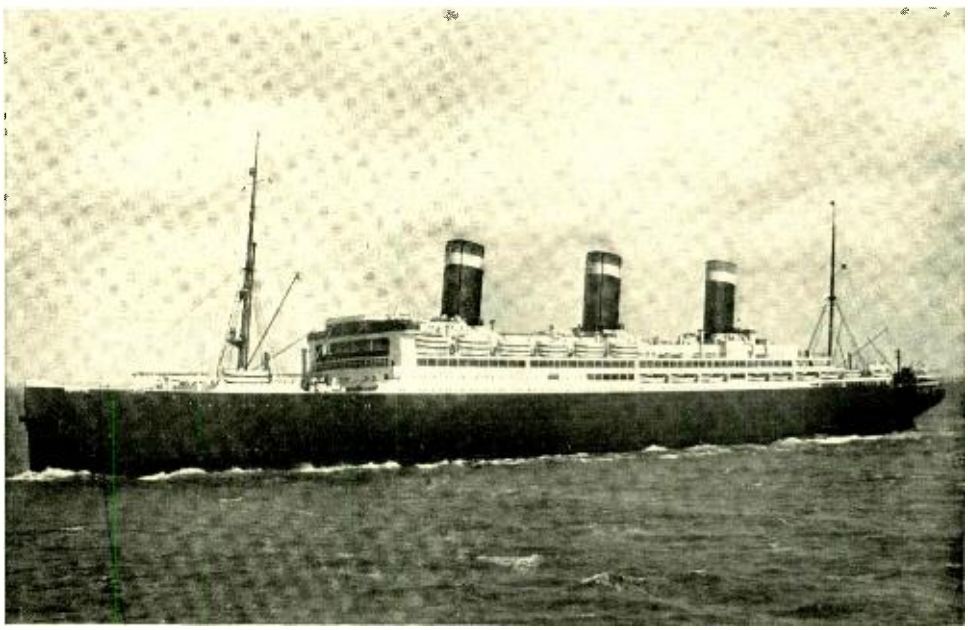
BELL LABORATORIES RECORD



The "Leviathan", first ship to be equipped for regular commercial ship-to-shore radio telephone service

VOLUME EIGHT—NUMBER FIVE

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1930

LIKE most of the years which have preceded it, 1929 has been a year of gratifying achievement for us of Bell Telephone Laboratories. Our disappointments have been few—less by far than one might reasonably expect in a great complicated operation having for its objective the production of new things of science.

In closing the book of 1929 and opening that of 1930 I am impressed forcibly once again by the fact that in our work each development completed opens the way to other possibilities. Looking forward as best I can into the year ahead it seems clear that none of us will lack for worth while things to do. Frequently I surmise our difficulty will be to choose the thing that should be done from the many that might be undertaken.

Added to our other problems we have this year the problem of providing enlarged permanent space and facilities for our greatly increased activities. Although this may put an added strain on us, it should not give us material concern. We have worked together too long to have any doubts as to the ability of the organization to carry through successfully any operation we undertake.

While, therefore, we can look forward with confidence, we must not lose sight of the fact that in many directions we are facing an increased development activity in our field throughout the world. Much of it is directly traceable to our own past accomplishments, but whatever the cause there is an added incentive to us to continue to do our best.

ANOTHER year has closed with its record of achievements in which all associated with the Laboratories may well share that pride and satisfaction of accomplishment. Our fundamental researches have added to the sum total of useful knowledge, and new developments have extended and improved the facilities for electrical communication. We have striven with success, we trust, to effectively do our part in providing for ever better, wider and more economical service, which is the aim and policy of the Bell System.

A new year has opened with new problems and opportunities — work immediately important for the solution of current problems and work broadly and specifically, as well, directed toward more distant future needs and possibilities. Our program is larger, our field greater, our responsibilities ever increasing, but with added personnel and continually improved facilities, and with team work and loyalty to our ideals, we are approaching the tasks of the new year with determination and confidence.

Although we, of the Laboratories, are not directly engaged in the operations of furnishing telephone service, we are privileged to play an important and far-reaching part through our development of new and improved instrumentalities, and otherwise aiding the operating companies in rendering a more pleasing and satisfying service to their customers. We look forward with pleasant anticipation to a service of increasing effectiveness.

Telephony between Ship and Shore

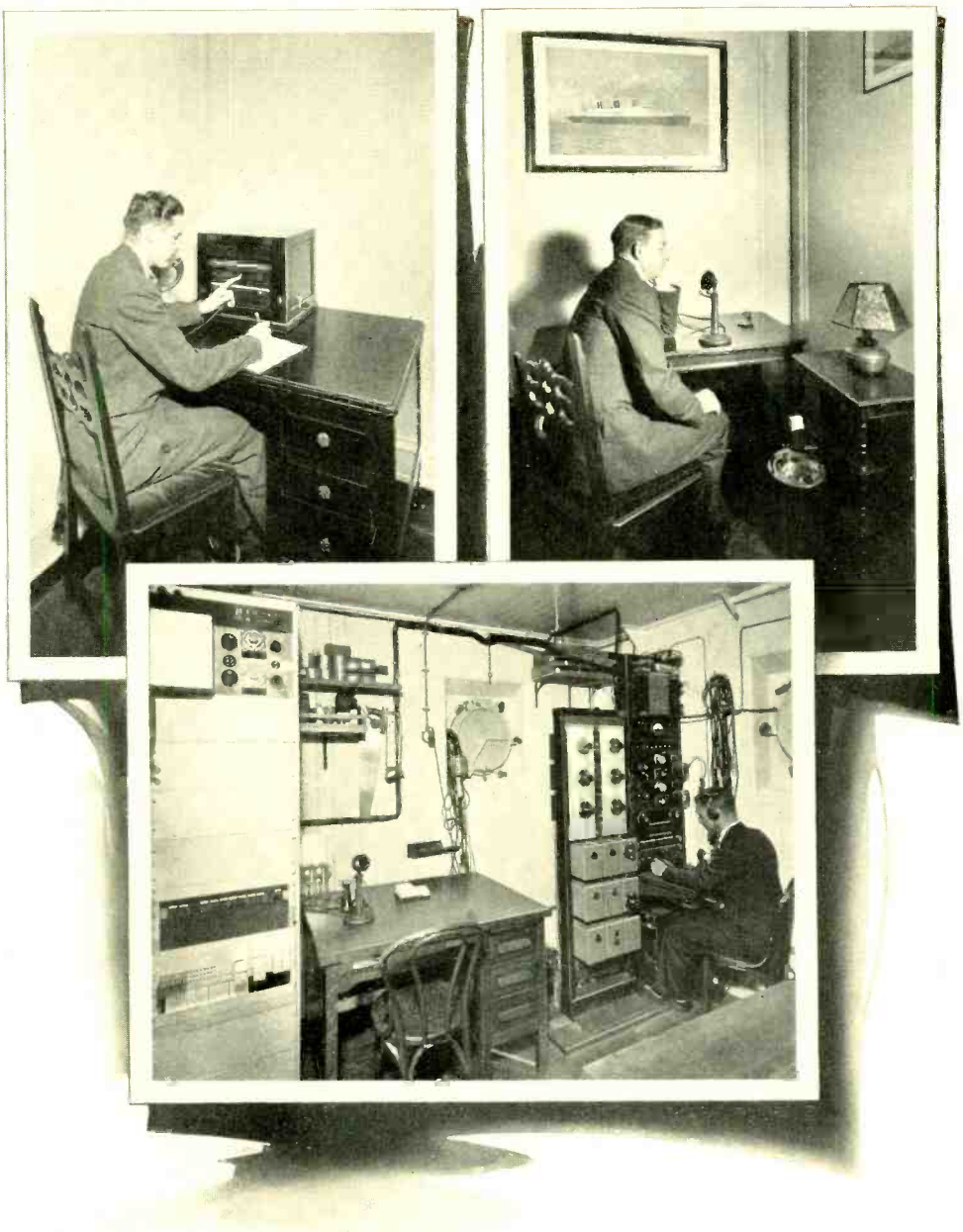
By R. A. HEISING
Radio Research

IN a demonstration on December 8 preparatory to commercial opening, telephone calls passed to and from the United States Lines' steamship "Leviathan." By the demonstrated system of wire lines and radio links, of a general type which has become familiar in its transatlantic application, passengers on the Leviathan can now converse with their friends ashore.

The new facilities are the outcome of a long series of experiments extending back beyond the time of the war. After early work on communicating systems to operate between war ships, a program of ship-to-shore telephone development was initiated in 1919. Radio stations for both transmitting and receiving were built at Green Harbor, Massachusetts, and Deal Beach, New Jersey, and corresponding equipment was installed on the coastwise steamers "Ontario" and "Gloucester" plying between Boston and Baltimore. Apparatus was ultimately designed which allowed these vessels, while at sea, to maintain two-way conversations with land telephones. Wavelengths were in the broadcast range, and power levels were about one kilowatt in the transmitting antennas on land and one-quarter kilowatt on ship.

Work toward making ship-to-shore telephony available to the public was suspended in 1922. Though trials had been successful from a technical standpoint, the development was not carried to the point of the establishment of service to the public because conditions prevailing in the shipping world did not seem to justify the establishment of a commercial telephone service to ships. In the meantime progress in other applications of radio was bringing forth new methods and equipment, of which much was applicable to the ship-to-shore problem. Especially influential were the growing use of very short carrier waves and tuned directive antennas, of frequency control by quartz-crystal oscillators, and of high-power water-cooled vacuum tubes. When in 1929 ship-to-shore telephone development was resumed, it could build upon the Bell System's extensive experience with both broadcast and transatlantic radio telephony.

Though in many ways similar, the problems of ship-to-shore telephony differ in several obvious and important respects from those of transoceanic telephony. Both ask point-to-point radio communication; but in the ship-to-shore case between points of which one—the ship—is moving. Space for apparatus and antennas on the ship is furthermore severely limited. Finally, resonance effects in metallic structures, interference by adjoining electrical apparatus, and persistent mechanical vibration, all escapable on shore, are inevitably to be dealt with on the all-steel, machine-packed vessel. Short waves were chosen for use, after extensive transmission observations on transatlantic



Above left, K. C. Wilsey of the Equipment Development Department and the switchboard in a room adjoining the telephone booth which gives service to the ship-telephone user; above right, F. R. Lack of the Radio Research Department using the transmitter in the Leviathan's telephone booth adjacent to the ballroom; below, in the receiving room of the radio house I. E. Fair of the Radio Research Department at the line terminal equipment

vessels, and a survey of the available channels. Of the two paths which such waves may take between stations —that along the surface of the earth, and that upward to a reflecting layer and down again—the "ground wave" promised greater utility, at short distances. The reflected waves must, however, be used at greater distances. Field-strength surveys had shown that the absorption of ground waves by the earth's surface was considerably less over water than over land. To verify these results for shorter waves, and especially to determine absorption effects at the shore line, a further survey employed fixed receiving stations at Long Beach, Long Island, and at Nantucket; and a transmitting truck cruising near Deal. From these tests it appeared that stations transmitting and receiving to and from the sea should be located at the water's edge.

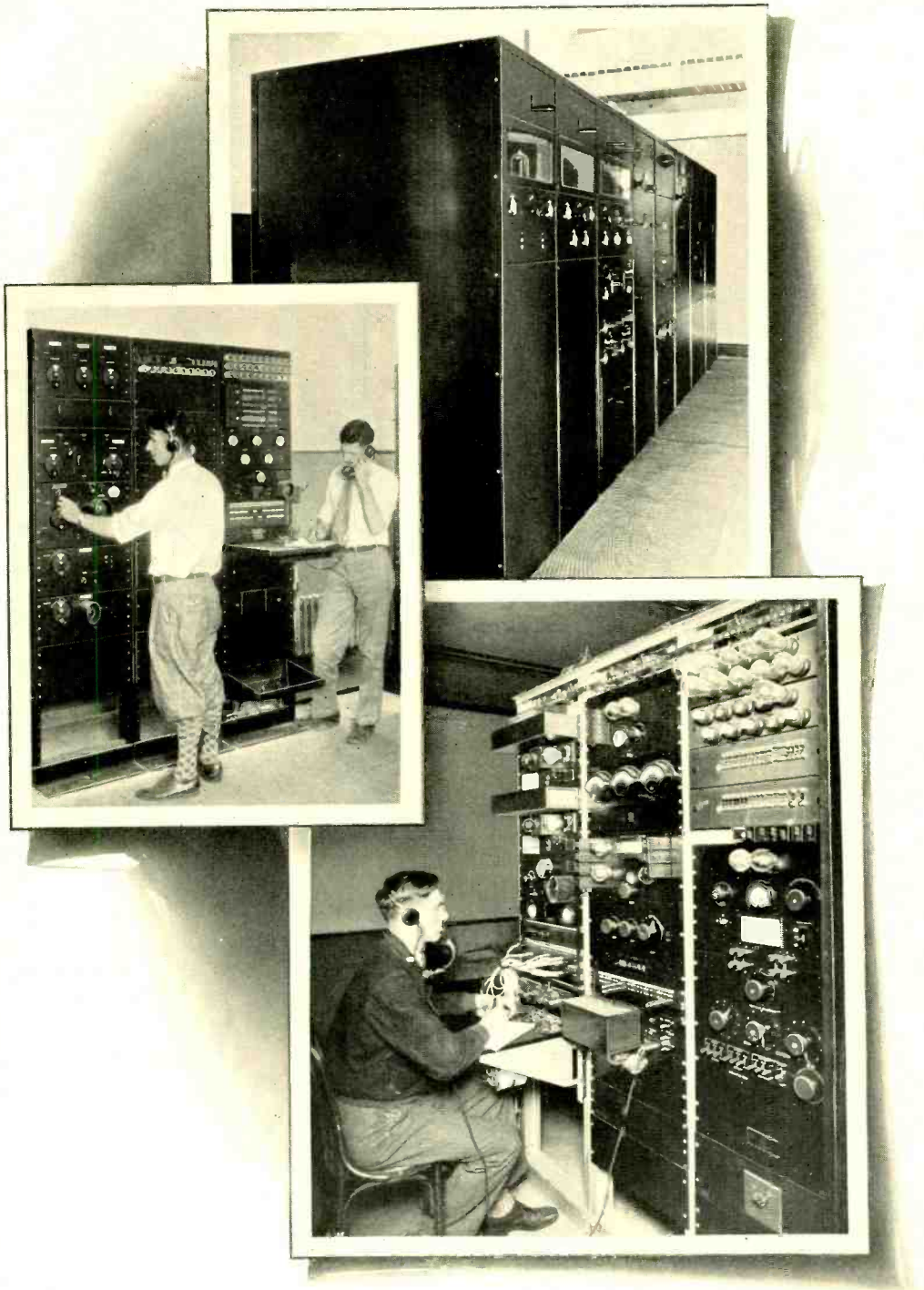
Short waves are amenable to directive transmission and reception, but the use of directive antennas on shore is complicated by the changing position of the ship. To avoid rotating the shore antennas so as always to point toward the ship, the land stations can be placed where the line of the ship lane intersects the shore. The best choice of station sites is thus quite restricted. Directive transmission and reception aboard ship is not feasible, for even were space available for rotating antennas to allow for changes in the ship's bearing, absorption and reradiation from the vessel's metalwork would be serious.

With modifications on these accounts, a system (similar to the transatlantic short-wave system) was put in experimental operation in August 1929. The shore transmitter was one of the experimental ones at Deal which had been used for commercial transatlantic telephony; for measuring the reception on shore a receiver was installed at Elberon in a truck; for operation on the "Leviathan" apparatus was specially designed and built. During the ship's successive trips throughout the autumn, the system was tried out and modified, and the shore receiving station was established in a permanent location at Forked River, New Jersey, on Barnegat Bay, where a set similar to those at Netcong was installed. In reducing the shore end to commercial form all that now remains to be done is to install a transmitter at the ultimate site at Ocean Gate, New Jersey, which is five miles along the shore from Forked River.

The scheme of transmission involves the use of four different carrier frequencies: two of about 4200 kilocycles for transmitting in the two directions at short distances, and two of about 8700 kilocycles at longer distances. In the transmitters the output of a crystal oscillator is amplified and modulated by the voice currents. The carrier and both sidebands are radiated. In the receivers the incoming signals are demodulated in two steps, and between these steps they are amplified and filtered of all extraneous frequencies.

The apparatus by which this is accomplished ashore has been described* in connection with its transatlantic use. Only in adapting it to the particular ship-to-shore frequencies has it been modified. Aboard ship the apparatus is somewhat more special. It is all located in a small two-room radio house on the top deck of the "Leviathan," midway between the second and third funnels.

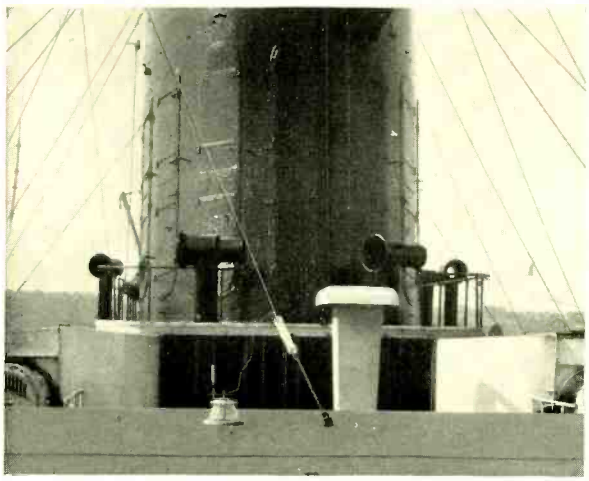
*Bell Laboratories Record, *August*, 1929.



Top, the shore transmitter now at Deal which will eventually be moved to Ocean Gate, New Jersey; left, the shore receiver which is housed at Forked River, New Jersey, and H. W. Powers and C. Breunich of the Long Lines Department; bottom, C. F. P. Rose of the Radio Research Department and the line terminal equipment enclosed in copper screening at Deal

In the starboard room are the transmitter and its power supply; the port room, shielded from the other by copper mesh, contains the receiver and the line-terminal equipment.

The ship's transmitter is divided into two parts for operation at the two carrier frequencies; these parts



The antenna used for transmission on ship board is a wire reaching upward and connected at its lower end to a lead passing through a bell shaped glass insulator into the radio house

are independent save for their power supply, common voice-frequency and power-amplifier sections, and the transmitting antenna. In the shorter-wave part, a crystal oscillator (for which a duplicate is provided in reserve) supplies current at 4415 kilocycles to a harmonic generator which doubles the frequency. The 8830 kilocycle output of the frequency doubler is then amplified by two power-stages. The modulator, which consists of two 250-watt tubes, modulates the output of this amplifier by the voice currents. The radio-frequency signals pass out, for radiation by the antenna, through an antenna-tuning circuit which offers low impedance to the carrier and sidebands and high impedance to currents of other frequencies. The longer-wave part of the transmitter differs from the shorter-wave part only in the replacement of the frequency doubler by an amplifier containing a single tube.

Power, controlled at a board adjacent to the transmitter, is provided by a motor-generator set supplying two thousand volts to the plate of the power-amplifier tube and fifteen volts to the filaments of all the tubes in the transmitter. A low-pass filter in the high-voltage line prevents ripples at audible frequencies from reaching the plate of the power tube. The whole motor-generator set is enclosed by panelling covered on the inner side with sound-absorbing material and on the outer with grounded copper sheet, and is kept cool by a stream of air from a blower.

Signals from the shore are received by an antenna just behind the third funnel; through circuits at the foot of the antenna and in the receiver, any signals picked up from the simultaneously operating transmitters on the ship are attenuated far below the audible level. In the first detector the received signals are combined with the output of a local oscillator to give beat-frequency signals of about three hundred kilocycles. These are amplified in three stages and then detected and the voice frequencies are passed to the line-terminal apparatus. Although no filter in the usual sense is used at any point to select the signal-frequency band sharply, the interstage circuits of the three intermediate-frequency amplifiers are tuned to make a satisfactory

discrimination. To remove the effects of "fading" — the slow variations of volume to which short radio waves are subject — an automatic volume control taps the output of the third amplifier, rectifies the taken portion, and applies the resulting direct current, whose magnitude varies with the signal's volume, as grid bias in the tube of the first detector.

The voice signals after being detected and amplified by the radio receiver, or before going to the radio transmitter, pass through a control operator's position located adjacent to the radio equipment. The received signals pass through a volume control and repeater and the transmitted signals pass through a similar volume control and repeater. Volume indicators on both the transmitting and receiving sides show the control operator the amount of voice frequency volume being received and transmitted. By means of the volume controls a constant volume or level is delivered to the subscriber and the radio transmitter independent of the talker's volume. Splitting and monitoring keys are provided at the control operator's position enabling him to monitor on the circuit and talk either on the radio or to the ship's subscriber.

From the control operator's position and equipment the circuit goes to a special radio PBX located in a room next to the subscriber's booth. This operator has splitting and monitoring facilities similar to those at the control position. The PBX operator has also a talking trunk to the control operator separate from the radio circuit and a connection to the ship's telephone system in order that persons on the ship who are called can be quickly located.

The ship subscriber uses a standard desk telephone which has a high grade transmitter. The only other difference from the ordinary subscribers' phone is that the transmitter and receiver pairs are kept separate and shielded from each other. This is done to prevent received signals from getting into the transmitter circuit and being transmitted back to the talker as an echo.

Following the demonstration, the ship-to-shore system was made available to the public. Service will be available while the ship is within range. Development work will continue, aimed at extending the period of service, and improving its quality.

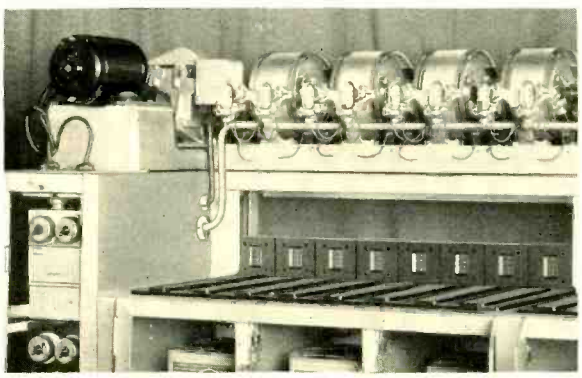
The Call Announcer

By W. H. MATTHIES
Local Systems Engineer

IN a number of recent talks before general audiences Sergius P. Grace, Assistant Vice-president, gave demonstrations of the call-announcer machine. A number was dialed from a telephone on the stage and immediately afterward that number was repeated to the audience by a loud speaker connected through trunks to the call-announcer machine in the Machine Switching Laboratory on the seventh floor of this building. The demonstrations attracted a great deal of attention and were written up widely in the daily press. Development work on this system has now progressed far enough to permit certain of the essential features to be described for readers of the RECORD.

In some localities, it is necessary to transfer calls in the same exchange from dial to manual telephones, and in such cases when the subscriber dials a certain number, the equipment flashes the number before an operator who completes the call to a manual telephone. The new call announcer performs a similar function except that the equipment speaks the number instead of flashing it.

The apparatus will be used with the panel system and will be controlled chiefly by relays in the sender.* It employs recorded speech to announce to a distant operator the number which has been registered in a panel sender. It enables the tandem operator to write up the number on her key set, as she does for nearby offices using the call indicator. After doing this she is free to attend to other calls. A call so written up remains recorded in the sender till the distant "B" operator takes up the call. When this is done relays in the sender are operated and connected to the call-announcer machine to announce in the correct sequence the digits of the number that is wanted.



A close-up of the machine showing the driving motor and four of the cylinders with the exciting lamps, optical systems and photoelectric cells

The principal objective of the development was apparatus that would translate a registration in a panel sender into the actual speech sounds corresponding to a number wanted. For such a system the general methods of sound recording as developed in the Laboratories were available.

* BELL LABORATORIES RECORD, December 1928, *page* 143.

C. J. Beck, F. K. Low, and C. C. Towne are shown examining the call announcer, which has some of the covers removed from the sound-film units and one of the amplifier units partly withdrawn

Experimental models were built to employ disk and film recording, respectively, and it was decided to use the latter in the final design. The apparatus as now arranged consists of a number of cylinders bearing on each outer edge strips of film on each of which is recorded four times, with short intervals between, a single digit or one of the station letters. These cylinders are mounted on a common shaft and driven by a small motor through a suitable reduction gear. In front of each film is a lamp which is focused on the film through an optical system; and within the edge of each side of the cylinder, and just back of the film, is a photoelectric cell.

For each sound system, consisting of a lamp, film, and photoelectric cell, there is a three-stage amplifier unit mounted just beneath and in front of the rotating shaft. By this unit, the very weak signals from the photoelectric cells are amplified to a suitable level. Additional two stage amplifiers are mounted on an associated relay rack. The metal cabinet on which the apparatus rests is divided into individual compartments, each of which contains plate battery supply for one amplifier unit.

The cylinder on which the film is wrapped had to be large enough to allow a photoelectric cell to be mounted within its shell. This required a circumference much greater than necessary for a single repetition of a number or letter; four announcements on a single film gave a satisfactory length. The actual announcement of one digit takes about .27 second and the interval between announcements is set at .08 second. Standard-speed film is employed; in fact the optical system and the photo-electric cell are those standardized for sound-pictures.

Due to the weakness of the signals from the photoelectric cells, some 70 db gain is required to reach a desir-

able level for the announcement. Of this total gain about 40 db is obtained in the amplifier units of the machine and the remaining 30 db in the amplifiers on the relay racks. The amplifier units of the machine are all removable so that replacements may be readily made.

The call-announcer arrangement permits completion of traffic from the panel tandem board to those manual boards outside of the range of panel call-indicator pulsing, to those offices normally served over phantom trunks and to types of offices for which panel call-indicator offers special difficulties, or for which the costs are unreasonable considering the small traffic or short life of the manual toll board. If the panel sender tandem equipment did not have the call-announcer feature, it would be necessary to make other arrangements for handling the traffic to these points which would be much less satisfactory from an operating and equipment standpoint. It does not replace, in general, the call indicator but rather supplements it.

Changes in Headquarters Telephone Numbers

The following changes, which went into effect on December 13, 1929, *have been made in the telephone numbers of the switchboards serving telephone company headquarters in New York:*

The A. T. & T. switchboard formerly listed as "Cortland Official 60" *has been changed to Exchange* 9800.

The New York Telephone Company switchboard formerly listed as "Whitehall Official" has been changed to Exchange 4600.

The change has been made to facilitate traffic in calls originating from dial stations. Heretofore it was not possible to dial the official two digit numbers directly and with the constantly increasing numbers of dial stations in New York City it was deemed desirable to make this change. On calls originating from manual coin boxes, the coin will be refunded by the operator as before. On calls from dial coin boxes the coin will be refunded automatically when the receiver is hung up after the conversation is completed.

Calls to these switchboards from Bell Laboratories' extensions should be passed as "A. T. & T." or "New York Tel.".

Systems Drafting Moves

By C. D. DUSHECK
Equipment Development

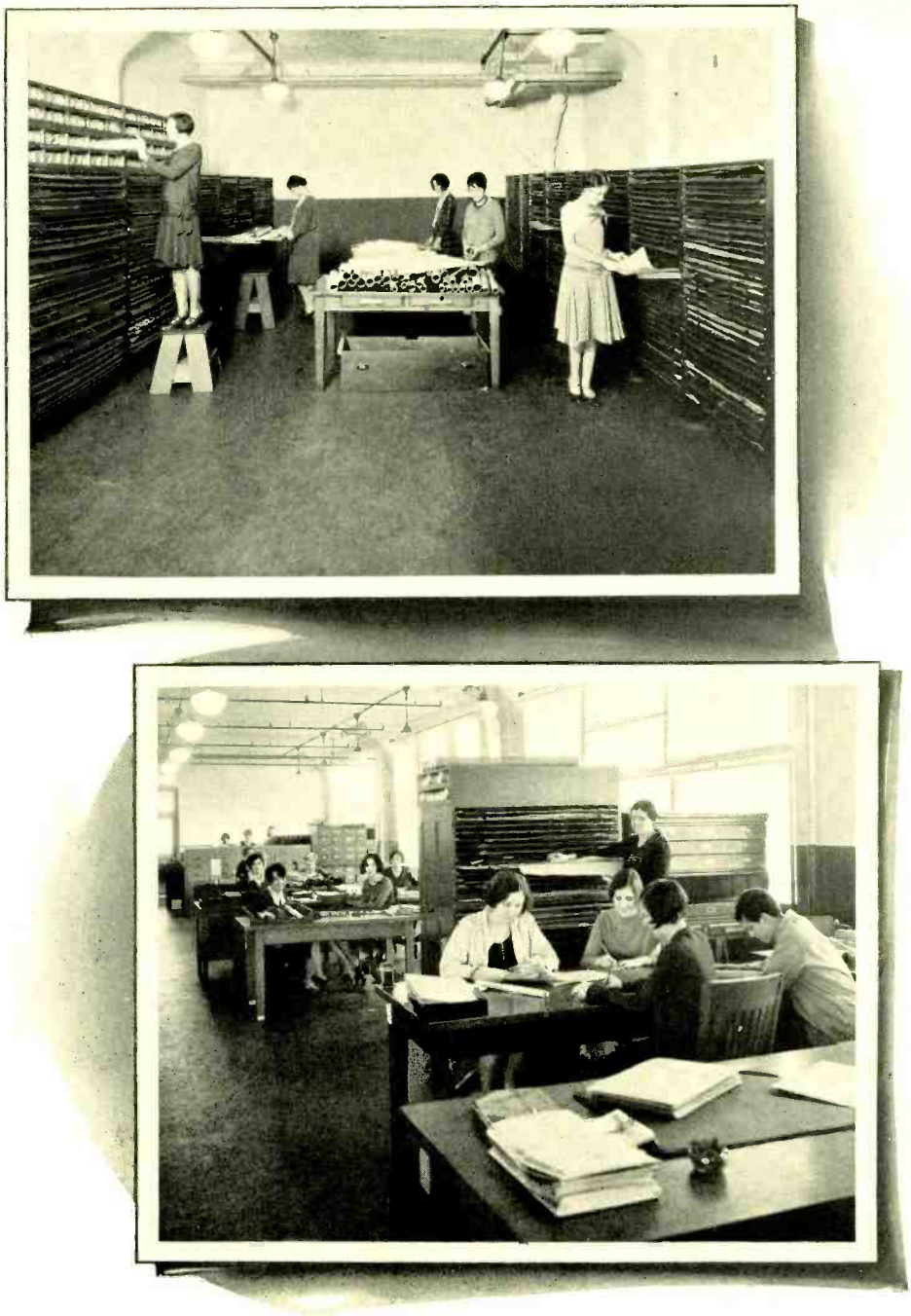
AFTER three years on the fifth floor of Section H, the Systems Drafting Room has moved to quarters on the two upper floors of the Davis Building at 250 Hudson Street. Standing by the entrance to the westbound channel of the Holland Tunnels, this new building is open to light on all four sides.

During its tenure of the fifth floor of Section H, Systems Drafting had accomplished much. In four years the group has increased about thirty per cent in size and its output during this same period has grown by half. Accompanying this twofold expansion has been a gain in quality and a decrease in the unit cost of tracings. On the average each man and woman produces more work, of higher quality, and at a lower cost, than was done in 1926. Its recent move to better and larger quarters is to be looked upon as an opportunity for greater progress.

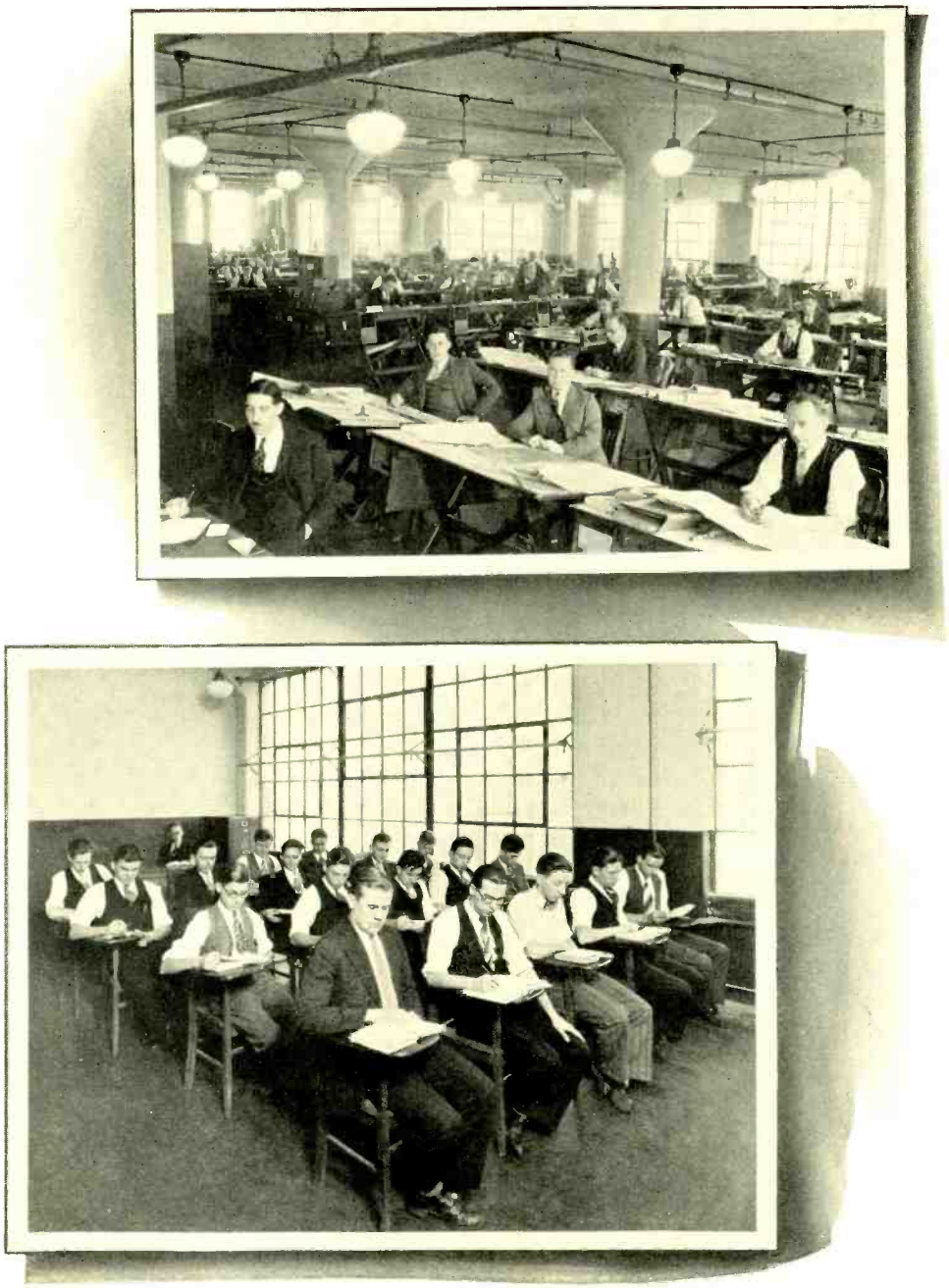
Not the least important of the many factors contributing to past success is the policy of carefully training its personnel. A large number of the members of the drafting organization enter the Laboratories directly after graduation from high school. These graduates are interested in drafting work, and receive special training in the student- and drafting-assistant courses. Much of the equipment and circuit drafting is different from the usual mechanical drawing so that the training courses have been especially valuable in enabling these young men to become acquainted with the problems of a telephone system. After several years in the drafting organization many of them, through their own ability and training acquired in out-of-hour courses and night schools, become members of the Technical Staff in the circuit and equipment organization.

Another factor of the success of the organization has been a group of draftswomen. Originating as a war measure, the employment of women for certain forms of drafting work has been highly successful. The small group of from six to ten at the close of the war has grown to nearly forty and additional types of drafting have been added to their work. The growth has largely come from women in other parts of the Laboratories who in this work have been able to find another interesting occupation they may follow.

Many smaller improvements have probably contributed their share to the betterments and economies obtained. The Wrico lettering system was introduced about three years ago and has done much to speed up production and at the same time to produce better looking drawings through more uniform and neater lettering. Sometimes very minor improvements make considerable savings. One such is an electric ink dryer. Small electric fans blowing hot or cold air as desired reduce the time that draftsmen must wait for heavily inked lines to dry. Mechanical erasers



Above, the fireproof tracing vault at the Davis building; below, the clerical group which handles all tracings and vandykes and orders all blueprints



Above, general view of the drafting room in the Davis building; below, drafting assistants engaged in class-room studies

Another view of the drafting room showing a group of draftswomen

are also among the lesser economies.

Included in the new layout are fireproof vaults for housing tracings and vandykes. With the existing practice, tracings are handled only while changes are being incorporated, and then only by the draftsmen. Vandykes are made immediately on the completion of a tracing and all prints are produced from them. This preserves the tracings by subjecting them to only the minimum possible use. Separate vaults are maintained for both tracings and vandykes. The blueprinting apparatus is also located at the Davis Building so that tracings need never leave the building, which still further reduces wear and tear on them.

Representative views of the new drafting room are shown in the accompanying illustrations. In the pent house some score of the newer men work on change orders, and another group of comparable size and of more experienced men are there engaged on wiring diagrams. On the fourteenth floor just below, the rest of the total personnel of some 180 men and women carry on the various other activities which include the production of standard circuit and equipment drawings for the Bell System, distributed by the American Telephone and Telegraph Company.

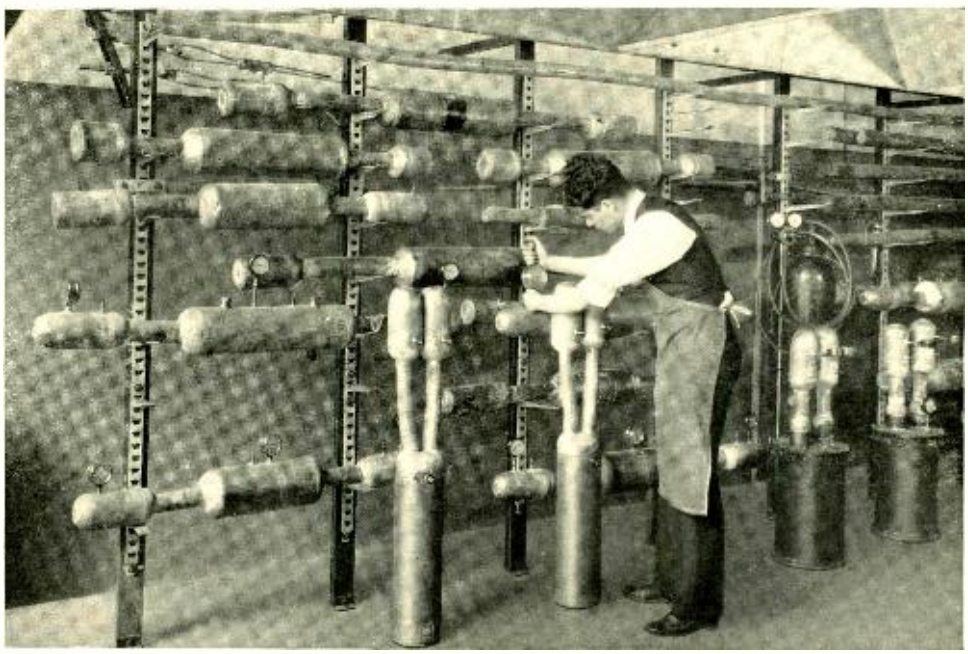
Outside Plant Development in New Quarters

By C. A. CHASE
Outside Plant Development

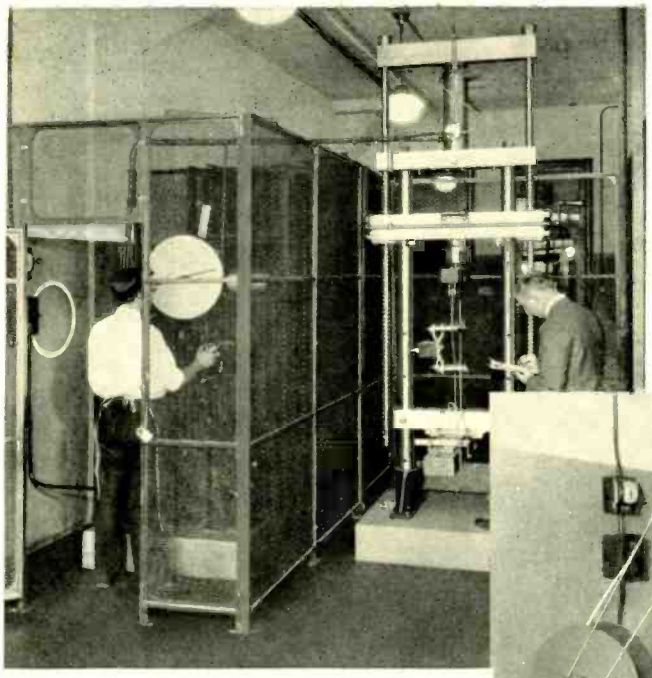
ON the tenth floor of the Maltz Building at 480 Canal Street, the Outside Plant Development Department is now settled in well-equipped quarters overlooking the Hudson River. Twenty thousand square feet of floor space has been divided into suitable offices, laboratories, and storerooms and so arranged as to be adapted to Outside Plant Development needs.

The south and west sides have been used for laboratory space while offices occupy most of the space on the north and east. The open space between offices and laboratories is used for files, transcription, and drafting as well as for a two-position PBX serving both the tenth and eleventh floors, the latter housing the submarine cable development group of the Research Department. Grouped around the elevator shaft and stair well in the center of the building are a number of rooms for storage, power machinery, and other uses for which outside light is not essential.

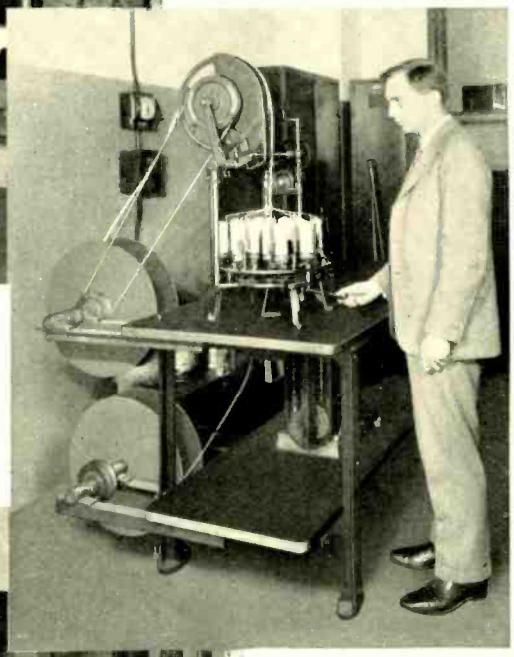
The General Laboratory, largest of the seven on the floor, contains mechanical testing equipment and a fair assortment of tools used in design studies by engineers of several different groups. Here, for instance, the Hardware, Insulator, and Tool



M. A. Specht testing gas-tight cable plugs



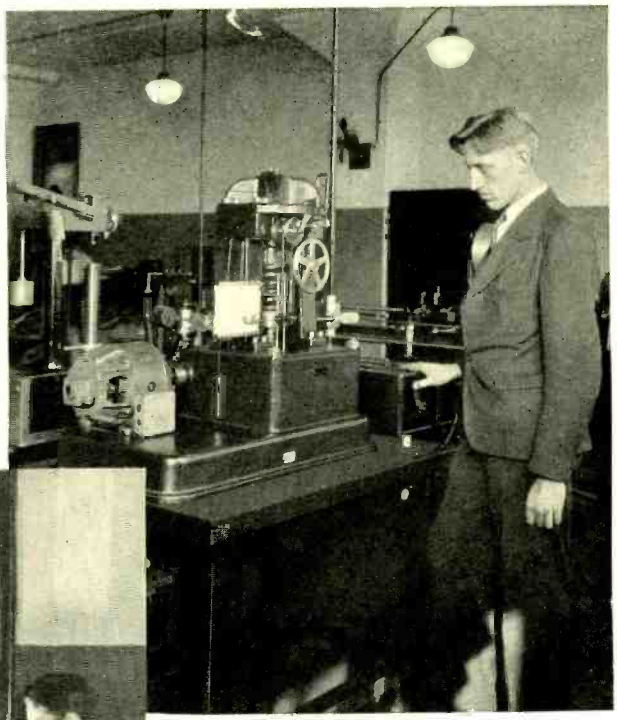
Below, A. H. Blake operating the braider



Above, C. H. Klein taking data and A. D. Benning operating the dynamometer while a transposition bracket is being tested to destruction on an Amsler testing machine

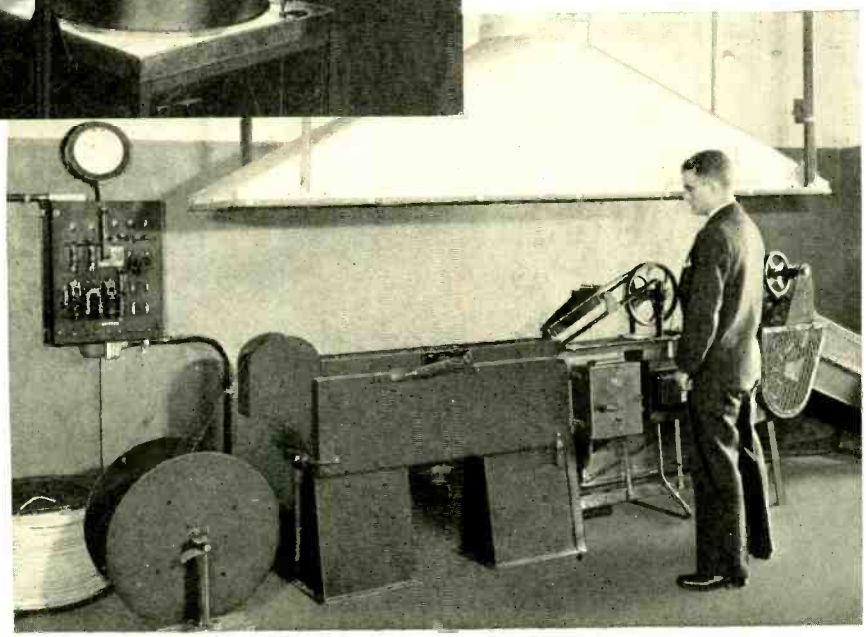
Left, A. H. Hearn examining cultures of wood-destroying fungi which are preserved in glass beakers where their growth may be watched

Right, E. H. Eiskamp operating a rubber-compression testing machine



Below, H. A. Johnson studying a sample that has been subjected to the action of the accelerated weathering machine

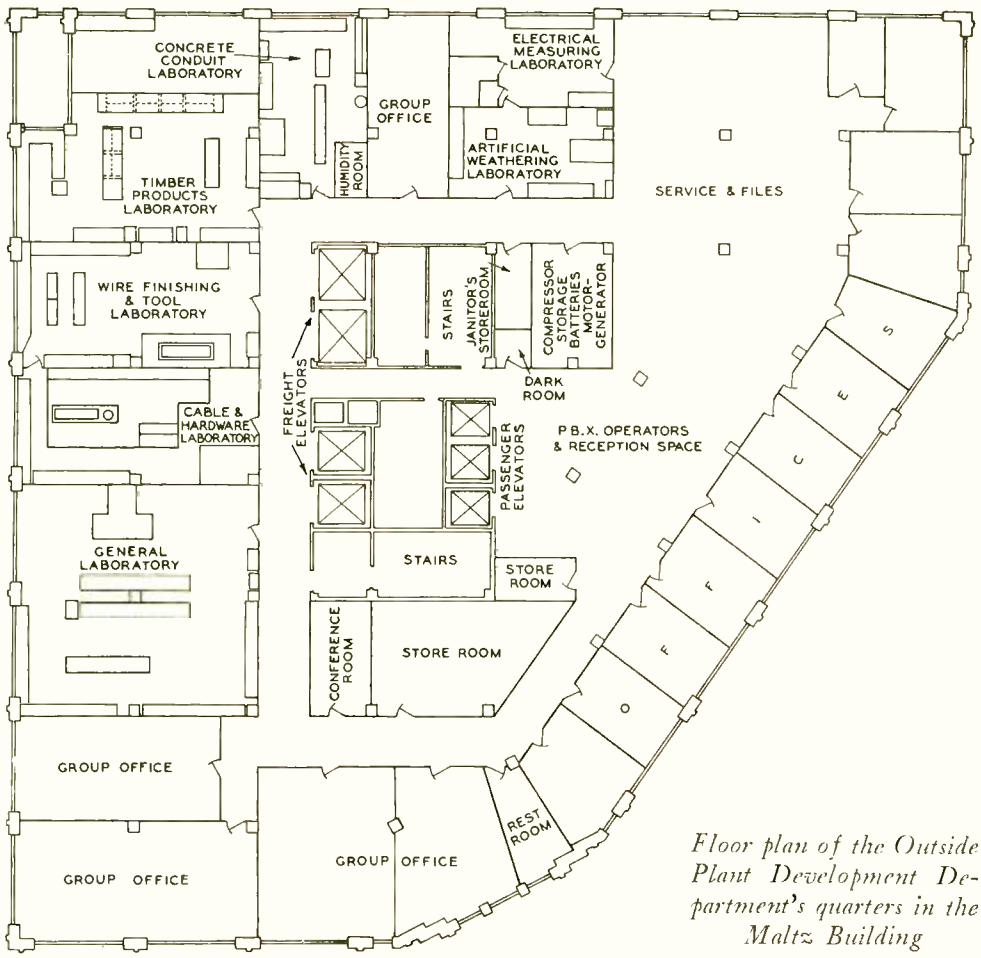
Below, F. E. Phillips watching the progress of braided wire through the weather-proofing bath



Groups keep an Amsler hydraulic testing machine busy applying various sorts of stresses to a wide variety of specimens of both their own and commercial designs. The Wire Group and the Miscellaneous Products Group make use of a Scott horizontal tensile testing machine for the small capacity tests required for wire, fabrics, and cords. The Rockwell hardness tester and special rubber compression machine located in this room are also in frequent use.

The equipment in the Cable Joining and Maintenance Laboratory is of a more specialized character. In this laboratory, investigations of mechanical solder-wiping devices, of cast joints, of split sleeve joints, and of solder-coated lead discs—used as an adjunct in hand wiping of multiple splices—are carried on, and the handling qualities of new or modified solders are carefully studied. This laboratory is also used for the development of apparatus for testing cable joints with gas pressure and for the development of methods and apparatus for the maintenance of continued gas pressure in cable sections. This work includes design of field and factory made gas-tight plugs for sectionalizing the cable, low pressure alarm contactors, and special test terminals for low pressure alarm circuits.

Studies of the protective coatings



Floor plan of the Outside Plant Development Department's quarters in the Maltz Building

General view of the department's quarters

of insulated wire, such as braids and waxes, and tests of rubber compounds and other insulating materials are conducted in the Wire and Tools Laboratory. The equipment includes a combination braider and server, and an electrically heated wax bath. The tool section of this laboratory is equipped with hand and machine tools employed in the design and standardization of Outside Plant tools.

The Timber Products Laboratory is supplied with facilities for studying the various species of timber now used or proposed for use in the Bell System. Special emphasis is placed on studying the relation between wood structure and wood preservation, and the deterioration of wood, either in storage or in service, caused by the many forms of fungi. The seasoning of wood, its moisture content in service and the rate of moisture movement, and its strength as it affects plant design are also subjects of investigations carried on there.

Miscellaneous electrical apparatus makes up the major equipment of the Electrical Measurements Laboratory. There is a Leeds and Northrup Insulation Resistance Set for use in insulated wire measurements, a high voltage set for breakdown tests on rubber gloves and insulated wire, a capacitance and conductance bridge for studying losses in insulators and insulating materials, and various other accessory equipment for special electrical tests.

Apparatus is available in the Artificial Weathering Laboratory for investigations of the aging of insulated wire, glass insulators, and paint finishes. The material under test is subjected to such aging influences as ultra-violet light, heat, and artificial rain alternately or in any sequence desired. The effects of many years of life in service are here procured in as many months.

The Concrete and Conduit Laboratory is used for the development and evaluation of new types of conduit, including various modifications of vitrified clay conduit such as mitred, transposition, and expanded web con-

duit designed to adapt this material better to the varied conditions encountered in underground construction. Studies are also made of joining methods, particularly of silt-proof joints in clay conduit. New designs of conduit such as precast concrete are investigated especially with regard to their adaptability to joint making and to the omission of top concrete protection. Studies are made as well of new manhole designs, such as those employing concrete blocks, and of rapid hardening cements for both duct run and manhole construction.

The layout of both offices and laboratories has been carefully planned to secure the best arrangement of available space and facilities and thus places the Outside Plant Development Department in a favorable position for the conduct of its activities.

Instructors for the 1930 *Laboratories Health Classes: back row, the Misses M. S. Harold, M. Ball, G. Kellogg, E. E. Dittmar, L. Feil, and L. M. McMahon; front row, Dr. C. A. O'Malley, the Misses E. Good, M. F. Kane, S. Crawford, and C. Mattice, and Mr. J. S. Edwards*

A Low-Insulation Alarm for Toll Cables

By F. B. ANDERSON
Toll Systems Development

A TOLL cable consists of several hundred copper conductors insulated with paper and protected by an outer sheath of lead alloy. It stretches from pole to pole across open country suspended from a steel messenger wire, and burrows beneath the pavements in the more populous districts as it spans the space between communities for the exchange of intelligence.

A mile of aerial cable exposes about 4,000 square feet of surface. An average span of fifty miles between terminals presents a vulnerable area of several acres. A puncture in any part of this leaden expanse threatens the serviceability of the entire cable, for moisture enters quickly through any break and permeates the paper insulation of the wires within the sheath. While it is dry, paper insulates very well, but the absorption of water reduces its effectiveness enormously, with consequent impairment of transmission. A sheath crack, in fact, together with a rain storm could put an entire cable out of service in a few hours.

Causes of injury to a cable are numerous. Flexure of the sheath as the cable expands in hot weather and contracts in colder intervals sometimes results in a cracking of the lead covering. Aerial cable seems to offer a peculiar attraction for rifle marksmen, especially those tempted by the scampering squirrels and chattering birds that use the cable for a private park. At dusk each survivor of miscarried extermination gives due thanks for the noble sacrifice of the

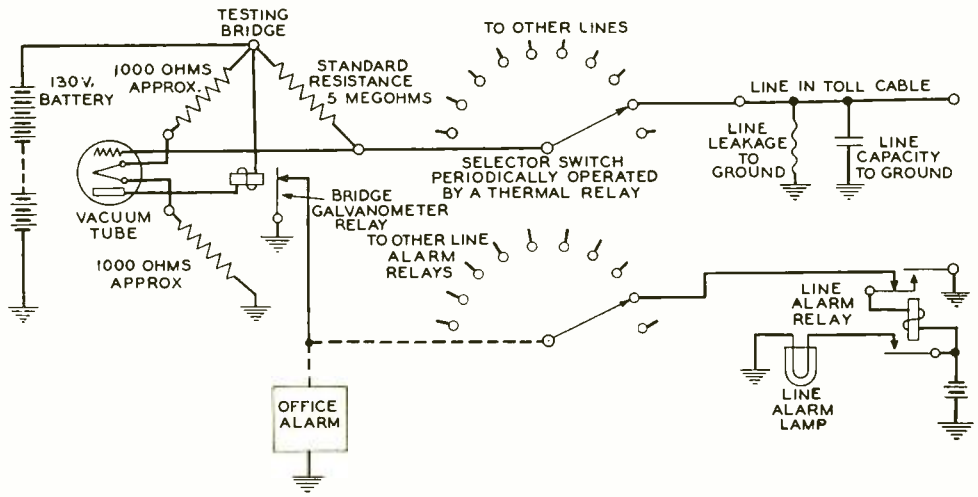


Fig. 1—A bridge to measure the resistance from line to ground, and a stepping switch to select successive conductors form, with suitable alarms, the essentials of the scheme

cable, which that day has enabled him to live to the next sunrise.

Dynamite and powder are also inimical to the health of the cable. The blaster, wrapped up in his own safety, at times neglects the possible presence

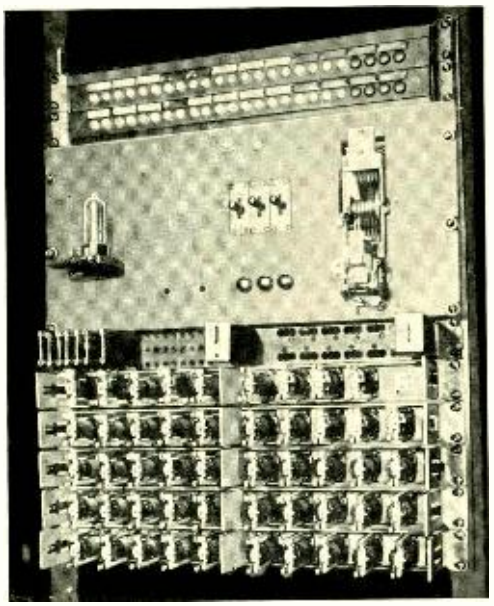


Fig. 2—The stepping switch, the vacuum tube for the bridge detecting circuit, and the line alarm relays are prominent features of the apparatus

of a cable, which suffers accordingly.

Underground cable is not so much exposed to great temperature variations, to the small boy's Christmas rifle, or to other hazards peculiar to aerial cable, but it, too, must contend with a variety of hostile forces. Subsurface moisture quickly searches out defective splices, and the laborer's pick or steam shovel occasionally unearths the cable with attendant damage to it.

These are but a few of the sources of injury to the cable. Numerous other causes of trouble arise, such as defective apparatus and workmanship, electrolytic corrosion, and surges from electric power and lightning.

In spite of all these adverse influences, however, the cable is kept consistently in service by the efforts of the maintenance men. At times, a fault will develop slowly, especially in dry weather, and grow rapidly upon the arrival of increased humidity or rain. Other faults, such as those due to bullet holes, often cause a partial service failure as an immediate indication of their presence.

In the past the test-board men have made tests of the cable conductors in an effort to uncover faults not sufficiently developed to be betrayed by a loss in transmission. Such tests could not economically be frequent and regular enough to discover every fault in its incipient stages; an automatic testing device was necessary to detect a fault soon after its arrival.

Such an automatic testing device has been developed in the Laboratories and is now in field service. The skeleton diagram, Figure 1, shows the essentials of its operation. It is a type of Wheatstone bridge in which the insulation resistance of the line to ground is compared with a standard resistance of five megohms. A vacuum tube serves as the bridge galvanometer, and operates or releases a relay to indicate the condition of the line. When the insulation tested has fallen below five megohms, the relay releases and causes an alarm to be registered for the particular line under test.

A selector switch is regularly stepped ahead by a slow-acting thermal relay about once every minute, and at each step a new line is tested. Over eighty separate channels may be tested in one revolution of the selector, so that representative conductors in all cables entering an office are tested every forty or fifty minutes.

The conductors tested are selected from the layers directly under the cable sheath, since these will be among the first affected by intruding moisture. The arrangement of circuits is such that telephone service is not interfered with during the test.

Upon the appearance of a fault in the course of testing, the alarm notifies the test-board man and lights a lamp individual to the line affected. The test-board man immediately checks the insulation of the line indicated, and tries to locate the fault with his equipment.* In due time a cable splicer is dispatched to the point determined by the test-board measurements to repair the defect.

The low-insulation testing apparatus thus plays its part in maintaining the cable in service. At times it detects slow leaks hours in advance of any other warning which may come as a result of impaired service as the cable becomes permeated with moisture. At such times, the repair process may be started just so many hours earlier, with a resulting reduction in the lost circuit time which is incidental to a fault, once it grows large enough. With a sudden and serious fault, the device supplements the warning of the transmission loss which results.

* Bell Laboratories Record, *December*, 1928, p. 161.

A Four-Year Index for the Record

Incident to the binding of Volume 7 of Bell Laboratories Record, *a four-year cumulative index has been prepared for the magazine, from its first issue in September*, 1925, *through August*, 1929. *An innovation is the addition of subject-headings to the index by title. The pamphlet will be useful not only to those who wish to bind their files of the magazine, but also to those who refer to the bound volumes in the Library. Copies may be requested by memorandum addressed to the Bureau of Publication.*

Notes on Panel Development

By CARL E. BOMAN
Equipment Development

WHEN a new system of any kind is being developed, the tendency of the designers is to follow rather closely the practices and forms found in some similar and well-known system and adapt them as well as possible to the new design. After a new system has reached the stage of production and use, and experience with it has accumulated, there follows a continuous change in the design to improve both manufacture and operation and to reduce costs, so that within a few years the design is likely to change in many particulars. Early manual switchboards followed then-current telegraph practice, and were of the peg-and-bar type. Needs of the expanding telephone system required more terminals and greater flexibility, which was obtained through the use of cords, plugs, and jacks. The design of equipment for telephone service soon became a separate art since the requirements for the two systems were so different. In later years, however, with the rapid expansion of facilities in both fields and the use of the same wires for both telephone and telegraph service, many of the problems have become more or less alike, so that a large part of the terminal room equipment for telegraph service looks very much the same as that in use in a modern telephone office.

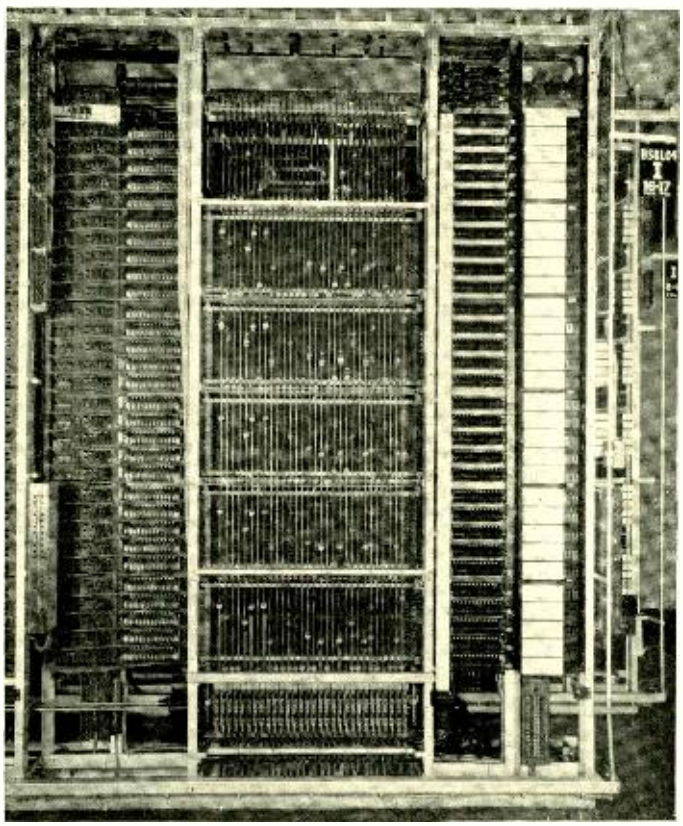


Fig. 1—With the old type selector frames the repeating coils and condensers were mounted on separate racks (not shown here) and wired to the selectors

In like manner the panel system of today is quite different from

the semi-mechanical equipment installed in Newark in 1914 or even from the panel dial system installed in 1919. Although these differences might not appear extensive to one unfamiliar with the development, they are found not only in the equipment itself but in the methods of both production and installation. For instance, it had been the practice for many years with manual apparatus to ship the various pieces of equipment separately, and to assemble and wire them in their final position. Long experience had proved this desirable and it was natural that such a method should be followed in the early panel installations. The frameworks, apparatus, and local cables were shipped separately to the central office where the installer erected the framework, mounted the apparatus and local cables, and then connected and soldered the cables to the apparatus.

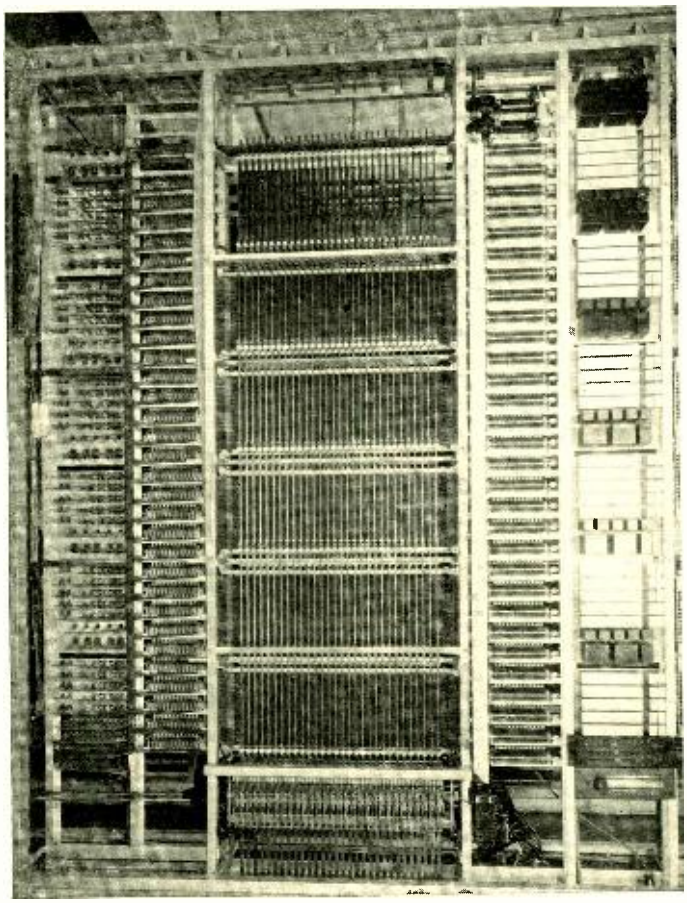


Fig. 2—On the new type frames the repeating coils and condensers are mounted with the relays in units of five circuits each

The very large amount of equipment required for the panel system, however, rendered this method of installation less satisfactory than it had been found for the smaller amount of equipment required for a manual office. The recruiting and training alone, of the necessary installing forces in the various cities where the equipment was being installed, proved a task of considerable magnitude. The problem of the inspection department in its work of maintaining a uniform quality of the finished product also was difficult because the assembly operations had to be carried on in a number of scattered localities. It was therefore early recognized that it would be highly desirable to relieve the installer of as much of the assembly and wiring operations as possible by having this work performed at the factory.

Under present arrangements, fully wired and tested units are shipped

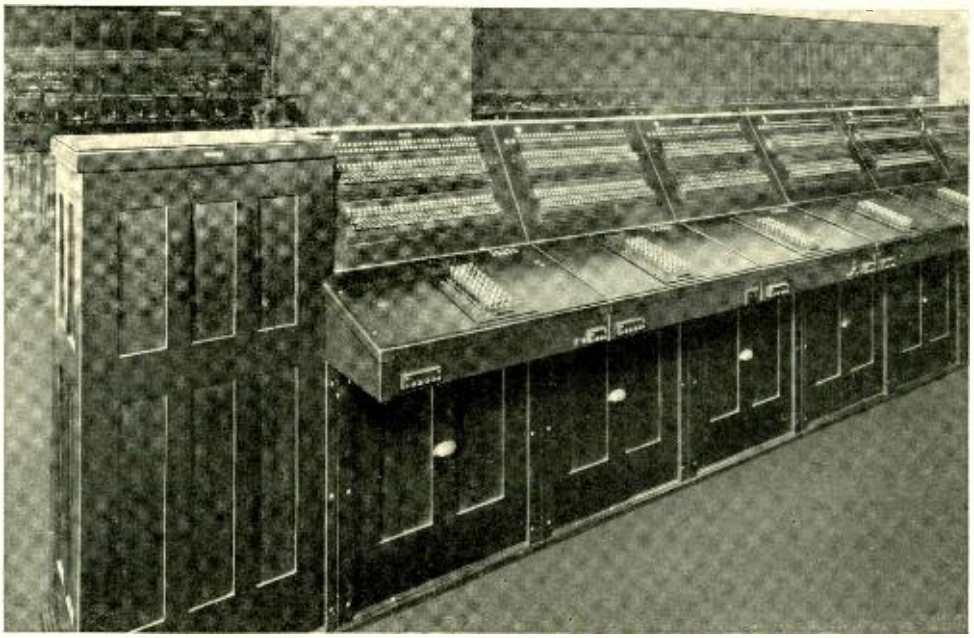


Fig. 3—A cordless "B" switchboard of the earlier type showing large cable-turning section needed to take care of the large number of conductors

from the factory, and reach the installer in so nearly perfect a condition as to require only a small part of the labor formerly expended in order to bring the apparatus into proper adjustment. This change in the methods of production has been not merely a case of transferring the work from one place to another; a lot of painstaking development has been required to bring it about.

As a first step in determining whether large units of equipment, such as selector bays, could be successfully assembled in the factory, a trial shipment was made to a distant city and then returned to the factory for observation and for a recheck of the adjustments of the apparatus. The results of this trial were very encouraging and indicated that the apparatus would withstand shipment better when assembled on large units, than when shipped individually. One element which contributed to the success in handling and shipping large equipment units was the introduction of welding in the fabrication of the iron frameworks. A more rigid structure could be obtained with this method than with the bolted and riveted construction formerly used.

In the studies made in connection with this transfer of work from the field to the factory, it was found that certain assembly operations could be performed at the factory without any changes in design, that in other cases minor redesigns would have to be made, while for a large part of the equipment extensive redesigns would be necessary. This was particularly true with the senders and test frames which more than anything else were lengthening the completion promises of equipments.

As the development of the panel system progressed still further, new schemes for performing the circuit and apparatus functions involved in

establishing connections between subscribers were devised. These have contributed greatly to cost reductions by reducing the quantities of apparatus used, and by making it possible to develop new equipment designs which are more flexible and better adapted to meet the different traffic requirements encountered in the field.

One very important trend in the development has been toward the design of convertible circuit and equipment arrangements which take care of, with considerably less expense than formerly, the transition from manual to dial service. The recently introduced call-distributing "B" switchboard equipment is a good example of this type of development. This is the equipment provided in a panel office to handle connections from a manual office. Due to the dissimilarity of the earlier incoming selector circuits for manual and dial service it was not economical to arrange the frames for conversion and much of the older manual apparatus mounted on them had to be discarded. In the recently introduced equipment the associated incoming selector circuits may be readily converted from manual to full selector service by a rearrangement in the local cable connections and relatively inexpensive changes in apparatus. The wiring for both types of circuits is provided initially.

The "B" operator's section is now of very simple and inexpensive design, with a relatively small amount of cabling required to make connection between the section and the associated apparatus units. In the old designs, approximately 500 wires were required per operator's position for this purpose, while in the new design only 30 wires are necessary. The importance of keeping the "B" switchboard investment as small as possible is evident when it it realized that as the manual equipment is supplanted by the dial type, the need for these sections gradually disappears.

About the time that the new call distributing type of "B" operator's equipment was being designed for the "panel" system a similar development was being carried on for the step-by-step system, and by co-ordinating these projects it was possible to develop a universal section which could be used for both. The types of apparatus used for the switching mechanism differ radically for the two sys-

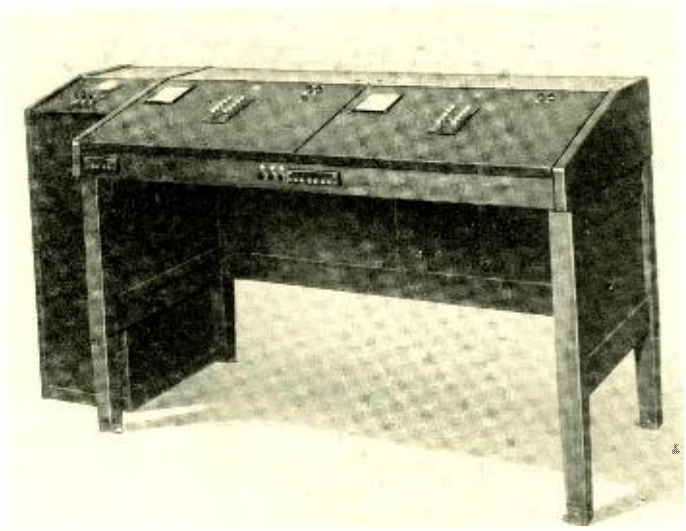


Fig. 4—The new call distributing "B" switchboard requires fewer wires per position and besides requiring less equipment may be used for either the step or panel systems

tems, but it was possible to make the operator's end of the circuit arrangements so nearly alike that a universally wired section could be provided to meet both conditions. Instead, therefore, of having two designs, one with a small demand for the "step" system and another with a larger demand for the "panel" system, one design with the combined demand for the two systems was developed. Both types of equipment will benefit by the manufacturing economies resulting. The illustration given is not a rare case, for a large amount of concentrated effort has been expended during the last few years to eliminate duplication where one design could be made to serve more than one system.

In the development of the "panel" type of selector frames a great deal has been accomplished. In the early days of "panel" manufacture numerous designs of frameworks and equipment arrangements were evolved due to the circuits being in a state of flux, caused on the one hand by the rapid development of the system, on the other by the non-interchangeable mounting arrangements of certain apparatus. It was impossible to provide universal framework designs at this stage of the development. In the development of a new project of so large a magnitude as the panel system it was impossible to foresee all the conditions which would arise, and it was only after considerable experience that definite requirements could be set up. As the trend in the requirements for the panel system became more definite it was possible to point out specific cases where certain changes in the apparatus, from a mounting standpoint, would greatly aid in reducing the number of equipment designs necessary.

This was done, for instance, in connection with the reciprocating-bar type interrupters used in the panel office for giving interrupted tones, busy back, and the like. These interrupters are mounted near the top of the sequence switch bays of the selector frames, and are driven from the same shaft that drives the sequence switches. Originally there were two designs which did not mount interchangeably with each other, or with the sequence switches. This was, to a considerable extent, responsible for a large number of framework designs for similar types of circuits, since new interrupters with different interrupted intervals were being added from time to time to meet added requirements of the system. A number of dif-

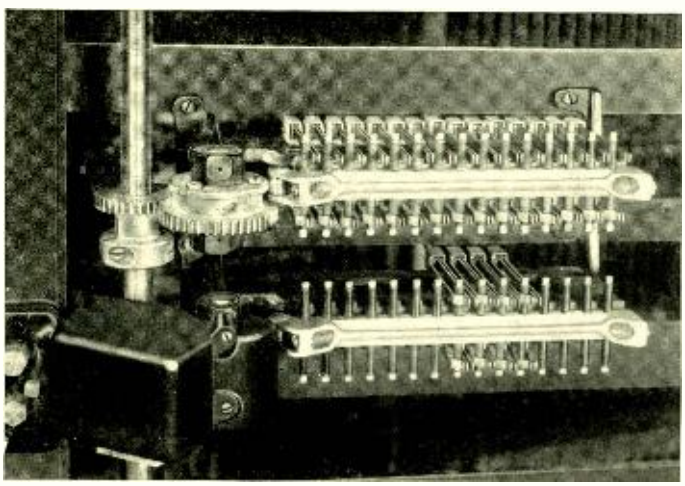


Fig. 5—Reciprocating-bar interrupters of the old type would not mount interchangeably with sequence switches and the supporting framework had to be drilled to mount the reduction gears

erent equipment combinations of these interrupters resulted which made necessary a number of slightly different framework designs.

The redesign of the interrupters to make them mount interchangeably with sequence switches made it possible to adopt one uniform design for all sequence switch bays, as far as the mounting arrangement was concerned. A more flexible and uniform design was then developed for the associated relay bay. These combined developments have made it possible for the factory to replace a large number of non-interchangeable welding fixtures, used in the fabrication of the iron frameworks, by fixtures of universal design.

With the recent introduction of the "Battery on the Cut-off Relay" type of central-office circuits, a further simplification in selector-frame designs was introduced. One design—obtainable in three widths of relay bays, and with a flexible feature which takes care of added requirements arising from time to time—replaces eight selector-frame designs, all of which differed in width and in minor details of design. This new design should result in substantial reductions in both engineering and manufacturing costs. It facilitates central-office planning by making possible more regular floor plan layouts; it reduces the number of variable items to be taken into consideration in the preparation of the manufacturing information; and it makes it possible to concentrate manufacture and installation on a lesser number of designs. It is also expected that, from a design standpoint, these and other recent developments will facilitate placing the panel equipment on a progressive assembly basis, similar to the methods employed in the production of PBX switchboards and other equipment having a large demand.

In recent years the older telephone systems have been advanced by the use of designs and methods of manufacture evolved to meet the requirements of new systems. The fact that several systems are in use has thus acted as a stimulus in the creative work connected with central-office design.

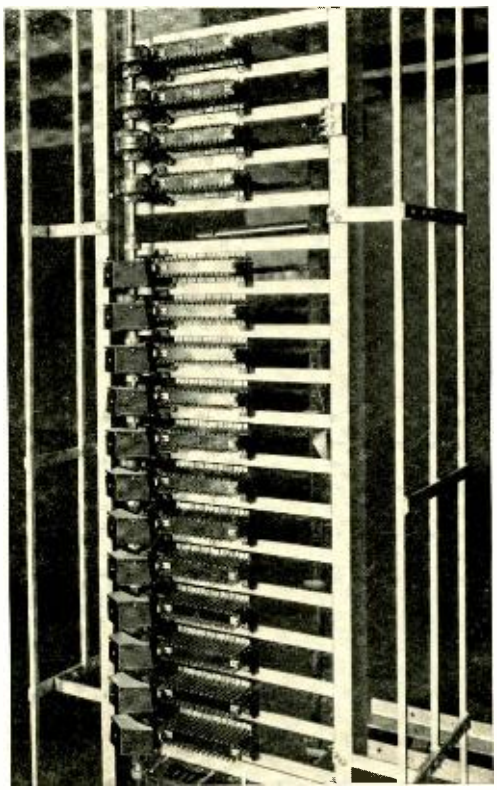


Fig. 6—The new interrupters are self contained and mount interchangeably with sequence switches

From the standardization of equipment designs, especially where the equipment is produced in large quantities, intangible savings are an important result. Designs are frequently adopted where it is difficult to evaluate any tangible savings at the time of their introduction. It is only by

reviewing the situation after the designs have been in production a year or two that a check can be made of the real economic value resulting therefrom.

In a large organization, such as the Bell System, the fewer and more universal the designs, the easier it is to maintain standardization, and the less it costs to disseminate information to the various persons and departments interested. There is probably no other single industry where so many people have so many different items of equipment to deal with, and it is because of this that universal and flexible designs play so important a role in production and maintenance economy.

Revision of Death Benefit Schedule

Certain amendments to the Plan for Employees' Pensions, Disability Benefits and Death Benefits, which modify and extend the provisions covering benefits in cases of death by sickness of active employees and payments after the death of employees retired on pension, have been approved by the Board of Directors, effective January 1, 1930. *A leaflet containing the text of these amendments is being distributed to all members of the Laboratories.*

While a full understanding of the changes can be secured only by careful reading of the amendments, some of the principal points may be stated, in general terms, as follows:

(*a*) *A Sickness Death Benefit schedule which permits payments at the death of employees of two years' service or more has been substituted for the former schedule which permitted payments only after five years of service. Under the new schedule the amount which may be paid increases with each year of added service from two to ten years, and the former provision which limited the payments in any case to a maximum of* $2,000 *has been removed.*

(*b*) *A provision has been added which permits the Committee, in its discretion, to make payments after the death of a retired employee to his wife or dependent relatives, such payments not to exceed the amount which could have been paid as a Sickness Death Benefit if the retired employee had died on his last day of active service. This replaces the former provision which limited such payments to a continuation of the pension for not over twelve months.*

(*c*) *The provisions in regard to beneficiaries have been so revised that in most cases the Benefit Committee will have wide discretion in determining to whom payments shall be made and the amount of the payments. In certain specified cases, however, the amendments provide that the entire amount stated in the Death Benefit schedule shall be paid.*

(*d*) *Under the amended provisions the normal method of payments of Death Benefits is in installments, but the Benefit Committee in its discretion may make payments in lump sums.*

The Manual Tandem Board

By C. G. SPENCER
Local Systems Development

IN a very small community it would be possible to have telephone service without a central office by running lines from each subscriber to every other subscriber, and by having a simple switching arrangement in each home so that a subscriber could select the line he wanted to call. With this arrangement in a community of eight homes there would be a total of twenty-eight connecting lines, and for each station there would be required one plug connected to the telephone and seven jacks connected to the lines to the other subscribers; in all there would thus be eight plugs and fifty-six jacks. If a central office were installed only one line would be required from each subscriber to the office—or a total of eight lines in place of the twenty-eight of the former arrangment; and only eight jacks, one for each line—instead of fifty-six before. The number of plugs required would depend on the number of calls that might be placed at any one time which could not be more than four so that the maximum would be eight plugs.

The installation of a central office thus produces a great economy in both lines and switching equipment. In any but the very smallest communities the expense and complexity of a system without a central office would be so enormous that the possibility of installing such a system would not be given a second thought. A service comparable to that performed by a central office for a group of subscribers, is performed by the tandem board for a group of central offices. It reduces both the number of interconnecting trunks and the amount of switching equipment that are required in the central office.

In a district having but a single central office, a complete connection consists only of a link connecting two subscribers' lines, represented diagrammatically in Figure 1. Here S-X represents a calling subscriber's station, S-Y a called subscriber's station, and "a" the connecting link or cord circuit. The latter consists of a repeating coil arranged to feed battery current to the transmitters of both

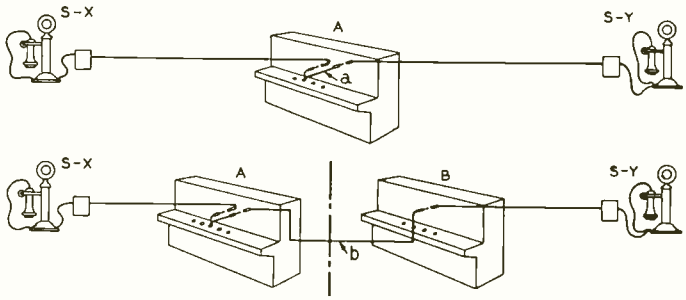


Fig. 1 (above)—In single-office areas, two subscribers are connected by a single cord circuit terminated in plugs at each end; Fig. 2 (below)—Multiple-office areas require both "A" and "B" boards in each office; an additional link and connecting operation becomes necessary

stations, a supervisory relay for each end of the cord circuit, and the necessary lamp signals. The complete connection is handled through a single switchboard, which for convenience is called the "A" switchboard.

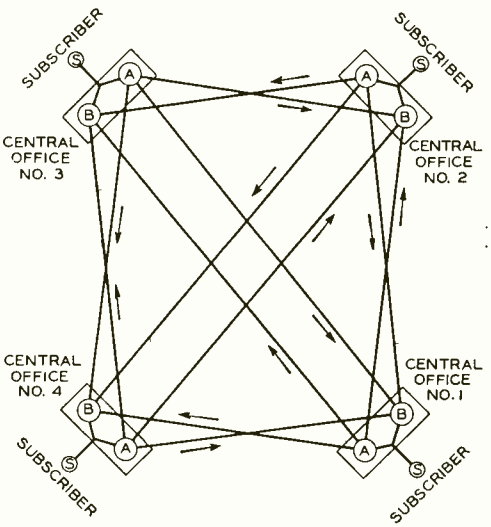


Fig. 3—Between each office in a multi-office area two groups of trunks are required, each group connecting the "A" board of one office with the "B" board of the other

As the number of telephones in an area increases, there comes a time when all connections cannot be made in this manner because of physical limitations in the size of the switchboard. Additional offices, therefore, are provided and trunk circuits are introduced between the cord circuit shown in Figure 1, and the called subscriber's station. This connection is shown schematically in Figure 2, where S-X and S-Y represent the calling and called subscribers, and "b" the additional circuit which serves as a connecting link in the transmission system between two offices. This consists of a jack at the originating end, a repeating coil with the necessary control relays for transmitting the supervisory signals from the called station to the originating "A" operator, and a plug at the terminating end.

This scheme introduces a new type of switchboard section, and requires space in the "A" board for a group of jacks known as the outgoing trunk-multiple. The new type of switchboard section, at which calls from other offices are completed, is called the "B" switchboard for convenience in distinguishing it from the "A" switchboard referred to above. This system may be applied to a considerable number of offices, but requires a group of trunk circuits from each office to every other office of the group. It is known as direct trunking. Figure 3 shows a direct trunking diagram between four offices.

Although direct trunks are, of course, desirable whenever they can be justified, if employed exclusively in a large multi-office area, a serious loss in overall trunk efficiency would result. It is necessary to provide a sufficient number of trunks between each pair of offices to care for the maximum number of calls being made at any one time and, since the busy periods between an "A" board and the various "B" boards in the same exchange area may not coincide, there will probably be at all times a considerable number of idle trunks.

If interoffice connections could be made through a common central point, however, the number of idle trunks would be materially reduced. In Figure 4, such a central switching point is shown, and in Figure 5 the switching arrangements for a single call are represented diagrammatically. This system, frequently met with in large areas, is generally referred to as the tandem system.

In Figure 5, S-X and S-Y represent the calling and called stations as before, "b" a trunk which is very similar to the one described in connection with Figure 2 except that the signalling arrangements are somewhat modified, and "t" the tandem trunk.

Here the "A" operator selects an idle trunk to the tandem office and, receiving a signal that the tandem operator is connected, passes only the name of the called office to the tandem operator. The tandem operator selects an idle trunk to the desired office and plugs into the jack, her set being then automatically disconnected. After her set is disconnected, the tandem operator has no means of again getting in on the connection and has no further duties to perform until a disconnect lamp indicates to her that the connection should be taken down.

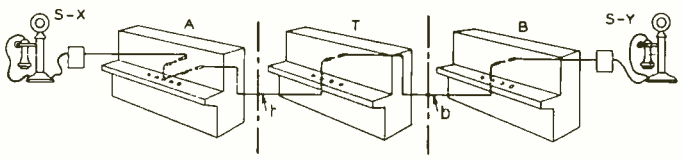


Fig. 5—Tandem operation introduces a third link and operation but very greatly reduces the equipment and trunks required

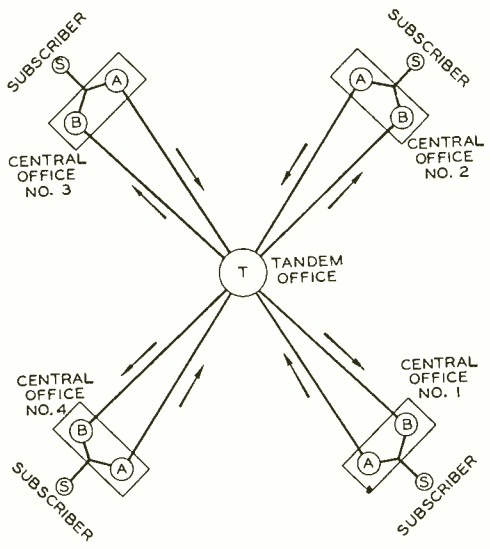


Fig. 4—When a tandem is used instead of having two groups of trunks from each office to every other office, only two groups to the tandem are required

While the choice between direct and tandem operation is partly determined on the basis of trunk efficiency it is also affected by the cost of providing facilities of a grade necessary to meet transmission standards. Tandem operation usually involves a longer length of circuit than direct trunking in addition to the tandem office equipment, so that to meet comparable standards a better grade of facility is required for the tandem trunks. For tandem operation to prove advisable therefore the increased efficiency should offset the cost of better trunks, so that the total cost of the plant to care for the traffic considered, is less with tandem operation than with direct trunking.

The reduction in trunks brought about by the tandem board is sometimes greatly enhanced by favoring geographical conditions. Occasionally there are two adjacent areas between which considerable traffic exists. If each of these areas is served by a tandem board, an economy of trunks may be brought about by running a common group between the two tandem boards instead of separate groups from the tandems to each of the offices in the other area. Double tandem is not considered an entirely satisfactory method of operation, however, particularly in the case of manual operation, because of the delay on the call and the increased

chance of error. Because of these service reactions and because of the relatively small savings brought about by the double tandem method of operation when the traffic has reached any sizeable proportions, this method is used only between points where the normal traffic is small.

Since the introduction of straightforward trunking, the tandem switchboard has come to be used to a greater extent as a means of providing for toll service between adjacent sections. It has enabled telephone companies to materially extend the range of their "A" to "B" toll service. The connections are handled on a call-by-number basis, the "A" operator making out the ticket and timing the call. The traffic is handled in the same manner as regular interoffice business except for the tickets and timing, and the connections are made with practically no delay.

The tandem switchboard is also used as a means of rerouting calls during periods of light load in order to bring all calls into a few adjacent positions, known as night positions at the "B" board. This materially reduces the number of operators required for light load periods. The arrangement is possible because trunks from a tandem board are, as a rule, located in one or two positions at the head of the trunk switchboard, which gives somewhat the same effect as having a small trunk group from each office coming into the position at the head of the trunk switchboard.

The present standard tandem switchboard is operated on a straightforward-trunking basis using the automatic-listening method. Each position consists of an operator's telephone set, a positional control circuit, and sixty trunk circuits. As a call comes in on a trunk, a lamp lights to indicate that a call is waiting. The trunks with waiting calls are connected in numerical sequence to the operator's telephone circuit by means of a chain of relays. Three short impulses of tone are sent, by relays in the control circuit, to the "A" operator to indicate that the tandem operator is ready to receive her order, and a small portion of this tone is bypassed to the tandem operator, warning her to be prepared to receive the order. To indicate the calling trunk a lamp associated with it is automatically flashed.

To avoid the necessity for making busy tests at the tandem board, the outgoing trunks are equipped with idle-trunk indicating lamps. A lamp is kept burning over the jack of the lowest numbered idle trunk in a group to a particular office, and the tandem operator may plug into the jack under that lamp without testing it. As soon as the operator does this, the indicating lamp is extinguished and the lamp of the next lowest numbered idle trunk is lighted.

At present there are over twenty manual tandem switchboards in the United States, seven of which are of the standard automatic listening type. In the New York area there are three manual and two mechanical tandem boards. Here a number of calls require double tandem operations as the connection may be routed through two tandem offices.

NEWS AND PICTURES
of the
MONTH

including Club Activities and Biographical Notes

S. P. Grace demonstrates the call-announcer system

News Notes

BELL Telephone Laboratories was prominently represented on the Sunday morning of December 8 when ship-to-shore radio telephone service was formally opened. Vice-President H. P. Charlesworth, W. Wilson, A. A. Oswald, and R. A. Heising were among the group gathered around the table in the board of directors' room at 195 Broadway as President Gifford of the American Telephone and Telegraph Company, followed by representatives of the United States Lines, radio officials of the federal government and the navy, and heads of the prominent press associations, talked with Commodore Cunningham aboard the *Leviathan,* 200 miles at sea.

At the time these opening talks were being made F. R. Lack, F. B. Llewellyn, G. Thurston, H. J. Scott, E. Vroom, C. C. Munro of the Laboratories, and J. L. R. Van Meter and E. L. Behr of the American Telephone and Telegraph Company were on board the *Leviathan* in charge of the receiving and transmitting apparatus. In addition to the Long Lines operators, J. C. Schelleng, A. E. Kerwien, R. C. Shaw, E. B. Ferrell, L. H. Schwartz and R. Kircher of the Laboratories were at Deal Beach in charge of the transmitting apparatus; and F. A. Polkinghorn, R. P. Jutson, J. C. Gabriel, F. A. Hubbard, Frank Giovanini, D. M. Black, R. R. Roush of the Laboratories, and F. W. Schramm and H. B. Coxhead of the American Telephone and Telegraph Company were in charge of the receiving apparatus at Forked River.

During the twenty-four hours following the opening of the service a total of thirteen calls was completed, nine coming from the shore and four

The gathering at Bell System Headquarters which marked the formal opening of ship-to-shore telephone service. Mr. Charlesworth is seated at Mr. Gifford's right. A. A. Oswald stands directly in front of the central pillar; at his left are R. A. Heising and W. Wilson

originating aboard the vessel. It is expected that within a short time this service will be extended to other liners in the transatlantic service.

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THE LABORATORIES has purchased for its historical museum some of the earliest apparatus in the sound picture art. The apparatus was that developed by Eugene A. Lauste and applied by him to the synchronous recording of sound and scene on motion picture film, first in England and later in the United States. The first demonstration of this apparatus in the United States was conducted in conjunction with Jean A. LeRoy an old friend and himself the inventor of the first motion picture projection machine. These two pioneers in the motion picture arts, both silent and with sound, have been retained by the Laboratories to guide and assist the preparation of their apparatus for historical record.

Mr. Lauste's work dates back to 1905 in England and in fact he obtained a British Patent in 1906 covering a method for synchronous recording. During 1911 he came to the United States and formed an association with LeRoy who had been a contributor to the development of silent pictures. Working together in LeRoy's machine shop on Third Avenue near 13th Street they produced, in 1911, a synchronous film record of motion picture and sound. Shortly after Lauste returned to England and the association was interrupted to be taken up again in their later years when Lauste returned to America to live in Bloomfield.

The purchase of this apparatus will preserve for posterity a fuller record of the now widespread commercial art of sound pictures.

THE SOCIETY for Promotion of Engineering Education, middle Atlantic section, held its winter meeting in the auditorium on December 14. Vice-President H. P. Charlesworth welcomed the visiting members and an address outlining the educational program of the Laboratories was given by G. B. Thomas. The meeting was also addressed by R. I. Rees, Assistant Vice-President of the American Telephone and Telegraph Company and president of the society, F. L. Bishop, secretary, and President C. R. Richards of Lehigh University. Papers on engineering education were read by Professor William D. Ennis of the Stevens Institute of Technology and Professor Bernard Hague, senior lecturer in electrical engineering, University of Glasgow and visiting professor in the Polytechnic Institute of Brooklyn. A demonstration lecture of television in natural colors was given by Herbert E. Ives. F. L. Hunt spoke on sound picture development, which was followed by a showing of several sound picture films.

Those who attended the meeting were entertained by the Laboratories at dinner in the restaurant. Previous to the meeting the visitors were taken on an inspection tour of the Laboratories and a visit was made to the Long Lines offices at Walker Street. R. J. Heffner, R. A. Deller, R. L. Shepherd, P. M. Neave, A. N. Holden, L. A. Elmer, H. W. Garbe, D. P. Barry, and W. A. Hyde served as guides.

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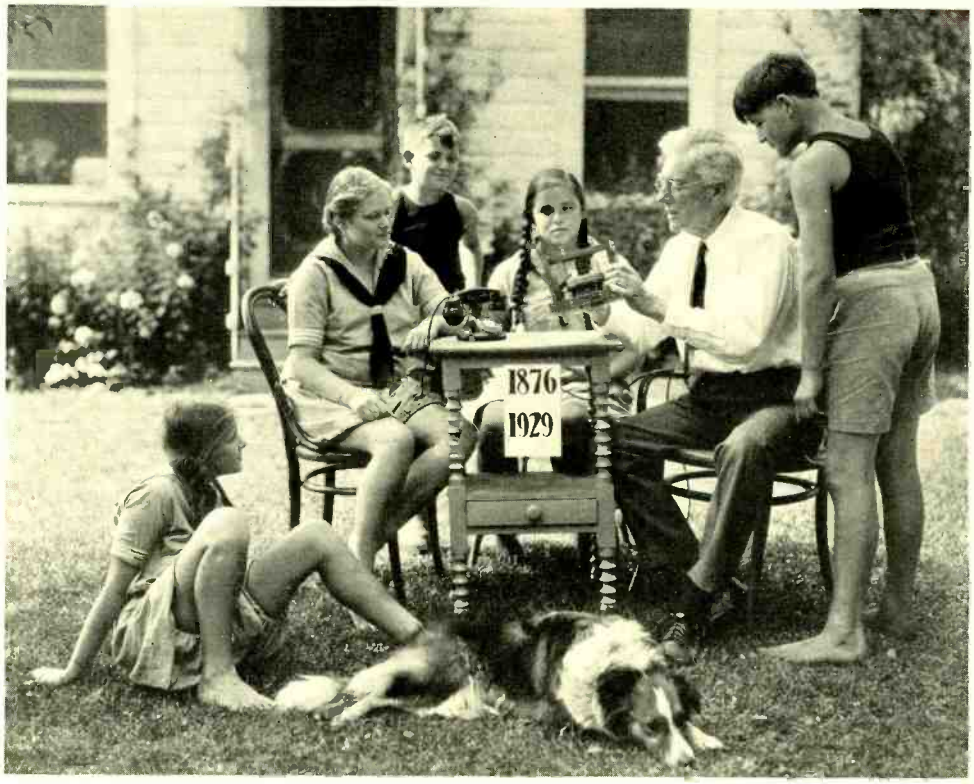
AS PART of the program arranged for the society's annual convention in New York during the first week in December, members of the American Society of Mechanical Engineers made an inspection tour of the Lab-



At his summer home in New Hampshire, Thomas A. Watson describes to his grandchildren a replica of the first telephone, which he built for Dr. Bell fifty-three years ago

oratories on December 6. The tour was under the direction of L. S. O'Roark, G. F. Fowler and P. M. Neave of the Bureau of Publication, assisted by L. E. Abbott, H. G. Arlt, H. N. Bick, F. G. Buhrendorf, P. B. Drake, A. L. Dunn, L. A. Elmer, R. C. Ennis, A. G. Ganz, and W. H. Harvey, members of the society and of the Laboratories technical staff.

The delegation was greeted on behalf of the Laboratories by John Mills and was entertained by an acoustical program given in the auditorium. About 125 members of the society were present.

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AT THE 151st regular meeting of the Colloquium on November 25, Joseph A. Becker spoke on copper-oxide rectifiers. He described the manufacturing processes and mentioned various theories proposed to account for the rectifying action. After pointing out where they failed to meet requirements, he proposed a theory of his own explaining the rectifying action, based on experiments performed in the Laboratories. About eighty members attended the meeting.

ADMINISTRATION

H. P. CHARLESWORTH has been selected by the Nominating Committee of the A. I. E. E. as candidate for the vice-presidency representing the New York district. The term of office is

two years, beginning August 1, 1930.

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On November 15, S. P. Grace gave an address at Lehigh University in Bethlehem, Pennsylvania, on recent developments in the work of the Laboratories. The affair which was held under the joint auspices of the engineering societies of the Lehigh Valley region was attended by a large audience. President Charles Russ Richards of Lehigh introduced Mr. Grace to the assemblage. Mr. Grace's remarks were illustrated by several demonstrations at which he was assisted by R. M. Pease.

Previous to the address Mr. Grace attended a dinner given in his honor at the Hotel Bethlehem. Several officials of Bell Telephone Company of Pennsylvania and the Lehigh Telephone Company as well as civic and business leaders of Bethlehem were present. Philip C. Staples, vice-president in charge of operations of the Bell Telephone Company of Pennsylvania gave a brief talk at the conclusion of the dinner.

The address and demonstration were again given on December 2 and December 10 when Mr. Grace spoke before the Technology Club in the Onondaga Hotel at Syracuse, and at the luncheon of the Merchants' Association of New York at the Hotel Astor. More than 1,600 guests attended the luncheon of the Merchants' Association, the largest in the history of the organization. On December 17 the talk and demonstration were given before the Telephone Pioneers at Chicago.

On December 4, a demonstration of the call announcer was given to the supervisory staff of the New England Telephone and Telegraph Company at New Haven. P. Husta, F. K. Low and C. A. Grierson of the Systems Development Department were in charge of the preliminary tests.

Systems Development

E. J. Kane was at Hawthorne for several days to discuss community dial and step-by-step central office equipment.

Messrs. S. F. Butler, D. C. Meyer and A. O. Adam attended the cutover at Detroit of the first battery-on-the-cutoff-relay panel dial office. While there they inspected the new No. 3 toll switchboard and repeater equipment now being put in service in what is one of the largest toll installations ever made.

C. E. Boman and H. E. Marting went to Cincinnati to inspect an improved method of superstructure to support panel selector frames.

A. B. S. Kvaal spent several days discussing drafting practices with drafting departments at Hawthorne.

V. T. Callahan made a trip to New Orleans to discuss the installation of new foundations under the gas engines at the Galvez and Franklin offices there.

C. H. Bidwell was at Harrisburg, Pennsylvania, in connection with development work on the No. 5 toll test board.

L. A. Mortimer assisted in lining up the toll circuits from New York used in the demonstrations of the automatic call announcer given in conjunction with S. P. Grace's talks at Bethlehem, Syracuse, and Chicago.

J. Lafferandre was at Forked River, New Jersey, on work concerned with the installation of radio receiver power plants for ship-to-shore service.

F. R. Jeffreys visited Netcong,

Supervisory force in charge of Systems Drafting

New Jersey, to supervise the installation of wire line terminal equipment and associated power plants required for transatlantic telephone service.

J. W. WOODARD and engineers of the Western Electric Company were at Boston to discuss with representatives of the New England Telephone and Telegraph Company power facilities now being supplied for new central office equipment.

AT BOSTON J. M. Wilson arranged with the New England Telephone and Telegraph Company's traffic engineers for modifications in experimental operators' chairs in a number of central offices.

A. S. KING visited Jackson and Kalamazoo, Michigan, to assist in installing of toll line dialing equipment.

E. W. HANCOCK visited Boston in connection with the trial installation of dust covers for sequence switches.

T. F. LEFEVRE went to Columbus, Ohio, to study the effect of a new adjustment of slow release relays for step-by-step equipment.

G. V. SMITH assisted in S. P. Grace's demonstration of the call announcer at Bethlehem, Pennsylvania.

J. G. WALSH went to Hartford to make a field investigation of dial pulse correcting repeaters.

MESSRS. L. M. ALLEN and B. F. LYNIP were at Philadelphia to observe contact resistance measurements on sequence switches, both with and without covers.

L. W. WICKERSHEIM is a candidate for the Ph.D. degree in the Washington Square graduate school of physics of New York University.

C. C. MUNRO has been making tests on the *S. S. Leviathan* of the voice frequency equipment for ship-to-shore service.

MESSRS. R. W. Chesnut, J. A. Mahoney, D. M. Terry and W. F. Kannenberg were in Washington to discuss the development progress of the 2-A carrier pilot channel system under trial on the type C carrier service between Washington and Palm Beach.

RESEARCH

J. C. SCHELLENG was on a trip

through the west and south where he delivered a number of talks before American Institute of Electrical Engineers sections on *Transatlantic Radio-Telephony*. Mr. Schelleng spoke at St. Louis, the University of Kansas at Lawrence, Oklahoma City, Dallas, and Houston.

As part of a series of public scientific lectures, C. J. Davisson spoke on *The Wave Properties of Electrons* at the Carnegie Institute of Technology at Pittsburgh. His address was divided into two parts which were given on consecutive nights during the latter half of November. He later gave a talk on the same subject at the Royal Canadian Institute at Toronto.

Mr. Davisson attended the autumn meeting of the National Academy of Sciences at Princeton during the middle of November.

C. A. Kotterman was in Washington to inspect and adjust the models in the scientific exhibit maintained by the Laboratories at the National Academy of Sciences building.

J. M. Finch attended a conference on multiple bank interleaving paper at Hawthorne.

Messrs. H. H. Lowry, S. O. Morgan, W. A. Yager, A. C. Walker and E. J. Murphy attended a conference at the Massachusetts Institute of Technology held under the auspices of the committee on insulation of the National Research Council. Mr. Walker spoke on *Electrical Properties of Textile Insulation* at the meeting.

A. R. Kemp visited the plant of the Rome Wire Company at Rome, New York, on matters concerned with rubber covered wire.

R. M. Burns and C. L. Hippensteel visited Hawthorne to discuss the work on metal finishes. Mr. Hippensteel also visited Lafayette, Indiana, where a number of soil corrosion specimens were buried for test.

H. E. Haring and C. L. Hippensteel were at Philadelphia on investigations of cable sheath corrosion, similar to those recently carried on in New Orleans.

A. E. Schuh was at Hawthorne on work concerned with paints, lacquers, and varnishes. With E. W. Kern he visited the lacquer laboratory of the DuPont Company at Parlin, New Jersey, and the paint and varnish laboratories of the same company at Philadelphia. While on this trip they also visited laboratories at the University of Pennsylvania.

H. E. Ives and K. K. Darrow attended the American Physical Society meeting at Chicago. Dr. Ives later participated in a conference at the Yerkes observatory on *Astronomic Photoelectric Photometry*.

A. G. Landeen has returned from San Pedro, California, where he has been making modulation tests on the Catalina cable.

D. D. Foster attended the meeting of the National Academy of Sciences at Princeton. At the invitation of C. J. Davisson he gave a paper, *The Use of Oblate Ellipsoids for the Measurement of Magnetization in Anisotropic Substances.*

H. Fletcher attended a conference of the American Federation of Organizations for the Hard of Hearing at Baltimore. He delivered a short talk at the meeting.

Outside Plant Development

Messrs. D. A. Quarles, C. D. Hocker, G. A. Anderegg, C. W. Green, V. B. Pike, J. J. Harley, with several members of the American Telephone and Telegraph Company, made a trip to Phoenixville, Pennsylvania, to observe the progress of ex-

periments on cable systems which are being made there. The group also inspected fireproofing on aerial cables located in the vicinity.

C. D. HOCKER visited the Seamless Rubber Company at New Haven, Connecticut, on matters concerned with linemen's rubber gloves. With W. H. S. Youry he later visited the United States Rubber Company in this same connection. Messrs. Hocker and Youry also visited the International Braid Company and the Hope Webbing Company at Providence in regard to prepared cotton sleeves for use on splices in cable conductors.

S. C. MILLER accompanied by A. L. Fox of the American Telephone and Telegraph Company made an extensive trip which took in the Pacific coast and the southern states in the interests of various outside plant development problems.

E. M. HONAN visited the Rome Wire Company at Rome, New York, to discuss problems relative to the manufacture of rubber insulated wire.

J. G. BREARLEY visited Morrisville, Pennsylvania, and R. C. Jones visited Springfield, Massachusetts, in connection with the splicing of toll cable with special insulation.

L. S. FORD was transferred from Hawthorne to Kearny to establish headquarters for current engineering on lead covered cable. H. G. Rife and C. M. Jennings of Mr. Ford's staff at Hawthorne were also transferred to Kearny. R. P. Ashbaugh is in charge of the current engineering groups at Hawthorne, reporting to Mr. Ford.

G. A. ANDEREGG, with C. G. Sinclair of the American Telephone and Telegraph Company, recently visited Texas, Oklahoma, and telephone headquarters in St. Louis.

GENERAL STAFF

A. H. SASS has been elected to membership in the Edward J. Hall chapter of the Telephone Pioneers.

HENRY WESEMANN, JR., a member of By-products group under C. T. Boyles, died on November 28, 1929. Mr. Wesemann's service with the Western Electric Company and the Laboratories dated from 1915.

PATENT

THE following members of the Patent Department visited Washington, D. C., during the period from November 7, to December 4, 1929, in connection with the prosecution of patents: H. K. Baker; E. V. Griggs; S. B. Kent; I. MacDonald; G. T. Morris; J. G. Roberts.

APPARATUS DEVELOPMENT

F. F. LUCAS returned on December 6 from Tokio, Japan, where he read a paper *The Nature and Structure of Troostite* before the World Engineering Congress. He also spoke before large meetings at the imperial universities at Kyoto, Sendai, and Tokio. Among the mementoes of his trip were Japanese dolls representative of the native flower girls of Kyoto, presented to him at the University there; and a Japanese tea set received at the Tohoku University at Sendai. He was extensively entertained by Japanese scientists and medical men before whom he discussed his studies of cancerous growths.

H. N. VAN DEUSEN spent a week at Hawthorne in connection with various material problems.

E. MONTCHYK was at Charleston and Huntington, West Virginia, to make a survey of base-metal contacts in step-by-step offices.

C. E. NELSON spent the first two weeks of December in Huntington making measurements of contact noises with the newly developed noise meter. E. Montchyk and L. Dickinson visited Stamford, Connecticut in connection with this same problem.

H. P. TARAKAJIAN visited Philadelphia to make contact resistance measurements of sequence switches on trial installations.

H. A. ANDERSON inspected the manufacturing methods of the Western Electric's supplier of masonry drill holders at Bayonne, New Jersey, and made suggestions for improvements in the heat treating operations.

W. FONDILLER attended the American Management Association convention in Detroit. While in Detroit he visited the Ford and General Motors Research Laboratories. Mr. Fondiller addressed the American Institute of Electrical Engineers on *Developments in Communication Materials* in New York. D. Levinger of the Western Electric Company also spoke at this meeting on the relation of manufacturing problems to material problems.

MESSRS. H. N. Van Deusen, C. H. Greenall, I. L. Hopkins, J. R. Townsend and H. A. Anderson attended an A. S. M. E.-A. S. T. M. conference on *Statistical Analysis and Presentation of Data* held December 5 at the Engineering Societies' Building. Mr. Anderson presented a paper on the statistical analysis of test data from 80,000 die cast specimens.

J. H. SAILLIARD spent several days in Chicago investigating difficulties in the installation and operation of sound picture apparatus in theatres there. He also attended a conference at Pittsburgh on sound picture apparatus.

R. V. TERRY visited the Bausch & Lomb Company in Rochester in connection with the optical system for

A stage in the evolution of chicken croquettes. Here we see John Bachor dismembering a fowl on a day when chicken is posted on the restaurant menu

sound picture systems. While at Rochester he also visited the Gleason Gear Works.

A. L. DUNN made several trips to the Ball Company in Newark in connection with trunks for the portable recording equipment.

C. E. HOLLISTER visited Wheeling, Allentown and Newcastle, in connection with investigation of contacts in pilot wire regulators.

F. A. ZUPA and J. A. CSEPELY have been at Hawthorne for engineering training.

R. M. PEASE was in charge of the demonstrations given at S. P. Grace's talks at Bethlehem, Syracuse, Chicago and the Hotel Astor, New York. At these demonstrations Mr. Pease was assisted by L. A. Mortimer, G. V. Smith, and J. K. Beins.

G. B. BAKER was in Columbus, Ohio, on field studies of slow-release step-by-step apparatus.

MESSRS. H. Pfannenstiehl, R. A. Miller and C. A. Clarke recently attended the convention of the Motion Picture Theatre Owners of America at Memphis. Mr. Miller was also at Chicago conferring on exciting lamps for theatre reproduction systems.

O. C. ELIASON was at the Utica Tool Company's plant at Utica, New York, to confer on the manufacture of special pliers for skinning wire.

MESSRS. H. H. Glenn, E. B. Wood and D. R. Brobst visited the DuPont Company's Laboratories at Parlin, New Jersey, to discuss problems in the use of insulating lacquers.

J. H. BOWER attended a meeting of the dry cell committee of the American Standards Association at Chicago, and then went to Hawthorne in connection with switchboard lamp manufacture.

H. G. ARLT and J. A. KOHM visited the experimental laboratories of the DuPont Company at Parlin, New Jersey, on November 28.

J. R. TOWNSEND visited the American Brass Company and the Scoville Manufacturing Company at Waterbury, Connecticut, in connection with the investigation of requirements for non-ferrous rod stock.

W. J. FARMER was present at the installation of cable with a new sheath alloy at New Castle, Pennsylvania.

A. H. FALK visited Kearny in connection with studies of solders.

D. T. MAY and E. MONTCHYK, accompanied by G. Rish and G. M. McCarty of the American Telephone and Telegraph Company, were in Harrisburg, Pennsylvania, in connection with base-metal contact work.

A. B. BAILEY inspected the 1 kw transmitter of the Edison Electric Illuminating Company of Boston.

B. BAUER and H. A. REISE made a field strength survey for the proposed 50 kw equipment of the Columbia Broadcasting System.

J. C. HERBER made surveys for a 50 kw broadcasting equipment for the Voice of St. Louis, and a 1 kw equipment for the Monumental Radio Company of Baltimore. He inspected the 5 kw equipment of Larus Brothers at Richmond, Virginia, and made a survey for speech input equipment for the Montgomery Broadcasting Company of Montgomery.

J. C. MCNARY made a field strength survey for a 50 kw equipment for the Voice of St. Louis.

J. F. MORRISON inspected the 5 kw transmitter of Station WOR of L. Bamberger and Company of Newark, New Jersey, and the 5 kw transmitter of Station WABC of the Columbia Broadcasting Company. He supervised the installation of speech input equipment in the studios

of the Columbia Broadcasting Company and converted to crystal control and high percentage modulation the 5 kw transmitter of the Universal Radio Corporation at Kearny.

F. E. NIMMCKE made an inspection of the 5 kw equipment for Hale Brothers of San Francisco.

O. W. TOWNER made a survey for a 1 kw equipment for the Electrical Equipment Company of Phoenix, Arizona. He inspected the 1 kw equipment of the Puget Sound Broadcasting Company of Tacoma.

THE FUNDAMENTALS of film and wax recording were detailed by F. L. Hunt in a talk before the Philadelphia section of the American Institute of Electrical Engineers.

PUBLICATION

PAUL B. FINDLEY addressed the Scranton Section of the A. I. E. E. and the Engineers Society of Northeastern Pennsylvania at Scranton on December 13. His talk on Sound Pictures was illustrated by two films reproduced on a portable sound picture projector set.

W. C. F. FARNELL addressed the Cooper Union Branch of the American Institute of Electrical Engineers at Cooper Union, New York, on *Some Side Lights on Communication*. The talk was illustrated with lantern slides.

L. S. O'ROARK gave a talk before the Telephone Pioneers of America at Springfield, Massachusetts. In conjunction with the talk a demonstration was given by G. F. Fowler.

A. N. HOLDEN talked on telephone research before the Science Club of Teachers' College, Columbia.

From the Scranton "Times"

INSPECTION ENGINEERING

W. A. BOYD spent a week at Hawthorne where he attended the inaugural inspection survey conference on amplifier apparatus.

P. H. BETTS visited the Chicago plant of Electrical Research Products Inc., in connection with inspection work on sound picture apparatus. He later joined Mr. Boyd at the survey conference.

H. G. EDDY and R. O. HAGENBUCK attended an equipment survey conference on panel system equipment held at Hawthorne.

R. J. NOSSAMAN visited Pittsburgh in connection with a special investigation on panel system apparatus.

O. S. MARKUSON spent the week of December 2 at Hawthorne where he attended an apparatus survey conference on interphone cable.

P. S. OLMSTEAD attended a survey conference on station apparatus held at Hawthorne.

MESSRS. H. F. Dodge, G. D. Edwards, W. A. Shewhart, H. G. Romig and F. W. Winters attended a joint A.S.M.E.-A.S.T.M. conference

held in New York. Mr. Shewhart led the discussion and presented a paper on the economic applications of statistical methods. Mr. Dodge followed with a short paper on the presentation of data and control of quality. One of the important results of the meeting was the decision to form a committee composed of members of the various engineering societies for the development of statistical applications in engineering and manufacturing.

ROUTINE investigation matters called upon the members of the Field Engineering force to visit a number of cities during December and the latter part of November as follows:

A. M. ELLIOTT made a trip to Utica and Syracuse.

J. A. ST. CLAIR was in Los Angeles, California.

W. E. WHITWORTH visited Denver, Des Moines and Minneapolis.

I. W. WHITESIDE and R. C. KAMPHAUSEN visited New York to discuss complaint investigation matters with the Inspection Engineering staff of the Laboratories. After leaving New York, Mr. Whiteside visited Pittsburgh, Baltimore and Washington; Mr. Kamphausen continued on to Indianapolis.

T. L. OLIVER visited Birmingham, Mobile, New Orleans, Louisiana, and Pass Christian, Mississippi.

D. S. BENDER was in Boston, Falmouth and Springfield, Massachusetts, and Providence.

C. A. JOHNSON made trips to Milwaukee, Gary and Decatur.

G. GARBACZ visited Cincinnati and Columbus.

Contributors to this Issue

R. A. HEISING received the E.E. degree from the University of North Dakota in 1912 and the M.S. degree from the University of Wisconsin two years later, and then entered the Research Department. He participated in the long-distance radio-telephone experiments of 1915, in wartime radio-communication developments, and in the early ship-to-shore telephone work. For the past five years he has had charge of numerous fundamental investigations in short-wave radio transmission and systems, as an application of which his group has produced the ship's radio equipment for the new ship-to-shore telephone system.

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WHEN the Western Electric Company came from Thames Street to West Street, W. H. MATTHIES helped in the moving. He left to enter Massachusetts Institute of Technology and returned, on graduating in 1902, as a student engineer. In 1904 he was sent to Berlin, and later to Antwerp where he had charge of early work on machine switching. Leaving Belgium as a war refugee, he was for a time in Scandinavia, and returned to West Street in 1916. In charge of the circuit laboratory for a while, he later took charge of local circuit design. In 1921 he was made Local Systems Engineer, supervising both design and laboratory work on local circuits.

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IN 1902 C. D. DUSHECK started work with the Western Electric Com-

C. A. Chase

C. D. Dusheck

R. A. Heising

pany as Junior Draftsman in the old Clinton Street factory at Chicago. After two years he was transferred to the Engineering Department of the Wisconsin Telephone Company where he spent several years superintending underground construction and outside plant work. Returning to the Western Electric in 1909, he was assigned to cabling layouts of Manual Central offices. In 1913 he entered the Systems Development Department at New York. In 1920 he assumed charge of the circuit drafting group, and in 1927 of the entire drafting organization of the Systems Development Department.

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C. A. CHASE received the B.S. degree in Naval Architecture and Marine Engineering from Massachusetts Institute of Technology in 1922. After several years of marine work, including considerable time at sea, while acquiring a marine engineer's license, he joined these Laboratories in the fall of 1927. Since that time he has been concerned with specifications and other staff work with the Outside Plant Development Department.

W. H. Matthies

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C. G. SPENCER has had a long and varied experience, in recent years with the Laboratories, and earlier with the Western Electric Company. Beginning in the Manufacturing Department of the latter organization in 1899, he transferred to the Engineering Department in 1905. In 1911 he changed to apparatus design at Hawthorne, and in 1915 to the Systems Development Department in New York. In connection with the Stockholm-Goteberg cable project he was sent to Sweden in 1921, and returned to the Systems Department in 1923. At present he is supervisor on development of manual systems.

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F. B. ANDERSON graduated from the University of Pennsylvania in 1926 and immediately after entered the Systems Development Department of the Laboratories. He has specialized chiefly in the design of systems for detecting and locating faults in toll cables, and

F. B. Anderson

C. E. Boman

C. G. Spencer

in the development of high gain D.C. amplifiers.

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AFTER getting his E.E. degree from the University of Minnesota in 1905, CARL E. BOMAN spent two years with the Stromberg Carlson Company and for the following two years was engaged in maintenance work for the New York Telephone Company. In 1909 he joined the Western Electric Company in Chicago, in the Equipment Engineering Branch, and in 1921 went to London and Antwerp in connection with the proposed introduction of dial equipment in London. In 1921 he was transferred to the Laboratories where he has taken an active part in the development of dial equipment for central offices.

When Prince Louis Victor de Broglie announced some years ago his theory of wave mechanics, it embodied the implication that electrons would be found to act like waves in the same sense that light and x-rays are waves. Later this was fulfilled by the research work in these Laboratories of C. J. Davisson and L. H. Germer. Recently Prince de Broglie has received the Nobel Prize for 1929 in the field of physics. To a letter of congratulation from Dr. Davisson, he replied " . . . I know very well that if I have received the Nobel Prize, it is because your splendid research has provided confirmation of the ideas I had developed."

Notes of the Club

THE results in the Club elections which were held on Monday, December 16, are as follows: President, D. R. McCormack; Vice-President, T. C. Rice; Second Vice-President, May Murtagh; Departmental Representative for Apparatus Development, W. J. Means; Plant and Shops, F. Mezger; Patent and Inspection, J. A. Hall.

Bridge and Dance

Another evening of Bridge and Dancing will be held on Thursday, January 16, in the club rooms of the New York Telephone Company at 140 West Street. The committee has been busily shopping around and promises something new in the way of sur-prizes. Tickets are one dollar and may be obtained from D. D. Haggerty in Room 164 or from your Departmental representative.

Bridge will be played from seven to nine. There will be seventy-two tables, each of which will be awarded a prize. Coffee, ice cream and sandwiches will be served.

Informality is to be the spirit of the occasion. You may come directly from work. The music will be furnished by the Clef Club which will play the snappiest of tunes from eight to twelve.

Hiking

Save your pennies and keep Sunday, January 12, open for a day of winter sports with the Laboratories Hikers.

We have made arrangements to go by bus to Camp Ken-a-dee on Lake Stahahe in Interstate Park. The skating on the lake we hope will be good and by January 12 there ought to be enough snow to make ideal tobagganing, snow-shoeing, and the carving of snow statues. The main cabin at the camp is large and cheerful and has a very inviting fire-place. We will have a large meal and a pickup supper guaranteed to appease the hunger of the heartiest of eaters.

The entire cost is only $3.50. If interested get in touch with Phyllis Barton at once because the bus accommodations are limited.

The Hiking Club has enjoyed an active fall season. The campfire suppers on the shore of the Hudson were very popular and will be recalled with happy memories. On most occasions two or three fires were built so that all could gather about and broil their steaks and frankfurters. Huge quantities of excellent coffee were produced in the club's venerable coffee pot. With the gathering dusk the hikers gathered in close about the fire and rich melodies echoed from the historic Palisades across the Hudson.

Those who joined in on the all-day hikes were fully recompensed for their exertions by the scenic beauty of the regions visited, the clear streams, ponds, and rugged peaks. The wonderful view from the crest of Halfway Mountain, with the towers of New York showing clearly thirty miles away, will be long remembered by those who made the Tuxedo-Suffern hike, and those who undertook the strenuous Arden-Bear Mountain

trip will not forget the climb out of the shaft of Bradley's mine.

The mileage record went to Anne Mueller, Betty Mains and Ruth Dunbrack for the women, and Ed Fogarty, Larry Whitman and Sam Neill for the men. The crowd voted Betty Mains and Ed Fogarty the best all-around hikers.

Christmas Posters

Sixty excellent posters were submitted in the Christmas poster contest. The choice for first prize finally narrowed down to a group of six which were of such marked merit that the final selection was made with utmost difficulty. The poster finally selected by the judges was drawn by E. Alenius of Systems Drafting, who was awarded the ten-dollar gold-piece offered as first prize.

Mr. Alenius' poster, which is made up in the modernistic trend, elicited much favorable comment when exhibited on the bulletin boards. Honorable mention and prizes of $2.50 in gold were awarded to the designs by M. Remmelman, E. Alisch, Lillian M. Smith, J. Neill and Annette Richter. Mr. Remmelman's poster, displaying an attractive blending of sharp black tones against a dull buff background, portrayed the family dressed in Christmas finery proceeding on its way to church. The poster designed by Miss Smith showed a dull gray sky, and the heavy snow of Christmas time heaped on the roof and about the window-ledges of an isolated peasant's cottage. Mr. Alisch's poster was impressionistic in design and portrayed a village street and the slanting-roofed houses which break out from a heavy mantle of snow in color work of striking blue.

A scene portraying Christmas in a sixteenth-century English village was favored by Mr. Neill. Rich orange lights burst from the windows of the snow covered houses and apprentice lads with their fiddler lift their voices in Christmas carols. Miss Richter's poster was the only one not in color. It sketched a lady at her doorstep as she accepts the Christmas greetings and bids adieu to her escort on the eve of Christmas. The intricate tracery work of the grilled and holly-covered door is painstakingly drawn in Miss Richter's poster.

Photographic Contest

The third annual Photographic Contest, which is open to all members of the Laboratories, is now under way. Entries should be sent to D. D. Haggerty not later than March 3. After this date the photographs submitted will be judged and exhibited.

In order to encourage our amateur photographers two classes will be established in this contest: a senior group and a junior group. Prints are to be divided into four groups, portrait, landscape, still life and baby prints. For further information regarding rules and prizes consult D. D. Haggerty, Room 164, ext. 542.

Indoor Golf

Plans have been completed for an Indoor Golf Tournament which will be played on Thursday, January 30, at the Miniature Golf Course of America, 41 East 42nd Street. Entries should be forwarded to D. D. Haggerty and accompanied by an entrance fee of $1.50.

In addition to the prizes donated by the Club for the winners of the various flights, a valuable prize will be given to the player shooting the lowest net score in the tournament.