HOLD

BELL LABORATORIES RECORD

WORKING THE BASE METALS
By J. H. White

ECHO ELIMINATION
By G. C. Crawford

50 KW. BROADCAST TRANSMITTER
By A. W. Kishpaugh

NOVEMBER 1927 VOL. 5 NO. 3

Bell Laboratories Record

A Monthly Magazine of Information for Members of BELL TELEPHONE LABORATORIES, INCORPORATED

Edited by the Bureau of Publication:
PAUL B. FINDLEY — Managing Editor

Printed, not published, *by*
BELL TELEPHONE LABORATORIES, INCORPORATED
463 West Street, New York, N. Y.

Printed in U. S. A.

Bell Laboratories Record

Volume Five NOVEMBER, 1927 *Number Three*

Power Rating of Broadcasting Transmitters

By O. M. GLUNT

Assistant Apparatus Development Engineer

RECEPTION of low-powered broadcasting stations at far distant points is interesting and often very remarkable. The real work of the broadcaster, however, is to make possible the flawless reception of programs and to provide an unfailing service over as large an area as possible surrounding the station. For broadcasting purposes no advantage can be taken of the vagaries of transmission or of any directive effects and, therefore, improved reception and reception over greater areas must be had either by the generation of more power or by the more effective utilization of the power that is generated. There are certain obstacles, such as fading and interference, which cannot be wholly overcome by the expedient of using a large amount of power, but high power tends to mitigate their effects as well as to increase the area of high grade reception.

It is possible that the maximum power to be used in broadcasting will eventually be fixed primarily by technical difficulties, but at present the determining factors are largely economic. In general, the cost per unit area served decreases as the power and area are increased, so that with the present trend toward the broadcasting of better and more expensive programs, economic considerations point to increasing the areas regularly reached by most stations. Although the situation as it confronts each broadcaster must be analyzed by himself, taking account of the extent and character of the population which it is useful for him to reach, there seems little doubt but that the future will bring with it an increase in the power of most broadcasting stations.

In this connection the general adoption of a comprehensive method of rating the output of broadcasting transmitters is important. A rating now commonly used merely expresses the unmodulated high frequency power delivered to the antenna and on this basis broadcasting transmitters are referred to as one-kilowatt sets, five-kilowatt sets, and so on. This method of rating, while it is based upon a definitely measurable quantity, is quite inadequate, failing as it does to take into consideration the maximum obtainable percentage of modulation. This is an equally important factor in determining the effectiveness of the power in the distribution of a program, and the complete specification of the performance capabilities of a transmitter must be expressed in terms of both of these factors: power output and percentage of modulation.

Most readers have observed in tuning their radio receivers that the presence of a carrier even when unmodulated can be detected by an increase in the noise received. Most of this noise is static or local electrical disturbances "beat in" by the carrier, although the latter in itself is inaudible. The loudness of this noise is proportional to the carrier amplitude and independent of modulation. The program signal on the other hand is proportional to both the carrier power and the percentage of modulation. To obtain the best signal-static ratio, therefore, it is important that a high degree of modulation be attained. It can be shown that from a signal-static ratio standpoint a one-kilowatt broadcasting transmitter capable of one hundred percent modulation is substantially equivalent to a five kilowatt broadcasting transmitter capable of forty per cent modulation. The importance of complete modulation has not yet been generally realized among broadcasters or listeners and it is probable that the modulation of most of the existing stations can be increased, thereby affording greater coverage without the radiation of any more carrier power.

It is not a simple matter, however, to adapt the apparatus of a given station to a higher percentage of modulation. It may mean certain new equipment capable of handling the greater peak power which increased modulation entails. As between two stations each capable of generating the same carrier power, that possessing the greater degree of modulation will, in general, be more expensive to build especially in the larger units.

The question is sometimes raised as to the extent to which modulation can be carried without loss of quality. Recent tests conducted by Bell Telephone Laboratories indicate that modulation at peak values of the audio wave may be carried to one hundred per cent without perceptible sacrifice in this respect. The new fifty-kilowatt set which is now under test at our laboratory in Whippany, N. J., is capable of this performance and extensive investigations have proven that its quality is excellent.

The Fifty-Kilowatt Radio Transmitter

By A. W. KISHPAUGH
Apparatus Development Department

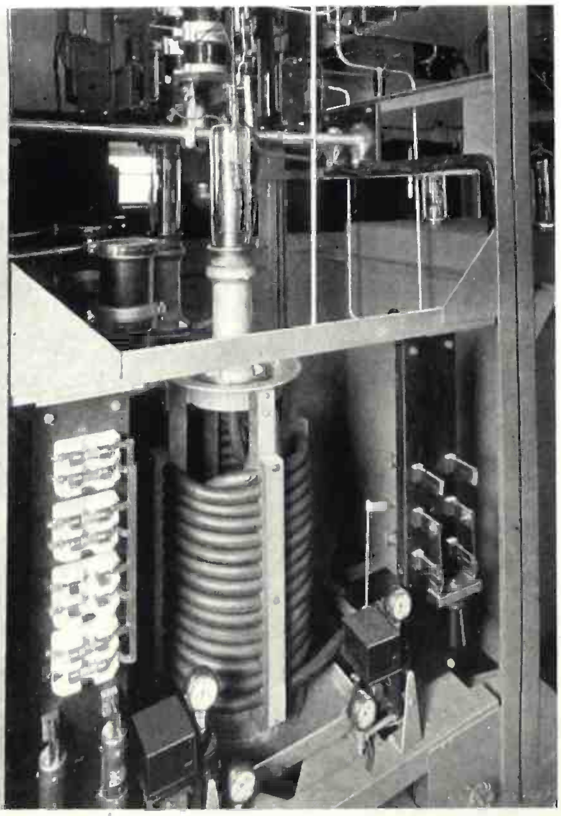
MANY late-at-night radio listeners during the past months have been surprised at hearing, with more than ordinary volume, music and speech which in due course they find to have been transmitted from our Laboratories' experimental station at Whippany, New Jersey. These listeners have been scattered over a considerable portion of the United States and some have been located at far distant points outside of this country. Reports of reception have been particularly gratifying since the tests have been carried on during the summer, a time generally unfavorable to good radio reception.

The particular equipment used in the tests at Whippany is the development model of the Western Electric 7-A Radio Broadcasting Transmitter, rated at 50 kilowatts. It has been created to make possible the provision over areas of reasonable magnitude of broadcasting service consistent with the ever growing requirements of the art.

The transmitter uses twenty-five vacuum tubes, of which fourteen are water-cooled. These tubes and their related circuits are mounted on and behind ten panels; on a floor below are installed some of the bulkier pieces of apparatus such as transformers, generators and filters. While the normal unmodulated output to the antenna is fifty kilowatts the tube capacity is adequate to deliver the 200 kilowatts which are required during peaks of modulation.

With so many broadcasting stations on the air, it is of first importance that each one maintain its carrier frequency constant at the value assigned by the Federal Radio com-

A general view of the transmitter room at Whippany mission. To this end, the frequency of the carrier-wave is controlled by the oscillation of a small quartz plate. Cut from a single crystal, with proper

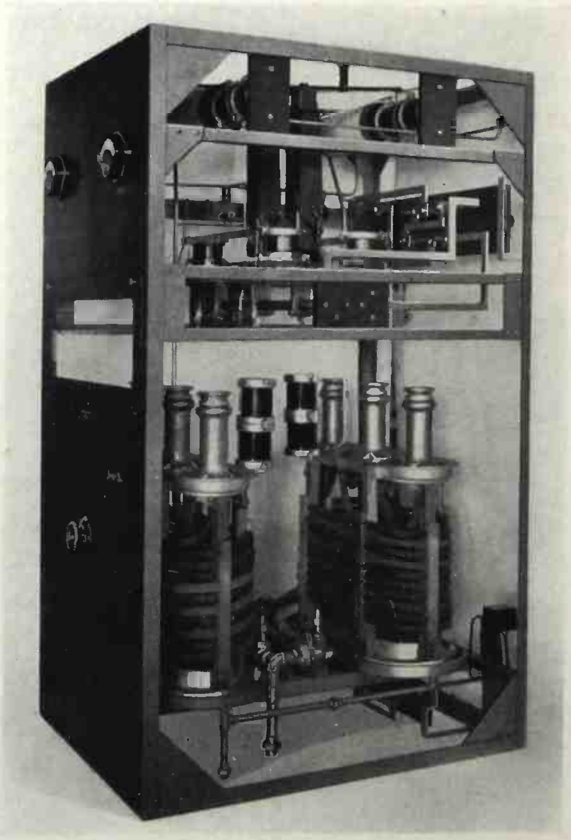


Rear view of the tube unit for the next-to-last stage

orientation as to the crystalline and optical axes, the quartz plate, carefully ground to a thickness determined by the desired frequency, is then associated with a master oscillating circuit. As one precaution to ensure constant frequency, the plate is mounted in a container where its temperature is held constant.

Speech currents from the control room are amplified by two stages in the set proper; the output voltage from the last of these is used for modulation. The radio frequency generated by the vacuum tube under control of the crystal is amplified in five stages. On the plate voltage of the second-stage tube is superposed the audio-frequency voltage for modulation. The audio-frequency voltage is sufficient to effect complete or one hundred percent modulation of the carrier oscillation. The importance of this is discussed by Mr. Glunt in his foreword. The modulation stage is followed by three more stages of radio frequency amplification, each of which is a push-pull circuit. Water-cooled tubes are used in the last two stages: two in one and six in the other. Tuned circuits form the interstage couplings and also transfer the output power to a transmission line which leads out to the antenna system. In the final tuned circuit, currents as great as one hundred amperes may flow through the heavy copper tubing of the inductance coils.

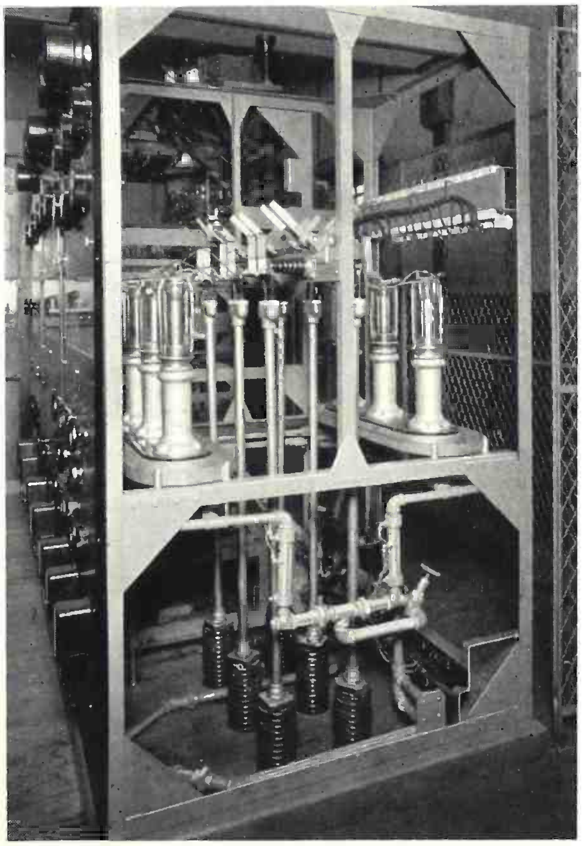
Power for the set, amounting to about 250 kilowatts, is drawn from central station lines as 440 volt, 60-



A side view of the last-stage tube unit before the tubes were placed in their jackets cycle, three phase alternating current. A major portion of this power goes to a six-phase vacuum-tube rectifier which supplies direct current at 17,000 volts to the last two radio stages. Direct current from a 1500-volt rectifier is supplied to the other stages. One motor-generator set supplies about 550 amperes direct current to the amplifier filaments; another set supplies grid-bias voltages. Outputs of both these generators pass through filters, that for the filaments using electrolytic condensers and a large choke coil.

To prevent excessive heating and consequent damage to the vacuum tubes, provision must be made to remove the heat generated in operation. For many of the tubes, radiation into the air is sufficient, but for others water cooling is necessary. These tubes are inserted in jackets through which water flows in contact with the tube anodes. Water is led to and from the tube jackets through lengths of coiled hose. This is to provide the necessary insulation between jackets, which are connected with the anodes and therefore at high potential, and the other parts of the cooling system which are grounded. The water in turn is cooled by radiators through which air is forced by large fans. About a hundred gallons of water a minute flow through the cooling system; should the water cease to flow, or should its temperature rise beyond a safe value, power is automatically removed from the tubes.

The layout of the Whippany laboratory includes a control room where the speech input amplifier and related equipment are located. Adjoining it is the transmitter-room itself. Along one wall of this room is an assembly fronted by seven panels housing the audio and radio frequency circuits. At the end of the room is a group of three panels: one for general power control, which carries the push-buttons by which the set is started and stopped; one for the 17,000-volt rectifier and one for the 1500-volt rectifier. Tubes for these rectifiers are mounted behind their respective panels. The transformers and filtering equipment for the higher-voltage rectifier is located directly beneath, on a lower floor. On this floor are also the motor-generator sets.

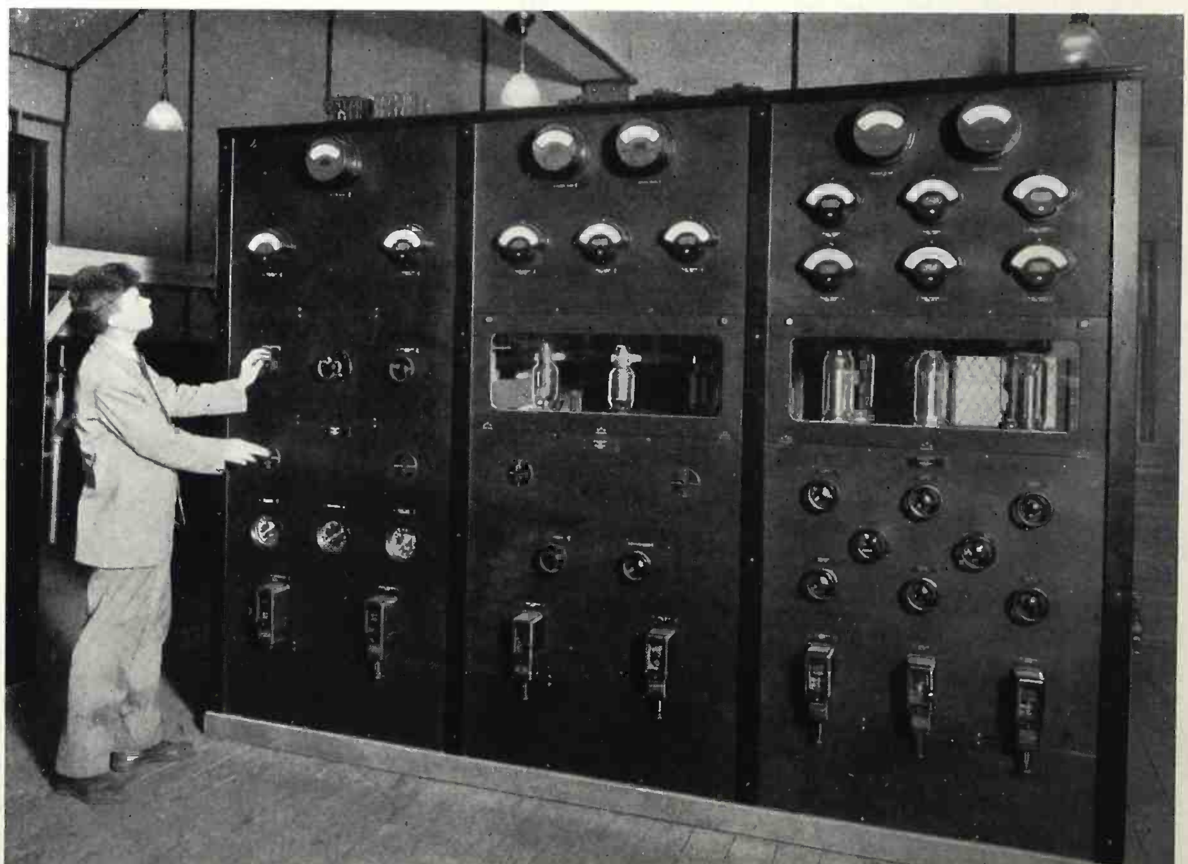


An end view of the power supply group showing the 17,000-volt rectifier tubes

In order to keep the station and its equipment outside the more intense field of the antenna, connection is made between the transmitter and antenna by a two-wire line about five hundred feet long. The voltage between wires is approximately six thousand and the line functions as any other though the power is transmitted at a very high frequency. The tuned circuits for coupling to the antenna are located in shielded compartments at the end of the transmission line directly beneath the antenna.

Much thought has been given to the protection of the operating staff against high voltages. Throughout the transmitter access is had to the circuits through doors and windows which must be securely locked before the circuits can be energized; in order to open these points of access it is necessary to unlock them through a mechanism which first disconnects the power supply and grounds the high voltage parts. All parts requiring adjustment or replacement are readily accessible. Other portions of the apparatus are arranged with a view primarily to the compactness of the equipment. This promotes economy in floor space, facilitates protection, and enables important elements to be observed by a minimum of personnel.

Satisfactory service to broadcast listeners—the sole justification of any station — requires that everything possible be done to minimize interference with other programs. To avoid the annoying "whistle" which results from heterodyning of its carrier with that of a station occupying an adjacent frequency-channel, the carrier must remain very close to its assigned value. This requirement is well met through crystal control. Moreover, radiation of harmonic frequencies must be as little as possible, since this is in effect a transmission of



The power-supply group; the panels are respectively for power control, for the 1500-volt rectifier and for the 17,000-volt rectifier the program at a frequency which may conflict with that assigned to another station. The disturbing effect of harmonics being proportional to their absolute value, special precautions must be taken in the construction of so powerful a transmitter. Careful shielding of the circuits, together with the form of the circuits themselves, have served this purpose so well that the radiation of second harmonic is approximately one tenth watt—that is, one five-hundred-thousandth of the fundamental radiation.

Addressing the National Association of Railroad and Utilities Commissioners, President Gifford said:

"Professor Cabot of the Harvard Business School made the following comment on the Bell System: 'The thing is a modern miracle which I can only explain to myself by assuming that the men who conceived, created and have developed the telephone were men of the rare automotive type whose driving power came from within, and who, therefore, did not need the external stimulation which competition alone can give.'

"Undoubtedly a very great factor in continued progress and improvement of telephone service is the intangible but quite real spirit of service that has become a tradition in the telephone business, but the results of the Bell telephone business have a broader foundation than the one Professor Cabot has recognized. It is fundamental in our plan of organization to have at headquarters and in our laboratories several thousand people whose sole job it is to work for improvement. They are engaged in studying what is used in the telephone business and how it is used and endeavor to find a better thing or a better way. Of course the people engaged day by day in trying to maintain a high standard of telephone service are doing their part, and a most important part, in increasing quality and keeping down cost of service, but progress is assured by having a large group of scientists and experts devoted exclusively to seeking ways of making the service better and cheaper."

Working the Base Metals

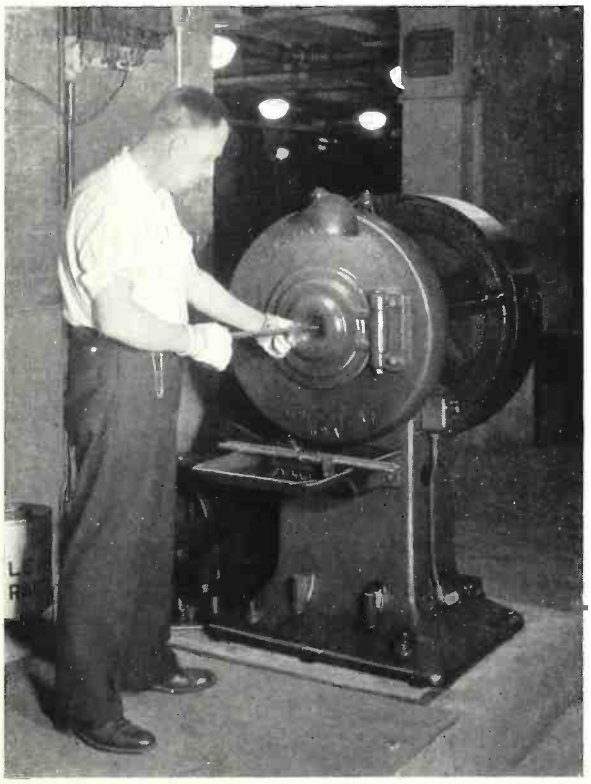
By J. H. WHITE
Research Department

THE laboratory for working base metals began its existence some ten years ago during the development of loading coils with cores of compressed iron dust. Its first equipment included mills for grinding the specially embrittled electrolytic iron, machinery for sieving, annealing and heat treating it, and a one-thousand ton hydraulic press for compressing the iron dust into strong coherent cores. At the present time the laboratory equipment is used very largely for the production of magnetic alloys in various forms but in addition considerable work is done with aluminum alloys for diaphragms, with lead alloy for cable sheaths, and with brasses, bronzes, and steels for a variety of purposes. Individual machines are not large compared to those of industrial plants, due to the fact that they are used for experimental batches only; but their variety and versatility is great.

The laboratory's equipment and its use may well be illustrated by following the process of manufacturing experimental quantities of permalloy tape such as are used for development work on continuous loading of submarine cables.

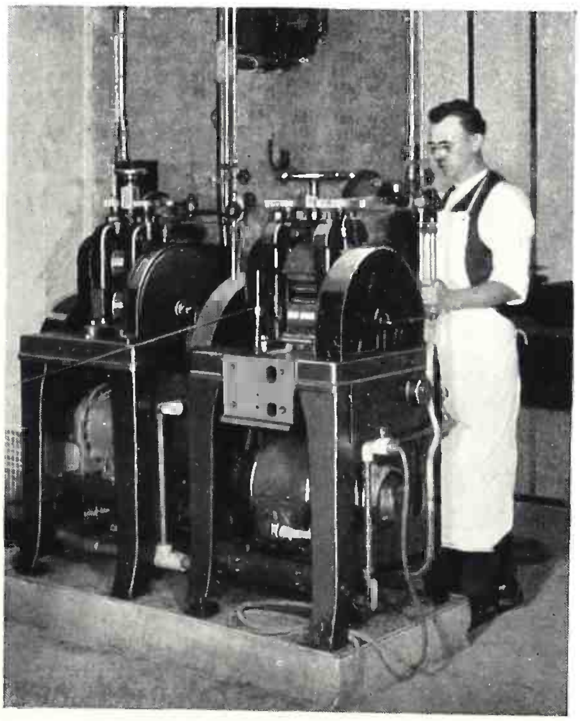
The purest nickel and iron obtainable are melted together with every

O. J. Barton prepares to pour a "melt" from the induction-furnace precaution to prevent the melt from being contaminated with foreign substances. A crucible of pure quartz is used to avoid impurities that might be present in the less expensive re-



Four thousand blows a minute are struck on the permalloy rod as M. Tompa feeds it into the rotary swaging machine

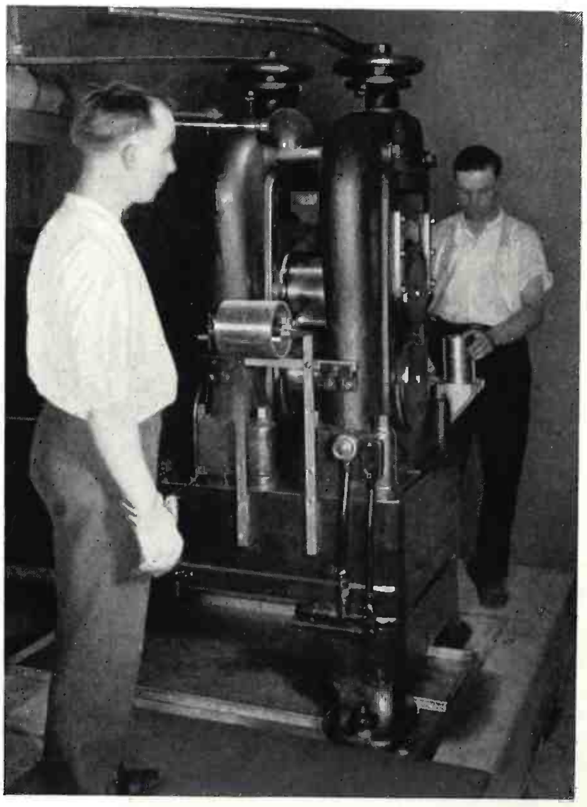
fractory materials. A high-frequency furnace of the induction type serves a similar purpose as it eliminates contamination by the fuel or electrode materials which are used with the commoner methods of melting iron. After the metal has melted it is poured into a cylindrical iron mold three quarters of an inch in diameter and sixteen inches long. When the alloy has cooled, a long series of reducing operations ensues before the permalloy assumes its final shape. Cold swaging, or cold or hot rolling, follow in a score or two of successive steps or "passes," until the rod becomes a wire about one tenth of an inch in diameter. The rotary swaging machine is far superior to other means of reduction of metals which are difficult to work. This machine contains ten hammers, which deliver four thousand blows a minute upon a split die whose central tapered hole has a minimum diameter slightly less than the size of the initial bar or wire. A succession of such interchangeable dies of progressively smaller diameters is used. Such treatment gives a very gradual reduction with a minimum of strain. Many of the alloys which have been made in the laboratory could have been reduced in size by no other means as they were not strong enough to with-



A permalloy wire is flattened into tape under the supervision of F. C. Kahnt

stand a rolling or forging operation.

At definite stages between the rolling or swaging processes, the metal is annealed to remove strains set up by working. Before the rod has been reduced sufficiently to be called a wire it is heated for annealing purposes by passing an electric current through it; suitably low voltage is secured from step-down transformers. After the rod has become a wire one tenth of an inch in diameter, it is coiled up and put in a metal pot in an electric



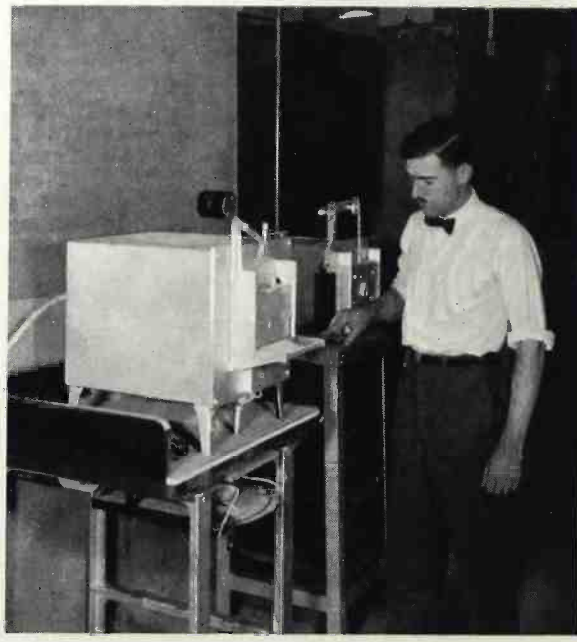
R. J. Riley and J. M. Artiges roll out a sheet of diaphragm stock

furnace for a long anneal. Precautions are taken to prevent oxidation during this process. After twenty-four hours the wire, which entered the pot somewhat tarnished, emerges with a brilliant lustre. By this prolonged anneal the wire has become very soft and can thereafter be drawn down through steel dies without difficulty. The drawing operation is much more rapid and proceeds with little attention from workmen.

Frequently it is necessary to draw wire to extremely fine sizes. Then diamonds are used for the dies on account of their hardness, the diamond being the only material that can be used when great lengths of wire must be drawn to diameters kept within narrow limits of accuracy.

After the drawing process, the permalloy wire is flattened by being passed through rolls. As before it is frequently annealed, each treatment removing the hardness caused by the previous working. At length, after its long journey, it appears as a flat tape, about one eighth of an inch in width and six thousandths of an inch in thickness, ready to be applied to the cable conductor. A similar process is carried out at Hawthorne on a commercial scale.

Some of this laboratory's output of permalloy takes the form of rods, wire or narrow rolled sheets. Permalloy dust is also produced: the cast

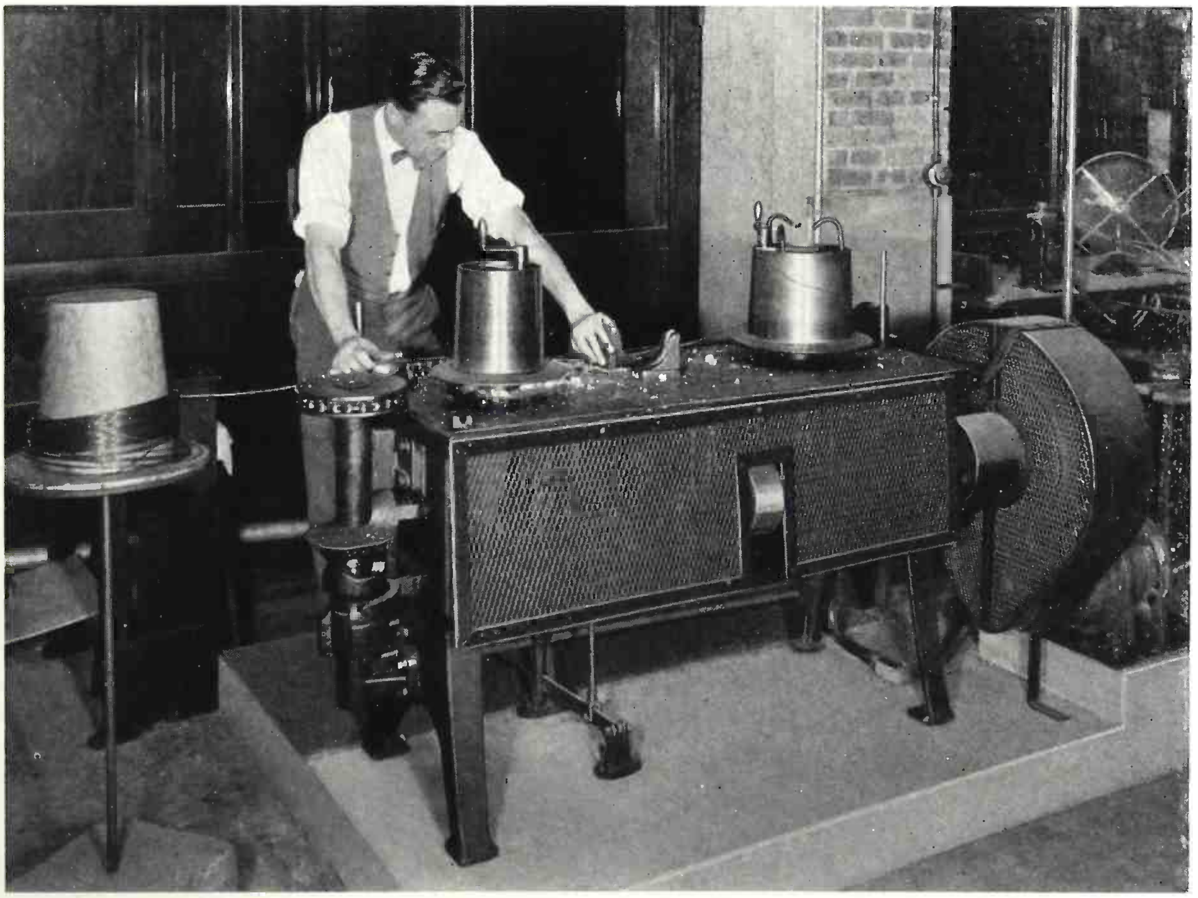


C. V. Wahl heat-treats duralumin diaphragms

ingot, properly embrittled, is hot-rolled to develop the proper grain-structure and is then reduced to powder in ball-mills.

Aluminum alloys are of importance in the communication art; their combination of strength and lightness makes them well suited as diaphragm material. Sheets of these alloys are rolled out to thicknesses as small as three thousandths of an inch. Lead alloys suitable for cable sheathing also have their share of attention; after melting, to insure proper alloying the metal is cast into slugs and extruded by a thousand-ton lead press into the form of samples for further tests of strength, fatigue, resistance and corrodibility and the study of changes of these properties with time.

Since the metal working laboratory is used only for experimental purposes variety is the keynote of the alloys produced as well as of the equipment used. In the permalloy group alone there is an indefinite number of proportions in which the iron and nickel may be mixed which results in products of different magnetic qualities. Sometimes other metals are also added in small quantities to give some particular characteristic. The same is true of the aluminum and other alloys that are handled in the base metal laboratory. The expeditious production of varied forms of metal with a minimum loss of material is dependent no less on the skill and experience of the chemists and metallurgists engaged in the work than on the completeness of the equipment.



The wire-drawing bench is one of the oldest of metal-working machines. Its modern counterpart in our Laboratories is operated by D. Wallace

Echo Elimination in Transatlantic Service

By G. C. CRAWFORD
Systems Development Department

STAND a thousand feet from a cliff and shout toward it. About two seconds later your voice, having travelled to the cliff and bounced back, will return to you. This phenomenon, called an echo, may occur also on telephone circuits when the electric current meets any sudden change in circuit conditions, such as a change from open wire to cable. Under these conditions, part of the current is reflected from the point where the change occurs and returns back over the circuit to its source where it reproduces, with reduced volume, the sound sent out. A telephone echo, however, is not always caused by a reflection. Anything allowing a portion of the current to return to its source will produce the same effect.

The seriousness of an echo depends not only on its volume but on the time interval by which it follows the original sound. Just as the echo present in a small room is not troublesome, so the echo on relatively short telephone lines is not noticed by the user. In these cases, the echo occurs practically simultaneously with the original sound. But in loaded cables the time of transmission is much increased, and the longer distances over which such cable is now used are sufficiently great to cause trouble from this source. One of the most serious forms of echo develops on four-wire cable circuits. It is caused by an inequality of impedances of two-wire circuit and network associated with each hybrid coil so that part of the current is allowed to return to its source.

The four-wire circuit shown in Figure 1 illustrates a typical set of circumstances. Assume this represents a cable circuit from New York to Chicago. The little squares marked

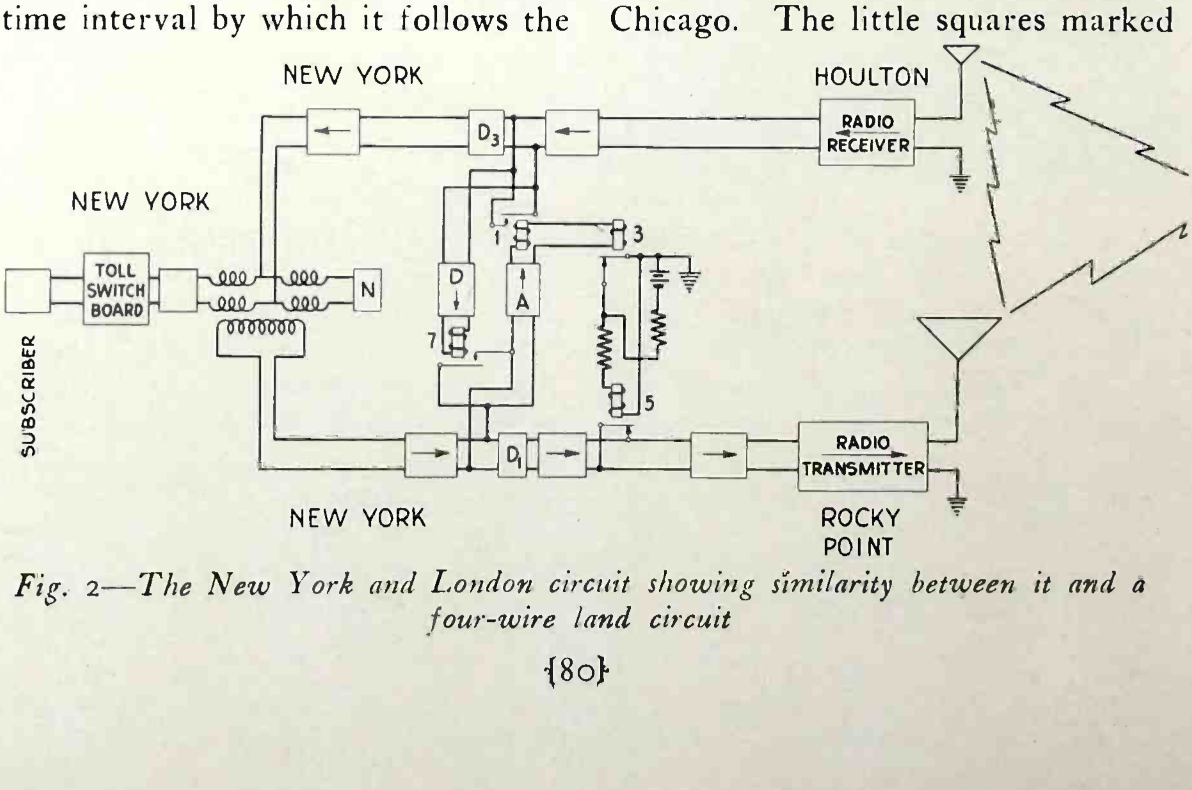


Fig. 2—The New York and London circuit showing similarity between it and a four-wire land circuit

with an arrow are repeaters and those enclosing an "N" are the balancing networks. The voice current leaving New York passes through the hybrid coil and continues by the lower path toward Chicago where it arrives about five hundredths of a second later at the central point of the hybrid coil. If the balancing network at Chicago were a true equivalent of the local circuit, the arriving current would split in two, half going to the network and half to the receiving station. As the currents in the balanced windings are equal but opposite in direction there would be no resulting induced current in the upper path.

If the network is not an exact balance, however, and it never can be made so practically, there is an inequality in the current in the two branches which will induce a current in the upper circuit. This current will return to New York which it reaches in another five hundredths of a second, or one tenth of a second after it left. The result will be an echo in New York. Due to the unbalance at New York this first echo will induce a current in the output circuit of its hybrid coil which will travel back to Chicago, producing another echo there. If the gain in the repeaters were sufficiently great—greater than the loss in the hybrid coils and the line—this circulating echo would continue indefinitely, producing singing and making conversation impossible. In general, telephone circuits are so adjusted that the size of the echo is well below a value that could possibly cause singing.

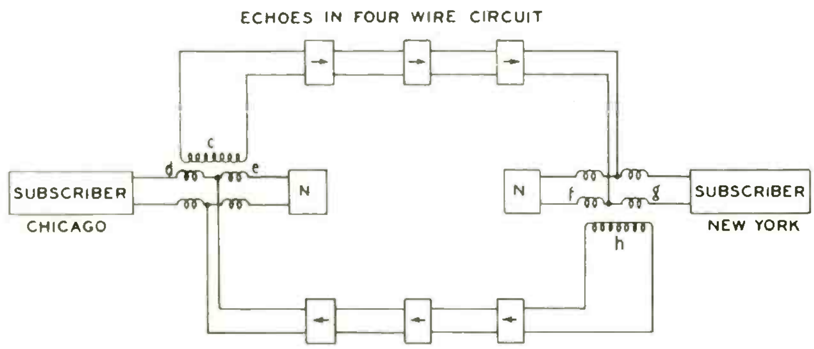


Fig. 1—Diagrammatic representation of four-wire circuit between New York and Chicago

The transatlantic service is essen-

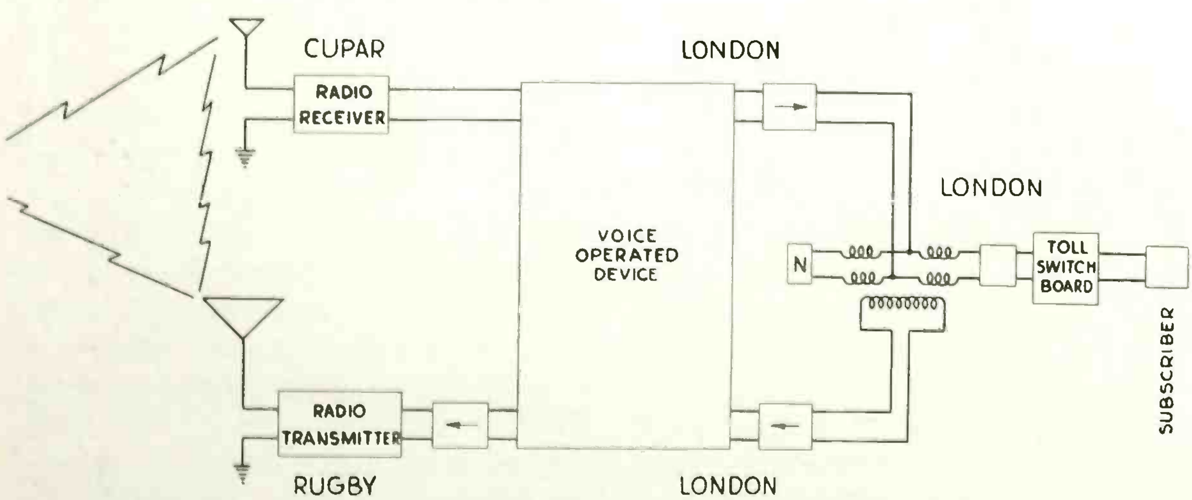


Fig. 2—The New York and London circuit showing similarity between it and a four-wire land circuit

tially a four-wire circuit; the east bound side running by wire from New York to Rocky Point, thence by radio

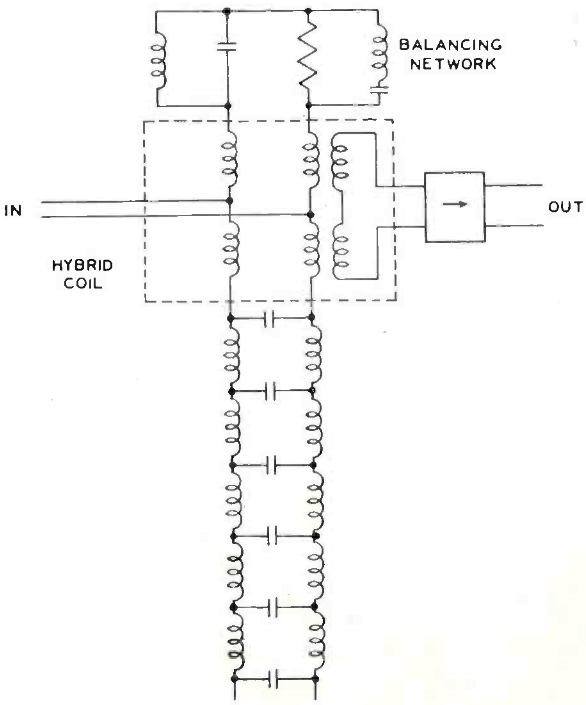


Fig. 3—Schematic representation of the delay circuit used with the voice operated relays

to Cupar and from there to London by wire, while the west bound side runs similarly from London to Rugby, to Houlton and to New York. Due to this it is subject to the same echoing that may disturb any four-wire circuit. Because both Rocky Point and Rugby transmit at the same wave length, however, a condition exists which in a sense reunites the two paths for the length of the radio circuit. In a normal four-wire channel the circuits in each direction are physically separate so that leakage can not occur from one to the other, while in the transatlantic this separation breaks down over the radio path. The speech waves outward bound from Rocky Point will be picked up by Houlton and from there will be returned to New York as an echo.

Due to the large power of the transmitter necessary to work across the Atlantic, and to the high gain in the receiving circuit, not only echoes but singing might occur around the local circuit—New York, Rocky Point, Houlton, and New York—if positive measures were not taken to avoid it. For this purpose voice operated relays are installed at New York which exercise such control over the transmitting and the receiving circuit that they can not both function at the same time. Voice operated devices accomplishing a similar function are used at the English end of the circuit.

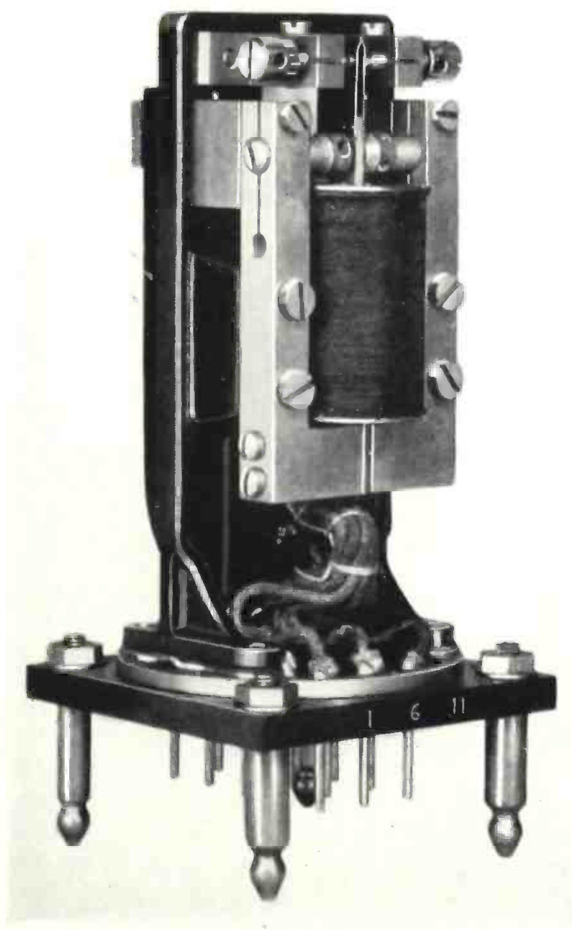
The method of operation of these devices at New York may be followed in Figure 2. A small portion of the voice current, outward bound from the hybrid coil at New York, is picked up by an amplifier-detector A. The amplified and rectified voice current leaving the amplifier-detector operates the relays 1 and 3. Relay 3 in turn operates relay 5, which removes the short circuit that is normally across the outgoing circuit. Relay 1 shorts the incoming circuit to prevent all echo and singing effects.

There are complicating features however. No mechanical relay can operate instantly. From six to ten thousandths of a second is consumed by the operation of the relays used with this apparatus. Also, which is of even more importance, the voice sounds require an appreciable time to build up to the value required to operate the relays. Due to this, relay 5 would remain closed for a short time after the conversation had started causing the first part of each outgoing sound to be absorbed. To avoid such a thing a delay network—D_1—is inserted to retard the voice current about twenty-two thousandths of a second. This gives relay 5 ample time to operate.

When transmission is in the opposite direction the incoming message, through an amplifying detecting device D, operates relay 7, thereby short-circuiting the outgoing circuit. This is done to prevent the incoming current passing through the hybrid coil and operating the amplifier-detector A in the outgoing circuit which would operate relay 1, short-circuiting the incoming speech. To prevent such an occurrence before relay 7 has had time to operate, a delay network—D_3—has been inserted which holds up the voice for eleven thousandths of a second. This is sufficient time to allow relay 7 to operate, making any such action impossible.

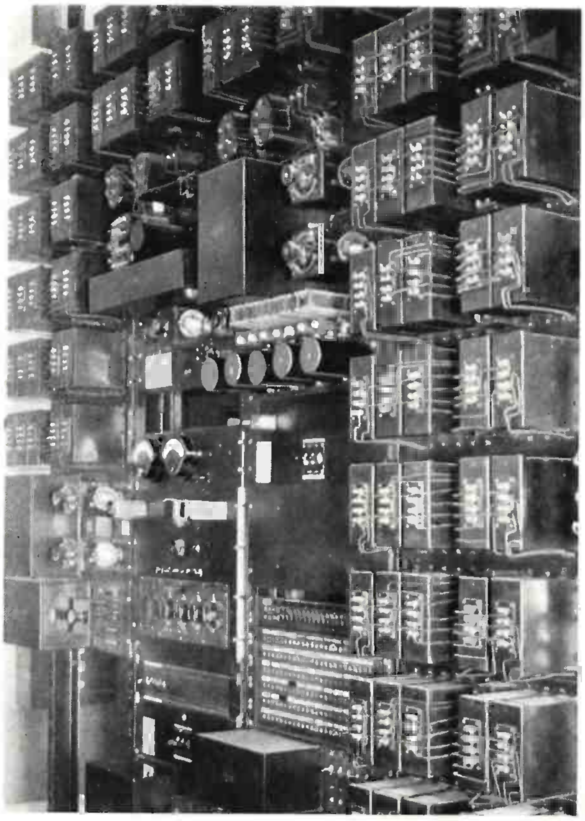
Still other refinements are necessary. After the voice current terminating a phrase in New York passes the point where the amplifier-detector is connected, the current holding relay 3 open will stop flowing. The circuit would therefore be shorted before the speech, held up by the delay circuit D_1, was ended. This condition is aggravated by the slow dying down of the voice currents toward the end of a sound. Their value drops below the amount necessary to hold relay 3 open an appreciable time before the sound is actually completed. To avoid such chopping off of syllables a time-delay is incorporated in relay 5 which holds it open long enough for all voice currents to pass through the delay circuit D_1, to the point where the contacts of relay 5 are located. This is obtained by a circuit, not shown on the diagram, which allows a condenser to be charged through the winding of relay 5, holding it open for a short time after relay 3 has closed. The charging takes place through a resistance and the time required is sufficient to allow the voice currents to pass through the delay circuit.

The echoing, which may be so detrimental to telephone conversations and has made necessary the use of these voice operated relays, is employed to good advantage in the delay networks used in conjunction with them. As has been mentioned before the harmful effect of the echo is due to the time required for the electric



Sensitive relay used for echo elimination on the transatlantic service

current to pass through the circuits. The velocity of a current in an open wire circuit with little inductance or capacity is high, approximating that of light, but in loaded cable circuits



Panels mounting the delay circuits and voice operated relays. The five cylindrical covers in the center of the picture enclose the relays while the sections of the delay circuits are in the rectangular boxes mounted all around them

is much less; the more inductance and capacitance the lower the velocity. The delay circuits are thus made up of sections of reactance and capacitance. To get the required delay of twenty-two thousandths of a second, it was found that 288 sections would be required. This was cut in half by taking advantage of the echo effect. The input to the delay circuit is connected to the central points of a hybrid coil as shown in Figure 3. The current here divides, half being absorbed in the balancing network while half goes into the 144 sections of artificial line. This is open circuited at the end causing the current to be reflected or echoed back. In returning it passes again through the 144 sections of line and through the hybrid coil in such a way as to induce a current in the output circuit. This is amplified and continues as the delayed speech.

Echoes have their advantages, therefore, as well as their disadvantages. True engineering lies in taking advantage of their good points and suppressing their bad. The delay circuits and voice operated relays show how effectively this is done on the transatlantic circuit.

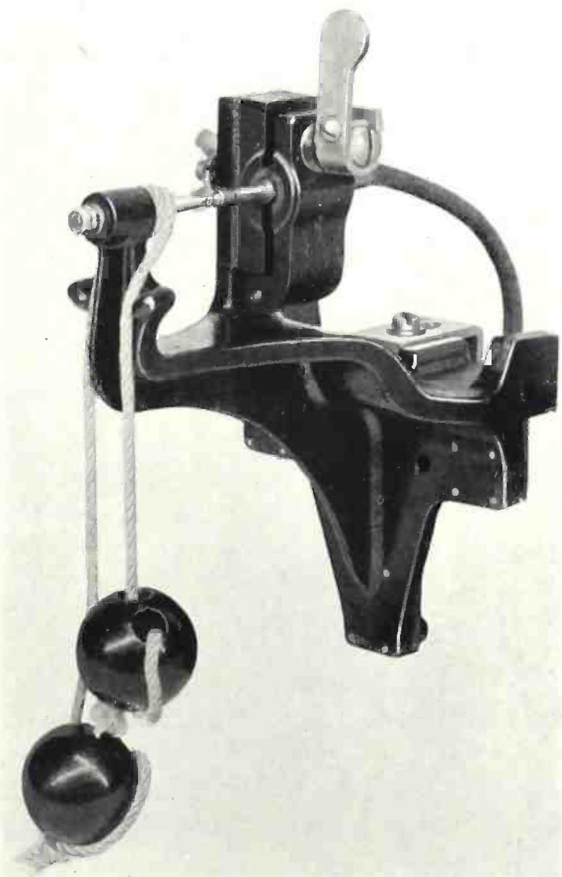
Polishing the Contacts of Telephone Plugs

By W. J. ADOLPH
Apparatus Development Department

FROM extensive handling the contact surfaces of switchboard plugs gradually become covered with a thin film of dirt and grease, which if neglected might prevent satisfactory electrical contact. Accordingly, the plugs are cleaned at regular intervals to prevent circuit noise and to keep transmission at a high level. A portable buffing wheel driven by an electric motor has long been used, taken in turn to the various switchboard positions. While this method is rapid, and on most of the contact surface quite effective, it has one serious limitation. The tip and ring contacts are lower than the sleeve and the dead-collar; to reach the depressed surfaces, the upstanding ones get rather more than their share of rubbing. It seemed that more thorough cleaning and appreciably longer plug life might be secured by a change in method.

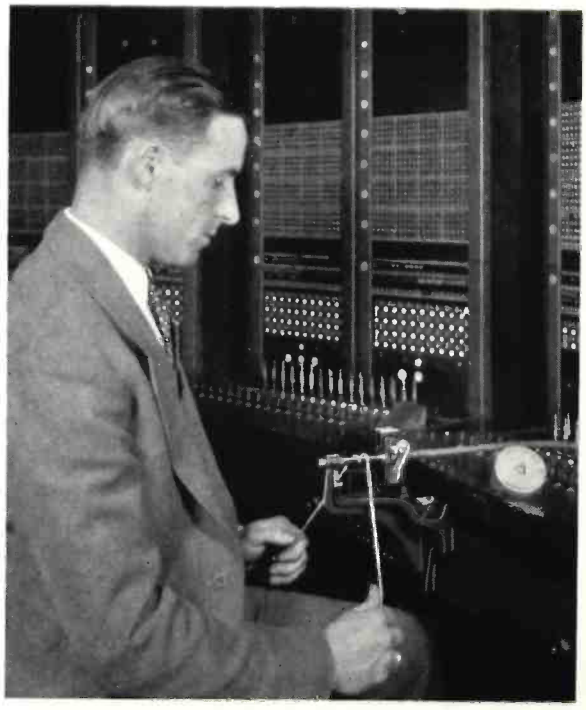
First was tried replacement of the buffing wheel by a rotating wire brush. But the contact surfaces, although they looked quite clean, were shown by noise and transmission tests to be worse after cleaning than before — the metal brush had not rubbed the dirty film away, but merely burnished it onto the surface. Further tests showed that best results were obtained when the plugs were rubbed slowly, with comparatively heavy pressure, and when a fine-gained polishing paste was used.

Based on these experiments a simple cleaning procedure has been adopted, using as a medium a short length of braided cotton cord coated at one end with polishing paste. The cord is looped around a plug and pulled back and forth, rubbing all the way around; first the coated end is used, to scour away the dirt, and then the comparatively dry, dirty powder is rubbed away with the other end of the cord, or with a rag. Rubbing speed and pressure naturally applied



Polisher with plug inserted, ready for use by a user are in the proper range for best results. Even the groove in the tip is cleaned thoroughly, since the cord, on account of its small diameter and yielding nature, can rub against sides and bottom.

The holding fixture, a casting, slips over the lockrail and under the keyshelf, where on account of its shape it stays without clamping. At the back is a leather-lined chuck for grasping the plug shell; and at the front, facing it, is a centering pin. The plug is pushed forward through the chuck until its tip is stopped by a cup-like depression in the end of the centering pin; then the chuck is closed. Support of the tip in this fashion braces the contact members, protecting them from bending in case of too vigorous rubbing; the pin also holds the loop of cordage between operations and prevents interruptions to cleaning by slipping of the cord over the end of the plug.



Frank Lohmeyer demonstrates the polisher, in whose development he had a considerable part

Simplicity and convenience are two advantages of this method. Needless wear of plugs is avoided, and there is less chance of harming their insulation. Most important of all, the contact surfaces are thoroughly cleaned and so kept fit for their essential duty in establishing telephone connections.

Radio Conference Delegates Visit the Laboratories

THE delegates to the International Radiotelegraph Conference which has been meeting at Washington since October 4, about three hundred in number, visited the Laboratories on the afternoon of October 31, and in the evening attended a demonstration of several recent developments held in the auditorium. Representing more than fifty nations and forty-one companies engaged in communication by radiotelegraph, the members met at the invitation of the United States Government to bring up to date international treaty agreements on radio communications, which at present are in accordance with treaties signed on July 5, 1912, at the International Radiotelegraph Convention held in London. According to Secretary Hoover, elected President of the Conference at the opening meeting, the fundamental purposes "are to arrive at such modifications as may be necessary in existing international treaties as will promote the wider use, reduce the conflicts, and stimulate the further progress of radio in international communications."

After having spent the morning in inspection of operating and test rooms of the Long Lines Department in the Walker-Lispenard Building and of a panel-type dial system office of the New York Telephone Company at the same location, the party went to the New York Telephone Company's building at 140 West Street. There, at a luncheon, the delegates were welcomed on behalf of the Bell System by Mr. Gifford; before and after luncheon they visited several of the distinctive parts of the building.

Then the party came to the Laboratories, where it was divided into groups of ten for a systematic inspection of activities and equipment in the building. The groups started at different points, but all covered the same ground as far as time permitted. To expedite the visit and to prevent confusion, each laboratory and room to be visited was provided with large descriptive placards in French, the official language of the Conference, and also in English. In addition the work being conducted in the various rooms was described briefly by the guides. Due to the efficient manner in which the tours were organized, practically every part of our Laboratories was seen by the delegates, and many expressed surprise at the great diversity in the lines of investigation that compose the development program of the Bell System.

After their rapid but extensive inspection trip the delegates left at the end of the afternoon, to be guests of the American Telephone and Telegraph Company at an informal dinner at the Waldorf Astoria.

From there they returned to the Laboratories at 8:30 to witness the demonstrations in the auditorium. As the guests assembled music was provided by a phonograph connected to a public address system. Then came a short program of motion-pictures synchronized with sound. Immediately following, Dr. Jewett spoke to the delegates briefly, welcoming them from the standpoint of their scientific interests.

At the end of Dr. Jewett's talk H. E. Ives gave a short talk on the principles and apparatus of television. Sending and receiving apparatus had been set up, and were thereupon put into operation. There was no outside connection, but pictures were sent from the transmitting apparatus and were reproduced, both enlarged and reduced in size, by the two sets of receiving apparatus.

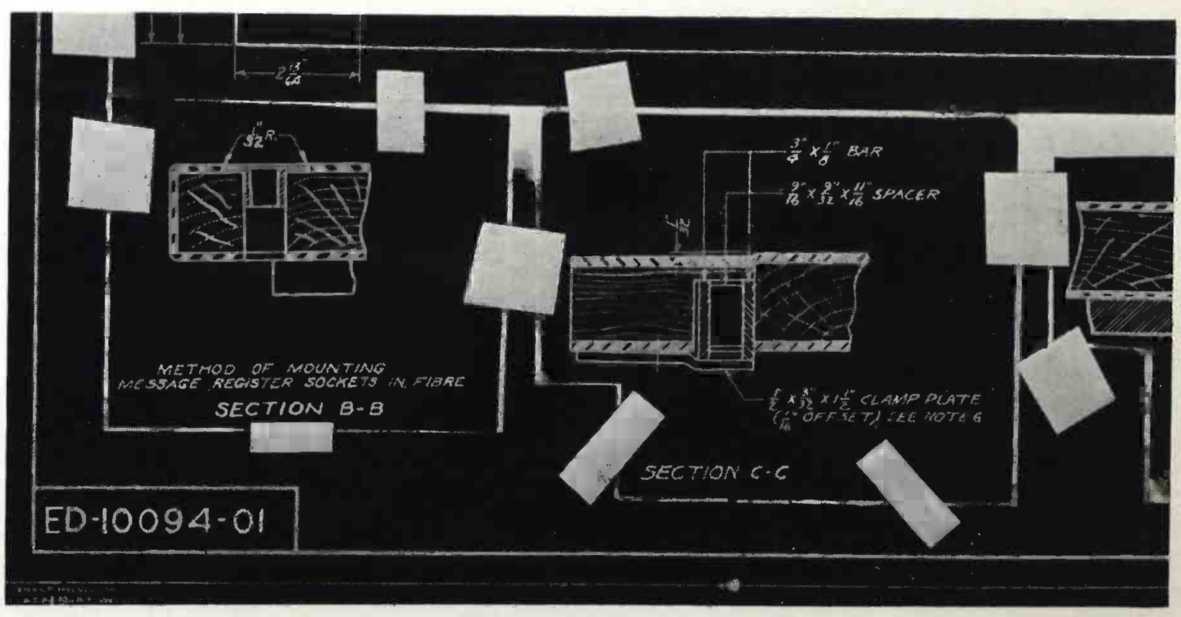
During the television demonstration, connection was made by transatlantic telephone with the London office of the American Telephone and Telegraph Company so that the delegates could converse with guests whom Mr. Shreeve and his associates had invited. There were provided in addition about a dozen receivers, giving an opportunity for more extended listening than any person could make while he was talking over the circuit. Interest in the transatlantic conversations, so directly in line with the interests and scope of the Conference, was enhanced by the morning visit to the Walker-Lispenard Building, where representatives had seen the handling of transatlantic calls by traffic and technical operators.

Saving the Tracing in the Systems Drafting Group

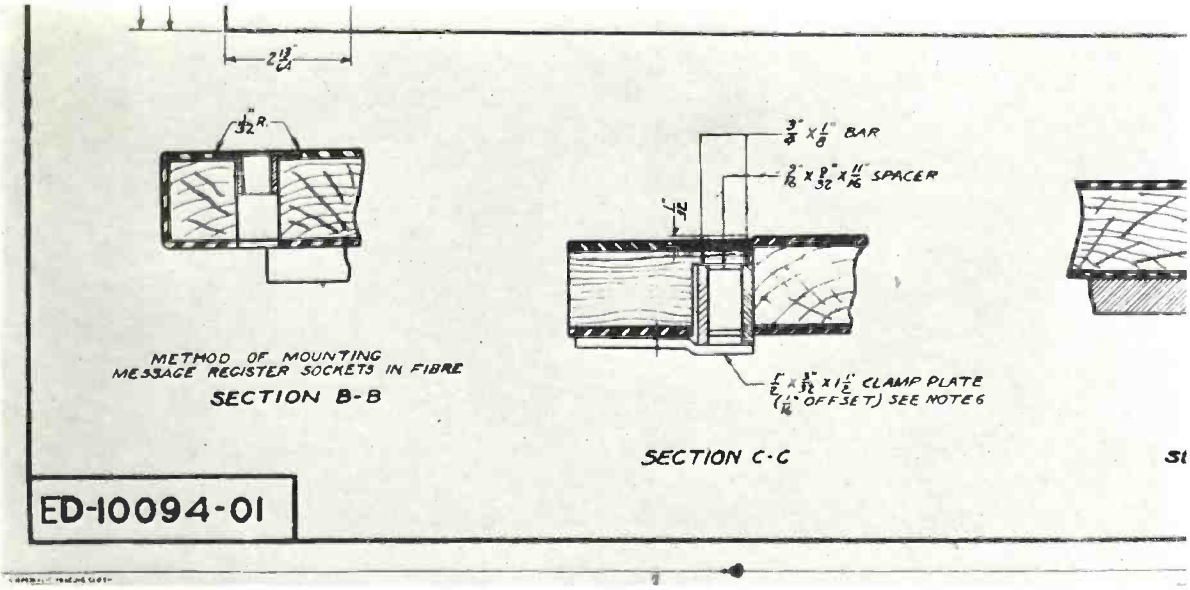
By W. L. HEARD
Systems Development Department

PARADOXICAL as it may sound, most of the tracings used in the Bell System are not tracings. Underlying this anomaly is the fact that usually tracings are very costly things, particularly those of some of the extremely complicated circuit drawings. A single tracing may be valued at as much as four or five hundred dollars. Because of this high cost every effort has been made both to utilize substitutes for the purpose of making blueprints, and to find more economical means of reproducing or making new tracings as they are required. Thus many of those used, instead of being actually hand drawn, are reproduced or built up from the original ones by inexpensive methods.

As a result of this policy, very few prints are made from hand-made tracings. The heating that a tracing undergoes in passing through the blueprint machine dries it and ultimately cracks appear. When a new tracing has been finally approved, a number of vandykes are immediately made from it. These are brown prints on translucent paper which may be used as negatives for blueprinting purposes. Prints made from vandykes have blue lines on a white background and are easy to follow.



Preliminary step in the reproduction of a tracing. Sections of vandykes of different drawings are pasted together in the proper relative positions before being placed on the gelatin



Section of final reproduced tracing made up as shown on the opposite page

Some of the vandykes are left in the vault to be used for making prints and others are sent out to Hawthorne or wherever prints of the drawings will be required. Another advantage of this system is that prints may be made while the original tracing is being changed.

"Prevent deterioration of the tracing," is a guiding imperative of the Systems Drafting room. Not only are vandykes used for making all blueprints but the tracings themselves are handled by no one but the draftsman working on them. Engineers' approvals are obtained from blueprints, furnished specially for this purpose.

While the wear on tracings is considerably reduced by this use of the vandykes, still greater savings are made by the use of reproduced tracings which further cut down the number of hand-made drawings required. These are on regular tracing cloth and by the outsider could readily be mistaken for the more genuine article. Two commercial methods of reproduction, the "See Bee" and the "Litho Print," are used.

The "See Bee" is regular tracing cloth, one side of which has been covered with a sensitized coating which prints black when exposed to light. To make a reproduced tracing of this type, the sensitized cloth, in contact with a vandyke, is passed through the blueprint machine. The tracing is then developed which leaves black lines on the transparent background.

The "Litho Print" is made by a gelatin contact process on regular tracing cloth. A blueprint made from a vandyke is placed, before it is washed, on a special gelatin plate. The lines on the print, which have been exposed to light, etch into the gelatin. When the print is removed the gelatin is rubbed with a special ink which adheres only to the lines. The plate, being impressed on tracing-cloth, leaves an imprint which is equivalent to the original tracing.

One of the principal savings due to these methods of reproducing comes not from making duplicate tracings but from building up new ones from sections of other drawings with new material added. It may be necessary to make a number of minor changes or additions, such as adding coin-collecting features to standard circuit drawings. To make completely new tracings would be an enormous waste of time as perhaps on a large and intricate drawing only a few additional lines or notes need be supplied.

The method used is to cut from a vandyke of the existing drawing those parts that will be used on the new one. These may be rearranged if desired; and they are then placed on the gelatin in their proper position. From this a reproduced tracing is made which may then be finished by hand by the addition in ink of the necessary circuits or equipment. Also typewritten notes may, by a similar operation, be incorporated in the reproduced tracing serving to make it more applicable to the specific purpose for which it is to be used.

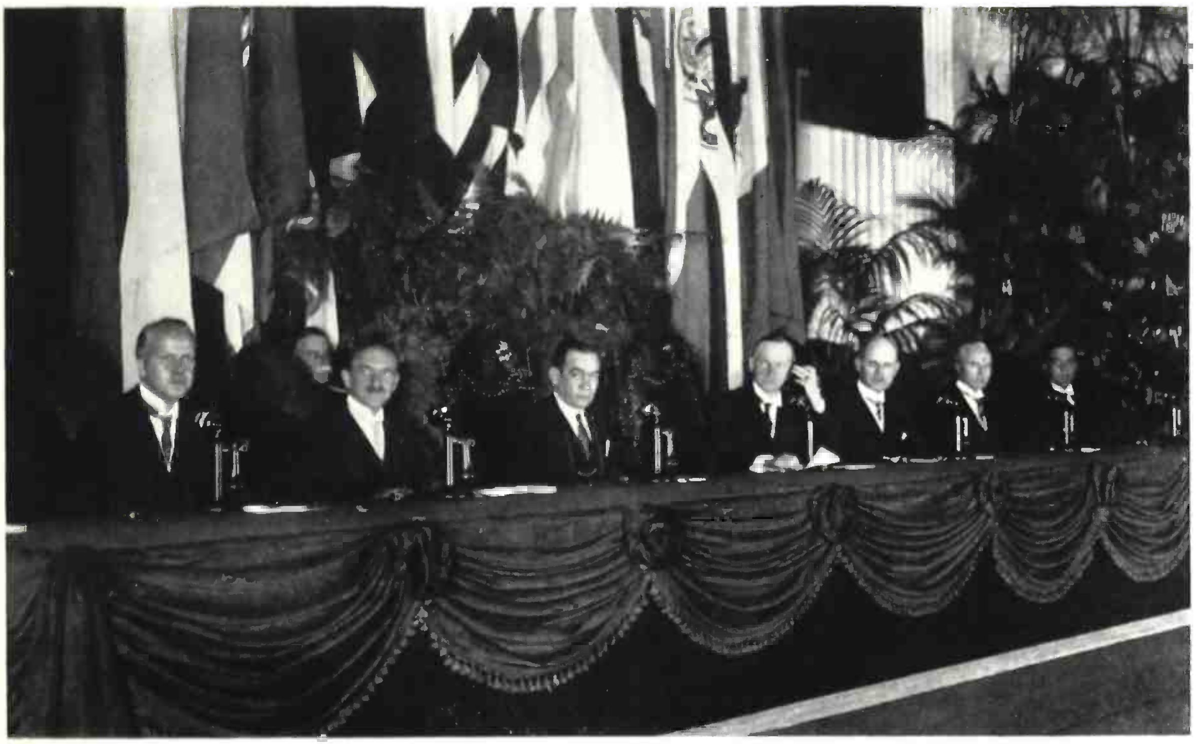
So flexible is the method that there is almost no end to its possible applications. Scarcely a drawing is made that will not have on it some circuits that have appeared on previous tracings. Whether they are drawn in anew or added by one of the reproduction methods is merely a question of balancing the time required to draw them against the small cost of the mechanical reproduction which for an entire drawing is only from eight to ten dollars. Some idea of the savings possible may be gained when it is realized that just the use of the vandykes and approval prints with Systems drawing is paying dividends of almost twenty thousand dollars a year due to the decreased wear on tracings.

Telephone Service Opened with Mexico

TELEPHONE service between the United States and Mexico was inaugurated on September twenty-ninth by distinguished gatherings in New York, Washington and Mexico City. Conversations were held between President Coolidge and President Calles, and between other prominent guests.

In the course of his comments, President Coolidge remarked: "Conspicuous among the accomplishments of the present age is the extraordinary development of means for facilitating communication between the nations of the world. . . . We owe a debt of gratitude to the engineering skill and public spirit on both sides of the boundary which has made possible the new link between Mexico and the United States."

More immediately applicable than he perhaps suspected, these remarks of President Coolidge were made of unique timeliness by the disastrous windstorm which centered its destruction in St. Louis a few hours before the scheduled conversation. During the preceding week men of the Long Lines Department and of associated companies had been busy day and night fitting together the various parts making up two lines between Washington and Mexico City. Because of its unusual importance, the opening had been doubly safe-



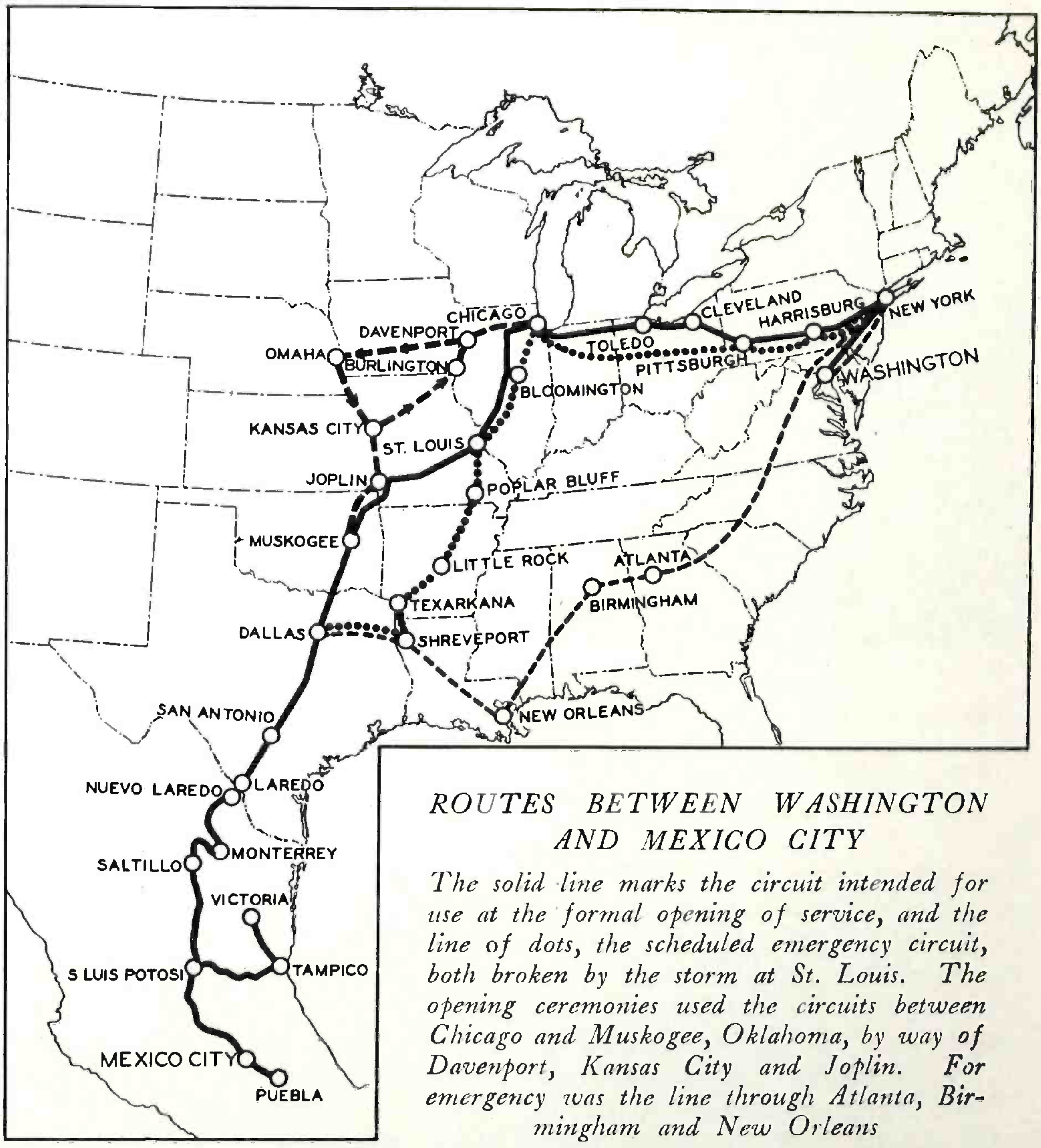
Guests of honor at the ceremonies in Washington: Mr. Gifford; Dr. L. S. Rowe, Director General of the Pan-American Union; Don Manuel C. Tellez, Ambassador from Mexico; President Coolidge; Wilbur J. Carr, Acting Secretary of State; Henry B. Orde, Vice-President International Tel. and Tel.; T. G. Miller, General Manager, Long Lines Department

guarded. Extra forces of linemen patrolled the lines at various points. Every man assigned to any part of the service in Washington, New York, Mexico City and the fifty repeater stations between knew his duties thoroughly. At the beginning of the afternoon, when the "dress rehearsal" took place, all parts worked perfectly, on the emergency circuit as well as on that scheduled for use. It seemed that everything was in readiness for service of the highest order from the start.

Then came a brief rest for lunch—and the St. Louis tornado! Both circuits were broken, and from news received by telegraph it was apparent that they could not be restored in time for the demonstration which was scheduled to take place within three and one half hours.

There was no time to be wasted. Within fifteen minutes other routes were being chosen, and plans for the emergency were being prepared. More than two hundred men leaped to the job of building up anew a regular circuit and an emergency circuit from Washington to Texas. Chicago was asked to get through to Muskogee, which was on the original route, via Kansas City; to New York was delegated the work of connecting a circuit through Washington to Atlanta, Birmingham, New Orleans, Alexandria and then to Shreeveport, where is was connected to the original emergency circuit.

Through this latter circuit was established at four o'clock the first contact with Mexico City following the break. Meanwhile the Chicago test room had succeeded in getting



ROUTES BETWEEN WASHINGTON AND MEXICO CITY

The solid line marks the circuit intended for use at the formal opening of service, and the line of dots, the scheduled emergency circuit, both broken by the storm at St. Louis. The opening ceremonies used the circuits between Chicago and Muskogee, Oklahoma, by way of Davenport, Kansas City and Joplin. For emergency was the line through Atlanta, Birmingham and New Orleans

a circuit—the one over which President Coolidge and President Calles spoke—through Davenport, Omaha, Kansas City and Joplin to Muskogee. Both circuits were ready by the hour announced for the demonstration. Since the great speed had prevented adequate testing of any of the circuits, two other routes were set up as an extra precaution, but were not needed.

" . . . extraordinary development of means for facilitating communication between the nations of the world. . . ."

The President indeed spoke for all who hear even in part the story of such a victory.

News of the Month

Charles G. DuBois has resigned from the Board of Directors of Bell Telephone Laboratories. In accepting his resignation as of September 30, the Board resolved " . . . that in accepting the resignation the board express to Mr. DuBois its deep feeling of regret at the loss to them and to the company of the wise counsel and advice of one who, as an organizer of the company and a director continuously from the beginning, had done so much to make Bell Telephone Laboratories, Incorporated, a success."

* * *

Mr. Jewett and Mr. Craft were present in Washington at the official opening of telephone service to Mexico on September 29.

* * *

S. P. Grace addressed the convention of the United States Independent Telephone Association on October 20 in Chicago, on some recent developments of the Laboratories. Assisted by V. A. Schlenker and L. W. Davee, he demonstrated how speech, made unintelligible by frequency-inversion, can be understood when a second inversion is made.

Research Department

E. M. Noll spent September 28 to 30 at Providence, Rhode Island, inspecting a compression testing machine for rubber, being built for the Laboratories by the Henry L. Scott Machine Company.

A. R. Kemp and C. S. Gordon were in Boston on September 22, visiting the Boston Woven Hose and Rubber Company and the Simplex Company in connection with work on friction tape and rubber covered wire.

J. W. Horton attended a special advisory committee on September 16 at Washington, D. C., the function of which was to prepare a report on Methods of Frequency Measurements for the International Radiotelegraph Conference.

W. Wilson, C. R. Englund, H. T. Friis, J. W. Horton and W. A. Marrison attended the meeting of the International Union of Scientific Radio Telegraphy (U.R.S.I.) held at the National Academy of Science Building at Washington, D. C., the week of October 10. J. W. Horton and W. A. Marrison presented a joint paper at the meeting on "Precision Determination of Frequency".

T. C. Fry attended a joint meeting of the American Mathematical Society, Mathematical Association of America and American Astronomical Society held in Madison, Wisconsin, September 6 to 9.

H. A. Frederick and D. G. Blattner made their regular bimonthly visit to the Victor Talking Machine Company at Camden, New Jersey, on September 22.

J. W. Horton and H. M. Stoller presented papers on television before a meeting of the Pittsburgh section of the A.I.E.E. held on October 11.

C. F. Keller visited Hawthorne the latter part of September in connection with the howler test set.

A. W. Hayes, J. T. L. Brown and H. C. Pauly recently visited Hawthorne, being interested in handsets, testing machines and deaf sets respectively.

W. G. BREIVOGEL recently visited the Western Electric distributing house shops in Boston and Philadelphia in connection with the handset job.

S. T. ACKER recently returned from a two weeks' stay at Hawthorne where he had investigated corrosion testing of duralumin for use in the stretched diaphragms of microphone transmitters.

F. F. FARNSWORTH and A. G. Russell went to Hawthorne on October 6, being interested in the gold plating of transmitter parts.

THE COLLOQUIUM resumed its meetings on October 10, when W. A. Shewhart spoke on "The Analysis of Small Numbers of Observation".

F. F. LUCAS returned to the Laboratories early in October, after having addressed the International Congress for Testing Materials on September 13, at Amsterdam, Holland. According to Iron Age, Mr. Lucas' paper on high-power metallography was "undoubtedly the most interesting paper of the Congress. . . . On all hands it was admitted that a new impetus will have been given to the study of metallography by the developments worked out by Mr. Lucas."

H. F. HOPKINS installed and operated an electric stethoscope connected to a public address system, used at a joint meeting of the Queensboro Tuberculosis and Health Association and the Medical Society of Queens, held September 27.

Apparatus Development Department

H. B. ARNOLD is at Camden, New Jersey, working with the Sub-Committee on Inductive Interference, Project No. 9 of the National Electric Light Association in a study of interference between power circuits and telephone lines at carrier frequencies. For this purpose special power and telephone circuits have been contructed.

Outside Plant Development Department

ON OCTOBER 10, L. V. Lodge was in Torrington, Connecticut, studying timber preservation problems.

C. D. HOCKER was in Key West, Florida, during October studying weathering of galvanized samples in connection with committee work of the American Society for Testing Materials.

W. H. S. YOURY and O. B. Cooke were in Asbury Park during October conducting tests on guy anchors.

DURING THE SECOND WEEK in October, C. S. Gordon was in Chicago for development work on drop wire attachments.

Systems Development Department

I. G. WILSON and E. VROOM visited Batavia, New York, to observe tests being made in connection with 21-A repeater development.

THE FIRST SHOP-MADE D-1 repeaters were tested at Hawthorne by A. C. Dickieson and F. H. Chase. K. M. Fetzer carried on several tests at Syracuse and Watertown on the D-1 carrier installation, which has been in service for several months.

A. E. BACHELET and R. A. LE CONTE visited the repeater stations at Pittsburgh, Bedford and Ligonier in connection with experiments which have been in progress between Pittsburgh and New York, directed toward use of cables for broadcasting circuits.

F. B. ANDERSON has been carrying on tests at Reading, Pennsylvania, on improved testing arrangements for repeater stations.

G. R. VERNON is making tests on the new two-hundred point line finders which are being installed in the new step-by-step office at Utica, New York.

P. T. SLATTERY visited Hartford, Connecticut, and Scranton, Pennsylvania, in connection with studies on step-by-step equipment.

W. J. LACERTE observed operation of the new cordless B switchboard at McKeesport, Pennsylvania.

J. R. STONE visited the General Electric Company's factory at Fort Wayne, Indiana.

G. C. CUMMINGS visited the new Cleveland toll office, to inspect several new features of the telegraph equipment. R. G. Koontz and G. A. Benson also visited the Cleveland office during the month.

ON ACCOUNT OF the large addition to be made to the Chicago toll office and changes in the present toll switchboard occasioned by change to the C. L. R. method of operation, J. W. Woodward went to Chicago for discussion of the project with the Telephone Company's engineers.

H. T. LANGABEER and V. T. CALLAHAN were at Buffalo, making tests on gas engines to be used for emergency power.

G. F. SCHULZE and E. H. SMITH spent a week at Hawthorne.

P. B. MURPHY, addressing the Men's Club of Nyack on September 26, described some developments of the Laboratories and presented the moving picture film, "The Magic of Communication".

INSPECTION ENGINEERING DEPARTMENT

DURING THE PAST MONTH, S. H. Anderson, W. A. Boyd, H. F. Kortheuer, W. C. Miller and A. Grendon were at Hawthorne for regular Inspection Survey Conferences.

D. A. QUARLES and S. H. Anderson were at the Fort Wayne factory of the General Electric Company during the week of September 19 for a Survey Conference on fractional horsepower motors.

ON OCTOBER 10, W. C. Miller and A. Grendon visited the factory of the Morkrum-Kleinschmidt Corporation in Chicago.

DURING THE WEEK of September 19, R. B. Miller was in Philadelphia in connection with the trial of a sampling plan for use in the inspection of newly installed central office equipment.

J. M. SCHAEFER, Local Field Engineer at Omaha, visited Helena, Montana, and Denver, Colorado, recently in connection with regular field work in his Territory.

PATENT

G. M. CAMPBELL, J. A. Hall, M. R. McKenney, G. T. Morris, G. H. Stevenson and W. B. Wells visited Washington during September and the early part of October in connection with the prosecution of applications for patents.

DURING JUNE, JULY, AUGUST and SEPTEMBER patents were issued to the following members of the Laboratories staff:

J. H. Bell	R. E. Coram
A. S. Bertels	L. T. Cox
N. Blount	S. T. Curran
H. Boving	A. M. Curtis (5)
J. T. L. Brown	G. W. Elmen
W. W. Carpenter	J. F. Farrington
E. H. Clark	J. G. Ferguson

C. B. Fowler (2)
J. C. Gabriel
J. O. Gargan (2)
E. W. Gent
F. H. Graham
A. Haddock (2)
A. E. Hague
L. N. Hampton (2)
R. V. L. Hartley (3)
H. C. Harrison (2)
R. A. Heising
E. E. Hinrichsen
C. D. Hocker (2)
J. W. Horton (5)
W. G. Houskeeper (5)
F. A. Hubbard (2)
H. E. Ives
H. B. Johnson (2)
J. B. Johnson
L. H. Johnson
W. C. Jones (2)
L. W. Kelsay
A. R. Kemp
W. C. Kiesel
G. R. Lum
R. C. Mathes (2)
E. C. Mueller (2)
W. A. Marrison
D. D. Miller
F. Mohr
E. L. Nelson
R. Nordenswan
E. L. Norton
H. W. O'Neill (2)
A. A. Oswald
L. F. Porter (2)
L. M. Potts
C. D. Richard
V. L. Ronci (3)
J. C. Schelleng (2)
T. E. Shea (2)
G. O. Smith
H. M. Stoller
H. S. Taylor
F. A. Voos
E. Vroom
G. P. Wennemer
E. C. Wente
E. B. Wheeler (2)
D. F. Whiting
W. Whitney
J. M. Wilson

General Staff Department

W. C. F. Farnell was a delegate of Edward J. Hall Chapter of the Telephone Pioneers of America at the annual Pioneers convention, held September 20 and 21 at Colorado Springs. Mr. Farnell went and returned on a special train carrying Pioneers from New York and New England.

A conference of those who represent the Bell System in its relations with educational institutions was held at Hawthorne September 22 to 30. From the Laboratories were G. B. Thomas, M. B. Long and John Mills. One session of the conference was addressed by President Jewett.

The electrical stethoscope was explained and demonstrated to the Flushing Forum on September 26 by Paul B. Findley of the Bureau of Publication.

Bell Laboratories Club

Golf

AFTER many rainy week-ends, the weather man presented our golfers with perfect weather for the tournament held at Salisbury Country Club on Saturdays, September 17 and 24. Sixty golfers teed off in the qualifying round of the Club's fifth tournament on the seventeenth, and turned in scores indicating that considerable time had been given to practice. Winners of the two prizes for low gross scores in the qualifying round were J. Hillier, 82, and O. Cesareo, 87; Mr. Hillier's score is the lowest at any of the Club tournaments. The two prizes for low net score were won by E. C. Mueller, 66, and E. Peterson, 67.

The thirty players qualifying for the finals were:

J. Hillier	J. C. Kennelty
E. H. Clark	J. B. Retallack
O. Cesareo	M. R. McKenney
H. W. Wood	A. F. Kane
S. J. Lambert	L. N. Hampton
R. J. Nossaman	J. V. Moran
N. H. Thorn	E. J. Canavan
A. L. Johnsrud	W. H. Clarkson
G. W. Haglund	W. F. Johnson
L. G. Hoyt	H. L. Downing
G. E. Kellogg	G. H. Heydt
A. A. Reading	C. H. Achenbach
E. C. Mueller	A. F. Price
E. Peterson	D. A. Quarles
W. H. Harvey	A. W. Lawrence

All those who qualified participated in the finals, and in addition some of the other golfers played September 24. Scores were exceptionally good. The players had been divided into two classes on the basis of their scores in the qualifying round; four prizes were awarded in each group, and in addition a prize was given to the player with low gross score for 36 holes. The winners were as follows:

Class A

Low Gross Score—H. W. Wood	84
Low Net Score—R. J. Nossaman	69
Second Low Net Score—G. W. Haglund	73
Third Low Net Score—A. A. Reading	73

Class B

Low Gross Score—A. W. Lawrence	92
Low Net Score—W. H. Harvey	69
Second Low Net Score—J. V. Moran	69
Third Low Net Score—J. C. Kennelty	70
Low Net Score for 36 Holes—E. C. Mueller	139

Bowling

The Bowling League opened the 1927-28 season on Friday evening, September 30, at Dwyer's Bowling Alleys, 1680 Broadway. The Bowling Committee received entries from one hundred and fifty men wishing to bowl as regulars, and to accomodate such a large number organized an additional group, D. The Club will use twenty-eight alleys each week, for a twenty-eight week season.

In addition names of about a hundred men were received who wished to bowl as substitutes. The substitute Committee is always glad to hear from men who desire to bowl irregularly. Such men may have their names placed on the substitute list by communicating with C. W. Lowe, Chairman of the Substitute Committee.

All league games will start promptly at 5:45. The charge for each evening's bowling is one dollar and ten cents per man.

Hiking

The Hiking Club's November schedule appears on the following pages. Those interested can obtain further information from Phyllis Barton.

Bell Laboratories Club

Tuesday, 1: *Basketball, Men, Labor Temple, 5:30 p.m.*
Symphony Orchestra Rehearsal, Auditorium, 6 p.m.
Women's Bridge Club, Rest Room, 5:15 p.m.

Wednesday, 2: *Women's Swimming Class, Carroll Club, 5:30 p.m.*

Thursday, 3: *Basketball, Men, Labor Temple, 5:30 p.m.*

Friday, 4: *Bowling League, Dwyers Manhattan Alleys, 5:45 p.m.*
Athletic Dancing Class, Women, Louis Vecchio's Studio, 5:30 p.m.

Saturday, 5: *Horseback Riding, Unity Riding Academy*
Chess, Commercial Chess League Tournament

Monday, 7: *Men's Bridge Club, Room 273, 6 p.m.*
Basketball, Women, Manhattan Trade School, 5:30 p.m.
Women's Swimming Class, Carroll Club, 7 p.m.

Tuesday, 8: *Hike, Grassy Sprain Reservoir*

Wednesday, 9: *Women's Swimming Class, Carroll Club, 5:30 p.m.*
Basketball, Men, Bell System League Tournament Stuyvesant High School, 7:30 p.m. Dancing after the game.

Thursday, 10: *Basketball, Men, Labor Temple, 5:30 p.m.*

Friday, 11: *Bowling League, Dwyers Manhattan Alleys, 5:45 p.m.*
Athletic Dancing Class, Women, Louis Vecchio's Studio, 5:30 p.m.

Saturday, 12: *Horseback Riding, Unity Riding Academy*

Monday, 14: *Men's Bridge Club, Room 273, 6 p.m.*
Basketball, Women, Manhattan Trade School, 5:30 p.m.
Women's Swimming Class, Carroll Club, 7 p.m.
Basketball, Men, Bell System League Tournament, Stuyvesant High School, 8:30 p.m. Dancing after the game.

Tuesday, 15: *Basketball, Men, Labor Temple, 5:30 p.m.*
Symphony Orchestra Rehearsal, Auditorium, 6 p.m.
Women's Bridge Club, Rest Room, 5:15 p.m.

Calendar for November, 1927

WEDNESDAY, 16: *Women's Swimming Class, Carroll Club, 5:30 p.m.*

THURSDAY, 17: *Basketball, Men, Labor Temple, 5:30 p.m.*

FRIDAY, 18: *Bowling League, Dwyers Manhattan Alleys, 5:45 p.m.*
Athletic Dancing Class, Women, Louis Vecchio's Studio, 5:30 p.m.

SATURDAY, 19: *Hike, Hunter Island*
Riding, Unity Riding Academy
Chess, Commercial Chess League Tournament

MONDAY, 21: *Men's Bridge Club, Room, 273, 6 p.m.*
Basketball, Women, Manhattan Trade School, 5:30 p.m.
Women's Swimming Class, Carroll Club, 7 p.m.

TUESDAY, 22: *Basketball, Men, Labor Temple, 5:30 p.m.*
Symphony Orchestra Rehearsal, Auditorium, 5:35 p.m.
Women's Bridge Club, Rest Room, 5:15 p.m.

WEDNESDAY, 23: *Women's Swimming Class, Carroll Club, 5:30 p.m.*

FRIDAY, 25: *Bowling League, Dwyers Manhattan Alleys, 5:45 p.m.*
Athletic Dancing Class, Women, Louis Vecchio's Studio, 5:30 p.m.

SATURDAY, 26: *Riding, Unity Riding Academy*

SUNDAY, 27: *Hike, Midvale to Suffern*

MONDAY, 28: *Men's Bridge Club, Room 273, 6 p.m.*
Basketball, Men, Stuyvesant High School, 7:30 p.m.
Basketball, Women, Manhattan Trade School, 5:30 p.m.
Women's Swimming Class, Carroll Club, 7 p.m.

TUESDAY, 29: *Basketball, Men, Labor Temple, 5:30 p.m.*
Symphony Orchestra Rehearsal, Auditorium, 5:35 p.m.
Women's Bridge Club, Rest Room, 5:15 p.m.

WEDNESDAY, 30: *Women's Swimming Class, Carroll Club, 5:30 p.m.*

Tuesday, November eighth, election day, the group will walk from Van Cortlandt Park to Grassy Sprain Reservoir, a distance of eight miles over dirt roads.

Saturday, November nineteenth, they will start from the entrance to the new building and go to Hunter Island. This is to be a short hike, over trails and dirt roads, and leads to a very attractive spot.

Sunday, November twenty-seventh, the hike will be more strenuous. It will lead from Midvale to Suffern, over fourteen miles of trails and cross country roads in the Ramapo Mountains.

Glee Club

With a professional instructor and an interested crowd, there should be many enjoyable evenings at the new Glee Club. D. D. Haggerty and Ada Van Riper will be glad to give information to all who want it.

Photographic Contest

Now is a good time for camera users to busy themselves in preparation for this year's photographic contest, to be announced later.

Christmas Poster Contest

There is to be a contest this year open to everybody. Those gifted with the ability to design and make posters are asked to send in their entries by December first. All posters should be twelve by sixteen inches, in not more than three colors and with space left for a Christmas Greeting which will be inserted after the winning entry has been chosen. The posters will be judged by an impartial committee, and one or more of the best will be reproduced and displayed on the bulletin boards.

Men's Bridge Club

The men's bridge club held the first meeting on Monday evening, October 10 at 6 P. M., in Rooms 273 and 275. Its tournament will extend over a period of ten weeks with meetings every Monday evening at the same time and place. Each player taking part is charged fifty cents weekly. L. P. Collins, section 6D, extension 563, is always glad to welcome bridge players who wish to take part in the activities of the club.

Women's Club Activities

Swimming. Those near the pool of the Carroll Club any Monday or Wednesday night can tell from Miss Steil's whistle that the Laboratories Club Class has started. There are thirty-three in the Wednesday class and twenty-six on Monday. The potential swimmers are divided into groups according to ability, and receive instruction within the groups. Watching a first dive or a swimmer float across the pool for the first time brings as much of a thrill to observers as to the swimmer. Everyone is showing progress even at this early date under the new plan.

Dancing. Twenty-five members arrived at Mr. Vecchio's studio on October fourteenth for the year's first lesson of the dancing class. All were pleased to see that the studio is larger, and that indications pointed to most interesting work this year.

Basket-ball. There is not much news yet about the Women's Basket Ball Team, except that they are practicing for games later in the season.

Bridge. The first game of the season for women was played on Tuesday, October fourth, in the Rest Room, with twenty-four players present. Since then these bridge enthusiasts have been playing each Tuesday night. Katherine Munn will appreciate it if those wishing to play will let her know by Monday.