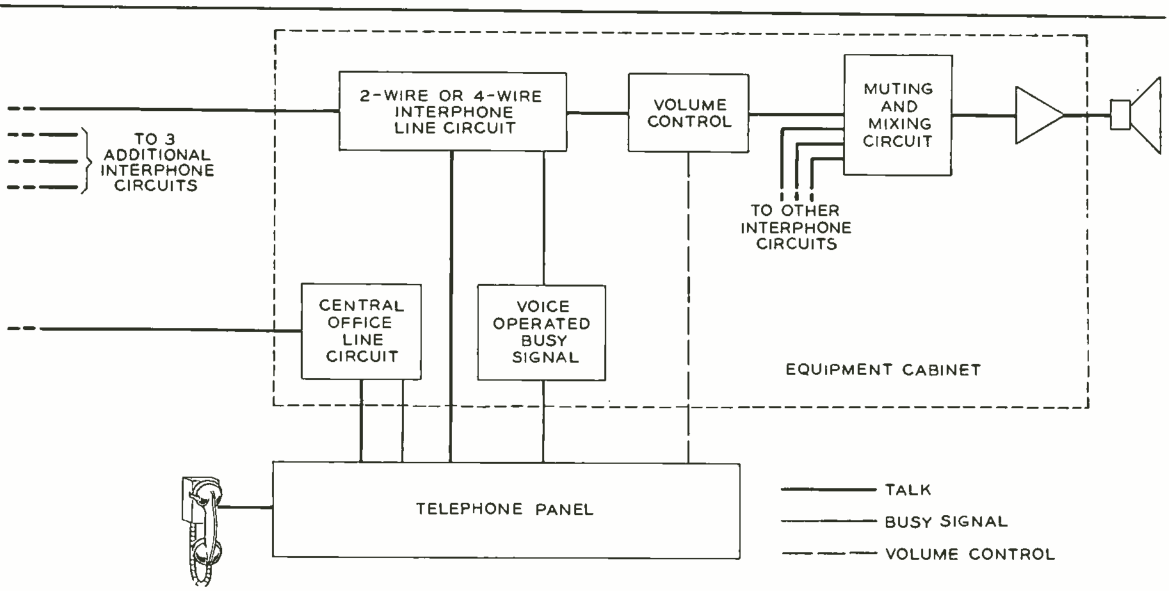


Fig. 4—The 111A *key equipment is arranged to provide terminations for as many as five lines of different types.*

which is remotely controlled from the telephone panel, is mounted in an enclosed type cabinet rack in an adjacent room. The common loudspeaker in a small wooden cabinet is suspended over the operating console.

The functions of the 111A key equipment are to provide appropriate terminations for private, local exchange or PBX, and intercommunicating lines to which the Communicator must have access during the course of his radio contacts. To meet these requirements, the new key equipment was arranged to provide terminations for as many as five lines of several different types, as indicated in Figure 4. Since one of these lines will generally be to a central office or airport PBX, the remaining four lines may be any combination of the following:

a. Two-wire or four-wire multistation interphone lines using loudspeaker signaling incoming and ringdown in the outgoing direction;

b. Two-wire local airport private lines employing loudspeaker incoming and 20-cycle ringing outgoing;

c. Two-wire local airport private lines employing 20-cycle ringing in both directions;

d. Two-wire dial intercommunicating lines; and

e. Two-wire loudspeaker intercommunicating lines.

These lines are provided to meet the specific needs of the location in which the new key equipment is employed.

Two basic types of key configurations are provided on the panel shown in Figure 3. The first, which appears only once on each panel, is always used for the central office or local airport PBX line. It is therefore equipped only with a line pickup key and an incoming signal indicator. It is located at the extreme left of the panel. The second, or private line key configuration, is for controlling the lines listed above, and appears four times on the key panel. It includes: a line pickup key, a switching key, a volume control, and a busy signal indicator. Also provided on this panel, on the right side, is: a dial, a "hold" condition indicator, a common ring-hold key, and a mute-all key. These items are furnished on a common basis; the dial, for example, is connected whenever a key is operated which is associated with either a central-office line, a dial PBX line, or a dial conference line. The mute-all key is, as its name implies, for momentarily muting all telephone lines associated with the common

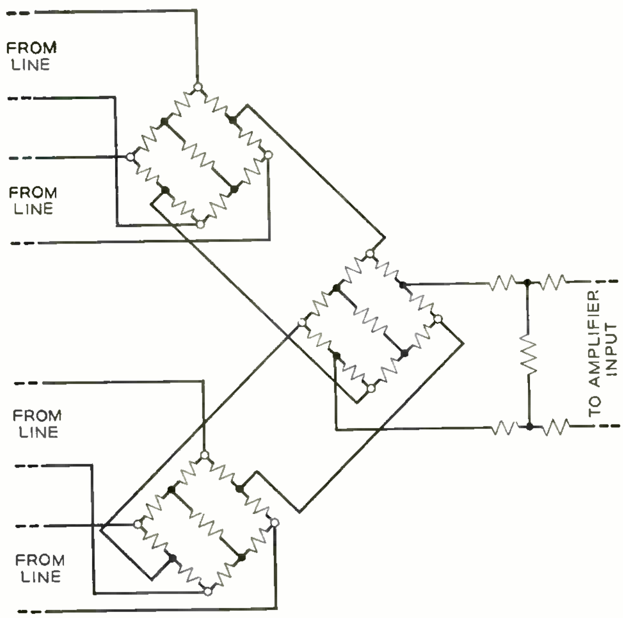


Fig. 5—This hybrid circuit permits a number of telephone lines to be connected to the loudspeaker simultaneously.

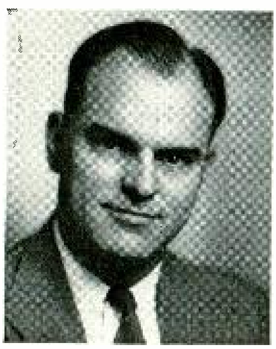
loudspeaker. This may be required when the Communicator does not wish to interfere with air-ground communications.

A novel feature of the 111A key equipment is the common loudspeaker associated with all lines employing incoming loudspeaker signaling. A standard Western Electric 755A-type loudspeaker is used. This speaker, and a similar one, furnished by the C.A.A. for air-ground communications, is mounted above the Air-Ground Operating Console facing the Communicator. The telephone loudspeaker is on the left of the Communicator, and the air-ground radio loudspeaker is on the right. This arrangement reduces the number of loudspeakers from as many as ten to two, thereby improving the general appearance of the station. To meet the telephone requirements for a common loudspeaker, however, it was necessary to provide two new circuits: a hybrid circuit, to permit a number of telephone lines to be connected to the loudspeaker simultaneously; and a voice-operated busy signal to identify the line or lines over which the Communicator is receiving a call by lighting the busy lamp associated with the line. The hybrid circuit, which is shown in Figure 5, was developed by E. B. Mechling. This circuit provides the means for connecting as many as four lines to the common loudspeaker, with a line loss of approximately 21.5 db, and a crosstalk loss of the order of 70 db. Additional gain is provided in the loudspeaker amplifier to overcome the 21.5 db loss. The voice-operated busy signal circuit is a vacuum-tube circuit that will be described in a future issue of the RECORD.

In keeping with the established policy of furnishing equipments intended for installation on subscribers' premises in closed equipment cabinets, the 111A key equipment is contained in a seven-foot double-door cabinet, capable of accommodating forty 23-inch mounting plates.

As with most new systems developed in the Laboratories, the 111A key equipment is a product of the coöperative efforts of many engineers. Significant among these, however, are P. B. Fairlamb and E. E. Arnold of the Switching Development Department, who carried out the detailed development of the circuits and equipment that are involved.

THE AUTHOR: W. O. ARNOLD received his S.B. degree from M.I.T. in 1937 and the M.S.E.E. degree the following year. In 1941, after almost three years of teaching electrical engineering at Cooper Union, he entered the Army. As an officer, he developed facilities for defense against enemy air attack. Overseas, he was associated with the U. S. Air Force units that supported Montgomery's 8th Army in driving Rommel's Panzers from the African desert. It was this field experience which later permitted him to return to the Air Forces' Watson Laboratories, where he was associated with the development of new communications and navigational facilities for the Air Forces. Since 1945, when he became a member of the Technical Staff of the Laboratories, he has been planning new developments for PBX and station systems. Many of these developments, as exemplified by this article, have been for the air transportation industry.



D. M. RUGGLES
Transmission Apparatus Development

Checking sense of cut in quartz crystals

Small quartz vibrator plates, like those used in radio transmitters, are in greater demand today than at any previous peacetime period. Many of the quartz crystals from which these plates are cut have a flaw known as twinning. For detection of twinning at an early stage in processing vibrator plates, the Laboratories have developed a simple device that prevents wasted time and thereby reduces production costs.

Natural quartz crystals conform to a general pattern consisting of a six-sided prism with three large and three small cap faces, as indicated in the lower portion of Figure 2, where the relative positions of both large and small faces are respectively marked *r* and *z*. The vibrator plates take their first form as wafers sliced from the whole crystal by a saw whose blade is a thin metal disc impregnated with diamond dust. The direction at which the wafer is cut through the crystal, and the physical size of the vibrator plate formed from this wafer, determine the frequency at which it will oscillate in a transmitter. One type of vibrator plate is oriented with reference to one of the small cap faces. Correct orientation of the cut for this plate is determined in practice by cutting a thin slice from the end of the quartz crystal to form a flat plane, to be etched with hydrofluoric acid. From the pattern of the etching, the atomic plane parallel to the small cap face is located approximately. Then its exact orientation is found by X-ray diffraction measurement. The entire crystal is cut into wafers based on this information. However, at some unknown distance from this flat plane nature may have played one of her tricks by effectively changing the relative position of the crystals' cap faces; it is said in this event that the crystal is twinned. The wafer that would be cut from a twinned crystal might therefore contain only a small part of a twinned area, or if the whole wafer were to be cut from

Fig. 1—Dorothy Schmidt demonstrates the test for sense of cut.

the twinned area it would be cut in the wrong sense, as illustrated in Figure 3.

The standard method of checking a wafer for twinning, by visual inspection using reflected light from the etched surface of the quartz, is effective if the wafer contains both a positive and negative sense of cut because a definite line of demarcation shows between two such areas. However, when wafers are composed entirely of a wrong sense and no line of demarcation exists, the sense of cut is not conveniently determinable by this method. As a result, many plates that were formerly cut wholly in the wrong sense were not discovered until the entire manufacturing process was nearly completed.

To check the sense of cut at the most advantageous time, each wafer is tested as soon as it is formed. This is done by determining the wafer's frequency constant which differs for the two senses. This con-

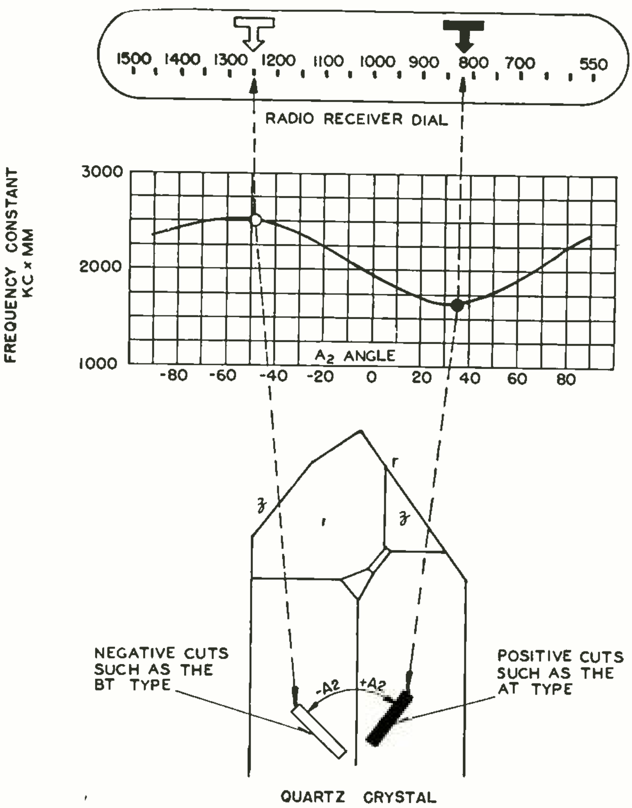


Fig. 2—The lower section of the figure indicates two among the types of vibrator plates that can be cut from a quartz crystal. Each plate usually is cut with relation to either an r *or a* z *cap face but due to twinning this might be done unwittingly with relation to the wrong cap face. The solid line in the graph shows frequency constants for all A2 angles of cut. The circled points on this line are those for the positive cuts such as the AT type, and for the negative cuts such as the BT type respectively illustrated, as connected by the upright dashed lines. With vibrator plates two mm thick, the dashed lines are extended to indicate the frequencies on the dial at which these plates would oscillate and thus identify their sense of cut.*

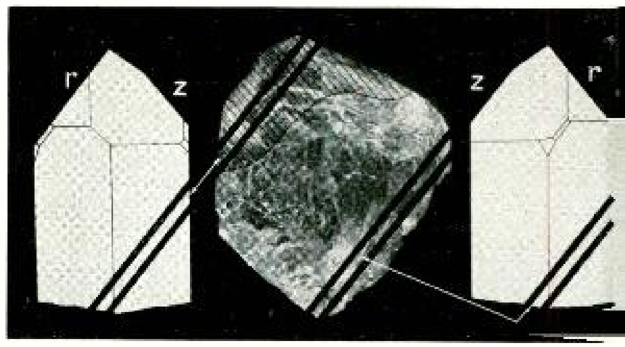


Fig. 3—The center figure is a retouched photograph of a broken piece of raw quartz crystal that, for purposes of illustration, is assumed to be twinned in the upper cross-lined area of irregular shape. Relative positions of cap faces referred to perfect crystal configurations are outlined for this area at the left side, and for the lower area at the right side, respectively. Two pairs of heavy lines at the right, joined by the white line, represent saw cuts to form a wafer correctly orientated, parallel to a z *face. But when the entire piece of quartz is sliced into successive parallel wafers, those cut from the top section are unwittingly parallel to an* r *face; they are in the wrong direction or sense with reference to the* z *face. By using the simple device described in this article, those wafers actually cut in the wrong sense are discovered and eliminated from further processing.*

stant is numerically equal to the wafer's frequency of oscillation multiplied by its thickness. The thickness is known, but the frequency must be found by a test. For the types of cuts illustrated in lower Figure 2, the positive cuts are at A2 angles of approximately 35 degrees and the negative cuts at approximately 49 degrees. In these cases a plus sense of cut, indicated by angle +A2, has a constant of about 1,625 kilocycle-millimeters and that for −A2 is about 2,500. The frequency of a wafer two

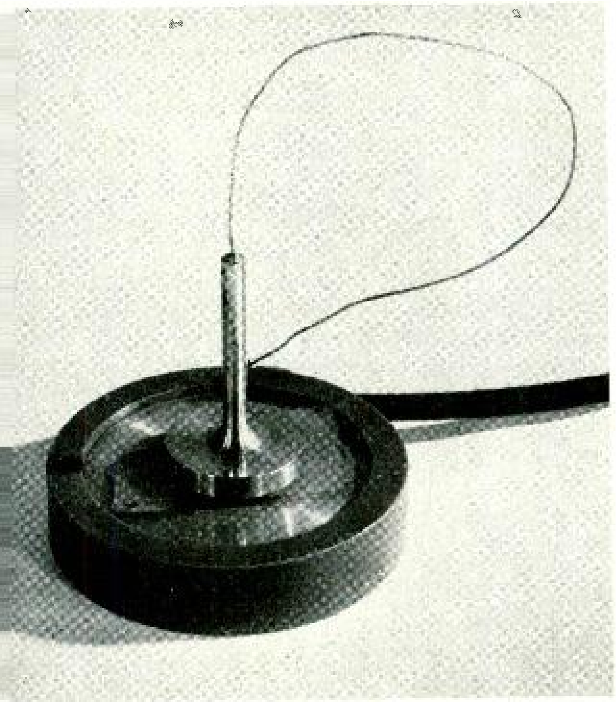


Fig. 4—Electrode arrangement to check the sense of cut of a rough quartz wafer destined for vibrator plate use.

millimeters thick, for example, would be half the constant, and to find which one of the two orientations exists, the device shown in Figures 1 and 4 was developed. This simple equipment is employed for the frequency determination because it is easy to use. Furthermore, the irregular shape and rough surface imposed on the wafer by the sawing operation prevents its normal action in a standard test oscillator.

The device consists essentially of two electrodes made of cast iron, one of which is connected to the antenna and the other to the ground of a radio receiver which can be tuned to the two possible frequencies of the wafer. At the top of Figure 2 the frequencies are shown for wafers two millimeters thick. For thinner wafers higher frequency bands are required.

The operator places the wafer on the electrode in the base component and moves the upper electrode across the top surface of the wafer as the receiver is dialed over a frequency band which covers the computed frequencies. At approach to the frequency of the wafer a scratchy noise will be heard in the loudspeaker. After the receiver is tuned for the greatest output of the speaker, the frequency of the wafer is read on the receiver dial and the sense of cut is thus identified. For the two-mm-thick wafer chosen as one example, the scratch on the loudspeaker would be evident at about 812 kc for a plus sense, or at about 1,250 kc for a minus sense, as shown in Figure 2. Much time has been saved in production by making this test a routine part of wafer manufacture.

THE AUTHOR: D. M. Ruggles in 1927 graduated from Chicago Engineering Institute in Applied Electrical Engineering and up to the war period he was employed as an engineer in the Chicago area. In 1941 he joined the United States Army Signal Corps Depot in Philadelphia where he supervised the quartz crystal laboratory and taught radio courses to Army personnel. He came to the Laboratories in 1944 and has been concerned with development of quartz crystal units for use in oscillator circuits.

Changes in Organization

General changes have been made in the organization of the Laboratories effective October 1 last. Reporting to M. J. Kelly, Executive Vice President, will be Ralph Bown, Director of Research; and Vice Presidents A. B. Clark, W. H. Martin and D. A. Quarles.

Reporting to Dr. Bown will be J. B. Fisk as Assistant Director of Research and also as Director of Physical Research; R. M. Burns, Chemical Director; J. R. Townsend, Materials Engineer; R. K. Potter, Director of Transmission Research; W. H. Doherty, Director of Electronic and Television Research; H. T. Friis, Director of Radio Research; W. A. MacNair, Director of Switching Research; L. Espenschied and E. C. Wente, Research Consultants.

Reporting to A. B. Clark will be J. W. McRae, Director of Transmission Development, and M. B. McDavitt, Director of Switching Development. Mr. McRae's staff will consist of E. I. Green, Director, and F. J. Given, Assistant Director, respectively, of Transmission Apparatus Development; G. W. Gilman, Director of Transmission Engineering; H. A. Affel, Director, and G. N. Thayer, Assistant Director, respectively, of Transmission Systems Development; and J. R. Wilson, Director of Electronic Apparatus Development. Mr. McDavitt's staff will consist of F. J. Singer, Director of Switching Engineering; A. J. Busch, Director of Switching Systems Development; and A. C. Keller, Director of Switching Apparatus Development. R. S. Plotz will be Assistant to Vice President Clark.

Mr. Martin's department will be divided into two sections, one of them headed by H. H. Lowry, Director of Apparatus and Systems Engineering. Reporting to Mr. Lowry will be H. J. Delchamps, Director of Apparatus Engineering, and M. H. Cook, Director of Systems Engineering. The other group will be headed by Mr. Martin; reporting to him will be A. F. Bennett, Director of Station Apparatus Development; R. J. Nossaman, Director of Outside Plant Development; and G. D. Edwards, Director of Quality Assurance.

Reporting to Vice President Quarles will be F. D. Leamer, Personnel Director; R. K. Honaman, Director of Publication; M. R. McKenney, General Patent Attorney; and W. Fondiller, Assistant Vice President. Reporting to Mr. Fondiller are A. O. Jehle, Comptroller, and M. B. Long, Treasurer. R. E. Poole, Director of Military Electronics Development, will continue to report to Mr. Quarles.

T. C. Fry has been appointed assistant to Dr. Kelly. M. B. Long, who had previously been appointed assistant to Dr. Kelly, will continue in that capacity.

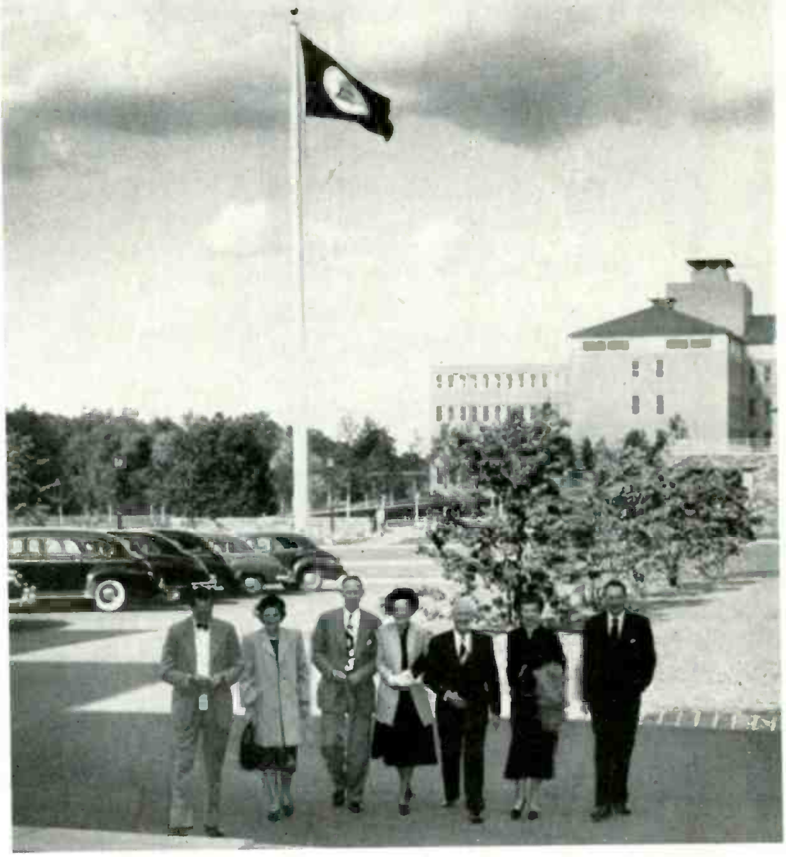
Return From European Visits

While S. B. Ingram and V. L. Ronci were in Europe last summer, they observed electron tube processes and constructional techniques in electron tube laboratories and factories. They also studied the tube development programs in various laboratories and spent a week at the Philips Company in Eindhoven, Holland. They report that war damage to the plant has been repaired and the staff of the laboratory is working industriously to make up for time lost in fields in which they were not permitted to work during the enemy occupation and to capitalize on some basic techniques which they were able to develop during that period for post-war use. In England, they made brief visits to the laboratories and factories of several of the leading manufacturers in the electronics field.

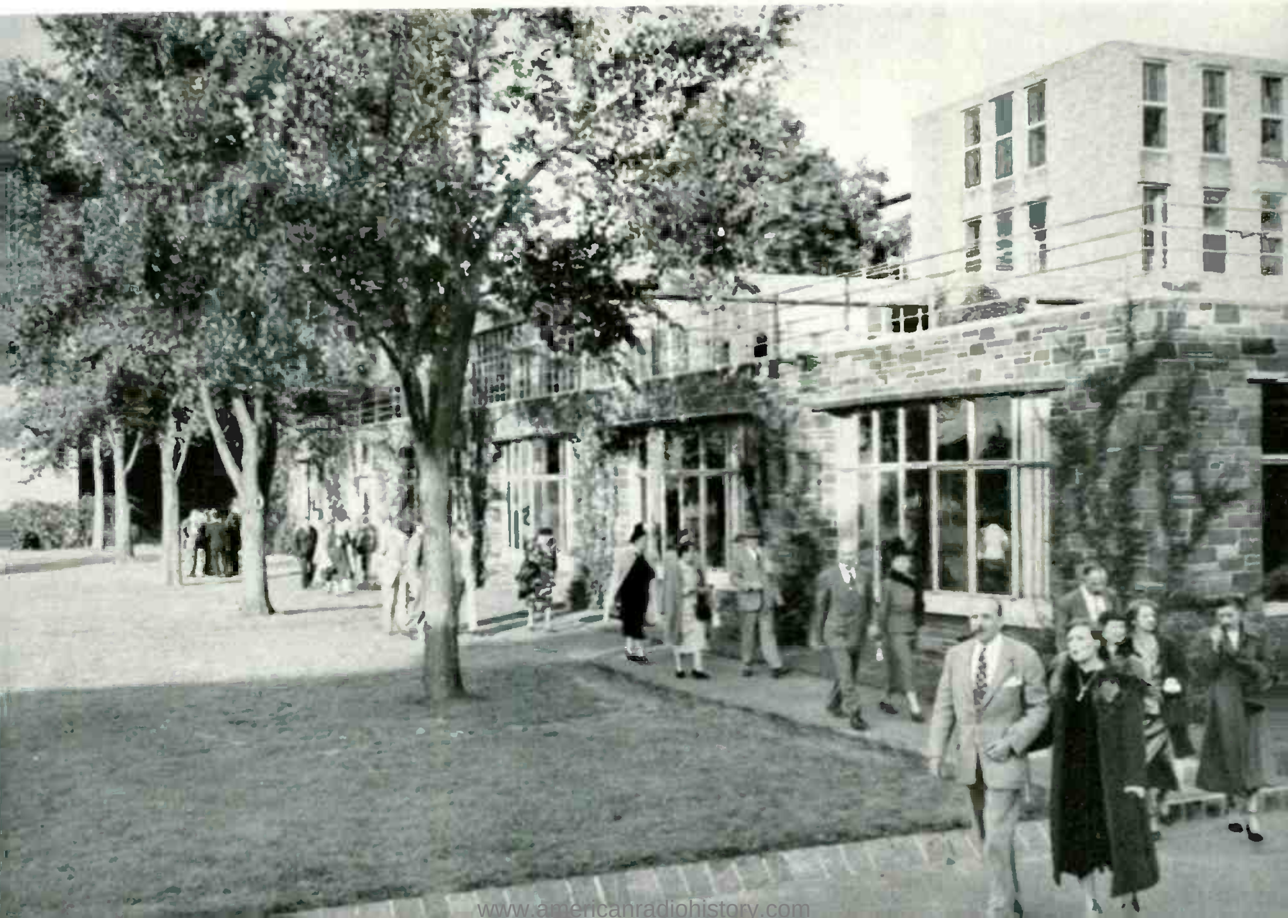
R. K. Potter and J. C. Steinberg have also returned from a visit to Europe which included London, Paris and Holland. The purpose of their trip was twofold—to present an invited paper before the Acoustics Group of the British Physical Society in London, and to obtain information and thought on acoustical research in Europe that might apply constructively to our own program of research in this field. The British Physical Society meeting was held on September 8 in the impressive auditorium of the Institution of Electrical Engineers with two hundred present. Both the paper and the film *Action Pictures of Sound* were well received. Mr. Steinberg presented the paper and Mr. Potter the subsequent discussion which lasted about an hour.

Fall Out-of-Hour Courses Open

During the week of October 17, classes in the Laboratories' Out-of-Hour Courses opened at West Street, Murray Hill and Whippany. The training program, which originated thirty years ago, is offered for the purpose of making educational facilities readily available to the men and women in the Laboratories. Courses are given by specialists in their respective fields, and new courses are added each year as advances are made in communication technology. The 1949-1950 curriculum includes courses in *Oscillation and Waves, Electronics Circuits, Manufacturing Methods, Development Economics, Freehand Sketching, Review of Engineering Mathematics, Fundamentals of Television, Laboratories Staff Operations*, and *First Aid*.



PIONEER OPEN HOUSE AT MURRAY HILL



Open House at Murray Hill

Nearly two thousand Pioneers and their families attended the Open House at Murray Hill Laboratory of the Frank B. Jewett Chapter of the Telephone Pioneers of America on Saturday, September 24. The accompanying photographs tell the story of the day which was highlighted by the honoring of Mary A. Douglas, a Pioneer with fifty years of service, and W. E. Reichle, who in July became the 2,000th member to join the Pioneers.

Tours of Building I and Building II helped Pioneers and their families to see demonstrated the many advances in the technology of communication. Suppers were served in both buildings on the hour from 5 to 7 p.m. The Open House demonstrations started at 3 o'clock and were scheduled to close at 8 or 9, but 11 o'clock found weary Plant men escorting the last visitors through the gates.











George Wahl demonstrates a telephone coin collector.

In the biological laboratory, Tommy is absorbed by J. Leutritz's talk on the culture of fungus isolated from a test post.

G. P. Spindler's glass blowing fascinates the family.

Larry learns the mechanism of the governor on the dial of the new subscriber combined set at the work bench of Richard Porter.

A Pioneer Family Tours Murray Hill

The Leydens, Arthur, Sr., of Murray Hill; his wife, Margaret, formerly of the Laboratories; Arthur, Jr., a college senior; Larry, a prep junior; and Tommy, in grade school, took this tour of Building I during the Open House at Murray Hill.

Life tests for dials are carried to millions of operations.

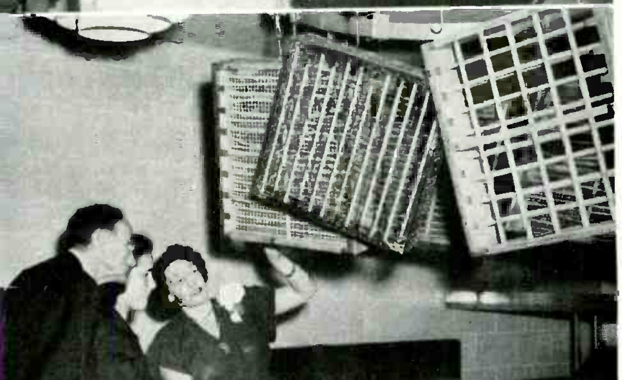
Arthur, Jr., changes the setting of rolls on the ten-inch rolling mill, while Larry learns the use of a micrometer in checking the thickness of Permendur strip.

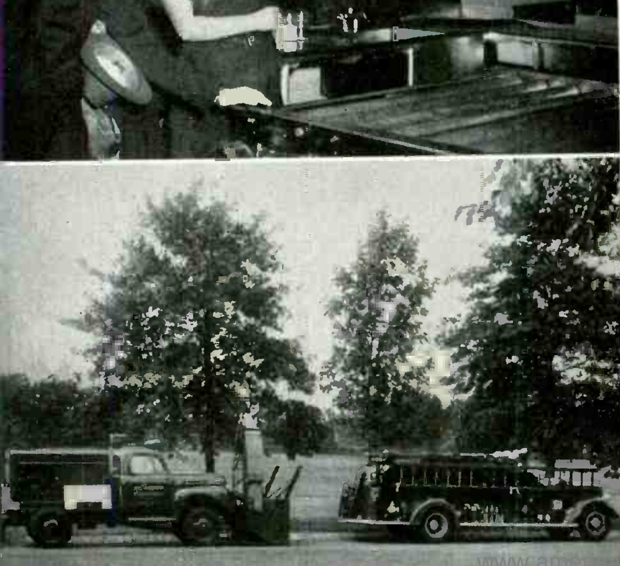
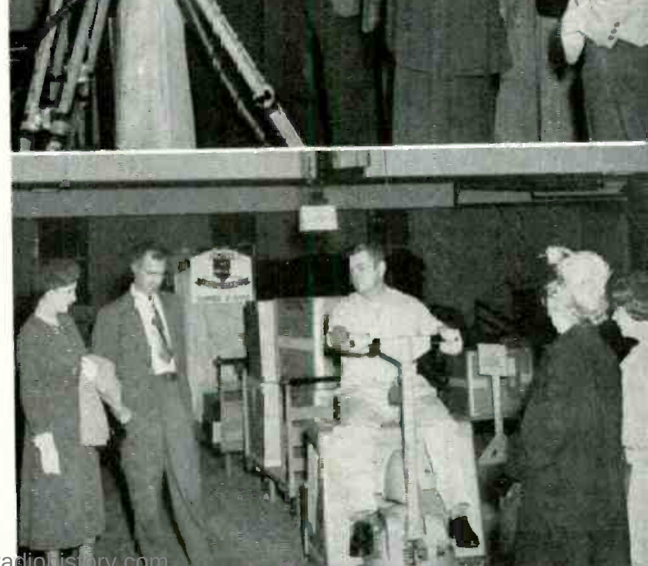
Tommy has found a broken conductor in the cable.

R. R. Stevens illustrates the new testing equipment for transmitters and receivers for the Leydens and other Pioneer families.

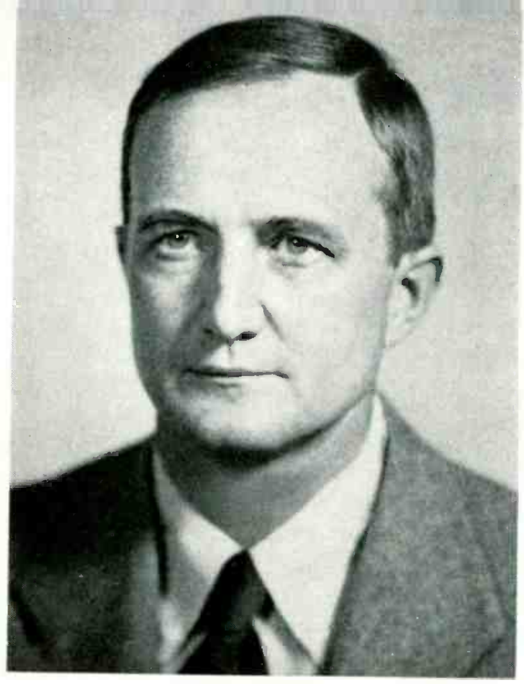






Harvey Fletcher



James B. Fisk

Harvey Fletcher Retires, J. B. Fisk Succeeds Him

In advancing the sciences of speech, hearing and acoustics, the Laboratories has long been outstanding. To these and related fields Harvey Fletcher has contributed notably during his career of 33 years in the Laboratories.

Educated at Brigham Young University (B.S., 1907) and at Chicago (Ph.D. summa cum laude, 1911), Dr. Fletcher was head of the Physics Department at Brigham Young until 1916 when he entered the Laboratories. Soon after, he joined with the late I. B. Crandall in laying out a comprehensive program to investigate the relationship between the physical characteristics of a telephone system and the ability to converse over it. An early branch of this work was Dr. Fletcher's study of hearing, which involved the development of the audiometer. With it, hundreds of people's hearing was measured; from the data were established the first truly scientific criteria of hearing acuity—an average threshold value of sound intensity at various frequencies and the departure (in db) of the individual's threshold from that average.

As audiometric measurements were made more widely, need for hearing aids became evident. Dr. Fletcher guided the development of the Western Electric hearing aid, the first such device to use vacuum tubes. He also developed a group survey method using recorded sound of decreasing volume, which has had wide acceptance in schools. With improved apparatus, the same method was used to measure the hearing of 750,000 people at the World's Fairs of 1939-40. Dr. Fletcher's interest in the deafened is evident from 15 papers, together with honorary membership in the Otological Society and presidency in 1929 of the American Federation of Organizations for the Hard of Hearing.

Masking studies, undertaken to find the effect of noise on telephoning, offered information on the mechanism of hearing. Through this technique, Dr. Fletcher and his associates were able to confirm and greatly extend earlier theories of hearing. Another outcome of these studies was Dr. Fletcher's membership in New York City's Noise Abatement Commission.

Meanwhile, studies of speech had been going on, and, with the technique by then available, the frequency spectra of speech sounds had been plotted. Studies of the actual voice mechanism resulted in an artificial larynx, which was made available at cost through the Telephone Companies.

Development of high quality transmission apparatus had been going on in various laboratory groups, and by the end of the 'Twenties Dr. Fletcher was testing a circuit whose transmission was indistinguishable from that of free space. Two such circuits, with microphones built into the head of a lifelike dummy, formed the famous "Oscar Show," to which thousands of people listened at the Chicago Fair of 1933.

The desire to add spatial quality to transmitted sounds without the use of telephone receivers led to "stereophonic" transmission over a three-channel system from Philadelphia to

Washington. Subsequently, the Fletcher group improved sound-on-film techniques and developed a three-channel system in which additional "tracks" controlled the reproduced volume. This system was demonstrated in Carnegie Hall, New York, in 1939.

With the addition of other research groups in 1933, Dr. Fletcher became Director of Physical Research and was given charge of the work in semi-conductors, magnetics, carbon, and contacts. To these he soon added a group in solid state physics. His personal research, which he never entirely gave up, has recently been on a comprehensive theory of telephone quality, which relates the listener's perception of speech to transmission loss, band width, distortion, noise and hearing acuity.

During the war Dr. Fletcher was in charge of N.D.R.C.'s section on acoustics. Among problems studied under his supervision were the air-raid siren, gun ranging, jungle acoustics, hearing under severe noise, and audio-camouflage. Results of Dr. Fletcher's work have been published in 47 papers, 19 patents and a book, *Speech and Hearing*, in the Bell Laboratories Series.

Interested in people, Dr. Fletcher has always been active in organizations. He is one of the founders and a past president of the Acoustical Society, a Fellow and past president of the Physical Society, and a Fellow of the A.I.E.E. and the A.A.A.S. He is a member of the National Academy of Sciences and the National Research Council. In 1924 he received the Levy Medal from the Franklin Institute and in 1949 the S.M.P.E. Progress Medal. He holds the honorary Sc.D. from Columbia, Kenyon, Case, Stevens and Utah.

In his earlier years a Scout Leader, Dr. Fletcher later became head of his church congregation, and of the churches in the local area. One of his five sons is general attorney of New York Telephone; another, Dr. Robert Fletcher, is a newcomer to our Electronics Research; and the other three either hold the doctorate in physics or are studying for it. In retirement, Dr. Fletcher will become an honorary professor in the Electrical Engineering Department of Columbia University, where he will establish a department of acoustical engineering. He will also undertake a revision of his book, *Speech and Hearing*, and will promote an institute on musical science. However, he expects these activities to leave him a reasonable amount of time for his outdoor hobby—fishing.

James B. Fisk, who became Physical Research Director on the retirement of Harvey Fletcher, has returned to the Laboratories after about two years as director of the division of research of the U. S. Atomic Energy Commission, and an academic year as a professor of applied physics and Senior Fellow at Harvard University.

Dr. Fisk received his Ph.D. from M.I.T. in 1935, following a bachelor's degree from Tech in 1931 and further studies at Cambridge University, England. From 1936 to 1938 he was a Junior Fellow in the Society of Fellows at Harvard, and then became professor of physics at the University of North Carolina. He joined the Laboratories as electronics research engineer in 1939. When the potentialities of the microwave magnetron for military application were discovered, Dr. Fisk was selected to head the development group in the Laboratories. Under his leadership, the Laboratories became the outstanding industrial organization in this field during the war. In 1945 Dr. Fisk became Assistant Director of Physical Research, where he played an essential part in establishing the policies, organization, and plan of work of the physical electronics, solid state, and electron dynamics groups.

Metropolitan Bell Symphony

Carnegie Hall, December 9

Watch the bulletin boards for the sale of tickets

Dr. Buckley and Mary Douglas admire the diamond brooch, gift of the Laboratories in honor of her completion of fifty years of service.

Robert W. King Retires

After receiving his doctorate of philosophy from Cornell in 1915, R. W. King remained there as an instructor until he entered the Laboratories in 1917 to work on electron tubes. He supervised the Bell System's earliest working exhibit—one on electronics for the National Academy of Sciences. Early in 1920 he transferred to A T & T as a personal assistant to John J. Carty, its chief engineer. A year later he entered the Information Department of that company as its first writer on technical subjects. This transfer placed him in a position to stimulate active interest in a publication that would bring outstanding technical papers of the Bell System together, and the *Bell System Technical Journal* was launched in that year with Dr. King as editor.

While plans were being made for the *Journal*, Dr. King discussed them with his technical associates, among them Campbell, Arnold and Carson. Such was the spirit of the organization that they could say in their foreword ". . . the communication engineer has become an original investigator and is extending the boundaries of human knowledge and supplementing the advances of pure science to find solutions for his various and sundry problems."

Because the editor did not want to interfere with publication in journals of professional societies, his early issues contained for the most part reprints. As time went on, more and more papers were offered, until now the *Journal* publishes original articles. Its circulation is world wide, and it has contributed immensely to the prestige of the Bell System in scientific circles—a prestige which has been of great help in recruiting the right kind of engineers and scientists from the universities. Dr. King has been the *Journal's* editor continuously for its twenty-seven years, except during his absence in Europe.

In 1927 Dr. King returned to West Street as Assistant Director of Publication of the Laboratories. A year later he became assistant technical representative of the Bell System in London, returning in 1935 to become assistant to Dr. F. B. Jewett, then President of the Laboratories. On Dr. Jewett's retirement in 1944, Dr. King became assistant to Dr. Buckley. Since the establishment of the Frank B. Jewett Fellowship in 1944, Dr. King has been secretary of the committee of award.

A.I.E.E. Committee Roster

Laboratories men serving on general committees of the A.I.E.E. are: *Board of Examiners,* F. J. Scudder and H. M. Trueblood (both retired); *Membership,* Charles Clos, District Vice Chairman; *Planning and Coördination,* J. D. Tebo; *Publication,* R. K. Honaman; *Public Relations,* R. K. Honaman, chairman; *Research,* M. J. Kelly, chairman, and M. B. Long, secretary; *Safety,* L. P. Ferris and A. H. Schirmer; *Standards,* R. D. de Kay; and *Technical Program,* M. J. Kelly and J. D. Tebo, who are ex-officio members.

D. A. Quarles represents the Institute on *United Engineering Trustees, Inc.*

Members on professional group committees are: *Charles LeGeyt Fortescue Fellowship* and *Edison Medal,* R. I. Wilkinson; *Lamme Medal* and *Management,* D. A. Quarles; and *Award of Institute Prizes,* M. J. Kelly and J. D. Tebo.

Those on technical committees are: *Communication Coördinating Committee,* A. J. Busch, secretary; *Aural Broadcasting Systems,* P. G. Edwards; *Communication Switching Systems,* R. C. Davis, chairman, and J. Meszar; *Radio Communication Systems,* A. C. Dickieson, secretary; *Special Communication Applications,* Newton Monk; *Telegraph Systems,* E. F. Watson; *Wire Communication Systems,* H. A. Affel, chairman, and L. G. Abraham, secretary; *Science and Electronics Coördinating Committee,* J. D. Tebo, chairman; *Basic Science,* J. A. Becker, W. H. MacWilliams, Jr., and J. D. Tebo; *Computing Devices,* W. H. MacWilliams, Jr., vice chairman; *Electronic Power Converters* and *Electronics,* D. E. Trucksess; *Metallic Rectifiers,* N. Y. Priessman and D. E. Trucksess; *Instruments and Measurements,* E. I. Green; *Carrier Current,* J. M. Dunham; *Protective Devices,* P. A. Jeanne; and *Transmission and Distribution,* P. W. Blye.

"Vets" Team Wins Whippany Softball Championship

The "Vets" softball team, a two-year-old organization composed entirely of veterans of the last war, won the Whippany Softball League championship by defeating the Shop Service team in four straight games in the playoff series.

The "Vets" earned the right to compete in the series classic by winning the first-half season over the six other teams in the league. Shop Service was top team in the second half, each half-season consisting of two complete rounds of play between all teams.

Members of the winning team are as follows: Gilbert Beck, Arthur D. Beers, Albert Diegler, Monroe W. Dring, Eugene P. Furst, Robert Haggerty, Richard R. Hough, Arthur J. Hickson, Thomas J. O'Connor, Joseph N. Spiewak, W. Arthur Sumner, Jacques P. Swart and Clifford Underhill.

Higher Coin Box Charges Asked

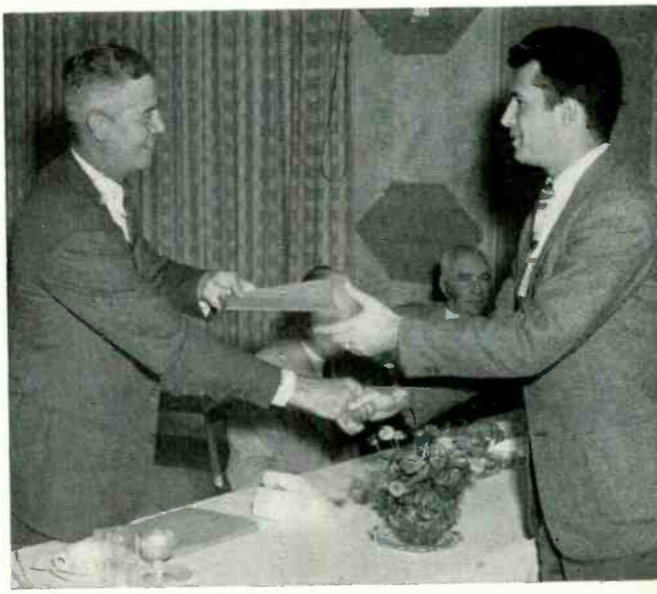
Charges of ten cents instead of five for local calls from coin telephones, to become effective late in 1950, have been asked at a Public Service Commission hearing by New York Tel.

This proposal, which is estimated to add $12,000,000 (after commissions) to the annual revenue of the company, would not become effective until next fall, since nearly a year would be required to make the necessary modifications in the public telephone system.

For the 12 months ending August 31, 1949, earnings dropped almost $9,000,000 from the preceding 12 months, President Keith S. McHugh pointed out.

Graduates of Training Courses

F. D. Leamer presented certificates to graduates of the Drafting Assistant and Junior Mechanics Training courses. At the right: J. A. Donlevy receives his certificate from Mr. Leamer.

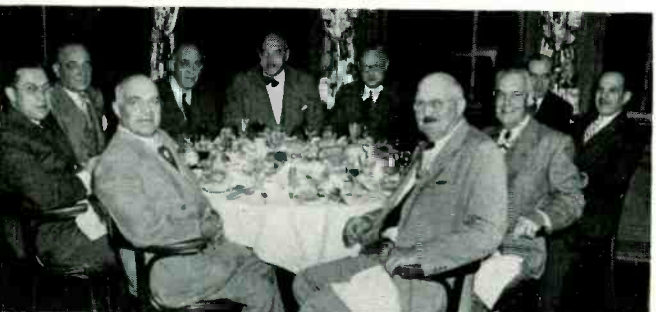


The New York graduates, below, standing: C. W. Peterson, R. H. Canton, R. G. Kaltenbach, H. J. Braun, G. W. Fiederowicz and W. A. Hoefener. Seated: J. A. Whittaker, J. A. Kotaski, Stanley Krell, Calvin Coats and E. H. Jockel. Not shown are T. J. Landis, A. W. Luhrmann, N. E. Wallin and J. F. Gulbin.

The New Jersey graduates, below right, in rear: P. S. Kubik, C. H. Kennedy, W. H. Stevenson and R. A. Hanzl. Middle row: J. D. D'Ursi, E. W. Van Wyk, E. W. Hayford, J. V. Sagarese, William Wiegmann and G. A. Carlson. Seated: R. W. Bruning, J. P. Swart, J. A. Donlevy, A. J. Hickson and J. N. Spiewak. R. L. Youngs, not shown, also graduated.

Legion Post Installs Officers

New officers of Bell Telephone Post 497, American Legion, were installed at their thirtieth anniversary dinner on September 21 at 2 Park Avenue, New York. The dinner was also a reunion of former members of the Research and Inspection Division of the Signal Corps who served in France in World War I. Honored guests included C. O. Bickelhaupt, O. E. Buckley, J. R. Bransford, R. Murphy, Past National Commander of the Legion, and H. J. Schroll. Mr. Murphy conducted the installation of 1949-50 officers. They are: *Commander,* W. J. Hogan; *1st Vice Commander,* G. J. McArdle; *2nd Vice Commander,* W. V. Pfandke; *3rd Vice Commander,* R. C. Kenney; *Adjutant,* A. W. Draper; *Assistant Adjutant,* F. J. Osolinik; *Finance Officer,* J. J. Morrow; *Service Officer,* E. N. Emmons; *Chaplain,* C. T. Miller, Jr.; and *Sergeant-at-Arms,* G. Scheurmann.



News Notes

MEMBERS OF THE NATIONAL INVENTORS' COUNCIL were luncheon guests of Dr. Buckley at West Street on September 13. The occasion was a meeting of the Council, of which Dr. Buckley is a member. After luncheon, the group visited a number of operating facilities of the Long Lines Department at 32 Avenue of the Americas.

DR. VANNEVAR BUSH, President of the Carnegie Institution of Washington and a Director of the A T & T, was escorted by Dr. Buckley on a tour of the Murray Hill Laboratories on the afternoon of September 21.

M. J. KELLY visited the Southwestern Bell Telephone Company on September 8. On September 21 he attended the American Naval Ordnance Association dinner in New York with D. A. QUARLES, R. K. HONAMAN, E. L. NELSON, W. C. TINUS and R. E. POOLE.

R. BOWN attended a meeting of the Directors of Industrial Research at the Mellon Institute in Pittsburgh and visited the Aluminum Company at East Kensington.

R. K. HONAMAN spoke before the Cleveland Engineering Society in Cleveland, October 3. His subject was *Frontiers of Telephony*.

F. W. SEIBEL, on completion of a temporary assignment as an assistant treasurer, has returned to Accounting, reassuming his duties as head of Payroll.

H. W. BODE and R. W. HAMMING attended the Harvard University Symposium on *Large-Scale Digital Calculating Machinery*.

N. B. HANNAY visited the Consolidated Engineering Corporation in Pasadena, California, to discuss mass spectrometer developments.

A. MENDIZZA conferred with Western Electric engineers from Winston-Salem at the Radio Condenser Company's plant in Camden where finishing and corrosion were discussed.

R. PLATOW attended a meeting at Philadelphia of A.S.T.M. Committee C-19 on Structural Sandwich Constructions.

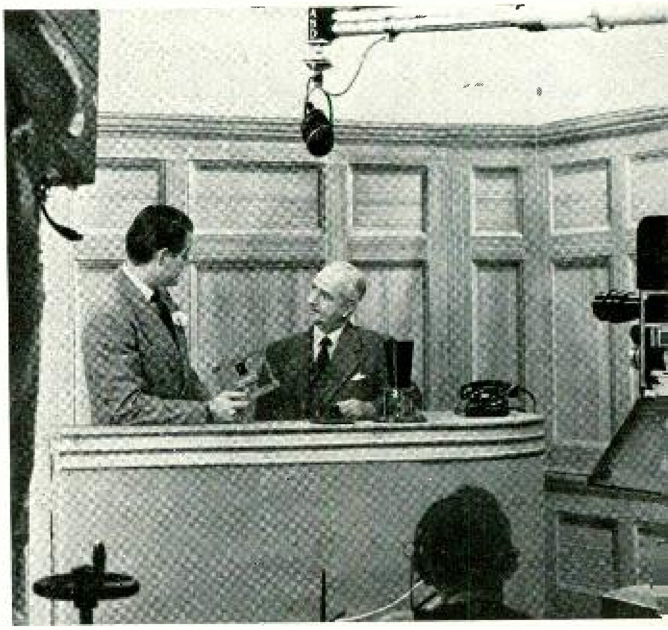
H. C. FOREMAN, R. W. FRIIS, R. S. PHAIR, K. D. SMITH and G. K. TEAL discussed precision microwave attenuators at Allentown.

C. J. CALBICK, H. CHRISTENSEN, C. J. FROSCH and G. K. TEAL participated in a symposium at Fort Totten, New York, on sintering and crystal growth.

C. L. LUKE attended the second annual Bell System Conference on Chemical Analysis held at Hawthorne.

R. M. BURNS, G. T. KOHMAN, L. A. WOOTEN, C. S. FULLER, V. T. WALLDER, G. N. VACCA, A. C. WALKER, E. BUEHLER, W. G. GULDNER, J. A. BURTON, J. B. HOWARD, J. H. HEISS, W. J. CLARKE, H. A. BIRDSALL and W. McMAHON attended the American Chemical Society meeting at Atlantic City.

B. M. OLIVER spoke on *Methods of Removing Signal Redundancy Especially in TV Transmission* at the meeting in Holmdel, October 7, of the Deal-Holmdel Colloquium.



J. T. Lowe, curator of the Bell System Historical Museum, was interviewed on September 27 by Chuck Tranum on his WABD television show, "Manhattan Spotlight." After some of the earliest telephone sets, Mr. Lowe showed and described briefly the new 500-*type combined set. Not seen by the television audience was another Laboratories development, the* 639-A *microphone, which picked up the voices.*

A New Method of Growing Large Quartz Crystals, by A. C. WALKER and E. BUEHLER, was presented by Mr. Walker before the Industrial and Engineering Chemistry Section of the American Chemical Society.

T. R. FINCH, S. E. MILLER and W. A. TYRRELL attended the National Electronics Conference on Electronic Research Development and Application in Chicago. Mr. Tyrrell presented a paper on *Waveguide Attenuation Measurements by a Cavity Decrement Method*.

F. W. CLAYDEN went to the New Haven and Westport central offices in connection with the step-by-step bank insulator replacement tool.

RETIREMENTS

Among those retiring from the Laboratories are G. B. Hamm with 49 years of service; L. S. Lillis, 44 years; R. E. Peoples, 39 years; W. E. Darrow and W. H. Frees, 38 years; Amelia Blauvelt and C. E. Hollister, 32 years; and Mabel Sleght, 28 years.

George B. Hamm

When the late H. D. Arnold decided in 1916 to relieve his research people of non-technical details, George Hamm was selected to set up a service organization. Mr. Hamm had started in 1900 as a messenger when West Street was Western Electric's only plant. He still remembers the finesse of water copying; there was little or no carbon paper in those days. Later he became a clerk, and for four years he helped to get new and changed apparatus into smooth production. When the shop moved to Hawthorne, he transferred in 1912 to the Distributing House.

G. B. Hamm W. E. Darrow

Mr. Hamm's natural helpfulness and vigor made him a good man to set the new service patterns and the rest of his Bell System career was in that line. In 1932 he was put in charge of service to the research people in the Graybar-Varick Building, and there, in 1940, he was given responsibility for working out the details and setting up the first self-service stockroom—now an established practice throughout the Laboratories. In 1941, when new equipment began to arrive in the then uncompleted building at Murray Hill, he was transferred there to look after its warehousing and distribution to its new locations. His job grew with occupancy, and eventually Mr. Hamm had charge of shipping, receiving, stores, local service and the like at Murray Hill. With the institution of area management and in anticipation of his retirement, he was placed in charge of storerooms in the general service group last year.

Mr. Hamm and his wife expect to continue to live in Westfield, where George looks forward to enjoying his three grandchildren, his well-equipped shop, and the visits of neighbors to borrow his second-best set of tools.

Wirt E. Darrow

When Mr. Darrow came over from New York Telephone to A T & T in 1919, there were still many cities served by two unconnected telephone systems. One of these was Indianapolis, where a manual and a step-by-step system were to be joined; Mr. Darrow organized the work and developed a number of the new circuits. Later he worked on an extensive series of jobs in Ohio, and then, for several years, was concerned with circuits to interconnect manual boards with panel and step-by-step systems. When his department was consolidated with the Laboratories in 1934, Mr. Darrow continued to supervise a group dealing with manual central office facilities and with auxiliary services given by operators in dial and manual offices. During World War II he was an instructor in the War Training School, and later wrote a number of instruction books on radars developed by the Laboratories. He then returned to Switching Engineering where he has since been engaged in various special studies.

Mabel Sleght Amelia Blauvelt

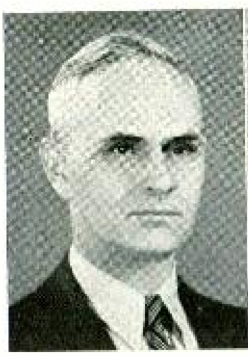
Mr. Darrow holds the B.A. (1909) and the B.E.E. (1911) degrees from Michigan. In the latter year he joined the New York Telephone Company, where, for eight years, he was an engineer on PBX problems.

Amelia Blauvelt

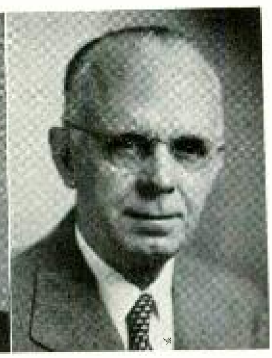
Amelia Blauvelt, after her retirement, has returned to her home in Hillsdale where she will live with her father and sister. She plans to resume her music which she has not been able to follow since she graduated from business college. She will also devote much time to her garden. Miss Blauvelt joined the Laboratories in 1917 and spent a short period in the Transcription Department. She advanced to secretary in the Physical Research Department, and, in that capacity, served engineers and physicists for many years, first at West Street and later at Murray Hill. In 1948 Miss Blauvelt came back to West Street and, at the time of her retirement, was responsible for the circulation and distribution of text material for the Communications Development Training.

Mabel L. Sleght

Mabel Sleght is one of those rare individuals who has so nurtured an avocation through the years that it became her livelihood when she stepped out of the business world. Immediately after retiring she assumed a full-time position as secretary to the director of a school of music and will do some teaching as well. In addition to being an accomplished organist and pianist, she has sung professionally for several years. Miss Sleght's serious study of



C. E. Hollister



L. S. Lillis

music began while she was at Vassar College and continued even while she was taking graduate work at Columbia University School of Library Science and at New York University School of Business Administration.

In 1921 Miss Sleght entered A T & T and became chief clerk in charge of both the D & R special library and transcription groups for a time. As the department expanded, she relinquished her duties in library work and, from 1925 to 1934, headed the Transcription Department. Shortly after the consolidation, she transferred to the Technical Library and for seven years was responsible for the compilation of bibliographies.

In 1942 she became a member of the Personnel Department where she served in various capacities, particularly in the Personnel Planning group. Since 1947 she had been concerned with the military clearances of members of the Laboratories engaged in confidential Government projects.

Leo S. Lillis

Inspection of telephone instruments was Leo Lillis' first job when he came to work in the West Street Building in 1905. At that time the instruments were owned by the American Bell Telephone Company and furnished to the Associated Companies as a service under the License Contract. Mr. Lillis went to Chicago in 1913, where he kept records of them and other stock maintenance records until 1918. Then he worked at 195 Broadway on pricing for Government contracts. At the war's end he returned to West Street in the cost estimate and order service groups, and took charge of this work in 1924 and continued in this capacity until 1942. During World War II he assisted in preparing deferment applications to draft boards, and later worked on various personnel studies.

In retirement, Mr. and Mrs. Lillis expect to extend their travels beyond Chicago, where they lived for five years before World War I. But their son, who works at Kearny, and their young granddaughter, are sure to draw them East again.

November Service Anniversaries of Members of the Laboratories

40 years

W. H. Bendernagel
J. S. Garvin
G. A. Johnson

35 years

F. A. Bonomi

30 years

James Abbott, Jr.
J. R. Bardsley
C. F. Boeck
W. L. Dawson
A. O. Easton
R. K. Honaman
D. K. Martin
L. F. Porter
Anna Ryan
D. C. Smith

25 years

Grace Goodall
N. A. Hall
A. C. Holetz
M. M. McKee
Ethel Millar
Catherine Pugh

20 years

J. C. Bain
W. C. Bengraff
G. J. Bloeser
P. G. Clark
W. W. Davis
Lawson Egerton
Mary Entrabartolo
W. A. Funda
A. J. Hannan
Catherine Henderson
W. H. Hewitt, Jr.
J. P. Houlihan
Albert Jost
Mary Kuhn
John Leutritz, Jr.
Thomas Mescal
Thomas Musca
Daniel Spicciati
J. D. Struthers
A. J. Stuart
G. F. J. Tyne
Robert Van Luipen
Albert Wilson

15 years

Maurice Ahern
John Bowens
Patrick Burke
W. W. Maas
Felix McGowan
J. J. Moylan
Walter Stanewicz
J. Z. Takacs
F. E. Tucker

10 years

G. D. Mandeville
A. A. Manner

R. E. Peoples   William Frees

Carey E. Hollister

Carey Hollister will have plenty to do after he retires on November 16. An expert rifleman, he belongs to the Laboratories Rifle Club; he is also quite a bowler, and, for twenty-two years, he has been a member of the Towaco Fire Department. He has been active in the American Legion, having been Finance Officer of Lincoln Park Post No. 279 for several years and has just completed a year as Post Commander. Moreover, he expects to do some traveling in the South and West.

Entering the Laboratories in 1917, Mr. Hollister had a degree from Cumberland University (B.S. 1915), and two years of engineering at University of Tennessee. Interrupted briefly by World War I, his career continued in design of coils for relays until 1928, when he took up design of apparatus for panel and step-by-step systems. Transferring in 1937 to Apparatus Specifications, he has subsequently worked on relay, outside plant, and general apparatus specifications.

Robert E. Peoples

Mr. Peoples received his technical training at Lewis Institute, Chicago, and joined the Western Electric Company at Hawthorne in 1909. Ten years later he transferred to the circuit development group at West Street, and, until 1923, designed selector circuits for the panel system. He then took up the design of test circuits for panel. During World War II he worked on an important military project and since then on crossbar test circuits.

William Frees

The nickel-plated desk stand was in high favor when William Frees started to work with the Bell System. His job was to polish the brass parts to a mirror finish before they went into the plating baths. Five years later, manufacturing was moved to Hawthorne and Mr. Frees went along. In 1918 he returned to New York and worked elsewhere for three years, then came back to us as a polisher and plater. His job has been to prepare and polish all sorts of metal parts for plating with copper, nickel, chromium, and other metals according to exacting Bell Laboratories standards.

Mr. Frees and his wife live in Union City, where they expect to remain. They have three girls and three boys, all married, and thirteen grandchildren.

Golf Tournament in New Jersey

Nearly sixty members of the Bell Laboratories Club participated in the golf tournament held at the Essex County Country Club on September 17. Winners were:

Class "A"—R. W. Rader, low net; J. E. Ballantyne, second; and E. F. Ennis, G. W. Galbavy, W. L. Whinn and C. H. Swannack, tied for third. Kickers: H. G. Petzinger and W. W. Carpenter, Jr.

Class "B"—E. K. Eberhart, low net; G. A. Palladine, second; H. T. Reeve, third; T. A. Pariseau, fourth; and R. P. Muhlsteff, fifth. Kickers: B. W. Kendall and J. G. Walsh.

Photographs of many of the golfers are shown on the opposite page.

Captains of Bell Laboratories Club Bowling Teams

New York—Women

Elizabeth Bates
Elizabeth Beck
Mabel Glidden
Madeline Gabay
Lillian MacNeill
Evelyn Wentsch

New York—Men

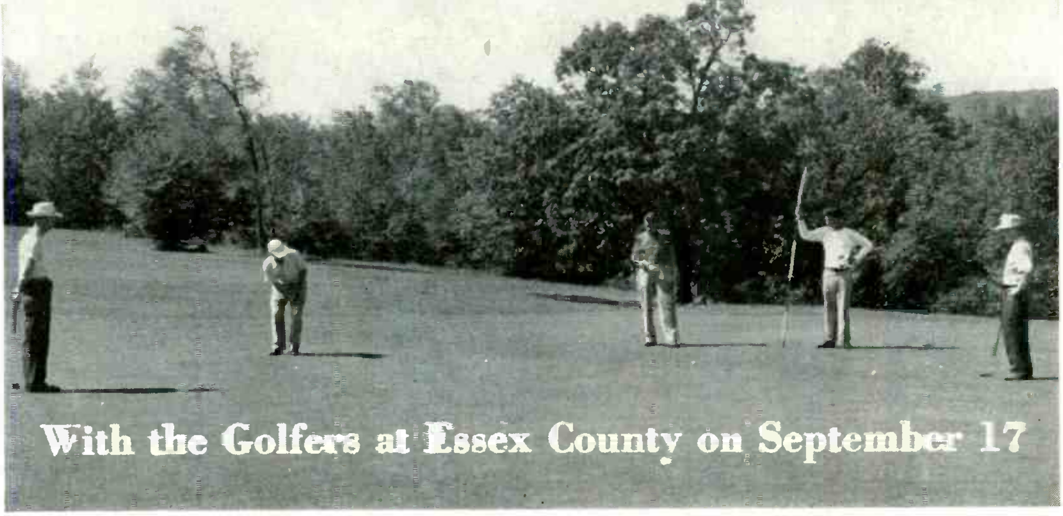
Emil Alisch
V. F. Blefary
P. O. Boschan
R. S. Byorick
R. H. Canton
T. J. Doherty
L. W. Drenkard
A. O. Easton
S. N. Foster
R. H. Gertz
W. L. Hardardt
A. G. Lang
F. J. Majorossy
Joseph Michal
E. W. O'Hara
E. V. Paholek
T. W. Quinn
G. A. Schiehser
G. W. Schuell
James Stamas
F. W. Treptow
J. G. Walsh
J. M. Watson
E. A. Wieland

Murray Hill

W. E. Balph
C. A. Bieling
Robert Black
Victor Blindt
H. D. Bone
R. H. Erickson
M. E. Fine
J. P. Fraser
C. J. Frosch
E. A. Galambos
B. C. Gaughran
J. F. Hurley
A. H. Jankowski
G. F. Kallensee
L. G. Kersta
P. P. Koliss
E. J. McCarthy
C. E. Mitchell
J. W. Nalencz
W. R. O'Neill
J. A. Pasternak
T. C. Rice
J. A. Rohrer
W. H. Schweyher
Morgan Sparks
H. L. Stark
C. R. Taft
Edwin Watkinson
W. L. Whinn
F. A. Wolfe

Whippany

N. C. Brower
R. R. Cordell
A. H. Diegler
R. G. Dolbear, Jr.
William Held
H. G. Hohner
C. E. Hollister
G. H. Keillen
E. F. Krommer
C. W. Norwood
T. J. O'Connor
G. A. Palladine
J. S. Parsons
E. T. Stammer
C. E. Underhill
E. W. Van Wyk



E. K. Eberhart watches his long putt roll up to the hole on the 6th. (It did not drop.) The others are S. J. Brymer, W. R. Baldinger, caddy, and W. F. Malone.

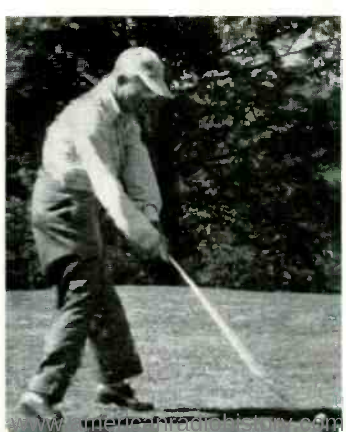
R. D. Fracassi, Smart Brand, D. K. Gannett and H. B. Coxhead waiting to drive off the 9th tee.

G. A. Palladine, W. L. Whinn, H. G. Petzinger and W. L. Patterson after driving off the 12th tee.

R. W. Rader chips as Joseph Sanfilippo (guest), G. J. Wolters and H. N. Sanfilippo watch.

E. G. Morton sank this 4-footer on the 11th, while T. A. Pariseau, D. L. Viemeister and A. G. Kobylarz watch.

J. G. Walsh (left) and D. K. Batchelor (center) drive off the 9th tee, while W. W. Carpenter drops a short putt on the 8th.



News Notes

H. H. Lowry retired from the Laboratories on October 31. A sketch of Mr. Lowry's career will appear in the December issue of the Record.

F. D. Leamer participated in the American Management Association Workshop Seminar, devoted to the subject of *Job Evaluation*. Meetings were held at the Waldorf-Astoria Hotel, September 28-30.

F. J. Given, A. J. Christopher and A. B. Haines gave talks at the Technical Conference on High Temperature Dielectric held at Princeton University under the sponsorship of the Research and Development Board. Mr. Haines attended a meeting of the Signal Corps Transformer Guidance Council at Squier Laboratory, Fort Monmouth.

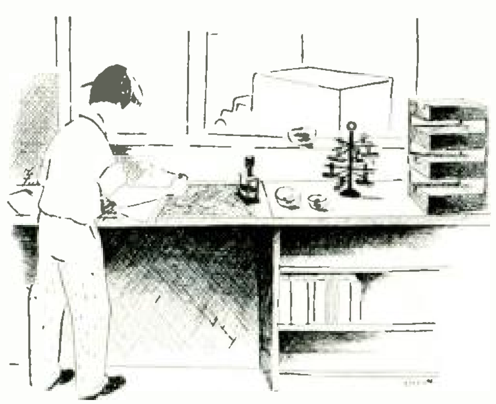
T. Slonczewski attended the National Electronics Conference at Chicago where he delivered a paper on *Automatic Calibration of Oscillator Scales*, prepared in collaboration with W. J. Means.

D. T. Bell and R. S. Graham attended the symposium on *Large-Scale Digital Calculating Machinery* sponsored jointly by the Navy Department Bureau of Ordnance and Harvard University which was held in Cambridge.

M. Salzer visited the Orchard central office near Philadelphia in connection with field studies of trouble recorder perforators.

M. A. Logan visited Washington regarding new mechanisms for the Bureau of Ordnance.

Problems relating to crossbar systems were discussed at various locations by D. S. Barlow, W. Buhler, A. A. Burgess, A. J. Engelberg, K. M. Fetzer, D. H. Gleason, A. A. Hansen, J. J. Kuhn, F. K. Low, R. L. Lunsford, R. K. McAlpine, J. Meszar, D. D. Miller, R. P. Murphy, R. C. Pfarrer, W. H. Scheer, S. P. Shackleton, H. O. Siegmund, D. H. Wetherell and W. Whitney.



J. P. Griffin and L. F. Koerner visited the Bureau of Standards in connection with the development of crystal units for frequency standards.

L. N. Hampton visited Teletype Corporation for a discussion of production problems relating to the automatic trouble recorder.

At Chicago, F. W. Treptow discussed the 356A packaged equipment, PBX's and key telephone equipments; E. T. Ball, W. E. Grutzner and O. J. Morzenti, crossbar; W. Bennett and Mr. Treptow, new PBX and community dial office equipments; C. C. Barber, crossbar switch development; B. F. Runyon and H. M. Knapp, relays; J. S. Garvin, the new 280-type polarized relay and step-by-step relays; H. A. Frederick, A. C. Keller, C. A. Lovell and H. O. Siegmund, new relay developments; A. W. Daschke, meter problems; A. Herckmans, H. R. Clarke, R. E. Prescott and W. L. Tuffnell, the new telephone set; B. O. Templeton, coin collector problems; and K. L. Warthman, the preparation of a course on manufacturing methods.

J. H. Waddell conferred at the Wollensak Optical Company in Rochester on optical problems in high speed photography.

D. G. Blattner, J. F. Baldwin and R. A. Hecht's visit to Point Breeze concerned the manufacture of switchboard plugs. Mr. Blattner and H. A. Larlee visited the Western Electric repair shops in Detroit, Minneapolis and Chicago.

M. O'Connell attended a meeting of the R.M.A. Committee on Vacuum Tube Sockets at Emporium, Pennsylvania.

C. A. Webber, W. S. Eno and Frank Lindberg conferred at Point Breeze on cords for the new telephone set.

A. W. Hayes and D. W. Mathison visited Chicago in connection with a quality survey. Mr. Mathison continued on to Detroit.

Robert Pope investigated corrosion of underground cable sheaths at Mobile and Montgomery, Alabama.

The Laboratories were represented in interference proceedings at the Patent Office by R. J. Fluskey before the Primary Examiner.

J. W. Schmied and E. B. Cave appeared before the Board of Appeals at the Patent Office in Washington relative to applications for patent.

R. E. Poole attended a conference at Sandia Base, New Mexico, on September 12.

A. H. Schirmer attended a meeting of the Correlating Committee of the National Electrical Code Committee of the National Fire Protection Association in St. Louis.

H. B. Brehm inspected trial installations of surge-resistant station fuses and NC-16 distribution terminals in the Western Division of the New England Company.

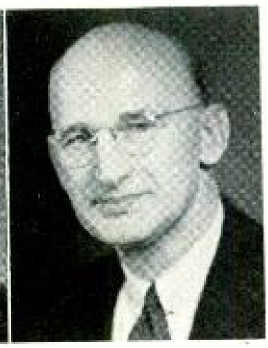
H. B. Brehm witnessed the field trial of surge diverters in Moscow and Shamokin, Pa., with Bell of Pennsylvania engineers.

Recent Deaths

Francis J. Voinier, September 20

Mr. Voinier started work at the Laboratories in 1928 as a messenger in the General Service Department. His early interest in accounting

F. J. Voinier
1911-1949



G. A. Ritchie
1886-1949

resulted in his transfer the following year to the General Accounting Department. After extended experience in various phases of Laboratories' accounting work, he was assigned to the Statistical Accounting Department, assisting in the operation of Laboratories' budgetary procedures. At the time of his death, he was a member of the Plant Accounting Department, assisting in the maintenance of Laboratories' plant investment records.

His outside interests centered around his church, St. John's (Lutheran), in Jersey City, and on scouting. He organized the Boy Scout Baseball League and served as Scout committee man, and, later, commissioner in the troop attached to his church.

George A. Ritchie, October 3

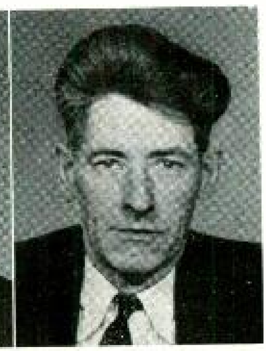
A graduate of Pratt Institute, Mr. Ritchie had been a draftsman for thirteen years in other concerns before he joined the Laboratories as an engineer in 1918. In 1924 he was made a supervisor in charge of design and development work on miscellaneous switchboard apparatus as signal plugs, cord weights, switchboard keys, and key mountings.

Mr. Ritchie's interests outside of the Laboratories were connected with his home, particularly in his basement workshop and in his garden. He also liked music, deep sea fishing and travel. He was on a vacation trip in Nova Scotia when he died suddenly.

Mirl Roland, September 20

When Mr. Roland became a member of the Laboratories in 1943, he was assigned to the Plant Department group servicing the grounds at Murray Hill. His next assignment was in the boiler house, hand firing coal. In 1947 he transferred to the Power Service group where he assisted in general plant operation functions and building maintenance. One of

J. T. Delaney
1897-1949



Mirl Roland
1894-1949

his jobs—replacement of lamp bulbs—brought him into contact with many people, who well remember his smile and homely philosophy.

John T. Delaney, September 10

On July 1, 1949, Mr. Delaney transferred from Western Electric to the Systems Engineering Department as a Member of the Technical Staff to engage in the preparation of Bell Systems Practices covering maintenance tests and operation methods for crossbar systems circuits. He brought to the Laboratories a wealth of circuit background, dating back to 1919, when he joined Western as an installer on panel and manual systems. He was interested especially in circuit work and was assigned to test operations. During the installation of the panel dial projects in the New York metropolitan area, Mr. Delaney handled test operations on most of those jobs. He also made tests in Philadelphia and Washington on similar installations and later was responsible for supervising the installation of various crossbar systems in the New York area.

News Notes

R. P. Ashbaugh and W. L. French, in Winston-Salem and Greensboro, N. C., made field observations of cable.

C. H. Amadon was in San Francisco, Eugene and Denver in connection with experimental treatments of Douglas fir and lodgepole pine telephone poles.

L. R. Snoke set up additional brush control experiments along toll cable right-of-way in eastern Pennsylvania, and, in New Haven, discussed chemical control of right-of-way with Southern New England Telephone engineers.

The Doll and Toy Committee again asks your generous and wholehearted support in fulfilling requests for Christmas gifts for children in local institutions and hospitals. Left to right: Jean Pick, Marguerite Hutchinson, secretary; Eleanor Burden, Fay Hoffman, chairman; and Helen Racz, treasurer, of the West Street Committee.

M. C. Biskeborn went to the General Radio Company for discussions on the design of high-frequency variable air capacitors.

G. Q. Lumsden and J. Leutritz, Jr., consulted with Bell Telephone engineers at Trenton, Ontario, during the inaugural treatments of red and jack pine poles with greensalt.

L. A. Leatherman checked performance requirements on the power equipment at the TD-2 station at Wyndmoor, Pennsylvania.

J. A. Potter discussed new rectifier designs with a manufacturer in Detroit.

"The Telephone Hour"

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

November 7	*Jussi Bjoerling*
November 14	*Robert Casadesus*
November 21	*Ferruccio Tagliavini*
November 28	*Fritz Kreisler*
December 5	*Marian Anderson*
December 12	*Lorne Munroe and Carroll Glenn*
December 19	*John Charles Thomas and Mixed Chorus*
December 26	*Zino Francescatti*

Two members of the Patent Department have been admitted to practice before the State Bars: A. J. Torsiglieri in Massachusetts and J. S. Rubin in New York.

H. M. Spicer observed the operation of the power equipment at the Wyndmoor and Buckingham, Pa., stations of the TD-2 system.

H. T. Langabeer conferred with engineers of The Bell Telephone of Pennsylvania at Philadelphia on power service requirements.

R. B. Bauer made trips to Baltimore, Washington and Minneapolis to study A4A toll training problems.

H. M. Owendoff inspected field operation of the new Western Electric frequency analyzer and level recorder at the Naval Experimental Station at Annapolis.

R. O. L. Curry, at St. Louis, attended the National Instrument Conference and Exhibit.

Engagements

*Georgette Ahrens—Edward J. Evans
Angela Catrini—*Jack J. Confusione
*Therese Curry—*Henry Bentele
Sybil Greenan—*Frederic N. Rolf
*Julia Klos—*Charles H. Dalm
*Clare Masker—Bert Fedor
*Elizabeth Merrell—*Robert W. Hull
*Dorothy Nauta—H. M. Christiansen
*Susan Waddell—William J. Neal

Weddings

*Helen Budric—Harry Asklof
*Jane Conlon—George Ulrich, Jr.
*Helen Herrmann—Robert J. Forrester
*Elizabeth O'Brien—William J. Brady
*Mary Reibel—Thomas J. Corcoran
Constance Simon—*Howard N. Seckler
*Patricia Sirett—Patrick A. Connelly
Margaret Tuttle—*C. Harry Haynes

*Members of the Laboratories. Notices of engagements and weddings should be given to Mrs. Helen McLoughlin, Section 11A, Extension 296.