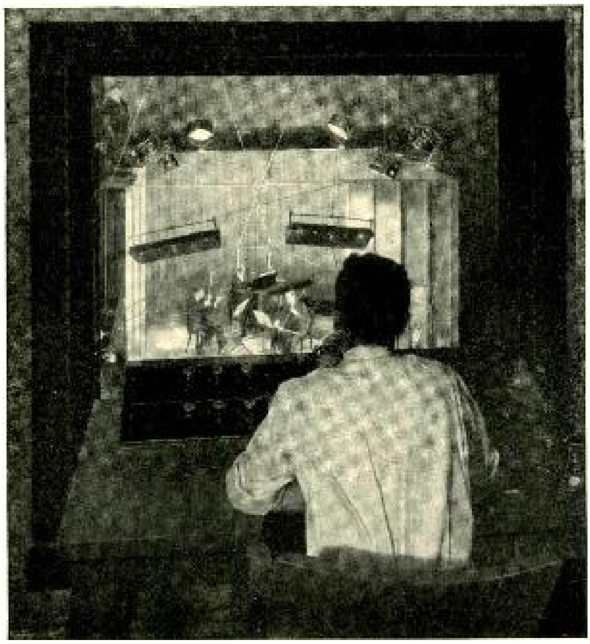
BELL LABORATORIES RECORD



Monitoring a "talkie" in the Laboratories' new sound-picture laboratory

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E. K. Hall Addresses Laboratories' Supervisory Staff on Personnel Policy

ON the afternoon of Friday, January 3, E. K. Hall, Vice-President of the American Telephone and Telegraph Company, presented to the supervisory staff of the Laboratories a stimulating outline of the personnel program of the Bell System and of the principles on which it is based. Stated in Mr. Hall's own words, "the personnel policy of the Bell System seeks to bring out and develop the best qualities in each individual, and to find ways and means to weld and integrate the individual performance of each into the competent, harmonious, team-playing cooperation upon which any successful group accomplishment depends."

Amplifying the methods by which this objective was to be attained, Mr. Hall outlined three main lines of action. First, endeavor to remove from every company, department, and office, practices or routines that are inconsistent with each individual's feeling that he is part of the enterprise. Second, develop and encourage every practice or policy that will tend to make each one feel he is part of the business, and therefore ready and anxious to assume the responsibilities as well as to enjoy the privileges and compensation that go with them. Third, develop methods to discover the individuals or groups who may still feel that they are only servants or hired men, and direct intensive effort toward making them see that membership in the Bell System is an infinitely more satisfactory status than that. Such a policy, wisely carried out, will tend to develop the best in each individual, and to weld that best into team play for the business of which we are all a part.

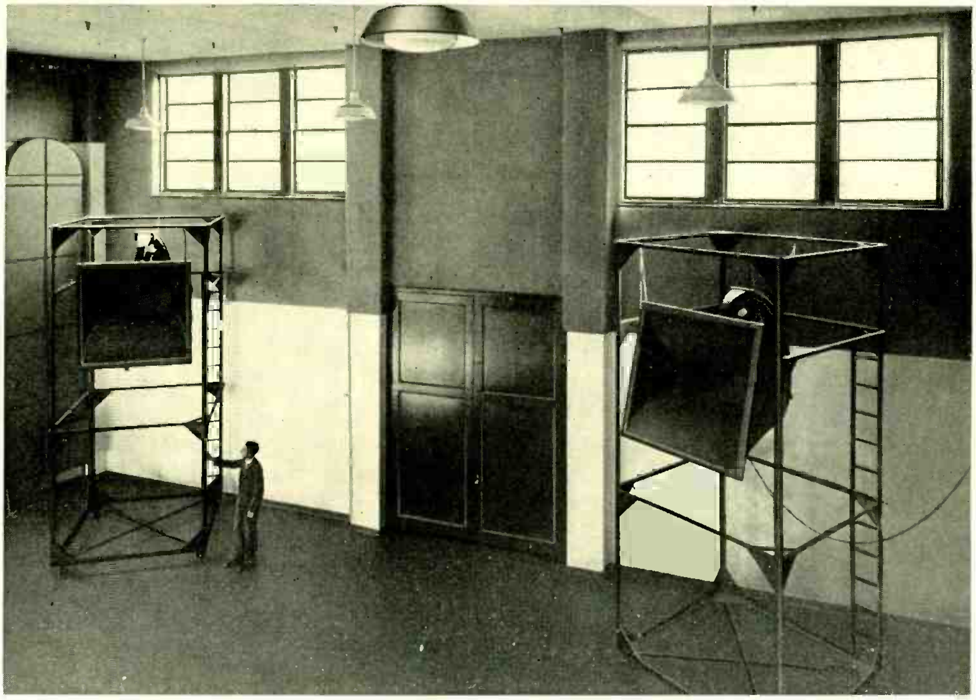
Development in personnel work is not the development of physical apparatus and equipment but the creation of a proper state of mind. Mr. Hall, in his colorful style, described two extreme cases — one a prejudicial and the other a beneficial state of mind. The one was characterized by aloofness, a detachment from and passive antipathy to the "job"; the other by a recognition of the essential unity of and community in interest between a man's business affiliations and his life as a whole. External conditions may be identical in the two cases. The difference is entirely in the state of mind, and the objective of any good personnel policy is to inculcate in each and every member of the organization that state of mind that will not only make him a more effective producer but a more contented member of general society — assuming always of course that the real facts and conditions of employment are such as justify a wholesome state of mind.

For some hour and a half Mr. Hall held his audience's undivided attention. Many pointed anecdotes accompanied and enlivened the entire talk and were told as only Mr. Hall could tell them. One of particular interest, an example of wise and farsighted treatment of an employee over whom the superior had absolute authority, was given toward the end of his talk. It happened in the World Series of 1925 when Washington, under the management of Bucky Harris, was playing the New York Giants. Washington, which had always been at the end of the league, began that year to pick up—gradually climbing from last to first place. They had substantially the same team they had had previously, and no one could understand what was causing the enormous gain in ball playing ability. It wasn't until the World Series that the cause — wise supervision by the man in authority — became apparent.

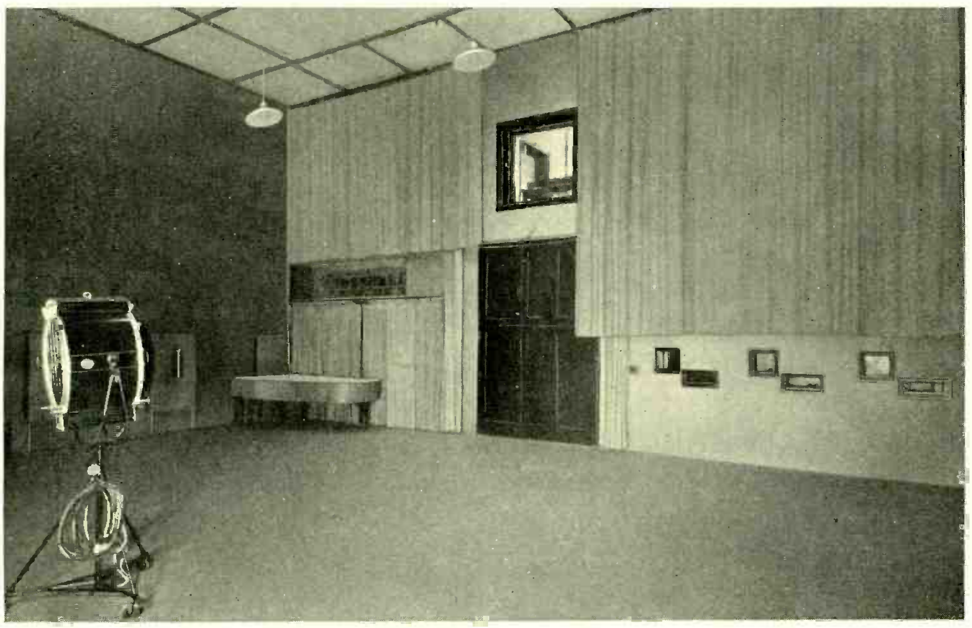
The story is too long to give in full but it brought out that it was Bucky Harris' treatment of his men, his ability to make them do what he knew was best for the team without any evident forcing of his will upon them, that brought out the best that was in them and made a team of ordinary ability into a winner of the World Series.

At several points Mr. Hall took the opportunity to compliment the Laboratories on the work they were doing. He spoke of how the ability of the Laboratories to produce constantly better circuits and steadily improved apparatus and equipment increases the confidence of the operating departments in the continued growth and success of the System as a whole. He also commented favorably on the manner in which information about new developments was being made available to the various departments and companies of the System, and on the satisfaction and efficiency which can result when adequate information is supplied promptly.

In concluding he summarized the objective of the Bell System personnel policy: — morale. "Morale to the individual is a desire to do the best, and brings the individual up to his maximum performance. Morale to a group brings the group up to a performance that is beyond anything that the individuals as a whole could perform. One part of the personnel job is, therefore, to try to eliminate from our business all the things that tend to destroy morale: worry, humiliation, loss of self-respect, loss of self-confidence, lack of faith, feeling that no one cares, lack of confidence in others; and to try to find ways and means of constructing and building up the things that make for good morale. Morale is not a soft quality. It's one of the sternest and most virile of all. Morale is to the individuals and to groups what temper is to steel. It can transform mediocre material into a superlative product. It does what we are trying to do in the Bell System: to bring out the best that is in the individual. I would like to leave as a slogan for you, for every executive and every supervisor in the Bell Laboratories, as I have tried to leave it in all the Companies throughout the Bell System, as the slogan of the personnel job—Morale."



Above: The monitoring room as viewed from the balcony
Below: The monitor's position may be seen through the square window at one end of the sound stage

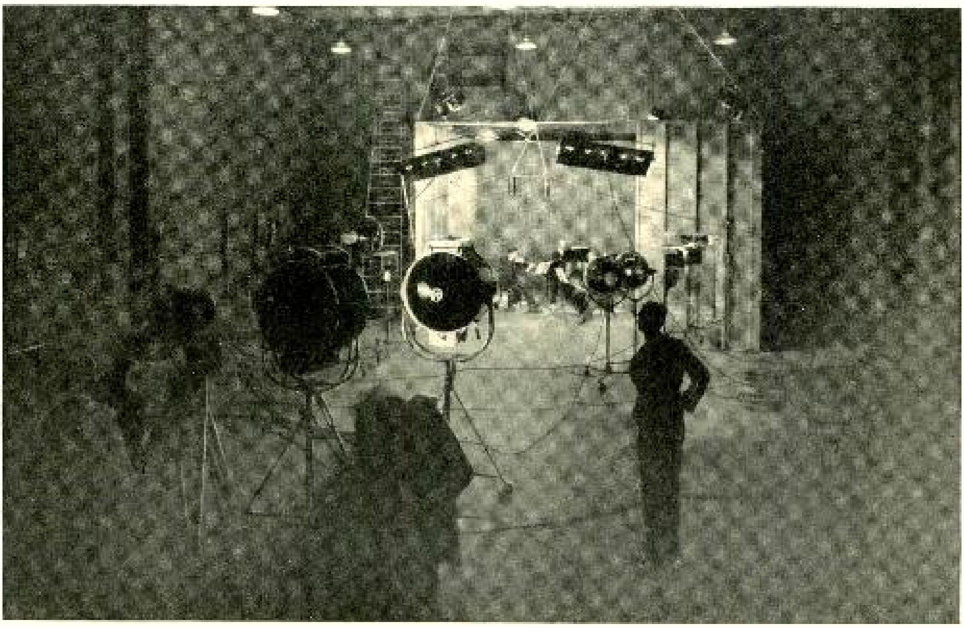


New Sound-Picture Laboratory

By H. S. PRICE
Special Products Development

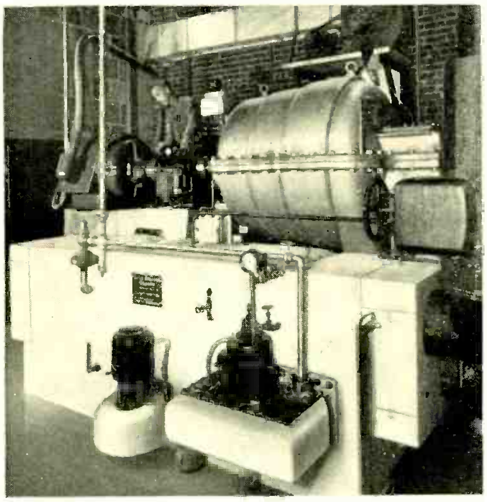
TO provide facilities for making experimental sound pictures under conditions similar to those in practice, but with full opportunity to vary conditions or otherwise efficiently do development work, a sound-picture laboratory has been built and equipped by Bell Telephone Laboratories. Located at 151 Bank Street, New York City, the building occupies a frontage of 49 feet and has a depth of 118 feet. Within this three-story building is a soundproof stage and a monitoring room, with a control balcony between them. Technical equipment comprises a single recording channel with its complement of both film and disc recorders, and complete power equipment; facilities for developing and printing by continuous processing machines; a review room with a completely equipped projection booth; and laboratories for research and development work in transmission, photography, and optics.

Office space is provided for the groups doing acoustical, photographic, and recording system development work under F. L. Hunt, W. Herriott and the writer, respectively. The complete personnel consists of a technical staff of some thirty men and a force for clerical and service work.



The sound stage during a "take"

Requirements of film processing, and the necessity for a sound-proof stage and monitor room, made air conditioning and ventilation neces-



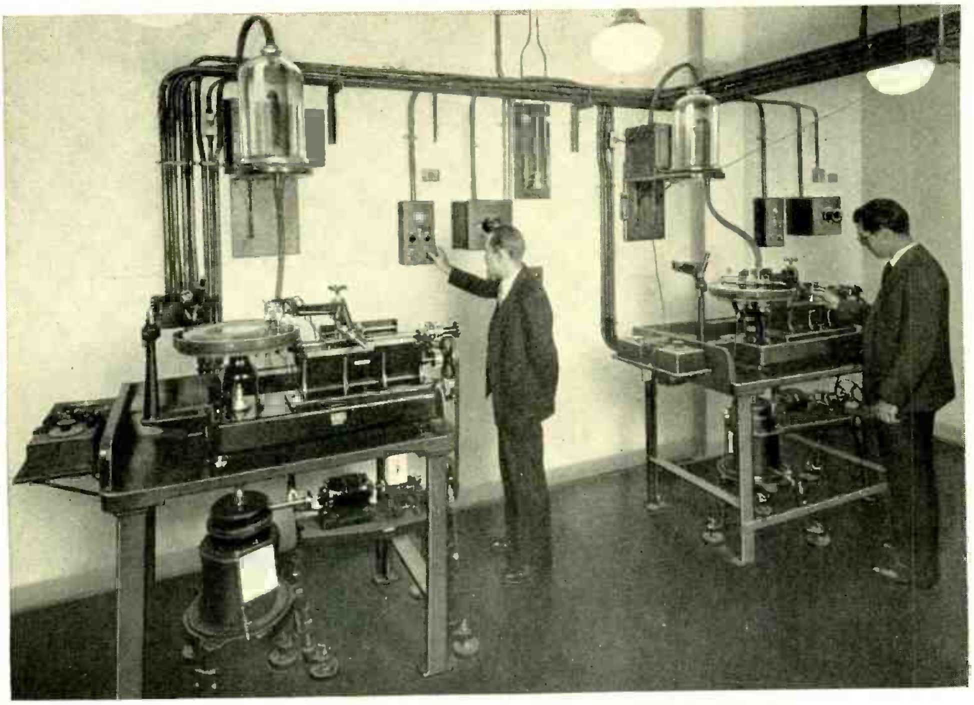
The refrigerating machine for the air conditioning plant

sary, so that a comprehensive system has been installed not only for temperature regulation and ventilation but for humidity control as well. On the first floor is the air conditioning plant consisting of air washers, blowers, a refrigerating machine, and accessory apparatus. All the heavy equipment is mounted on separate foundations to prevent vibration being transmitted to the building structure. Ventilating ducts, with subdividing partitions and baffles to avoid the transmission of machine noises or sounds from one room to another, extend to all parts of the building.

Dust is removed by an air washer, and during hot weather the water pumped to it is artificially cooled to bring the entering air to the required temperature. Steam coils are mounted in the ducts just ahead of all outlets, and thermostats mounted on the walls of the rooms control the steam admitted. Humidity for most parts of the building is held around 55%, but separate control is provided for film processing where a humidity of 70% is desired for printing and 35% for drying.

Omitting the stairwell, the third floor is divided into three unequal parts by transverse walls. The sound stage ocupies the seventy feet at the rear, for the full width of the building, and is acoustically treated to provide the proper conditions for recording. On both side walls are power outlets for stage lighting, provided by large incandescent units—some of them using 5000 watt lamps. Other outlets are for microphones, for camera motors, and for an extensive signalling and inter-communicating system. Sets will be erected, for the most part, at the north end of the stage where they will be visible from the window of the monitoring balcony in front of the south wall of the stage.

The intermediate amplifier and monitor's control desk



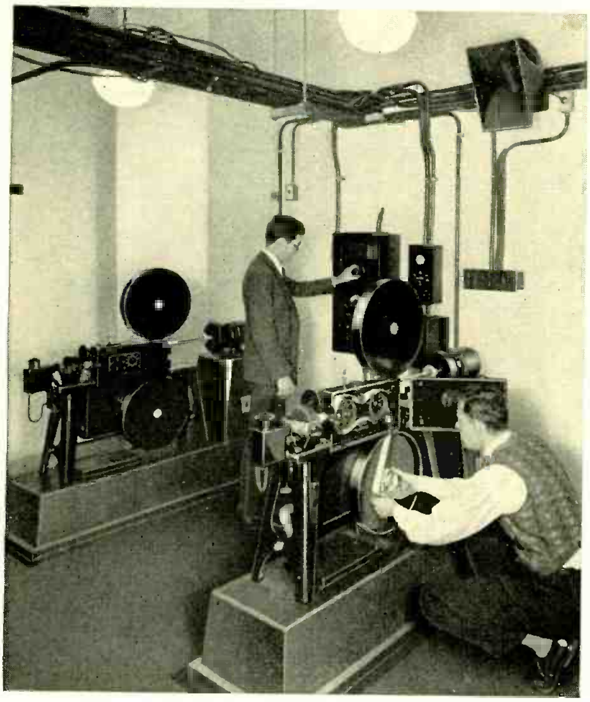
Duplicate disc recording machines are installed

There a monitor will sit, while recording is being done, at a table on which is complete control apparatus for adjusting the intensity of the "pick-up" from the microphones on the stage; a volume control and indicator; signal lamps; and inter-communicating equipment. At the left is a rack on which is mounted a microphone jack-panel and an intermediate amplifier.

This monitoring balcony is above the narrow central division of the third floor. Beneath it is a projection booth to be used for "scoring." Here pictures for which a musical program is to be recorded will be projected through double glass windows to a screen on the stage. The motors of the projectors will be synchronized with the disc and film recorders on the floor below, and an orchestra on the stage will play the score for recording in synchronism with the picture being displayed before them.

The front part of the third floor is the monitoring room which is open to the monitoring balcony. This room is treated acoustically to provide good listening conditions, and the usual sound-projector units are mounted on movable towers to facilitate obtaining the desired results. In this room the director and cast may listen to the scene just taken as it is played back from one of the waxes. During the taking of a scene the monitor observes the action through the window in front of the control table, and hears the sound through these horns, which he may connect at will either to the amplifier bus ahead of the recorders or to the monitoring photoelectric cell amplifier on either of the film recorders.

The second floor is devoted mainly



Two of the film recording machines

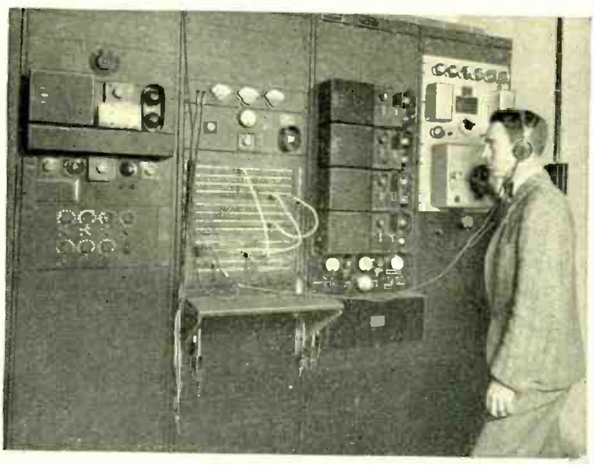
rent conditions, and another for experimental work. New apparatus will be tried out in this laboratory before being recommended for commercial service.

Duplicate test system, recorder lamp and condenser transmitter batteries, providing 24, 12 and 6 volt supplies, are installed in the battery room in addition to duplicate plate batteries tapped to furnish 350, 250, and 130 volt service.

In the power room are two charging generators, one of 12 volts and one of 72 volts. All batteries are subdivided when necessary to charge at one of these voltages. In this room also—in addition to the power switchboard—are two distributors for synchronizing the motors on cameras and recorders, and the sensitive speed control apparatus. The distributors are operated from the recording rooms by remote control apparatus.

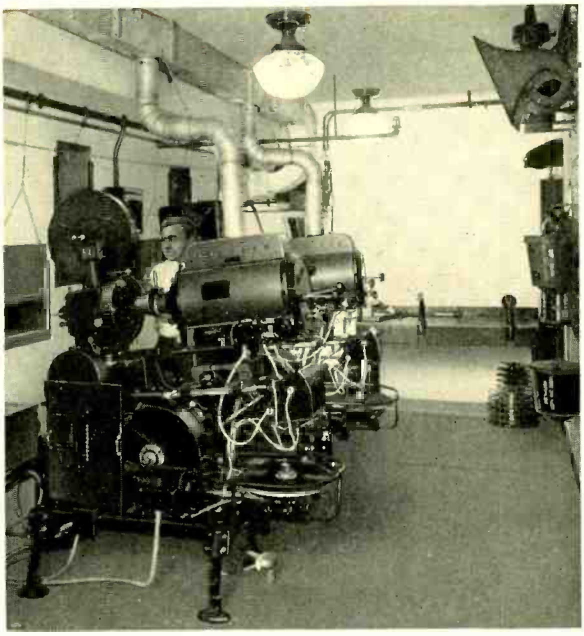
to recording laboratories, and general office space. Here too are dressing rooms for the performers, and power and battery rooms. The recording channel from the monitoring balcony comes first to the amplifier room where are located the main amplifier and the bridging amplifiers for each of the recorders. Here also are the monitoring amplifiers as well as testing apparatus and the patching sections which give free interchange of apparatus and circuits.

Disc and film recording each have their own room; the one with two wax recorders and the other with two film recorders. The proposed plan, here as throughout the building, is to maintain one complete set of equipment for standard recording under cur-



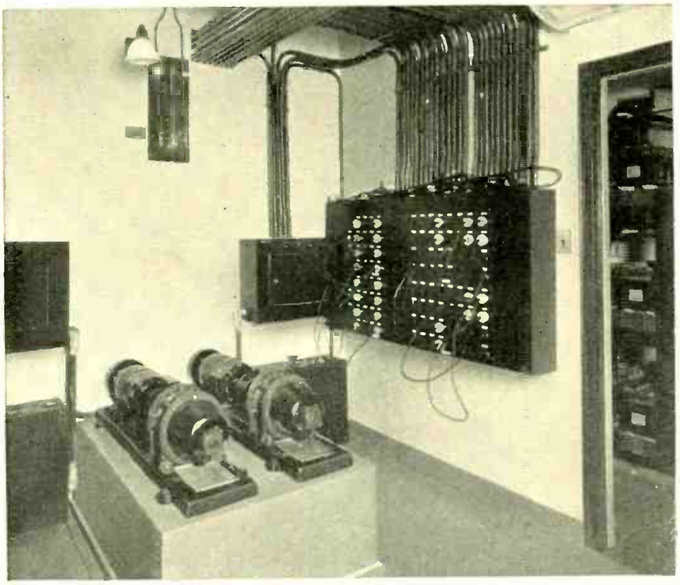
A transmission measuring position is mounted on these racks in addition to the monitoring, bridging, and main amplifiers

Also on the second floor there is a temporary rack-and-tank developing room where small quantities of experimental films may be processed. A motor driven drying rack—a large circular frame built of narrow slats on which the film is wound and rotated—allows rapid and convenient drying. At a later date this equipment will be removed and the space will be used for an optical laboratory.



In the projection booth of the review room are two standard projectors and space for a third to be used for experimental purposes

On the first floor, in addition to the administrative offices, review room, and air-conditioning room, are located the continuous film-processing machines. Of the two equipments one may be used for developing negative film and one for positive film, or one for standard and the other for experimental work. Each can process twenty-thousand feet of film a day so that ample capacity is assured. In addition there will be a printing room with two continuous printers.

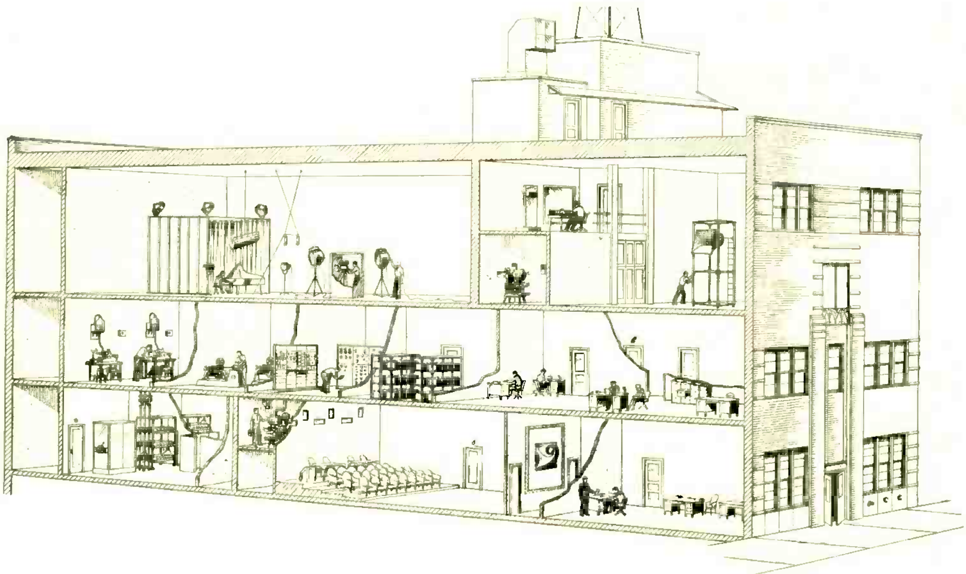


The distributors and their patching panel are located adjacent to the battery room

On the roof of the building is a fire-proof film vault where the nitrate film may be safely stored.

An important feature of the installation is the signalling and announcing system. On the monitoring table in the gallery is a microphone and a set of keys so that the monitor can talk through loud-speaking projector units to the stage or to any of the recording rooms. Interphones, giving two-way communication between all operating points, are also available. On the stage is a portable signal position for the director. It is a small table with an interphone and a signal panel. Similar signal panels are on the monitor man's desk, and on the walls of each recording room. As each of the recording rooms become ready, its lamp in all of the panels is lighted. The distributor is then started and when it is up to speed, a man at one of the recording position lights a "master start" lamp, and the taking of the scene begins.

The sound-picture is one of the great developments of the twentieth century. With the equipment and personnel available in Bell Telephone Laboratories, there is the prospect of many further refinements in the equipment and in the methods of making sound pictures.



General arrangement of various sound picture laboratories

Testing Ringers and Dials at Subscribers' Stations

By A. S. BERTELS
Local Systems Development

TO maintain the telephone plant so that subscribers will always have the best service practicable, it is necessary from time to time to adjust the equipment installed on their premises. The testing of ringers and dials requires central-office equipment, and circuits have recently been developed for this purpose in dial areas. By their use not only may trouble be located that has actually occurred but any slight defect that might eventually cause failure may be detected.

These new circuits are arranged so that tests may be made from a subscriber's station by an outside repair man without the aid of anyone at the central office. This gives to the subscriber a minimum of both service interruption and annoyance since conversation is eliminated and the duration of the test is shortened. In addition there is a saving of time for the repair man as well as for the central-office employee at a test desk.

The equipment required at the central office consists of three parts: a

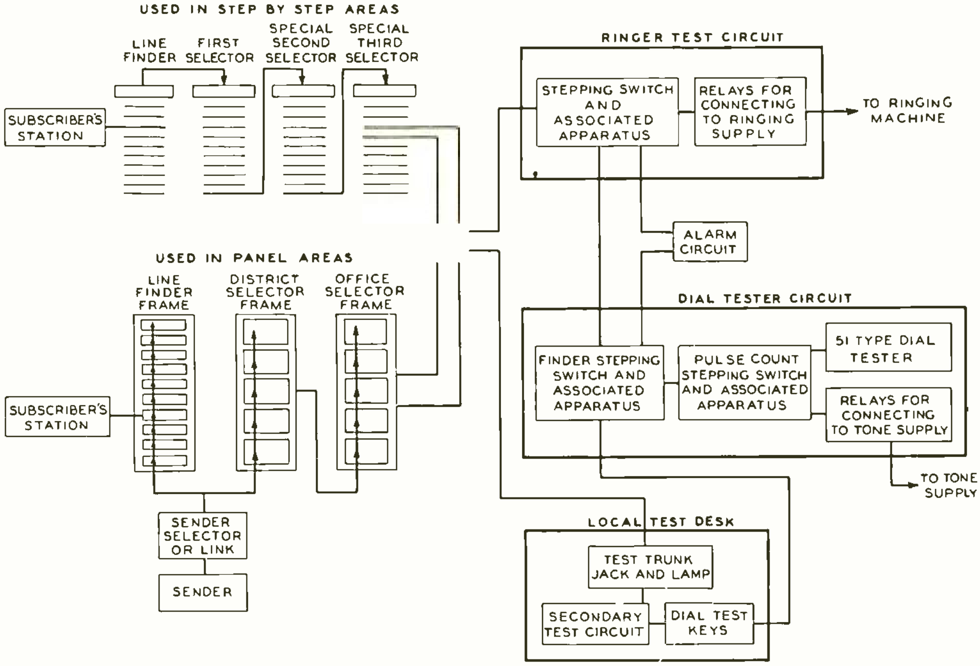
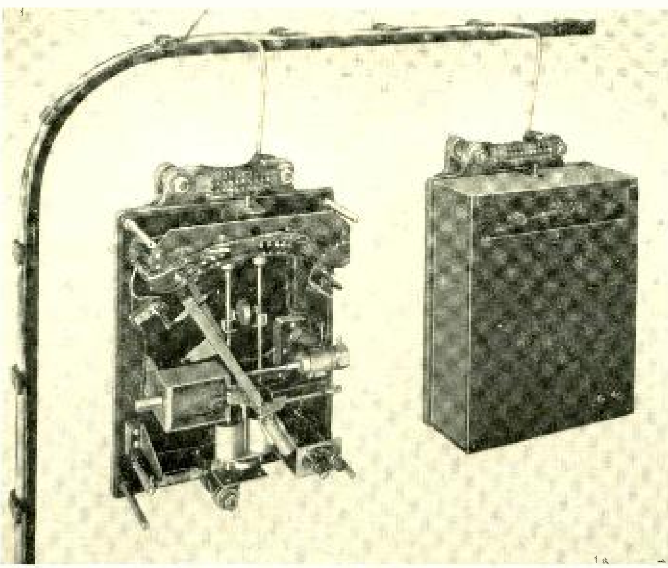


Fig. 1—The dial test circuit may be reached either directly from the subscriber's station or by way of a local test desk in the central office; the ringer test circuit, only from the subscriber's station

ringer test circuit, a dial test circuit, and an alarm circuit which functions with both of the others. To make a test, the repair man at the subscriber's station dials a code number which connects him to the testing equipment, and dial tone is returned to signify that the equipment is ready to function. The repair man then dials a second code depending on whether he wants to make a dial test or a ringer test. As there are both low and high speed dials in use and several types of ringing—such as single party, four-party semi-selective, and four-party full-selective—a group of codes is provided. After the second code has been dialed, the tests are applied automatically, for the most part, by the central-office equipment, and the repair man subsequently makes the necessary adjustments as described later.

In panel offices the test circuits are connected to either the district or office selector multiple, and in step-by-step offices, to a special third selector. A schematic diagram of the two arrangements is shown in Figure 1. Hunting features are provided so that the district, office, or special third selector may hunt for an idle test circuit when two or more men are testing from different stations at the same time.

Each ringer test circuit consists of a stepping switch, and associated apparatus which records and translates the code number dialed and makes connection accordingly to either the relays for connecting the ringing supply or to the dial test circuit. There are eight possible codes used to set up the circuit conditions for applying ringing current of the proper potential and polarity to the ringer under test: four single digit codes set up the proper circuit conditions for applying central-office ringing current to individual, two-party, or four-party stations; and four two-digit codes for applying the adjusting ringing current to any station of a four-party full-selective line.



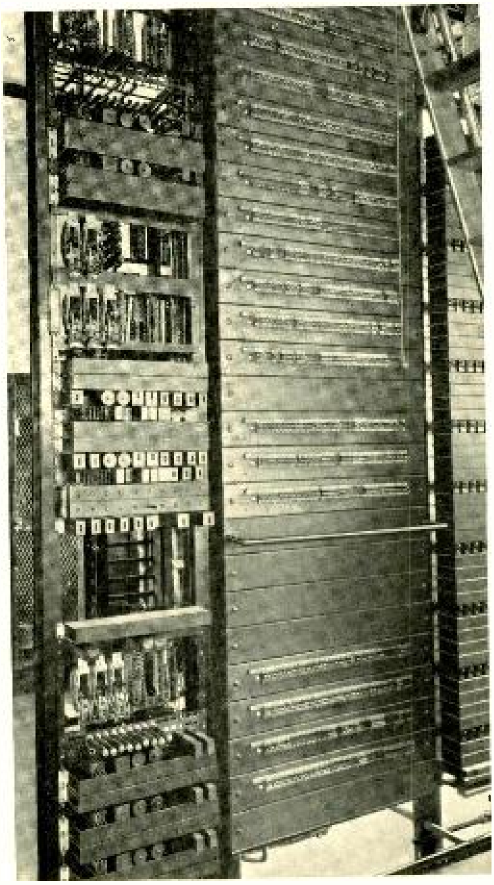
Two dial testers, one with cover removed, mounted on the wall of a central test bureau in New York City

After the repair man has dialed the preliminary test code —called the "ringer test" code—and heard the tone telling him he is connected to a test circuit, he dials one of these eight codes—if he is to make a ringer test—and then places his receiver back on the hook. This causes the ringing current to be applied, and the bell should ring. If it does not ring satisfactorily —and the line is not a four-party full-selective one—the repair man must adjust the bell until it does.

If the line is four-party full-selective, the repair man — instead of making the adjustment on the normal ringing current — hangs up his receiver and after again removing it receives dial tone, then dials one of the two digit codes, and again hangs up the receiver. This procedure connects to the line a special bell-adjusting ringing test which has a lower value of current than that used for regular central-office ringing. The A-C component of this circuit is obtained from the regular continuous-ringing supply of the central office by a step-down transformer, and the D-C component, from an independent dry battery of lower voltage than the central-office ringing battery. The bell-adjusting ringing current thus gives a closer adjustment, which is necessary on lines using superimposed ringing.

Repeated tests may be made, or the two kinds of ringing current may be applied alternately, by removing the receiver, dialing the proper code, and again placing the receiver on the hook. Gauges are used in making the adjustments to obtain the proper clearance between the armature and core. The gongs are then adjusted so that the striking of the clapper will produce the best results. After the bell has been adjusted it is frequently retested by dialing for the regular central-office ringing current. While dialing for the different kinds of ringing, the bell is observed to determine whether there is any tapping due to the dial pulses. To disconnect from the testing circuit the receiver is removed from the switchhook and replaced without dialing.

After the preliminary code for the dial test, four secondary codes are possible — corresponding to the eight



Relays and stepping switches for a group of dial and ringer test circuits are mounted on a single frame

codes for the ringer test. For the ordinary subscriber's dial only two of them are used, however; one gives an adjusting speed of from 9½ to 10½ pulses per second, and the other gives a test speed of from 8 to 11 pulses per second. The other two codes are the equivalent of these but are used to check the higher speed dials used by operators. A dial can be tested without first testing the ringer or after completing the ringer test, but a ringer cannot be tested after the dial without disconnecting and reestablishing the connection.

When one of the dial test codes has been dialed, the circuit associates a dial tester* with the line and returns a dial tone to indicate that the repair man should dial the number zero, which is used in order to obtain the greatest number of pulses possible by a single turn of the dial. At the break of the first dial pulse the testing mechanism functions, and at the beginning of the last pulse it causes a distinctive tone to be connected to the line — indicating whether the dial is normal, too slow, or too fast. The bells are observed for tapping while dialing for this test.

Adjustment of the dial is made by the use of tools provided for the purpose; a governor holder for securing the governor in place and a screw driver for adjusting its speed. After adjustment the dial is retested by the dialing code used for obtaining a test on the adjusting speed. Tests may be repeated any number of times by using the proper code and then dialing zero. The line may be disconnected from the test circuit at any time by replacing the receiver on the switchhook.

If the repair man happens to be making other tests through the local test desk, or if for other reasons he wishes to do so, he may obtain the dial test circuit (but not the ringer test) by way of this desk. It is equipped with keys which allow the desk man to apply the proper dial tests, and in this case both the repair man at the subscriber's station and the local desk man hear the tones indicating whether the dial is normal, too fast, or too slow. At the completion of the test, the desk man can talk to the repair man by operating the proper keys.

An alarm feature is provided which disconnects the test circuit from the line if it is held for an abnormal length of time, and brings in an alarm at the local test desk if the disconnect feature fails to restore the test circuit to normal. This feature prevents the subscriber's line from being kept out of service in case trouble should develop in any of the circuits used for these tests, and also prevents one of the relatively small number of test circuits from being held by a single test connection for an undue length of time.

The number of tests made is recorded on registers: one for the ringer and one for the dial test circuit. A register is also provided for recording the number of times these circuits are disconected for being held too long.

* BELL LABORATORIES RECORD, *August*, 1927, *p.* 427.

Idle Trunk and Position Indicating

By W. B. PRINCE
Local Systems Development

BEFORE the development of straightforward trunking, the originating operator — on receiving a call for a subscriber in a distant office — employed a call circuit to obtain a trunk assignment from the operator at the office desired. Upon obtaining the assignment she would insert the plug of the calling cord into an outgoing jack of the trunk assigned, and the terminating operator would complete the connection. This of course did not require a busy test by the originating operator.

With the introduction of straightforward trunking, the originating operator, instead of having a trunk assigned, inserts the calling cord into an idle trunk to the office called. Before doing this, however, it is necessary for her to ascertain whether the trunk is idle. Three methods are possible. With one, the operator touches the tip of the plug to the sleeve of a jack connected to a trunk to the office desired. If the trunk is in use she hears a series of small clicks known as a busy signal; if it is idle no clicks are heard.

The second method, in reality a variation of the first, employs a master busy tone. The entire group of trunks between two offices is divided into sub-groups of five trunks each, and the operator can determine whether all trunks of a sub-group are busy by testing the first trunk of that sub-group. The busy condition of the sub-group is indicated by a tone superimposed on the clicks previously mentioned. On finding no tone on a master jack of a sub-group, the trunks of the sub-group are tested individually until an idle trunk is found.

The third method, known as "idle trunk indicating" requires a lamp associated with each trunk at the outgoing end. A lighted lamp indicates to the originating operator that the associated trunk is available for a call.

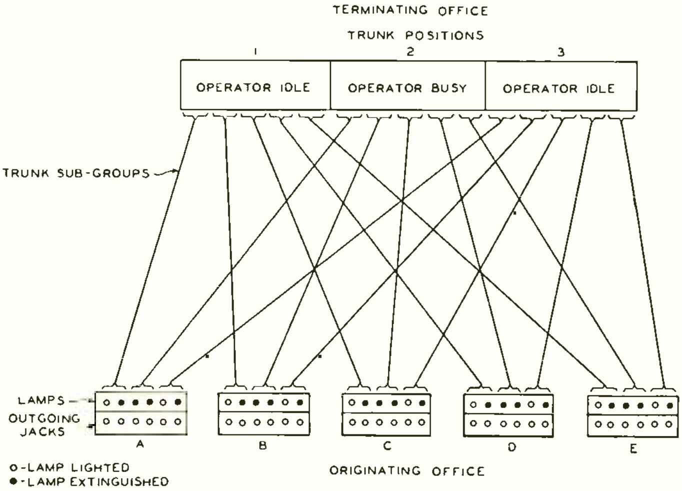


Fig. 1—In this schematic representation of "idle trunk and position indicating" each solid line represents a group of trunks with each of which an extra pair of conductors is required to operate the signals

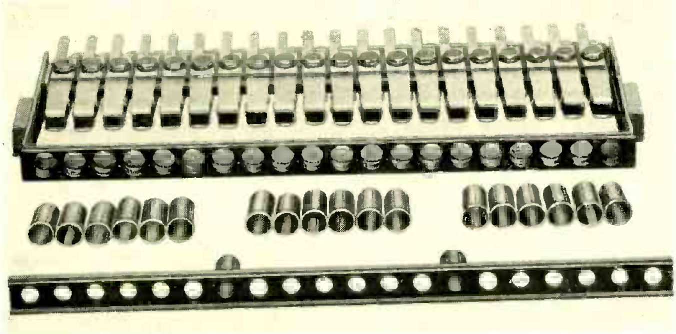


Fig. 2—In the slotted piece in the foreground is slipped the double designation strip described in the text

to the operators the first idle trunk in a sub-group. The difference in operation is that with "idle trunk and position indicating" the lamp associated with the first idle trunk in each of the sub-groups lights only when the trunk operator, as well as the trunk, is not busy, and is extinguished when the operator is answering a call. With "idle trunk indicating" the lamp associated with the first idle trunk of the sub-group remains lighted while the trunk is idle whether the trunk oper-

The group of trunks is divided into sub-groups as with master busy tone. Only the lamp associated with the first idle trunk of the sub-group is lighted at one time. It will readily be seen that this last method eliminates the necessity of making a busy test when selecting a trunk.

With any of these methods mentioned, when the originating operator inserts a plug into an idle trunk jack, the trunk operator receives a lamp signal indicating that a call is waiting on that trunk. If the trunk operator is busy handling prior calls, the originating operator must wait until she receives an indication that the trunk operator is free. During this period the originating operator is delayed. To eliminate this delay and to equalize the load of the trunk operators, "idle trunk and position indicating" was developed.

This system is closely allied to "idle trunk indicating" as in both cases lamps are used at the originating end to indicate

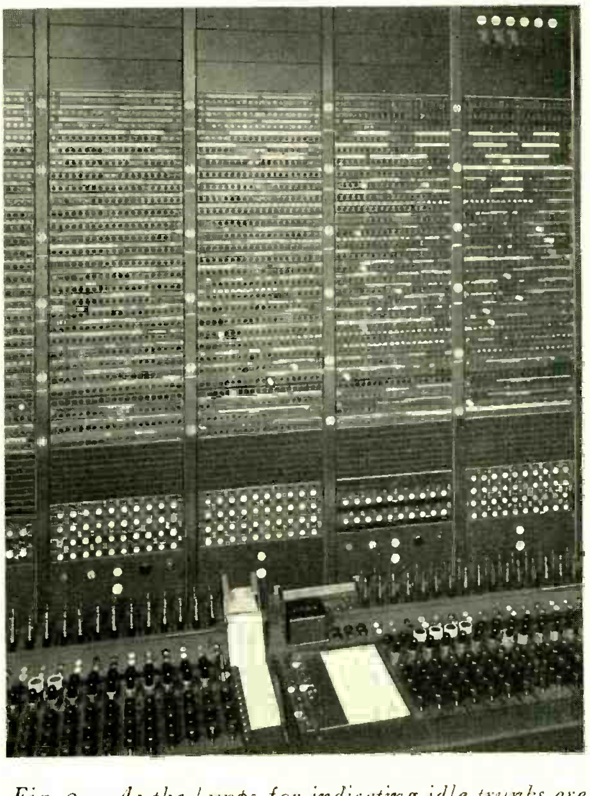


Fig. 3—As the lamps for indicating idle trunks are mounted behind the designation strip they are evident only when lighted

ator is busy or not. To control the lighting or extinguishing of the lamps with "idle position indicating' requires an individual cable pair for each sub-group of trunks from a particular office terminating in a single trunk position. All lamp signals are controlled over this extra pair. In Figure 1 appear five originating offices and three positions at a terminating office in typical arrangement.

To prevent the use of indicating lamps from occupying more jack space in the face of the switchboard than with the "busy test" method, it was necessary to develop a combination lamp and designation strip which had face dimensions the same as the usual designation strip. This is shown in Figure 2. The manufacture of such a strip necessitates holding the face of the mounting to very close tolerances. Individual lamp caps are not required; a common covering usually of two thicknesses of paper is used instead. The back paper has a black face and is perforated opposite the lamps, whereas the front paper, with office designations, is translucent. When a lamp is lighted, light passes through the hole opposite it and permits the operator to detect the idle trunk. Due to the mounting of the lamps behind the designation strips, the face of the board—as may be seen in Figure 3—looks very similar to that of a board not arranged for idle trunk and position indicating.

When "idle trunk and position indicating" equipment is used, and all the trunk operators handling trunk sub-groups from a particular office become busy, indications will be sent back as though all the operators were idle, provided there are idle trunks to that office. This arrangement prevents a condition in the originating office of no lamps being lighted in the trunk group to guide the operators. If all the trunks terminating in one position become busy, the circuit functions as though that particular trunk operator were busy.

Assume, for example, that there

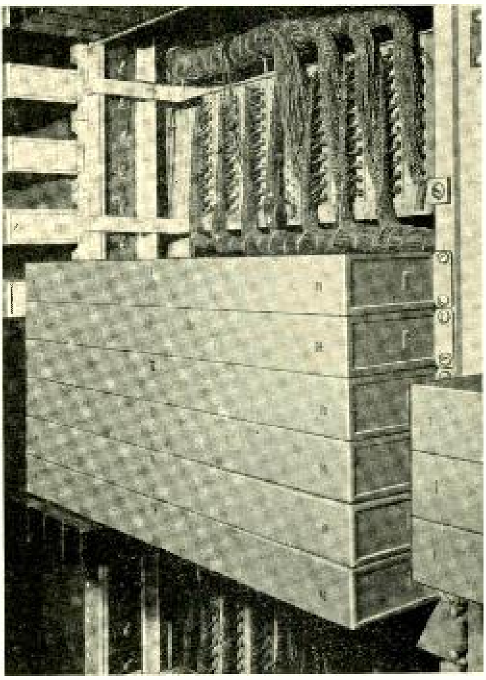


Fig. 4—Apparatus at the originating end is mounted in units for 120 indicating trunks. Six relay strips and the terminal blocks above constitute one unit

are fifty trunks between two offices, divided into groups of ten each, and that each group terminates in a different trunk position. If the five trunk operators are busy at one time, lamp indications will appear at the first idle trunk of each of the small groups. The originating operator would then have a choice of selecting a trunk terminating in any one of the five positions. Were all ten of the trunks terminating in any one position busy, no lamp associated with these trunks at the originating office would be lighted. As soon as one of the trunks becomes idle, a lighted lamp will appear at the originating office.

All trunks terminating in a trunk position equipped for "idle trunk and position indicating" need not be of the indicating type provided trunks

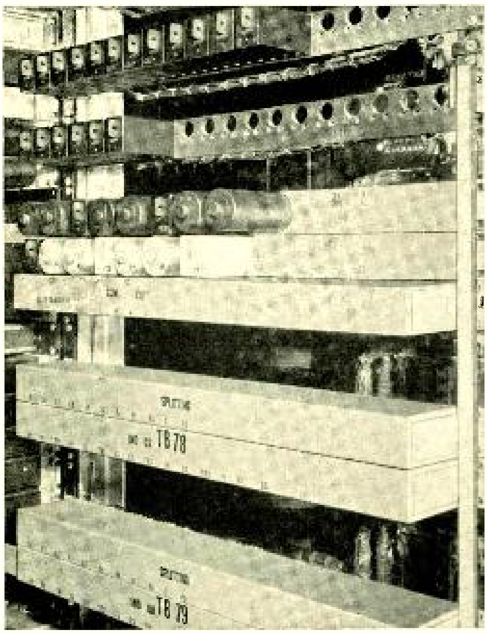


Fig. 5—Apparatus at the terminating end includes certain equipment common to the office and the strips of relays for each position

from any one originating office are either all indicating or all non-indicating. Both indicating and non-indicating trunks, in other words, may be handled at a trunk position. Under this condition indications will be given on the indicating trunks in the regular way and when the operator is busy on a non-indicating trunk, a busy condition will be indicated at the originating end of the indicating trunks.

For "idle trunk and position indicating" incoming trunks are split into a maximum of five sub-groups. The splitting is arranged so that the control of the trunks can be transferred to an adjacent operator. When this takes place the calls are answered by the operator occupying the adjacent position and the busy indications at the originating offices are controlled by the operator at the position to which the trunks are transferred.

The apparatus required for "idle trunk and position indicating" at both the originating and terminating offices is mounted on units suitable for relay rack mounting. The originating office requires one relay for each indicating trunk and the unit on which this relay is mounted, shown in Figure 4, has a capacity for 120 outgoing trunks together with the necessary terminal strips for terminating the leads to the associated outgoing trunk circuits and also for making the cross-connections required to split the trunks into subgroups. At the terminating office one unit, shown in Figure 5, is required for each position arranged for indicating, and in addition there is certain apparatus common to the office. Terminal strips are provided on this unit for cross-connecting the trunk subgroup in other positions associated with the trunks from the same office and to connect the equipment used for signalling the originating office.

"Idle trunk and position indicating" is operating with groups of from forty to three hundred trunks, although ordinarily 50 trunks is the smallest group economical. Its principal saving comes from the reduced operating staff at the originating office. Since testing is unnecessary for trunk selection, the waiting time of the operator is reduced. The load on the trunk operators is equalized because only trunks to idle trunk operators are selected by the originating operators.

The Telephone in its Infancy

By W. C. F. FARNELL
Bureau of Publication

BIOGRAPHIES of men who were responsible for the early fundamental developments in the telephone art have appeared in recent years, notably those of Bell, Vail, Berliner, Edison, and an autobiography of Watson. These men, and others, after their first hectic years with the telephone, turned to other pursuits and made contributions to science and industry probably of no less importance than the telephone. Later Vail returned to the telephone field and in his riper years extended the use of this service, so that it has been aptly stated, "He made neighbors of a hundred million people." The activities of these men, and of others, set the ball rolling so that what began as a laboratory of two men only, Bell and Watson, has now grown to a giant known as Bell Telephone Laboratories, where about 2,500 scientists and engineers are engaged in development and research work alone for the advancement of the communication art.

The book of the hour for those historically minded is The Beginnings of Telephony* by F. L. Rhodes, Outside Plant Development Engineer of the American Telephone and Telegraph Company. Himself a veteran in engineering work, Mr. Rhodes has written of the early days in telephone research, development, and practice in such a fashion as to give one an intensely interesting story. Not too long to become tiresome, it has enough of the essentials to enable one to be satisfied with the how, when, and where, of telephony up to twenty-five years ago.

Without detracting from the main story too much, references are made to the almost brutal attempt to wrest from the early Bell Company the benefits accruing from the original patent on which the telephone business was founded. In an appendix there are given résumés of the important legal battles that were waged during the early years, and also a list of the patents referred to in the various chapters.

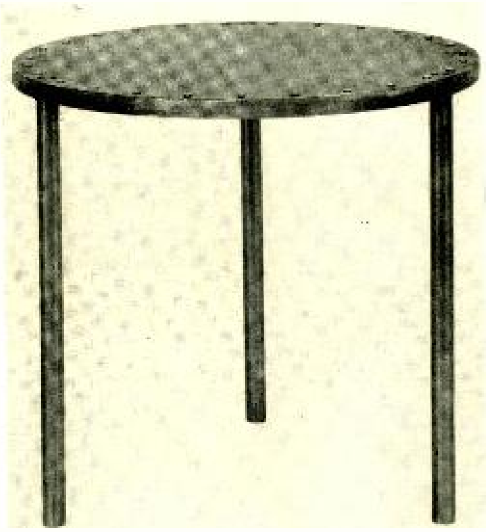


Fig. 1—An iron telephone diaphragm used for experimental purposes with electro-magnets

* *Harper & Brothers, New York;* $4.00.

Many photographs illustrate important steps in the improvements made during these early years and in the successful efforts to produce the best that research and scientific development could attain with the knowledge then available.

It will be a difficult matter for one so inclined to detect any erroneous statement, for the work abounds in specific references to authorities on all the important developments and historic occurrences. The author's experience in delving into early telephone history for accurate information on the beginnings of certain elements in telephone developments has led him to make his written story puncture-proof.

What of the human elements that asserted themselves during those early years? What was in the minds of the many men who fell into line to promote this rapidly growing industry

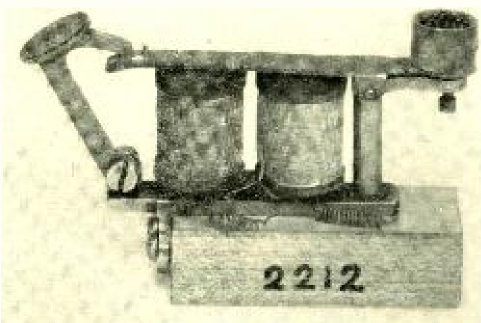


Fig. 2—An early telephone switchboard drop

when once its utility was recognized? The early struggles of Bell and Watson, and of Bell's financial backers are briefly recorded, as well as the attempts for subduing troublesome telephone lines. And this may be sufficient to give the human side of the beginnings, but oh, what a lot could be told of the succeeding efforts!

In the Bell System Historical Museum there are over two thousand exhibits of the physical developments in the communication art, extending from an original telegraph instrument built by Morse himself in 1843, down to the latest developments such as television in colors. Each exhibit has its own human story—not always recorded, but known to those responsible for the developments; for many are still living who made these improvements. The telephone as we know it has all been brought about within the memory of living men. Mr. Watson, co-worker with Mr. Bell, is still active in mind and spirit, and whenever he visits the Historical Museum always recalls some human incident.

The large iron diaphragm mounted on three legs, shown in Figure 1 was used by the two experimenters, Bell and Watson, when investigating electromagnets of different kinds in the early days before the advent of the first commercial telephone. When the investigations were completed, and the diaphragm was of no further use in the tests, Watson used it to heat his coffee pot with a Bunsen burner flame. One visualizes the intensive efforts of these two men, eating while working, to make the telephone a success!

And what difficulties were experienced in the design and development of the early switchboards. Look at the switchboard drop shown in Figure 2. Each line entering the central office, due to its length and construction, had varying electrical characteristics. Each line drop had to be adjusted so that it would operate properly when the subscriber called central. To make these adjustments one of the earliest forms of drop made in the Williams' shop in Boston that was successful had at the rear of its armature a variable counterweight called a "shot pan" in which small shot pellets were dropped until the armature would balance properly for operation for the particular line. Each drop in the central office required a different amount of shot to take care of the varying characteristics of the lines. Think of the fun when the critical point of adjustment was reached and the decision had to be made whether or not to add one more shot!

Then again take the early forms of devices for recording the number of times a subscriber used his telephone. The first meters devised for this purpose are shown in Figure 3. One readily recognizes them as gas or electric meter dial mechanisms in use today. These meters were the first attempts for counting calls for telephone subscribers. They were installed in New York City in 1898. A complex piece of mechanism? Yes, and many a man can be found today who more than blessed them during the short time they were in service, and before they were replaced by the cyclometer design now commonly used.

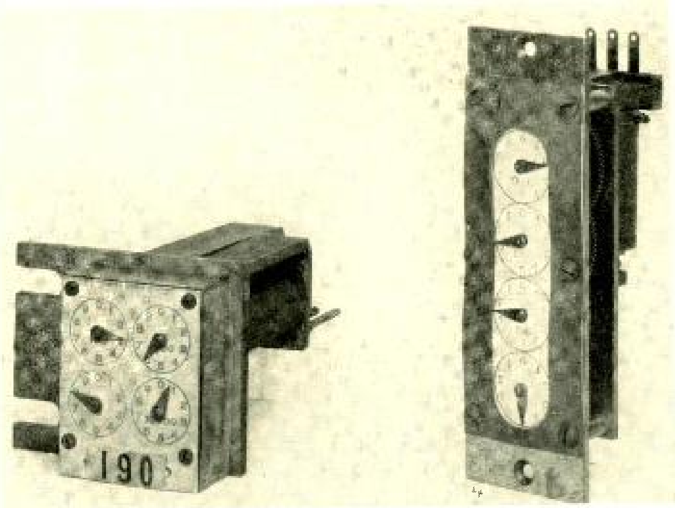


Fig. 3—The first meters for recording a subscriber's use of his telephone

But why go on? These three incidents do not even scratch the surface of the human element concerned with the development of the telephone in all its branches. Some day the story may be written. At present, however, while reading "The Beginnings of Telephony" let imagination run riot with its human side.

We of today may consider ourselves fortunate that what we now term as the beginnings of telephony, prior to twenty-five years ago, can be told briefly in one volume. Imagine twenty-five years hence when an authority again writes of the beginnings of telephony, and includes the developments up to the present, and then imagine if you can the ground to be covered, and the size of the volume. The tremendous strides taken in the extension of communication during the past twenty-five years are much more complicated and extend over a greater scope of activities and developments than the first twenty-five. Prospects for the future indicate that even today the communication art is still in its infancy.

Economics of Relay Winding Design

By N. Y. PRIESSMAN
Telephone Apparatus Development

THERE is a large class of relays in the telephone system which have switching operations to perform without regard to critical time requirements. A contact closure connects the central office battery to the relay winding and operates the relay, which remains operated until the opening of a contact somewhere in the circuit effects its release. There is here no troublesome question of the values to place on varying qualities of performance. The relay either operates or it does not. Practically perfect performances must be given for the successful operation of the system, but the roles the relays play are fortunately simple ones. Because of the large numbers of them in use and the long period of time over which they are energized, their total power requirement is considerable. It is for this reason that so much thought has been given to the design of their windings.

Obviously it is impracticable, and undesirable, because of the large number of types entailed, to design a relay structure and winding especially adapted to perform each circuit function. Instead, a series of relay structures of general usefulness are developed, one of which may be adapted to any particular circuit requirement by being equipped with the necessary springs and a suitable winding. Circuit requirements vary from the closing of a single pair of contacts to the performing of complicated switching arrangements among as many as 24 single contacts, and times of energization range from a few seconds per busy hour to nearly continuous operation.

Of the several types of relay structures thus developed, each covers a range of requirements, and only for the average requirements within its own province does it represent the best design. At the extremes of its range, the structure will differ considerably from the best that could be obtained; and it is one of the problems of relay-structure design to see that enough types but only enough are available to obtain a balance between the economies in operation that additional types would effect, and the losses due to increased manufacturing and supply cost brought about by increasing the number of types.

For any one type of relay structure chosen, the day-to-day design of relay windings also requires an economic balance. To adapt any chosen relay structure to a particular service a comparison must be made between the yearly charges on the cost of a winding that will operate the necessary springs, and the cost of energy used in holding the relay operated for the specified time. The total annual charge should be a minimum.

The annual charge rate on the cost of winding includes such items as interest, depreciation, taxes, and insurance. A charge for maintenance is not included because for a given relay structure and number of contacts, maintenance cost for the same ampere turns will be independent of the winding used. The total may be taken as 13% per year of the capital cost, but in making the economic balance referred to above only that part of the cost of the winding that varies with the number of turns or size of wire need be considered. The winding design may be varied as desired, subject only to the requirement that sufficient ampere turns be provided to operate the spring combination.

The overall cost of energy includes such items as rental, attendance, and charges on generator, emergency equipment, and power board; all of which vary in large steps. In consequence, small reductions in current drain might be made without affecting the costs of these items. The value placed on energy, for the purpose of making an economic balance, includes only that part of the energy cost which varies with small changes in consumption. The total charge for energy supplied to a relay depends, thus, on the rate proper to the class of equipment in which the relay is located, the resistance of the winding, and the total number of hours per year that the relay is operated.

The portion of the cost of winding affecting the economic balance is made up only of the cost of wire and the cost of winding it on the core. This latter cost is dependent on nothing but the number of turns; it is independent of the gauge of wire if only those gauges commonly used in relay windings are considered.

In Figure 1, curve "A" shows the annual charges on the capital cost of a winding for an "R" type relay made up of No. 38 gauge copper wire insulated with black enamel. A family of such curves, one for each gauge of wire, would show annual charges on all such copper wire windings possible. It will be noticed that this curve goes up at an increasing rate with the number of turns. This is due, of course, to the increasing length of turns as the winding grows deeper. Curve "B" on Figure 1, on the other hand, giving the cost of energy for a given time of energization, decreases towards zero as the number of turns increases. In consequence of the form of these curves, their sum — the total annual cost — has a minimum value.

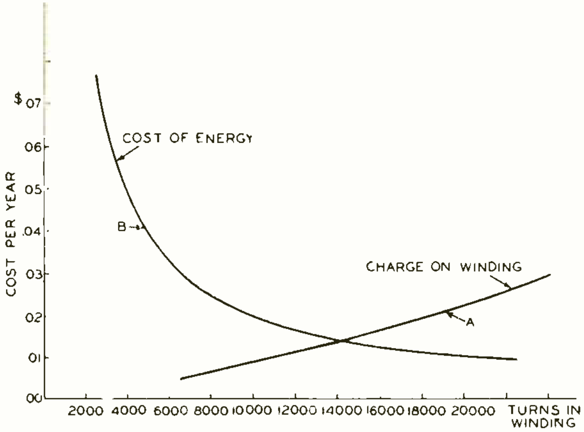


Fig. 1 — *With a small number of turns, the energy cost is high and the winding cost low, while for a large number the reverse is the case. At some one value of turns the total cost drops to a minimum value*

It is found that for uses requiring a large number of ampere turns and long holding times, the minimum point corresponds to a larger number of turns than can be accommodated on the spool. The theoretical minimum is thus not attainable under these conditions. In the average case, however, where a large number of ampere turns is not required, the total annual cost will shift in the direction of a lower number of turns which in most of such cases will lie within the space limitations of the relay.

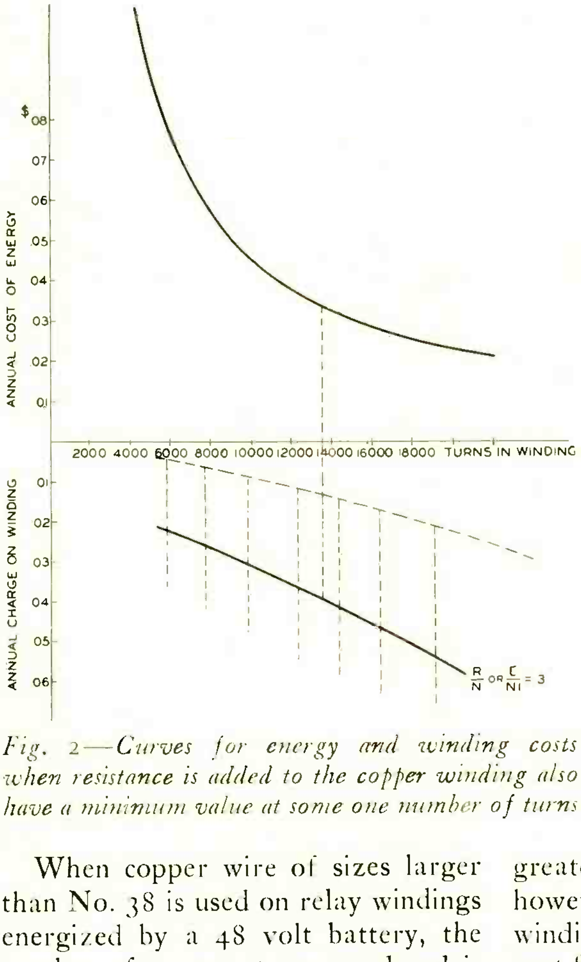


Fig. 2—Curves for energy and winding costs when resistance is added to the copper winding also have a minimum value at some one number of turns

When copper wire of sizes larger than No. 38 is used on relay windings energized by a 48 volt battery, the number of ampere turns produced is much higher than is ordinarily required. Even No. 38 gauge, the smallest in general use for relay windings at the time this study was made, produces a number of ampere turns above the average need. To reduce the ampere turns, and the additional energy consumption they require, it is necessary either to use finer wires, or to employ a wire material with a resistivity higher than that of copper.

The use of small sizes of wire in large windings presents some manufacturing difficulties and gives rise to an excessive amount of trouble from corrosion unless precautions are taken to thoroughly seal the winding against the entrance of moisture. Because of this difficulty a higher resistance winding has been obtained, not by the use of a smaller wire, but by splicing resistance wire in series with the copper winding. It seems surprising that an all-copper winding is not the most economical, and it would be so, for the "R" type relay at least, were the battery voltages encountered not so high. Other requirements, however, dictate the voltage of the battery.

As has already been pointed out, an all-copper winding of No. 38 gauge wire gives a greater number of ampere turns than is usually required. The minimum cost for an all-copper winding, therefore—the minimum sum of curves A and B of Figure 1 for No. 38 wire—is greater than need be because the ampere turns are greater. This cost may be reduced, however, by adding resistance to the winding, which will reduce the current flowing through it and thus lower the yearly cost of energy.

The extra turns of resistance wire do not add appreciably to the total turns but do increase somewhat the cost of the winding. For each number of turns, therefore, curves may be plotted to give the annual charges on coil costs for different amounts of added resistance. These would be vertical straight lines, one for each different number of turns, as shown by the dotted lines on the lower part of Figure 2. A curve through the upper ends of these lines would be the curve A of Figure 1—representing an all-copper winding. Through the vertical lines of Figure 2 it is possible to draw other curves each having a constant value for the ratio of resistance to turns. The values of the constants for each curve will be different—the lower the curve lies on the chart the higher will be the constant.

For each of these curves it is possible to plot corresponding curves for the cost of energy, one of which is shown on the upper part of Figure 2. Each pair of curves—one for energy cost and one for coil cost—represents a fixed ratio of resistance to turns or, what is the same thing, of voltage across the coil to ampere turns. As both the ampere turns desired and the operating voltage are known, the relay designer may readily select the proper curves to use for his particular problem. The minimum total cost is represented by the shortest vertical line connecting the two curves governing the particular conditions, and the intersection with the abscissa scale of this shortest line gives the number of turns in the winding.

This energy cost is in all cases less than that for an all-copper winding using the same size of wire. The method thus allows a balanced design giving a minimum cost even though the designer is restricted in the size of wire that may be used.

Announcement has been made of the leasing by the Laboratories of the eighth to the fourteenth floors inclusive in the new Graybar-Varick Building at 180 *Varick Street. The aggregate floor space is* 134,000 *square feet; it will be ready for occupancy next May. The lease extends for a period of five years with option for renewal. Rental for the initial term is in excess of half a million dollars. The space will allow for expansion and numerous readjustments of areas now occupied in the present building. This addition will bring the floor space of the Laboratories in New York City up to a total of* 800,000 *square feet*

A New Dial PBX for Residences

By R. W. HARPER
Local Systems Development

TO meet the need for more extensive telephone equipment for residences, a new dial PBX — known as the 750-A — has been developed. Although designed primarily for residence use, it is expected that the new PBX will find application with small business concerns as well.

Two sizes are available; the larger with a capacity of fifteen station lines and three central office trunks, and the smaller with eight lines and two trunks. The switching equipment is arranged to give three paths for intercommunicating connections for the larger size and two for the smaller.

Fig. 1 — Three trunk buttons, a hold, and a local button are mounted in the applique base of the hand-set used with the 750-A PBX

Studies indicated that the equipment should be arranged to allow answering central-office calls at various locations. As many of the stations as desired may be equipped, therefore, with a five-button key which permits any station so equipped to place or answer either central office or local calls, and to transfer central office calls to other stations. Every effort was made to reduce the number of wires connecting the stations to the switching equipment and as a result only six are required at the most. Other advantageous features are a low operating voltage, permitting the battery to be charged over cable conductors from the central office if desired, and a small compact switching cabinet of pleasing appearance.

Handsets will be used ordinarily but either deskstands or wall sets may be substituted where desired. A new applique base, mounting the five-button key, was designed for the handset as shown in Figure 1. For wall set and deskstand stations, a key as shown in Figure 2, is furnished. The handset is available in the standard black finish, and in addition in any of the five recently standardized colors.

All stations are provided with a subscribers set, the ringer of which is used to indicate an incoming intercommunicating call. To indicate incoming central-office calls, either differently toned bells for each trunk may be used, or a bell common to all trunks with lamp indicators to designate the calling trunk. A new mounting, shown in Figure 3, has been developed for the three lamps.

An intercommunicating call may be

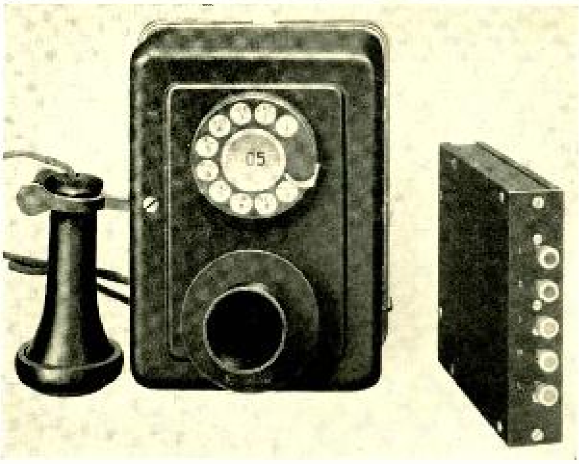


Fig. 2—A separate key is arranged for use with desk stands or wall sets

key. If the trunk is in use, a busy tone will be heard and another trunk will have to be selected. Relays, controlled by the trunk buttons, prevent all other stations from connecting to the trunk in use. If the central office is manual, the operator will be signalled; if it is a dial office, the desired number will be dialed in the usual manner.

An incoming call from a central office may be answered at any of the key stations unless they are specially restricted. The button corresponding to the trunk carrying the incoming call is depressed, and the handset lifted. The first station to answer locks out all other stations from connection to the trunk; any station attempting to make connection to a trunk in use will receive a busy tone. If the incoming call is for some station other than the one answering, the button "H" is depressed to hold the trunk, and the station wanted is dialed in the usual manner after depressing button "L". The "H" button is non-locking and does not cause the trunk button to release. Depression of the "L" button, however, releases the trunk button so that the

made from any station by operating the "L" button, lifting the handset, and dialing the desired station. Lifting the handset causes one of the three interconnection paths, or links as they are commonly called, to attach itself to the line. The calling station then hears dial tone, and dials one or two digits as required. A rotary selector of the 206 type follows the pulses, and at the completion of dialing, relays operate to establish the connection. The bell at the called station is rung with interrupted ringing current, and talking battery for both stations is supplied by the link circuit. The called station answers by pressing the "L" button and lifting the handset. When the line called is busy no connection is made, and the usual busy tone is returned to the calling station. With this arrangement secrecy is provided as in a dial central office.

An outgoing trunk call is made from any key station by depressing one of the three trunk keys instead of the "L"

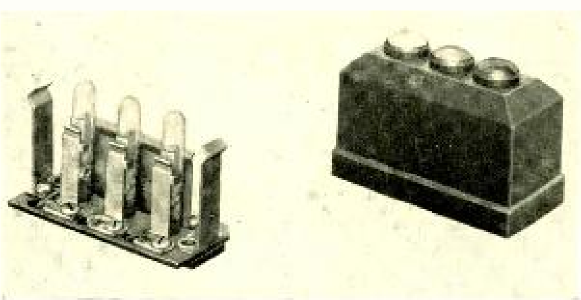


Fig. 3—A mounting for the three trunk lamps has indicating caps and may be placed where convenient

station called may make connection to the trunk carrying the call.

In connection with a residence there may be certain telephones, such as those in the garage or other separate buildings, to which it is not desirable to run six wires. For such stations an optional arrangement is available, requiring that only two wires be run, and that the five-button key be omitted. Such "keyless" stations may then either make or receive local calls but have no keys for originating or answering trunk calls. Provision has been made, however, so that by the addition of a small key cabinet, located, for example, in the butler's quarters, connection may be established between any of the keyless stations and the central office.

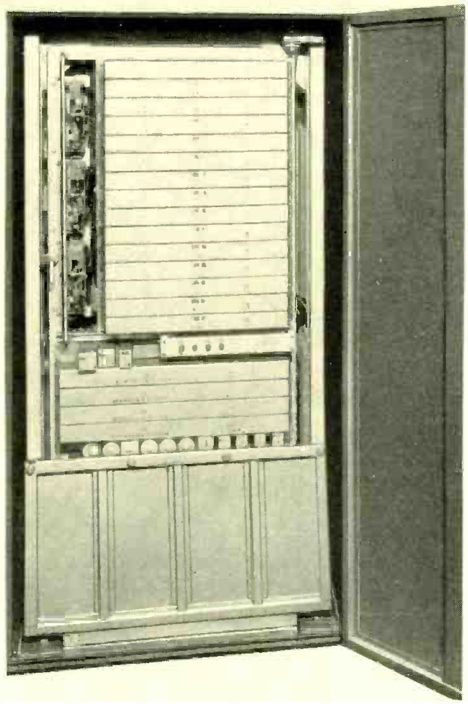


Fig. 5—When the gate is closed, the platform on which it rolls folds up against it

Fig. 4—Complete accessibility to the wiring and apparatus was obtained by mounting the switching equipment on a swinging gate

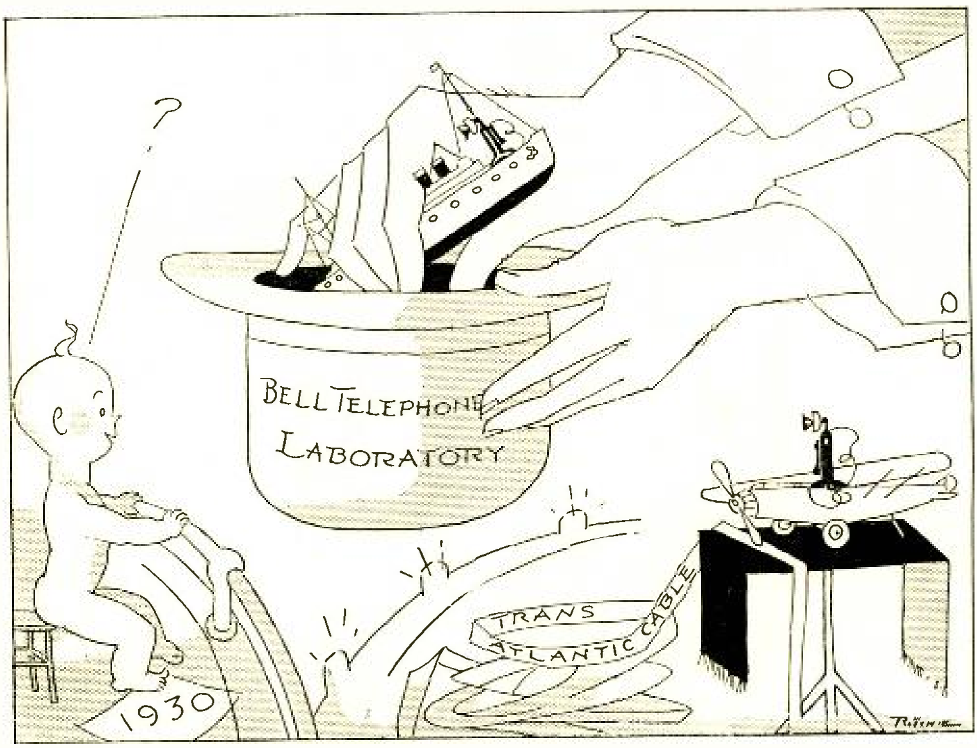
Provision is made for restricting any of the key stations from placing central-office calls. Such restricted stations, however, may answer incoming calls, or transfer them, in the usual manner.

All the switching apparatus, together with the power equipment consisting of an eight-cell storage battery, is mounted in a sheet metal cabinet five feet high and about two and a half wide by two feet deep. The switching apparatus is mounted on a gate which may be swung out when the door is opened to make the wiring side of the apparatus accessible.

The appearance of the cabinet is shown in Figure 4. The gate, when opened, is supported by a rubber-tired wheel, rolling on a metal platform, which prevents possible marking of the floor and also gives a level surface. The platform is folded up when the gate is closed as shown in Figure 5.

No power-driven machine is required at the new PBX to provide ringing current and the various tones. When a tone is needed, a relay is made to buzz through its contact, and by transformer action to a secondary winding on the relay core, the tone signal is produced. For the busy signal this tone is interrupted by slow acting relays. Continuous ringing current is obtained from the central office and is interrupted locally by slow-acting relays.

This system requires a comparatively small amount of apparatus and yet gives a maximum of telephone service. Every effort has been made to reduce the size of the switching cabinet, and particularly to design the station apparatus to harmonize with the requirements of residential service. The provision of handsets in several colors is a step in this direction. The new PBX is the smallest dial system yet produced, and it is an important contribution of the Bell System.



As our friends of the Ohio Bell Telephone Company visualize us

The New Chicago Toll Office

By J. W. WOODARD
Equipment Development

MANY of the most interesting development problems presented to the Laboratories for solution came about in adapting the new to work with the old. A case in point is the new toll office for the Chicago district. This is one of the many replacement projects required by the rapidly growing long distance traffic which, due largely to the increase in speed of service, has increased to such an extent that in many cases it has been necessary to engineer and install complete new toll offices in a comparatively short space of time to insure satisfactory public service.

When the problem was presented to engineers of these Laboratories of extending the old No. 1 office in Chicago, several plans were considered. After investigation it was decided that for the new equipment, representing about 250% of that then existing, it would be best to use the No. 3 switchboard* type. This necessitated the development of an interesting link to permit the No. 3 equipment, whose supervisory apparatus is in the toll line, to operate with the No. 1 equipment where all supervisory apparatus is in the cord. The enormous current drain of the busy signals and the extensive drop in the leads supplying them with current required many new features in the power plant. The idle-toll-line indicating lamps in the tandem board required many interesting developments that had not been heretofore considered for toll offices.

The installation includes 237 new No. 3 toll switchboard sections; an entirely new complement of directory, rate quoting, and ticket filing desks; a 6-section toll tandem and an 11-section service observing switchboard; and a complete No. 3 terminal room and power plant. It is, in fact, a complete new office built around the existing one.

The 237 toll sections are divided into 12 groups or lines of switchboard each of which has its particular function in the general method of supplying toll service. There are two lines of inward switchboard where terminate, with a few exceptions, all the incoming toll calls which must be switched to various local offices. The through switchboard also consists of two lines, one of 18 sections and the other of 14. This switchboard, as the name implies, is used to connect toll lines when the calls do not terminate in the Chicago district. The combined line and recording switchboard, with 147 sections divided into 7 different lines, is the largest in the office.

At these boards, the operators who record the calls make the first attempt to complete about 90 per cent of them. The remaining traffic includes sequence traffic (a number of calls filed by the same subscriber to be completed in order), calls on which indefinite information is furnished by the calling party, and calls on which

* BELL LABORATORIES RECORD, *June*, 1927, *p.* 337.

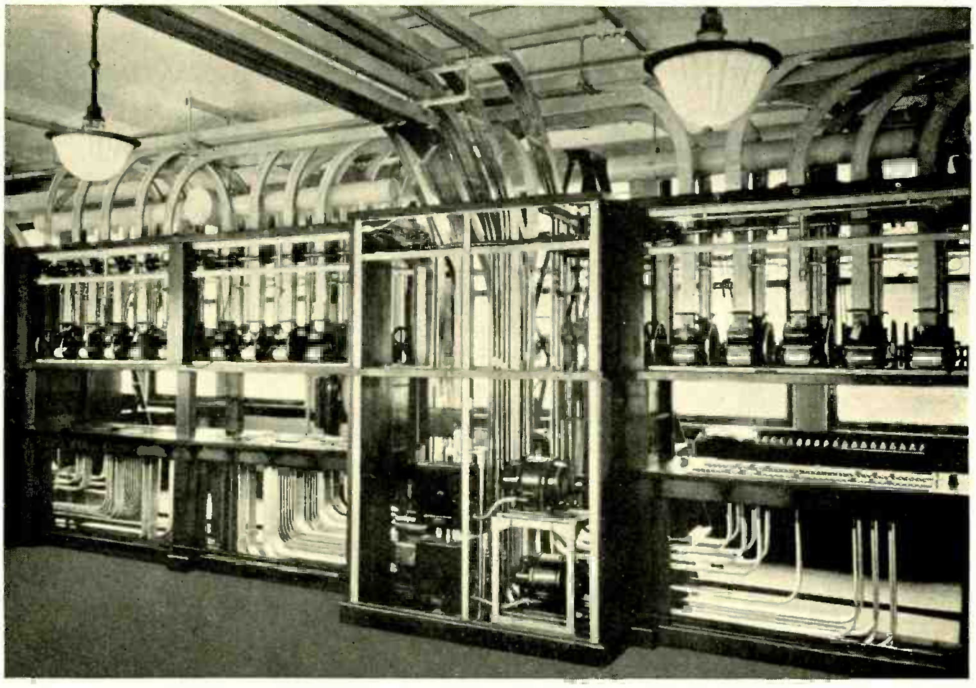


Fig. 1—New ticket distributing desk with panels removed

some delay is anticipated. These calls, together with those not completed on the initial attempts because the called telephone or party could not be reached, are sent through the pneumatic tube system to other switchboards known as the "point-to-point" positions. Here, as the name indicates, the traffic is segregated in accordance with the point called, and the operators at these boards make the necessary subsequent attempts until the calls are disposed of. The 117 sections of this board, divided into five lines, are of the No. 1 switchboard type, and are the reused old equipment. The pneumatic tubes from the CLR boards terminate in ticket distributing desks (shown with panels removed in Figure 1) where they are sent through other tubes to the proper "point-to-point" position.

The remaining 19 of the No. 3 sections form a twelfth line known as the utility switchboard. It is arranged to handle inward, outward, and through calls handled over circuit groups on which circuit efficiency is essential. These include groups such as the transcontinental where, due to the length and cost of the circuits, their efficient use is of particular importance, and groups which are temporarily congested due to circuit trouble or unexpected traffic growth.

The toll tandem switchboard is comparatively new for long distance toll traffic; it has been used generally heretofore only for short haul or AB toll service. The Chicago toll tandem has complete multiple of all the toll lines in the office and gives operators in the various lines of switchboard access to any toll line which, because of space limitations, does not appear at the board where the call originates.

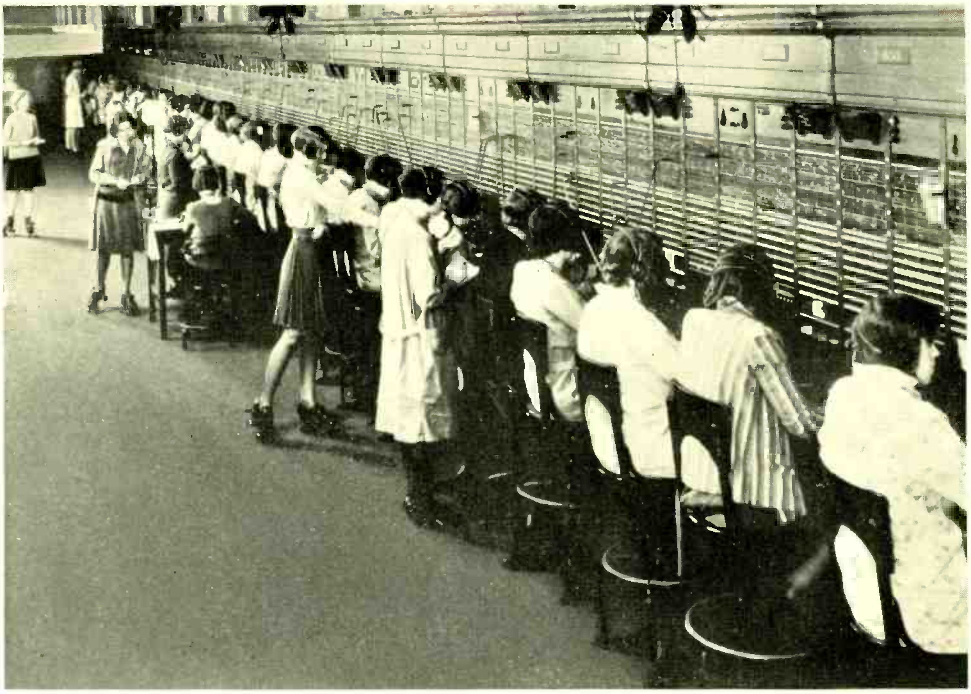


Fig. 2—Before the new board was installed girls on roller skates were used as auxiliaries to the tube system

Particularly distinguishing the new toll office from all others is the make-up of the various groups of toll sections. The groups of No. 1 board, although continued in service at this cut-over, will be converted very soon to the No. 3 type of board by the replacement of local cables and position equipment. At the time of cut-over, however, it was necessary, with a common group of trunks and toll lines, to operate two different types of toll switchboards having entirely different operating features. To make a working arrangement of this was comparatively simple insofar as the No. 3 toll positions themselves were concerned, since a new terminal room using the No. 3 type of terminal equipment was furnished as part of the new installation. The No. 1 toll positions, however, for design reasons, could not operate the signaling equipment in the No. 3 type toll lines and trunks; to translate the signaling features of the line and trunk equipment to terms of No. 1 switchboard and vice versa, it was necessary to furnish groups of relays known as "appliques". These were installed between the No. 1 switchboard and the No. 3 line and trunk equipment in such a manner that they may be removed with a minimum interruption of service when the last group of No. 1 switchboard sections is converted to the No. 3 type.

The pneumatic tube system, used to carry tickets to and from the distributing desk and to the ticket filing and rate quoting desk, entirely replaced the existing tube system, which was inadequate for handling the rapidly growing traffic. As will be seen from Figure 2, messengers on roller skates were formerly used in some cases to carry tickets where tubes were not available. The new tube system is one of the largest in the country and is the first system using a centrifugal exhauster. This type of exhauster has an advantage over that used before in operating at a constant pressure over a wide range of its rated capacity. Because of this it is not greatly affected by a change in the number of tubes in operation. The exhauster used in the past displaced a definite amount of air per revolution so that a change in the number of tubes required a corresponding change in the adjustment of the machine. The new exhauster has the added advantage of requiring only about one-third of the floor space of the older type.

Another feature of interest is the power plant. Normally the regular toll-office battery supplies current to all the busy signals as well as to other circuits in the office. In this office some of the busy signals were located so far from the power plant that a drop of as much as 8.5 volts was expected under the worst load conditions. To insure the operation of all busy signals, therefore, a separate battery of 13 cells, rather than the usual eleven, is used for busy signals. The cells for both batteries are the largest commercial type obtainable. Their size may be judged from the photograph of Figure 3.

Even with these large cells, the voltage could be maintained for only a few minutes in event of failure of power because of the large drain on the busy signals. It was therefore necessary to install a special circuit breaker arranged to remove the battery from the busy signals in all lines of switchboard except the through board while the power supply is off. While this battery is removed the operators make the regular "sleeve" busy test.

The power board, which controls the charge and discharge of this battery as well as of the regular talking and signalling battery, is shown in Figure 4. Measuring 69 feet in length, it is one of the largest power boards in any telephone office.

The intermediate distributing frame used for making connections between any line and a group of switchboard positions, is probably the largest frame ever installed at one time. It consists of 181 verticals and has a length of 121 feet. This abnormal size was made necessary by the large number of cross-connection wires required for the toll lines. Approximately 2½ million running feet of switchboard cable of various sizes were used to and

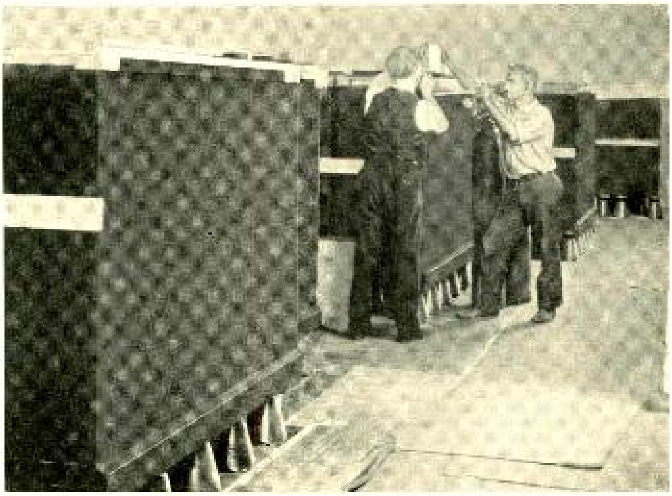


Fig. 3—The size of the cells of the storage batteries well emphasizes the magnitude of the Chicago toll office

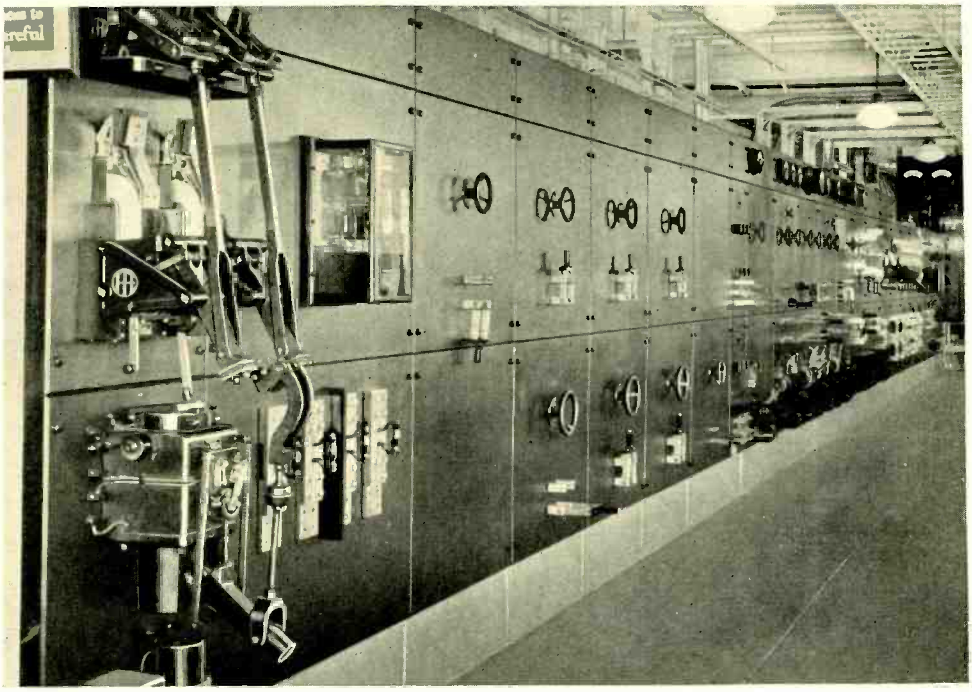


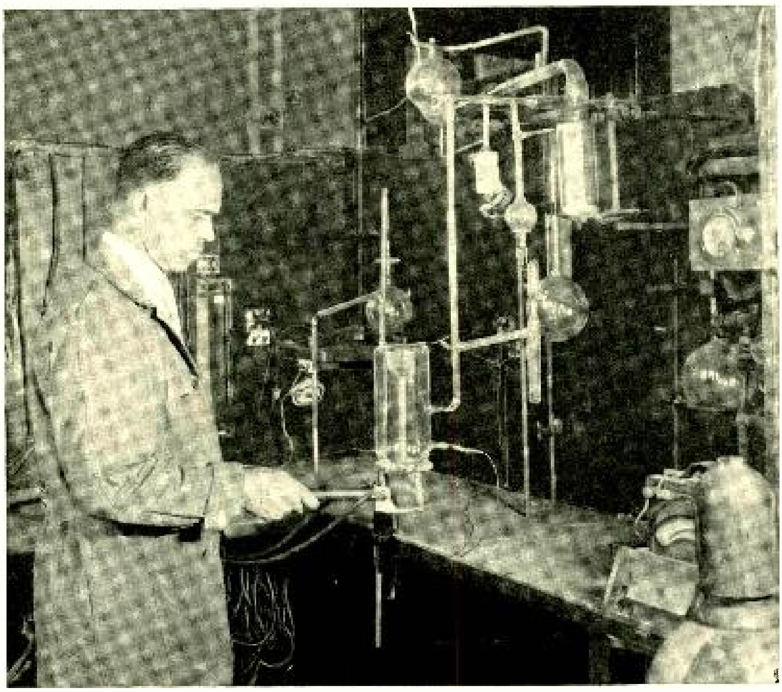
Fig. 4—In the foreground of the switchboard is the automatic breaker that disconnects the busy-signal load in event of power failure

from this frame and for cabling other units in the office.

Because this office had to be installed around the existing equipment and without causing an interruption of service, many difficult engineering and installing problems were presented. The large amount of equipment required, and the shortness of the time available, greatly taxed the manufacturing plant. In spite of all these unusual factors, however, the office was cut over approximately twenty-one months after engineering was started. This speed was achieved only through the close cooperation of all organizations in the Bell System who were involved in the project.

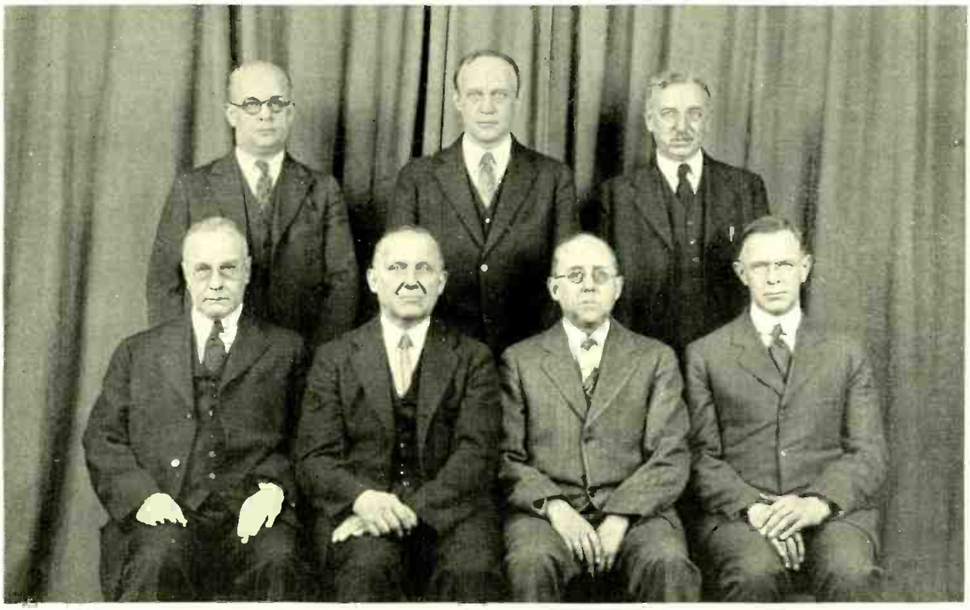
NEWS AND PICTURES
of the
MONTH

including Club Activities and Biographical Notes



An experimental photo-electric cell in the making, as G. R. Stilwell applies a high-frequency heater

Standing, R. Petersen, F. R. McMurry, J. A. McIntyre, J. L. Crouch. Seated, E. F. Gordon, Julia E. Scherr, Mary A. Douglas, J. J. Hughes, A. C. Merriam



Standing, S. W. Shiley, C. G. Spencer, Alfred Wolff. Seated, F. C. Soper, N. F. Schoen, A. G. Kingman, C. R. Barney

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Unavoidably absent from photographs: E. W. Hancock, E. B. LeCompte and Catherine O'Brien

Service Emblems Awarded During 1929

THIRTY-FIVE YEARS

Edward F. Gordon
Development Shop

Alfred C. Merriam
Staff

THIRTY YEARS

Mary A. Douglas
Development Shop

John J. Hughes
Tube Shop

John A. McIntyre
Research

Reinhold Petersen
Systems Development

Nicholas F. Schoen
Development Shop

Frank C. Soper
Systems Development

Charles G. Spencer
Systems Development

Alfred Wolff
Plant

TWENTY-FIVE YEARS

Charles R. Barney
Apparatus Development

James L. Crouch
Research

Edmund W. Hancock
Systems Development

Arthur G. Kingman
Patent

Eben W. LeCompte
Systems Development

Fred R. McMurry
Apparatus Development

Catherine O'Brien
Development Shop

Julia E. Scherr
Staff

Sam W. Shiley
Systems Development

TWENTY YEARS

Howard Broadwell
Joseph Bruccoleri
Lizzie Carton
William L. Casper
Walter G. Crawford
Thomas Creaven
Clyde Drake
Samuel H. Everett
Herbert W. Everitt
William Fondiller
Leroy S. Ford
Arthur Gent
Albert F. Gilson
Howard H. Glenn
Thomas Heenan
Carl H. Hitchcock
Henry Hovland
G. Arthur Johnson
Kenneth S. Johnson
Lewis H. Johnson
William C. Jordan
Frank Josberger
William G. Knox
Charles J. Kuhn
John J. Kuhn
Hiter H. Lowry, Jr.
Raymond P. MacLaren
Heber E. Marting
Granville Matthews
Daniel D. Miller
Emil C. Mueller, Jr.
John Murray
John H. Pflanz
Albert Pirovitz
Ralph L. Quass
William J. Shackelton
James Shaughnessy
Hugh C. Spryer
Joseph F. Sullivan
Gerard P. Tromp
Harry N. Van Deusen
Herbert Waller
Martin White
James C. Wright

TEN AND FIFTEEN YEARS

During the year 1929, 42 three-star and 162 two-star badges were awarded to members of the Laboratories.

News of the Month

SOME high-lights of his recent trip to Japan were outlined by Dr. Jewett to the Executive Conference luncheon on January 2.

Dr. Jewett and his party arrived in Japan on October 27, where he attended the World Engineering Conference and presented a paper, prepared jointly with Bancroft Gherardi, entitled "The Telephone Communication System of the United States." Delegates were lavishly entertained, notably by the Emperor, Prince Chichibu, and the Prime Minister. Dr. Jewett was one of a small group to visit the Mikimoto pearl farms and see how, by the insertion of "seeds" in living oysters, pearls are grown.

In addition to being one of the official United States delegates appointed by President Hoover to this Congress, Dr. Jewett was delegated as an official representative of the American Institute of Electrical Engineers, American Physical Society, Institute of Radio Engineers, National Academy of Sciences, National Research Council—Division of Engineering and Industrial Research, American Standards Association, Rutgers University, and the United States National Committee of the International Electrotechnical Commission. Dr. Jewett was also Vice Chairman of the American Committee and Chairman of the Transportation Committee.

Dr. Jewett has been appointed chairman of Section M, Engineering, of the American Association for the Advancement of Science. He has also been appointed to the executive committee of the Museum of Peaceful Arts to fill the vacancy caused by the death of John W. Lieb.

* * * *

THE NEWSPAPER accounts of the $10,000 prize to be awarded annually by *Popular Science Monthly* for outstanding scientific achievement included Dr. Jewett's name among the distinguished scientists on the Committee of Award. The prize, which is the largest single monetary award in America, has been instituted to heighten the interest of the American people in scientific accomplishment and will be conferred for the first time in September.

* * * *

RECENT DEVELOPMENTS IN TELEPHONIC COMMUNICATION, by S. P. Grace, was the principal address at the annual dinner of the Pennsylvania State Chamber of Commerce at Harrisburg on January 16. Mr. Grace's remarks were supplemented by demonstrations of the call announcer and other recently developed apparatus. A similar talk and demonstration were given by Mr. Grace before the Chamber of Commerce of Richmond on January 10 under the auspices of the Chesapeake and Potomac Telephone Company.

* * * *

AT THE meeting of the Colloquium on December 23, C. F. Eyring spoke on *Reverberation Time in "Dead"*

The party which talked from the plane: F. B. Woodworth, B.T.L.; F. S. Bernhard, B.T.L.; S. S. Klein, United Press; F. B. Hailey, Associated Press; G. G. Breed, International News; A. R. Brooks, B.T.L.

Rooms. Dr. Eyring pointed out that although Sabine's formula has been used to calculate reverberation times in the past, it gives too long a value of reverberation time for dead rooms. He presented a more general equation, of which Sabine's is a special case, applicable to live as well as dead rooms. The new formula is of importance in the sound-picture industry, for it indicates that a dead room may be obtained by the use of less absorbing material than that calculated to be necessary by the old formula.

At the meeting on January 6, J. B. Johnson spoke on *The Present Uncertainty Regarding the Charge of the Electron.* One value of this charge was found by Millikan, using the oil drop method, and another value by Compton and Siegbahn using a method based on the diffraction of X-rays by ruled gratings. Eddington, by calculations based on dimensional reasoning and assumptions regarding the relations between certain physical constants, found a third value which fairly well supports Millikan's value, but both differ from Compton's by far too great a difference to be accounted for by any known facts.

Two other possible methods of determining the charge are by measurements on the shot-effect and on thermal agitation in resistances. These have been studied in our Laboratories but so far have yielded no results approaching the others in precision. The discrepancy is thus one of the interesting puzzles of the moment.

* * * *

Possibility of telephoning from an airplane to a transatlantic liner, via Bell System radio links and an intervening wire network, was successfully demonstrated on December 22. A party of newspaper men took off from Hadley Field in the Laboratories' tri-motor plane with A. R. Brooks as pilot and F. S. Bernhard and F. B. Woodworth in charge of the radio equipment. Communication was established through Whippany and the ship-to-shore system with the *Leviathan,* then seven hundred miles out. J. L. R. Van Meter, General Traffic Manager, Long Lines, acted as master of ceremonies aboard the ship, introducing Commodore Cunningham of the United States Lines to Captain Brooks and to the reporters. Mr. Roy Howard, head of the Scripps-Howard group of newspapers, also spoke from the ship. About 200 passengers listened to the conversations through a loud speaker which was connected to the circuit. The feat created a great impression on the audience, and on newspaper readers generally, to judge from the extent to which dispatches were published. After the ship docked, sound-pictures were made by Fox Movietone News, reenacting the demonstration.

* * * *

MIDWAY between Europe and America as the *Leviathan* was steaming eastward on the trip when the ship-to-shore service was opened, the accompanying photograph was taken. These members of the Laboratories staff were on board to see that the equipment was functioning properly—the culmination of their several months work on the *Leviathan* testing and perfecting the ship-to-shore radio telephone.

On this first round trip with the ship-to-shore service available, a total of 130 commercial calls was made. In addition about the same number of service calls were put through including those to heads of all the Bell System associated companies in which greetings from the *Leviathan* were conveyed by J. L. R. Van Meter of the American Telephone and Telegraph Company. The radio telephone equipment is housed in the steel shack in the background, erected on the *Leviathan* last winter in Boston.

"But why the berets?" you may ask. You will agree that these men look like a sober and industrious group of Laboratories workers, not likely to adopt the French fashion of headwear out of mere whim or affectation. Which is very true. The shack housing the equipment is on the hurricane deck of the *Leviathan* about 100 feet above the water level, and when the strong winter blasts

Group on board the "Leviathan" for the opening of ship-to-shore telephone service: F. B. Llewellyn, F. R. Lack, H. J. Scott, E. Vroom, G. Thurston, C. C. Munro blow, the life of a fedora hat is hazardous to say the least. Hence the berets.

* * * *

At the annual meeting of the Edward J. Hall chapter of the Telephone Pioneers of America, Arthur G. Kingman of the Patent Department was elected president for the ensuing year. J. E. Moravec was named as delegate to the annual convention to be held in Los Angeles this fall. G. F. Atwood was designated as alternate for Mr. Moravec.

John H. Bell, at a dinner at the Calvary Methodist Church of East Orange, spoke on the work of the Laboratories and included with his remarks a showing of several films.

W. E. Viol has been elected to membership in the Edward J. Hall chapter of the Telephone Pioneers of America.

C. F. Flint spent several days at Selma, North Carolina, in connection with work on the 2-A pilot channel equipment.

E. P. Felch and W. W. Rindlaub were at Philadelphia to discuss with Western Electric engineers there a trial installation of sequence switch protection for panel dial equipment.

C. W. Britton visited repeater stations between New York and Pittsburgh to insure that the B-22 repeater equipment for program transmission was in proper shape prior to the inauguration of commercial service.

H. W. Heimbach spent several days at Hawthorne in connection with panel system cabling and wiring studies.

H. D. Kelso went to Springfield, Massachusetts, in connection with cabling for toll installations.

H. T. Langabeer visited Syracuse to test and inspect the automatic power plant installed in "8" office.

H. M. Spicer observed tests on various types of circuit breakers at the Westinghouse plant at Pittsburgh. With J. L. Larew he made a trip to the General Electric Company at Schenectady to discuss control equipment for toll lighting emergency alternator sets.

J. R. Stone spent several days at the General Electric plant at West Lynn conferring on "M" type generators.

L. M. Allen was present at the cutover of the Wabash-Harrison panel office at Chicago. He later made another visit to Chicago to conduct investigations on cordless equipment at the State central office.

H. S. Shope visited Cincinnati to make a study of the installation and operation of two machine ringing No. 11 switchboards.

W. J. Lacerte spent several days at Springfield, Massachusetts, making tests on the first commercial installation of two-party message rate trunks in Springfield step-by-step office.

H. W. Flandreau went to Atlantic City to make a study of the operation of new 114-EA relays used on a-c—d-c ringing.

F. J. Clarke visited Des Moines and Fort Dodge, Iowa, to discuss methods of interconnecting the No. 3 toll board with the North auto-manual system.

W. L. Dodge was at Pittsburgh to confer with telephone officials on questions arising out of the operation of new battery cut-off and call distributing cordless office equipment recently installed in the Pittsburgh territory.

D. A. QUARLES and C. S. GORDON made a trip to the Copperweld Steel Company at Glassport, Pennsylvania, to attend an engineering conference and to inspect the operations required for the manufacture of copper-steel wire.

F. F. FARNSWORTH and W. T. JERVEY visited the plant of the Porcelain Products Company at Parkersburg, West Virginia, in connection with the manufacture of porcelain tubes.

F. F. FARNSWORTH and W. J. LALLY visited the Bureau of Standards at Washington and the steel pipe plant of the Bethlehem Steel Company at Sparrow's Point, Maryland, in connection with the use of steel pipe for underground conduit.

R. H. COLLEY attended a conference at St. Louis on standard toximetric tests for wood preservatives. He also visited Washington to confer with the Department of Agriculture on the effect of fungus infection on the mechanical properties of wood.

L. V. LODGE made an inspection of thirty-two year old southern pine poles on the Washington-Norfolk line of the American Telephone and Telegraph Company.

G. A. ANDEREGG went to Dallas and Oklahoma City in connection with tape armored cables being laid by the Southwestern Bell Telephone Company.

F. B. LIVINGSTON was at Stamford to observe the handling of a new type of cable for building out capacitance and resistance of short loading sections to desired values.

W. H. STRACENER has been transferred from Kearny for engineering inspection work on lead-covered cable.

W. C. ROYAL has been transferred from Hawthorne to Kearny for the current engineering work on lead-covered cable.

W. A. SHEWHART attended the meeting of the American Association for the Advancement of Science at Des Moines and presented the paper *Economic Quality Control of Manufactured Product.*

L. E. GAIGE made a trip to Mobile in connection with investigation work on operators' telephone circuits.

A. N. JEFFRIES visited the Chicago toll office to conduct a special study on 49-type switchboard jacks.

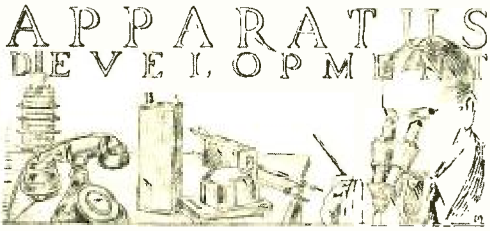
C. J. HENDRICKSON attended a survey conference on step-by-step switches at Hawthorne.

T. L. OLIVER, field engineer in the Atlanta territory, made a trip to Macon, Newman, Orlando, Melbourne, West Palm Beach, and Miami in connection with complaint investigation matters. Mr. Oliver later visited Charlotte and Knoxville in company with L. E. Gaige to conduct a special investigation on dials and dial testers. He then continued on to Ashville and Birmingham and Mr. Gaige visited Atlanta and Chicago.

GENERAL STAFF

JOSEPH KEARNS, formerly a power

plant engineer in department 560, who was retired on pension in 1926, died January 13, 1930. Mr. Kearns' service with the Western Electric Company and the Laboratories dated from April, 1903.



F. J. RASMUSSEN visited the Weston Instrument Company to discuss several meters which are being developed for the Laboratories.

J. S. ELLIOTT visited the Philadelphia Instrument shop in connection with the production of variable attenuators and attenuation measuring sets.

E. D. PRESCOTT addressed a class in the Newark night schools on the work and organization of the Laboratories.

M. W. BRYANT investigated the manufacturing difficulties encountered on the 3-A terminating network at Philadelphia Instrument Shop.

W. C. SIMPSON went to Kearny in regard to calibrating their capacitance bridges.

E. C. ERICKSON visited the Bureau of Standards in Washington relative to precision linear measurements concerned with projection, optics and interferometry.

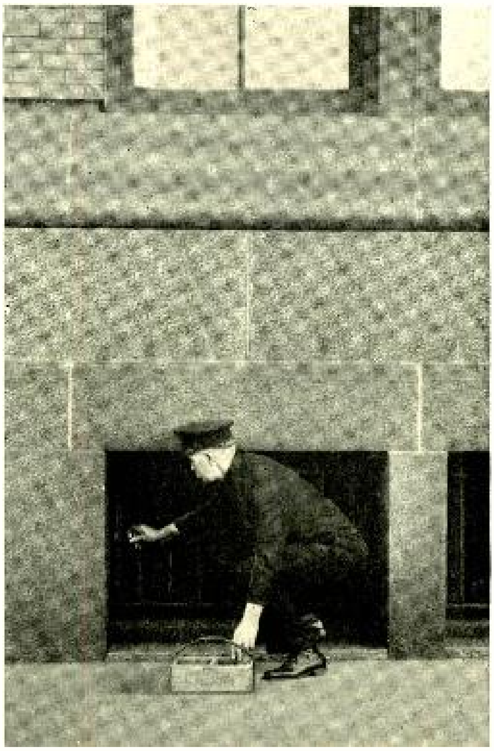
C. H. GREENALL conducted his class in *Materials of Design* through the cable shops at Kearny where studies were made of the problems encountered in manufacture of lead-covered cable.

J. M. WILSON with J. M. Finch of the Chemical Research group visited the chemical laboratories of Arthur D. Little, Inc., at Cambridge, Massachusetts, to discuss matters pertaining to paper and paper impregnation.

C. A. WEBBER and H. S. SMITH were at Whippany on work concerned with the development and use of a special cable for high frequency circuits of high current carrying capacity.

Mr. Smith visited also the Hope Webbing Company at Pawtucket in connection with the development of a special type of cord for telephone extension use.

N. INSLEY accompanied by R. A.



When leaving the building later than usual you may have observed Tom Creaven attaching locks to each of the basement windows, and wondered why he was doing it. The locks are put on as a protection against nightly intruders and taken off each morning in compliance with the fire laws which rule against locked doors or windows when the building is occupied

Miller made a trip to the National Lamp Works at Cleveland to discuss improvements in sound picture lamps.

J. N. Reynolds and H. F. Dobbin were at Hawthorne for conferences on recent developments in dial system apparatus.

D. H. Gleason visited Selma, North Carolina, in connection with the installation of 200 type selectors in carrier control circuits.

J. J. Sweetman and D. C. Lloyd visited Allentown, Newcastle and Wheeling to investigate contacts in toll circuits.

H. L. Walter visited the Bureau of Engineering in Washington in regard to telephone equipment for the United States Navy.

J. H. Sailliard was at Chicago to observe the operation of the new motor used with the Universal reproducing machine.

E. L. Nelson appeared before the Federal Radio Commission in Washington as an expert witness concerning the application of Station WABC of the Columbia Broadcasting System for permission to construct and operate a 50 kw broadcasting station at Columbia Bridge, New Jersey.

W. L. Black made an inspection of the speech input equipment at the studios of station WMAQ owned by the Chicago *Daily News*.

G. R. Vernon directed the installation of additional speech input equipment at the new broadcasting studios recently opened by the Columbia Broadcasting System at 585 Madison Avenue.

B. R. Cole and A. B. Bailey recently made a field strength survey for station WABC. Mr. Cole later visited station WGHP at Detroit where he installed a one kilowatt transmitter and associated speech input equipment.

W. L. Tierney visited Chicago for a conference with members of the staff of station KNX of the Western Broadcasting Company at Los Angeles.

A. B. Bailey completed the installation of the studio speech input equipment for station WHDH at their studio in Boston. He also made an inspection trip to station WABC at Jamaica, New York.

F. A. Hinners installed a 106-B broadcasting equipment at station WCAE owned by Gimbel Brothers at Pittsburgh.

J. C. McNary has been making a field strength survey for station WWJ at Detroit.

J. H. DeWitt, Jr. made a visit to station WLW, a fifty kilowatt Western Electric transmitter owned by the Crosley Radio Corporation of Cincinnati. He later visited station WSM of the Atlanta (Ga.) *Journal*.

O. W. Towner directed the installation of a one kilowatt transmitter and associated speech input equipment for station KAR at Phoenix, Arizona. Later he visited Los Angeles where he installed a crystal control unit for the one kilowatt transmitter owned by the Pickwick Broadcasting Company. He also made inspections of stations KECA and KFI.

F. E. Nimmcke has recently returned from the Pacific coast where he made an inspection of station KPO, the Hale Brothers' station at San Francisco.

W. R. Lyon has made several trips during the past few months to the Pittsfield works of the General Electric Company in connection with the purchasing and testing of transformer equipment. With its associated protective devices, this equipment is for the experimental high-voltage rectifiers being constructed at Whippany.

During the period from December 5, 1929 to January 4, 1930, members of the Patent Department visited the following cities in connection with the prosecution of patents: Washington, J. H. Cozzens, E. V. Griggs, G. H. Heydt, W. C. Kiesel and W. C. Parnell; Toledo, W. C. Kiesel.

From September 1 to December 1, 1929, patents were issued to the following members of the Laboratories staff:

R. E. Collis	A. C. Keller
A. M. Curtis	B. W. Kendall
J. W. Dehn	W. A. Knoop
H. J. Fisher	W. G. Knox
P. B. Flanders	J. J. Kuhn
L. S. Ford (3)	V. E. Legg
H. T. Friis	W. A. Marrison
J. J. Gilbert	C. R. Meissner
A. F. Gilson	C. N. Nebel
F. J. Given	E. L. Norton
H. C. Harrison (5)	E. Peterson
A. G. Jensen	H. Pfannenstiehl (2)
H. B. Johnson	A. G. Russell
J. B. Johnson	A. L. Thuras
L. H. Johnson	W. C. Jones

As part of a series of talks given from the National Broadcasting studios by the Noise Abatement Commission, Harvey Fletcher spoke on *How Noise is Measured and Why* over station WEAF on December 31. He included with his talk reproductions of the noises recorded in various sections of New York City.

On December 28, Dr. Fletcher attended a meeting of the White House Conference sub-committee on the Deaf and Hard of Hearing at Washington. Earlier in the month he gave a short talk before the Chicago League for the Hard of Hearing.

On January 21 he spoke on speech and hearing at Swarthmore college under the auspices of the honorary scientific society, Sigma Xi.

T. C. Fry attended the meeting of the American Mathematical Society at Lehigh University. Mr. Fry has been elected to the council of the society.

At the meeting of the National Academy of Science at Princeton, Joseph A. Becker presented a paper with D. D. Foster on the theory of thin films. On January 16, at the request of the Research Fellows he visited the Bartol Research Foundation at Swarthmore College and informally discussed his work on thermionic and photoelectric phenomena on adsorbed surfaces.

Messrs. C. W. Borgmann, C. C. Hipkins and C. L. Hippensteel visited Forked River to bury cable specimens for testing different methods of protecting cable against soil corrosion.

W. E. Campbell visited the Bureau of Standards at Washington in connection with an investigation of lubrication problems.

Messrs. W. R. Erickson, D. A. McLean and R. L. Peek, Jr., attended a meeting of the Society of Rheology at the Bureau of Standards at which Mr. Peek and Mr. Erickson presented a paper on the capillary flow of colloid solutions. Mr. Peek also attended the meeting of the American Mathematical Society at Lehigh University where he presented a paper on the solution of problems in diffusion.

J. H. Ingmanson and A. N. Gray

visited the Henry L. Scott Testing Machine Company relative to tests on the compression resistance of rubber. Mr. Gray is at present at Hawthorne and will be permanently located at the Point Breeze plant after February 15.

A. G. Russell visited Chicago in connection with the gold plating of handset transmitter electrodes.

The following members of the Research Department attended a meeting of the Acoustical Society of America in Chicago: H. D. Arnold, E. H. Bedell, D. G. Blattner, K. K. Darrow, H. K. Dunn, H. B. Ely, H. Fletcher, H. A. Frederick, H. E. Ives, W. C. Jones, J. B. Kelly, W. P. Mason, R. R. Riesz, L. J. Sivian, J. C. Steinberg, R. L. Wegel, E. C. Wente and S. D. White.

The following papers were presented: *A Time and Space Pattern Theory of Hearing* by Harvey Fletcher; *Measurement of the Constants of a Single Reed Wind Vibrator* by R. L. Wegel and R. R. Riesz; *A Chronographic Method of Measuring Reverberation Time* by E. C. Wente and E. H. Bedell; *Absolute Amplitudes and Spectra of Certain Musical Instruments* by L. J. Sivian, H. K. Dunn and S. D. White; *The Approximate Networks of Acoustic Filters* by W. P. Mason.

While in Chicago, H. D. Arnold, H. A. Frederick and W. C. Jones discussed several questions pertaining to carbon with the engineers at Hawthorne. H. A. Frederick and D. G. Blattner also conferred with Dr. Jacobson of the University of Chicago on his work on muscular electrification. Mr. Blattner was also at Cleveland and Toledo in connection with patent work.

A. F. Bennett was at Hawthorne relative to the work on the high quality deskstand transmitter.

Bureau of Publication

W. C. F. Farnell in company with W. C. Langdon of the American Telephone and Telegraph Company visited the Bell Telephone Company of Canada at Montreal for consultation in connection with the establishment of a historical museum of communication at the Bell Headquarters in Canada.

On January 7, Miss E. E. Dittmar, an instructor in the Laboratories' health course, spoke on health at the Y. W. C. A. in Freehold.

Contributors to this Issue

H. S. PRICE obtained the degree of Civil Engineer from Princeton in 1916 and of Master of Science from Lehigh in the following year. During the war period, from 1917 to 1919, he was a commissioned officer in the Signal Corps and at the end of that period transferred to the engineering department of the Western Electric Company—now Bell Telephone Laboratories. His work here has been varied. Radio design in 1920, Transmission Maintenance Apparatus Laboratory in 1921, Radio Installation Engineering in 1922 and 1923, Radio Development Laboratory in 1924, and Radio Installation Engineering again from 1925 to 1929. In the past year he transferred to the Sound Picture Laboratory, where he is in administrative charge of the building and of the group operating the sound-picture recording system as a whole.

N. Y. PRIESSMAN entered the Western Electric Company at Chicago from the University of Wisconsin in 1911. After two years in the shops and in the student course, he came to Bell Telephone Laboratories, joining the circuit design group. From 1920 to 1924 he was on leave of absence at the Universities of Chicago and Columbia. During this period, however, his summers were spent at the Laboratories to which he returned in 1924 and entered the Apparatus Development group where he has devoted most of his attention to relay design.

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R. W. HARPER's telephone career began as soon as he came to America from Scotland. After three years with the Plant Department of the Cincinnati and Suburban Telephone Company, and seven years of wide field experience with the Installation

H. S. Price

R. W. Harper

N. Y. Priessman

W. B. Prince

W. C. F. Farnell

A. S. Bertels

Department of the Western Electric Company, he entered the Engineering Department of the Michigan Bell Telephone Company in 1917. During the World War he served in the Signal Corps, and at its conclusion he joined these Laboratories. His work here has been in circuit design, especially, for the past six years, that of private branch exchanges, on which he now supervises the work.

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A. S. Bertels entered the employ of the Bell System in 1888 as night operator, at Wilkes Barre, Pa., for the Central Pennsylvania Telephone and Supply Company, now the Bell Telephone Company of Pennsylvania. About 1891 he became a telephone inspector and later wire chief and chief operator. In 1893 he was transferred to the Metropolitan Telephone and Telegraph Company, now the New York Telephone Company where he was employed as telephone inspector until 1898 when he was transferred to the inside central-office force as repair man. In 1901 he became special central-office inspector. In 1904 he had charge of the new central-office testouts and was made foreman of the switchboard wiring force. In 1908 he became chief foreman of the wiring force. In 1910 he began to study the semi-mechanical circuit at 463 West Street, where he later worked on the testing circuits of the new system. In 1913 he was transferred to the Engineering Department of the Telephone Company where he remained until 1915 when transferred to the New Jersey Division to work on routine tests for the dial system. In 1918 he was transferred back to New York City as Equipment Engineer and in 1919 to the Circuit Engineering Department of the Western Electric Company. At the present time he is in the Systems Department where his accumulated experience is contributing to the development of routine tests.

J. W. Woodard

W. B. Prince received the B.Sc. degree in Electrical Engineering from Virginia Polytechnic Institute in 1906 and joined the Student Course of the Western Electric Company at New York the same year. In 1908 he became a member of the Engineering Department, entering the Circuit Laboratory. In 1915, at which time vacuum tube telephone repeaters were first applied on a commercial basis, he supervised the building and testing of the repeater sets, and continued in this work until they were standardized and the work transferred to Hawthorne. During the World War he was engaged in war production work and at its conclusion entered the Systems Development Department. At the present time he is engaged in the design and development of local manual circuits.

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J. W. Woodard's telephone career began in 1911 with an independent step-by-step dial systems operating company in New England. After six years in this field he entered the employ of the Western Electric Company at the Hawthorne Plant in the central-office equipment engineering department. He transferred from Hawthorne to the Laboratories in 1920 and started work in the current development group of the equipment development department. He has worked in this same line since that time and now supervises the work of this group.

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W. C. F. Farnell's long telephone experience began in 1902 when he joined the Manufacturing Department of the Western Electric Company. Entering Cooper Union at the same time, he received the B. S. degree in 1906 and became head of final inspection in the New York shops. In 1909 he went to Hawthorne for inspection work with the Engineering Department, and two years later took charge of various detail design activities there. He continued design work from 1914 until 1917 in New York, and for nine years thereafter supervised the Engineering Information Department at West Street. Since 1926 Mr. Farnell has been Curator of the Bell System Historical Museum.

Club Notes

DURING the month of March the Club will hold an indoor handball tournament at Labor Temple, Fourteenth Street and Second Avenue, Manhattan. Play will commence Tuesday evening, March 4 and matches will be held from 5:30 to 7:30 o'clock on Tuesday and Thursday evenings for four weeks. The single-wall form of play will be used, and all games will be singles. The tournament will be conducted on an elimination basis, with all matches up to the semi-finals consisting of a single game. Semi-finals and finals will be decided by two games out of three.

The winner of the tournament will receive an order good for ten dollars' worth of merchandise at Alex Taylor and Company; the second man, an order worth five dollars; and

the two men eliminated in the semi-finals will each get an order worth two dollars and a half.

Entry blanks may be obtained from D. D. Haggerty, Room 164, and must be returned to him with the entry fee of twenty-five cents not later than Monday, February 24. Before each round each player will be advised of date, time, and the opponent with whom he is matched.

Bridge and Dance

Another Bridge and Dance has been planned. This party will be held on Thursday, February 27, in the club rooms of the New York Telephone Company at 140 West Street. Bridge will be played from 7 to 9 o'clock and

an attractive prize will be awarded to each of the seventy-two tables. Four special prizes will be given to the holders of the lucky numbers.

Refreshments consisting of sandwiches, coffee and ice cream are included in the subscription of one dollar.

Tickets may be obtained from D. D. Haggerty, Room 164 or from your departmental representatives.

Are You In?

Many inquiries have already been received about the third annual photographic contest, open to all members of the Laboratories, which is now under way. The contest will close on March 3, and all entries must be sent to D. D. Haggerty not later than this date.

This year a departure from the usual procedure has been instituted. The contestants will be divided into two groups, known as the junior and senio groups. Those who have been awarded more than one prize in previous competitions will be placed in the senior group. All others will be classed in the junior group. This step has been taken to encourage our amateur photographers who have not as yet won prizes and it is felt that it will greatly increase the number of persons competing.

As in past contests distinct classes of photography, with awards in each class, have been established. The classes this year will include portrait, landscape, still life and baby prints. Following the awards of the judges, winning photographs in each class will be exhibited. For further information regarding rules and prizes consult D. D. Haggerty, Room 164, extension 542.

Indoor Golf

The final tournament of the indoor golf season will be played on Wednesday, March 26 at the Miniature Golf Course of America, 41 East 42nd Street.

As in previous tournaments all con-

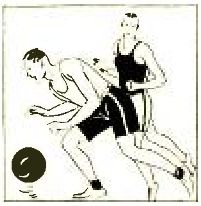
testants will play thirty-six holes of medal play in the qualifying round after which they will be divided into two groups of four flights each with prizes for the winner in each of the eight flights. Sixty-four players will be qualified for the finals.

Entries should be forwarded to D. D. Haggerty, accompanied by an entrance fee of $1.50.

In addition to the prizes awarded to the winners, a valuable prize will be given to the player turning in low medal score for the qualifying round.

On the Court

The first half of the Basketball season was completed on Tuesday eve-



ning, January 7, with last year's champion's out in front by a margin of two games and with every indication that they will keep this place at the end of the season.

This season all of the team captains were able to find new material which has tended to strengthen all the teams in the league and has made the interest and competition keener than ever before.

The League standing for the first half is as follows:

Equipment Drafting	7	0
Equipment Engineers	5	2
Apparatus	5	2
Toll Circuits	4	3
Tube Shop	4	3
Research	3	4
Commercial	1	6
Jr. Assistants	0	7

Leading Scores

	F.G.	*F.*	*P.*
Kontis-Tube Shop	34	8	76
Christ-Eq. Drafting	21	13	55
Scheer-Toll Circuits	17	3	37
Kasara-Research	16	5	37
Duerr-Apparatus	18	0	36

Club Orchestra

Since the early fall when the first rehearsals for the year began, the Bell Laboratories Club orchestra has been practicing faithfully and consistently. As a result the orchestra has improved greatly from every aspect of symphonic performance. During the early rehearsals many of those at-

tending thought the orchestra showed a marked advance over last season and at the most recent rehearsals the improvement over the early rehearsals was unquestionable. Real progress therefore is being made and attendance records at rehearsals this year greatly surpass those of last year.

The success of the orchestra and the interest in its work may be attributed partially to the democratic manner in which we select the music that is to be played. As a result of popular vote the orchestra has been playing several good symphonies, suites and overtures. Such composers as Beethoven, Mendelssohn, Tschaikowsky and Grieg are among the favorites.

The orchestra is not a closed corporation; there is still room for more. The orchestra is organized for the pleasure of Club members and if you play an instrument and wish to join, by all means drop in to a rehearsal on a Tuesday evening.