BELL LABORATORIES RECORD

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September 1926 to
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Bell Laboratories Record

Volume Three SEPTEMBER, 1926 Number One

Four Years' Progress in Radio Broadcasting

By NUGENT H. SLAUGHTER

THE advances in scientific knowledge and in the application of this knowledge to our every-day life have been so numerous and rapid of late that we are coming to accept as commonplace many achievements which are of profound importance to human progress. One of the most striking examples is furnished by the development of Radio Broadcasting, which four years ago was to most people a scientific curiosity, and today is an important element of home entertainment and education, ranking as a business well up among the major enterprises of the country.

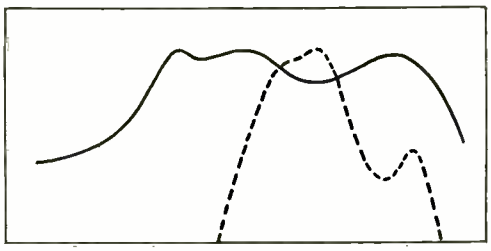
In the New York newspapers during 1922 there appeared schedules which look amusing in the light of the present situation. Ten stations in the New York area shared a single wave length, dividing the time among themselves. Certainly there has been progress in this respect.

Many of us recall the first long-distance remote-control broadcast event, the Chicago-Princeton football game in 1922, played at Chicago, and broadcast by WEAF. Today such use of telephone lines is a normal feature of operation of practically all high-grade stations.

The first broadcast transmitter to be sold by the Western Electric Company went into service for the Detroit *News* in January, 1922. The present total of one hundred and twenty-five stations of our design represents the bulk of the high-class broadcast stations of the country. The first installation was a 500-watt transmitter. More recent installations have included a 5000-watt transmitter with improvements in design, not only of the transmitter itself but especially of the associated equipment, which now provides much greater flexibility in use, better means of control and observation and a considerably better appearance.

The development that has taken place during the past few years in the various component parts of the complete broadcast system has resulted in an improvement nothing short of revolutionary in the overall performance. This improvement is in evidence to a greater or lesser extent to all broadcast listeners; and yet, such

are the failings of our powers of recollection that it seems well to make a direct graphical comparison between the old and the new. In 1923 (the earliest period for which

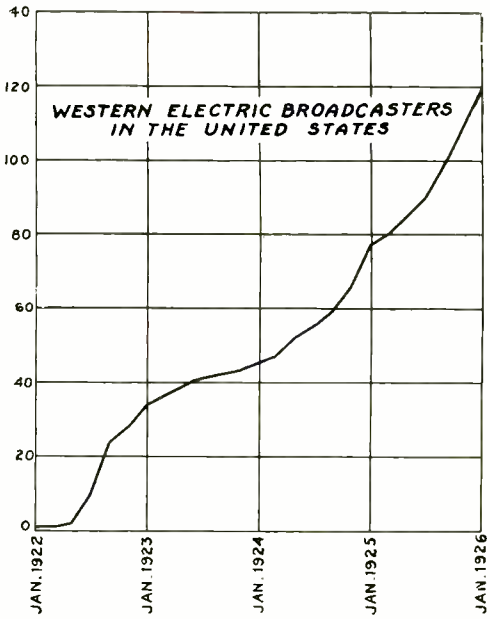


Transmission efficiency of radio transmitters: 1923 (dotted line) vs. 1926 (full line). Frequency, on the horizontal axis, is in logarithmic units

data is available) much less than three octaves of the musical scale were effectively transmitted and the result was considered highly satisfactory by most listeners. Today the range that is covered by the best type of equipment has been greatly extended.

Among the other changes for the better, none has been more important than the provision of higher power output from the receiving set. The operation of loud speakers from sets having output good only for head-set use resulted in overload distortion which completely overshadowed any frequency discrimination effects, serious as the latter were. Gradually, the public has learned that considerable power is required to produce volume without overload effects, so that today many are gradually renewing former social contacts that were rudely interrupted by "their" radio.

At the National Radio Conference in Washington in the fall of 1924, "Super-power" was a burning topic with more opponents than proponents. Inasmuch as "Super-power" in 1924 meant any power above 1000 watts, it is evident that the public has since then been educated as to the benefits of adequate power, because at the time of the National Radio Conference in 1925 transmitters of



5000-watt rating had come into use, and 50,000-watt transmitters were beginning to be used.

These accomplishments of the past four years, substantial though they are, serve chiefly to provide foundation for even more rapid development so that we may, in 1930, look back upon broadcasting of today as we now do upon that of four years ago.

Telegraphy by Typewriter

By FRED R. McMURRY

MOST telegraph messages are written out on a typewriter as received. If this typewriter can be operated by remote electrical control the sending operator will be saved the labor of learning and using the telegraph code, and the receiving operator can be replaced by anyone who can tear off paper.

The simplest means of operating a typewriter from a distant keyboard is a group of separate circuits, one for each typebar. Operating any key would then close a contact, and energize the proper magnet of the distant machine, pulling up an associated typebar against the platen and printing a character. An obvious objection to such an arrangement is the large number of wires that would be required between the keyboard on which the message is typed and the distant machine; the cost of the thirty or more circuits would be prohibitive, except for very short distances, in comparison with the Morse telegraph which requires but a single circuit.

Recalling that in the scheme just mentioned a signal would be a single pulse of current, and that each circuit would be idle most of the time, a solution suggests itself in the direction of sending all signals over a single circuit and guiding them into their individual channels at the receiving end by some identifying mark. (In carrier current transmission, such a "mark" is the frequency of each carrier). In printing telegraphy distinction lies in the particular sequence of current impulses and spaces; in other words, a code is used as in Morse telegraphy. In the Western Electric system, each signal is made up of five elements; as each element may be an electrical impulse or a space, a total of thirty-two signals are available.* Which signal is sent depends on the arrangement of projections from the lower side of the key bar. With that arrangement shown in Figure 1, the first, third and fifth selector bars are depressed and close contacts which send the sequence "impulse-space-impulse-space-impulse."

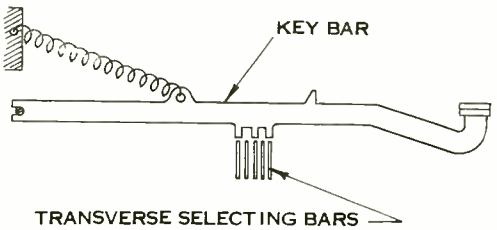


Fig. 1—Arrangement of key and selecting bars at sending end

To keep the wire working while the operator stops to pick up a new message or changes position, means are provided so that the operator can get ahead of the transmission. By throwing a switch, the keyboard will perforate a tape, which is then fed to a sending device. This operates at a uniform rate somewhat less than the maximum speed which a skilled operator can make for short periods.

** Two choices—impulse or space—are available for each of the five elements; hence the total number of different combinations is 2x2x2x2x2=32.*

Any lead of the operator over the sending device causes the tape to accumulate; while the operator stops, surplus is worked off. Where traffic is heavy, this method is an economy over direct sending, as it keeps the line and the receiving printer working without interruption.

In order that each signal may produce proper operation at the receiving end, each element must reach its appropriate magnet, and no other. Before the first element is transmitted, an impulse is sent which allows a brush to be driven over a commutator. After each revolution, the brush comes to rest in the same position; and during the single revolution required for each signal, its speed is such that it connects each of five magnets to the line at the right time to receive its appropriate impulse or space. These magnets in turn control the position of as many selecting bars, or vanes, extending across the front of the printer.

After the vanes have been set, twenty-six so-called "code-bars," each associated with a typebar, are moved toward the vanes. The projections cut in these code bars are all different; for any setting of the vanes, for example, 2 and 4 down, 1, 3 and 5 up, as shown in Figure 2, only one of the code bars can enter between the vanes, and thus be carried far enough forward to bring the striking surfaces into a position to be struck by the printing bail. The bail extends across the front of the printer, and by striking the link, rotates it and throws up the associated typebar, thus printing the letter.

Such functional, or "stunt," operations as paper feed and carriage return—five in all—are treated substantially as additional letters.

This system is known as the "start-stop" from the action of the brush. It is the one principally used on leased wires of the Bell System.* With the set shown in Figure 4, it is possible to use the printer to send and receive messages alternately over the same wire, making a home record of outgoing messages; or by addition of duplexing facilities to send and receive simultaneously.* A number of sets may receive the same message, as for example in the distribution of news to a number of newspapers.

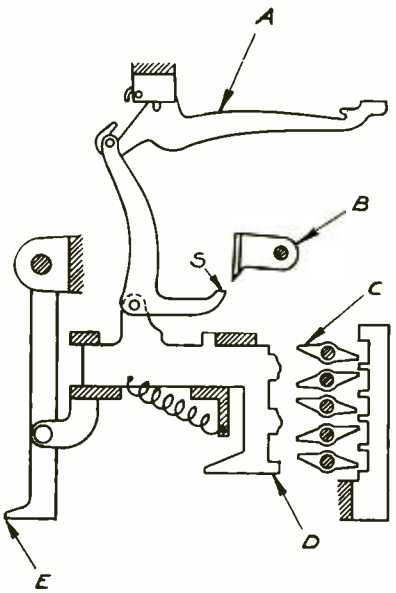


Fig. 2—Schematic diagram of selecting and printing system. A—typebar; B—printing bail; C—vanes; D—code bars; E—this point is driven to the right; S—striking surface

For conditions requiring the handling of a large amount of telegraph traffic over one wire another type of printing telegraph system, the multiplex, was also developed in our Laboratories. Many features of the two systems are the same, and in fact

* *For instance, between West Street and Hawthorne; see* BELL LABORATORIES RECORD, *May, 1926, page* 121.

identically the same printer unit may be used in start-stop and multiplex systems. The outstanding difference between the two systems, however, is in the method of "distributing" the impulses to and from the line. In the multiplex the brush rotates continuously while, as just stated, in the start-stop system it starts and stops for each character.

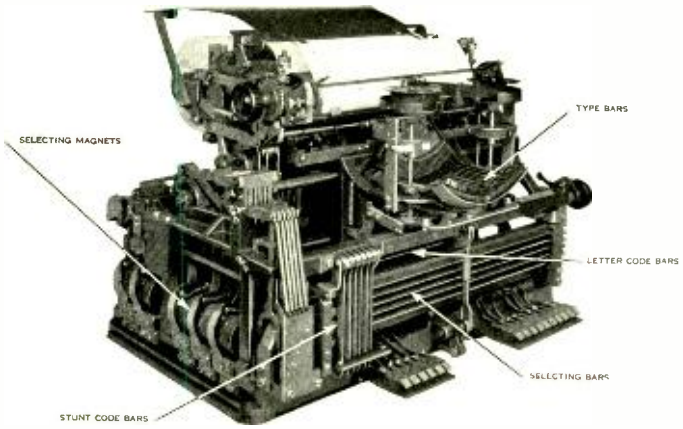


Fig. 3—The Western Electric No. 10-A Printer

In one variety of multiplex each commutator face is divided into quadrants, and each of these is associated with one of four sending (or receiving) equipments. Thus the printer associated with "A" quadrant at one end of the line is operated from signals received from sending apparatus connected to "A" quadrant at the other end of the line. While the brush is passing over "A" quadrant messages are thus transmitted over the line from and to the "A" apparatus. During the remaining three quarters of a revolution of the brush arm the signals which have been received from "A" quadrant are interpreted and printed, while the other sets are successively connected to the line for the transmission of signals. One line may thus be used to carry the signals from four sending equipments at one end, these signals being received and interpreted by four printers at the other end. By duplexing, four messages may be sent simultaneously in the opposite direction, or a total of eight messages over one wire.

Printing telegraphy has advantages for certain classes of communication service in that a permanent record is made of all messages received, and if desired, of all messages sent. Speed and economy in transmission are also obtained.

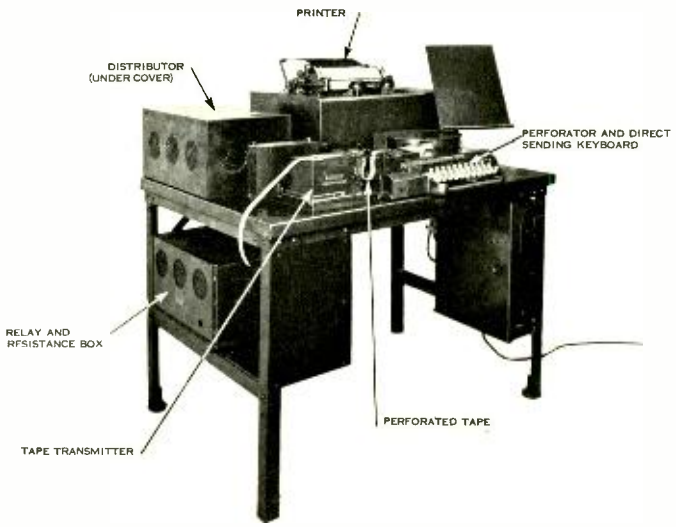


Fig. 4—A complete printer set for sending and receiving

Human Relations in Employment

By GEORGE B. THOMAS

RELATIONS which will exist between employer and employee depend upon the attitude or policy which each will adopt toward the other. Relations are mutual and each party to the business agreement of employment has responsibilities and duties to perform for the other. How fully these responsibilities are recognized and met depends upon the character and intelligence of the two parties. Common understandings, friendliness, and an ability to give sympathetic and unprejudiced consideration are necessary; and a spirit of justice must underlie and permeate all dealings.

Because the employer determines the nature of the business, its location, facilities for comfort and convenience, and other conditions of employment his responsibilities in these human and business relations cover a wider range than do those of the employee. His responsibilities are to each and every one of his employees. In addition to these he has related responsibilities to his customers and suppliers and to the general public and national welfare.

Although the principles underlying right relations with employees are the same for small and large businesses and the same for corporations as for individuals, private companies, and partnerships, there are certain differences in the methods which are due to differences in size and in organization. Increasing size of business and a larger number of employees bring new problems and increased responsibility to the employer. Organization as a corporation, introduces new situations as compared to the simpler form of employment by an individual; *but the corporation need not be less and may be more effectively human and consistent in its employee relations.*

A corporation is for legal and business purposes equivalent to an individual and it may and should have a definite policy of employee relations. A company policy usually differs from that of an individual in that it is arrived at not only by executive judgment but as the result of investigations and studies by experts in personnel relations who are organized in a department for such assistance to executives and supervisors. It should, therefore, be possible for the personnel policy of a company to be not only just as human, but also better informed than the policy of an individual employer. A company policy is also more likely to be consistent and not depend upon the whims or prejudices of an individual. It is established by employees in executive position who have traveled roads of advancement, which are open to the other employees, and have had experience in the work which they now direct.

A satisfactory policy in employee relations is always possible in any company where the executives are guided in their dealings by a spirit of justice and have grown up from the

ranks. Development of executives from the ranks not only insures that they are thoroughly familiar with the nature and demands of the work of their company but also means that they have had in their several positions the experiences of other employees and approach their executive tasks with sympathy and a knowledge of the employee's viewpoint. The establishment of right relations with employees, however, is dependent not only upon the attitude and experience of executives, but also upon each and every member of the intermediate executive staff and all the supervisors of a company. These other members must realize their responsibilities, for making the executive policies effective, and direct to that end everyday relationships with every employee.

To a new employee "The Company" is represented by the personnel department through whom he has been introduced, and by the supervisor to whom he directly reports. While the personnel department has, in its careful selection for employment, its method of introduction, and it follow-up of the progress of each employee, a very considerable responsibility, final and definite responsibility rests upon each supervisor to interpret, by his or her actions and attitude of mind towards every employee, the policy of the company. Consistency in the interpretation of the policy and uniformity in action on the part of supervisors are possible only when each supervisor is himself well informed and thoroughly in sympathy with the company's policy and makes adequate use of the information and advice which the personnel department may supply.

When each supervisor does his part in maintaining satisfactory relations, each employee has the right evidence of the company's policy. Unless each employee has the conviction that the policies of the company are based upon a spirit of justice such right relations are impossible and one of the fundamental elements of the success of the company and the progress of the employee is lost.

In a large and old company like the Western Electric Company the policy, which is followed to maintain right relations with employees, is the result of a process of evolution to which all the former executives have contributed, with thousands of other employees who have had the company's best interests at heart. Usually a company's policy is fairly generally recognized although it is not stated. From time to time, however, for the guidance of the constantly enlarging supervisory group, it may be desirable to make a statement of the policy in words. Such was felt to be the case early in 1924, while our Bell Laboratories were still a part of the Western Electric organization; and a statement of Western Electric policy was printed and distributed to its supervisory force. The policy then stated was and remains the policy of the Laboratories.

The statement affirmed the policy of paying every member of the organization adequately for service rendered, of maintaining reasonable hours of work and safe working conditions, and of favoring continuous employment. It promised that effort would be made to place each member of the organization in the kind of work best suited to his abilities and, by training, educational opportunities and advice, to assist each individual to progress in the Company's service; and it substantiated

those plans in operation for helping in time of need and encouraging saving and investing toward individual financial security. The statement gave official recognition to the encouragement of Club organization for social, athletic and other recreational activities. In this statement, also, it is made clear that each executive and supervisor is willing to discuss freely with any member of the organization any matter concerning his or her or the company's interests. It emphasized the fact that our daily work is a matter of human relationships which should be carried out in a spirit of friendliness and mutual courtesy.

While the chief responsibility for seeing that these policies are understood and applied rests upon the supervising forces, every member of the organization can and should assist in promoting and maintaining this cordial environment by making sure that all his individual practices conform to the spirit of these policies.

An Appreciation of the Vitaphone

The New York Times on August eighth said editorially:

"The classical languages have been sought for words with which to christen synchronized sight and sound. Words from two languages have even been put together to make euphonious names for it. But no single word, however compounded, is quite adequate to suggest the amazing triumph which man has at last achieved in making pictures talk naturally, sing enthrallingly and play all manner of instruments as skilfully as if the living beings were present instead of their shadows. Those who first heard and saw the pierrot of 'Pagliacci' in the person of the moving likeness of the living Martinelli fill a great hall with the vibrant sound which moved the audience as the presence of the singer could not have done more affectingly, were present as at the performance of a seeming miracle in which the tongue of the dumb image was made to sing.

". . . . . we may turn to the prospect of the future contribution of this invention. It is not to be put with the labor-saving devices of this machine age but rather with the inventions that minister to the enlightenment or entertainment of the world in the larger leisure which the labor-saving machine has brought to its millions. It was Orpheus's music that made Ixion's wheel stand still the brief moment that it lasted, but here is music with which the living Orpheus may sing perpetually to those who, tied to the wheels of industry or business or the professions, must find surcease of their labor in the higher reaches of the human spirit, if they are not to become as mere machines themselves.

"And as for the singers and the players on instruments, of whom it was said in ancient prophecy that they should ever be in the City of God, the prophecy has come true in the earth and in our own city. Those who sing and play here with perfection will ever sing and play on, terrestrially."

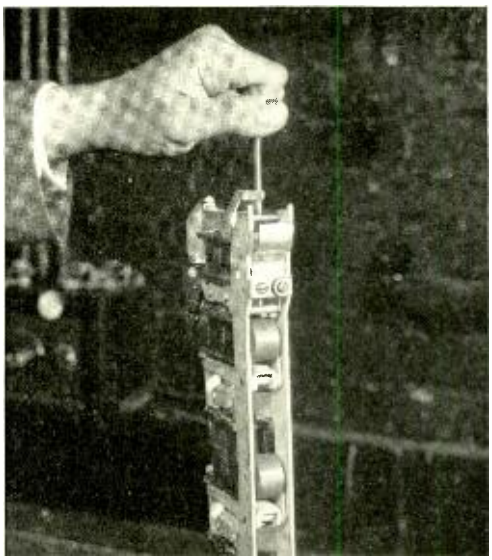
Odd Tools for Machine-Switching Apparatus

By A. D. HARGAN

IF a man's fingers were strong enough and slender enough and had a sufficient number of joints in them, many of the tools used in the maintenance of a telephone exchange would not be required. The "iron hand" and the "vise-like grip" would be desirable qualifications for a trouble shooter, if these characteristics could be combined with pipe-stem fingers and a delicate sense of touch. But the employment departments of the telephone companies would find it difficult to hire people having all of these qualifications, so our Laboratories are called on to provide for maintenance men artificial fingers, which will enable them to reach and adjust the various parts of the apparatus.

In the machine-switching system the apparatus has been very compactly arranged so as to conserve floor space; and this has called for a large number and a wide variety of tools for reaching the out-of-the-way places. These tools are required not only for adjusting but also for removing and replacing various units, for convenience in making tests, and for cleaning.

In the panel system the clutch must be accurately adjusted to drive the brush rods up to their proper level and to support them in this position. The pawl of the clutch is subject to adjustment and the only means of access to it is at the rear through an opening about the size of one's little finger. The long end of the No. 273 Tool was designed to reach down through this opening and grip the lever which controls the position of the pawl. The horizontal portion of the tool acts as a handle in this operation; by swinging it one way or the other, the relative position of the pawl and rack may be modified.

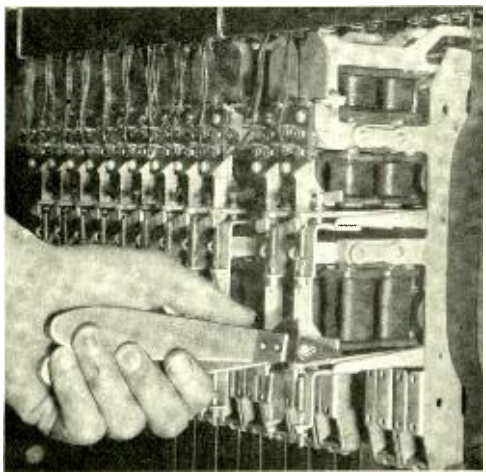


No. 273 Tool used for the elevator mechanism

The short end of this tool is really an entirely separate tool which was conveniently combined with the pawl-adjusting tool and is used for adjusting the back-stop lug of the clutch. This lug controls the armature gap in the released position. The vertical portion of the tool is then used as the handle to decrease or increase the gap.

Not only is the armature gap im-

portant when the clutch is in the released position but the gap when the armature is operated is even more so and is adjusted within closer limits. The front-stop lug, controlling the operated position of the armature,



No. 335 Tool for adjusting clutch

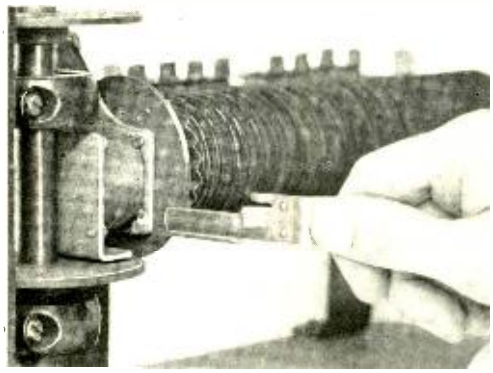
must be sufficiently heavy and rigid to prevent its being battered down or changed in position under the repeated blows of the armature. A change of even a few thousandths of an inch in the armature gap would affect the time required for the clutch to release. This in turn might cause the brush to stop on the terminal above that desired, and give a subscriber connection to a wrong number. For adjustment these front-stop lugs are bent by the No. 335 Tool. This tool has jaws like a pair of pliers. A fixed jaw engages with that portion of the clutch frame which supports the cable. The movable jaw may then force the stop-lug up or down as required. The bend is thus applied to the stop-lug alone and there is no bending of the frame of the clutch which might throw out other adjustments.

The tools just described illustrate metal developments for extensions of human fingers to adjust equipment. Tools have, however, the inherent disadvantage of being designed for special purposes, while fingers are generally adaptable. One gets so accustomed to the adaptability of his fingers that in working with tools he sometimes goes right along performing with the tool in his hand operations for which it was not specifically designed. Almost everyone has demanded of a screw-driver which he happened to have in his hand that it should act as a hammer or a chisel, and has poked and jabbed with it.

In designing tools another requirement, therefore, is introduced which might be stated like this: If the tool would serve, more or less well, for another purpose than that for which it was specifically designed and if such a purpose is likely to be met while the tool is in the hand of a user, then it should be designed either so as to be applicable to this second operation or obviously inapplicable.

An instance of this is the No. 253 Tool, which is a brake plate. It is used in making certain circuit tests on machine-switching equipment where it is desired to prevent the rotation of the sequence switch even if its magnet should be energized. The tool is inserted between the magnet and the driven disc so as to prevent the latter from being moved by the magnet and drawn into engagement. For this purpose the requirements of the tool are simple. It must be easy to apply, and since when in position it must stay there, it should be designed so that it will not readily be dislodged by vibration or by an accidental pull. It was found, however, that the long prong of such a tool was a good enough substitute for a screw-driver to be used for that purpose. Because

it was not designed for that use the prong was likely to get twisted, with the result that the next time it was inserted in a sequence switch it would cause a permanent distortion of the spring which supported the driven disc. In a new design of this tool shown in the accompanying picture the end is rounded to remove the temptation to use it as a screw-driver. In case it should be so used, however, its increased thickness and the flange along its lower edge will prevent un-

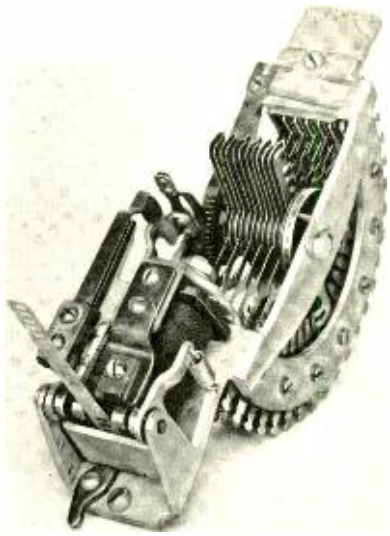


No. 253 Tool for preventing rotation of sequence switch

due distortion. This is only one of several illustrations of the problem of designing tools so that they not only will do efficiently the work for which they are required, but also may not, under ordinary conditions, be put to uses which would damage them and thus be detrimental to their primary purposes.

For maintenance of equipment, tools are required not only for adjustment but also for cleaning; and the No. 359 Tool is an illustration in point. It is used for cleaning the "200-type selector" where the armature and the core come together. Early experience showed that at this point there collected a black deposit which interfered with the operation of the selector and because it was highly magnetic was very difficult to remove. Various methods of cleaning had to be tried and all were found unsatisfactory, for one reason or another, until this particular tool was developed. It is formed by a strip of hardened steel, one-hundredth of an inch thick, with slot perforations at each end. The tool is inserted between the armature and the core; the magnet is then energized; and the tool withdrawn bringing with it the troublesome deposit.

The designing of tools sometimes accompanies the development or manufacture of apparatus or its installation; but frequently the tools are the outcome of several years of experience with the actual equipment. It is not always possible to anticipate



No. 359 Tool used for cleaning No. 200 type selector

the necessity for a tool, although to be able to do so in every instance might result in simplification. Unique requirements are constantly arising in connection with one piece of equipment or another and the development of tools must keep pace.

Abroad and at Home

EDGAR W. ADAMS has returned from London, where he has been organizing for the Western Electric Company a group to handle its European patent interests. Succeeding Mr. Adams in London is W. E. Beatty, of Western Electric. H. A. Whitehorn, transferred from our Patent Department to Western Electric, will shortly join Mr. Beatty in London.

P. B. FLANDERS has returned from several months in London, where he has been acting as consulting engineer to the Gramophone Company, Ltd., during the putting into production of several models of phonographs embodying our developments in sound-reproducing systems.

OCEAN TELEGRAPH CABLES continue to draw Laboratories men into out-of-the-way places. G. A. Locke is now at Horta, Azores Island, making final tests on the terminal equipment of the first permalloy-loaded cable. It is expected before September that these final tests will be completed and the system turned over to the Western Union traffic department for final traffic tests. At about that time M. B. Kerr will sail for Emden to supervise tests to be made on the Azores-Emden cable now being laid. A. A. Clokey will also sail shortly for a final inspection of the Horta station; thence he will go to Emden and at Penzance, England, he will join W. A. Knoop and W. S. Gorton who, in collaboration with Western Union engineers, are making acceptance tests on the second permalloy-loaded cable. At the western end of this cable, in Bay Roberts, Newfoundland, are J. J. Gilbert and E. T. Burton. Their tests will also yield data for the design of terminal apparatus.

AMONG RECENT VISITORS to the Laboratories were Oberpostdirektor Herr Artur Kunert, and Herr Hans Stahl of the Telegraphentechnisches Reichsamt. They conferred with A. A. Clokey and other engineers of our Laboratories, and of Western Union, regarding the terminal equipment now under construction for the Azores-Emden cable.

HARVEY FLETCHER and L. J. Sivian, from the Laboratories, and W. H. Martin from the American Telephone and Telegraph Company have recently returned from Europe where they were delegates of the Bell System at two international conferences held under the auspices of the Comite Consultatif International des Communications Telephoniques. The first conference held in London, May 27 to June 4, discussed the selection of a master telephone reference system for Europe and made recommendations which were later adopted by the Paris conference, held from June 21 to June 28. The result of the conference was the adoption of an exact replica of the American transmission reference system recently developed in our Laboratories and demonstrated at the London conference by W. R. Goehner. This replica will be built here, and installed and maintained in Paris as the European International Telephone Transmission Reference Standard.

STUDIES OF RADIO transmission at short wavelengths have taken a number of Research men far afield. J. F. Farrington, E. G. Ports, and E. A. Krauth were in Shelby, Montana and Seattle. J. G. Chaffee, E. J. Sterba, and S. C. Wright travelled to Minneapolis and Dickinson, N. D. At Cleveland and Chicago were stationed F. B. Llewellyn and C. R. Englund. E. Bruce and F. A. Hubbard made measurements aboard the S.S. *Minnetonka* on its trip across the Atlantic; and F. R. Lack and G. Thurston did the same on the S.S. *Republic*. Axel G. Jensen conducted the tests in London. In addition to these, a truck journeyed from Deal Beach to Oil City, Pa., and tests were made at intervals of fifty miles by C. V. Litton, E. K. Eberhart and H. C. Bauman.

P. A. ANDERSON is now located at Sao Paulo, Brazil, where he is supervising the installation of a one kilowatt broadcasting equipment for the Sociedad Radio Educadora Paulista. D. H. Newman is now located at Port-au-Prince, Haiti, where he is supervising the installation of a similar set for the Department of Public Works. F. S. Bernhard, who has been carrying on radio tests at Tocopilla, Chile, is now on his way to Valparaiso, where he is to carry on a study of power-line carrier-telephone equipment.

THE FIRST PUBLIC PERFORMANCE of the Vitaphone* was given August 6, before an enthusiastic audience. It was preceded by a dress rehearsal and a press performance at which many Bell Laboratories people were guests of Warner Brothers, the producers. The feature film was "Don Juan" with John Barrymore in the title role. Synchronized musical accompaniment, originally created by the Philharmonic Orchestra, was reproduced by the Vitaphone. In addition, there were "talking movies" of an introductory speech by Will Hays, a selection by the Philharmonic, vocal and instrumental numbers by Martinelli, Case, Talley, Elman and Zimbalist. The entire performance was most favorably received by the audience; equally commendatory were the press notices.

C. D. HOCKER was recently elected chairman of that sub-committee of the American Engineering Standards Committee which is concerned with methods of testing zinc coatings of iron and steel. He is also chairman of a committee of the American Society for Testing Materials interested in zinc coatings. The first named organization is probably the largest in the country fostering the standardization of various products. Its Sectional Committee on zinc coating is developing nationally uniform specifications for protective zinc coatings, and Mr. Hocker's committee is interested in methods of testing these.

Since all pole line hardware and steel strand used to support aerial cable is zinc coated, the Bell System is interested in the standardization work of the committee. Bell Laboratories has fostered a great deal of research in the field of protective coatings, and Mr. Hocker is uniquely qualified to serve the communication and electric power industries as chairman of this committee.

K. O. THORPE has spent several weeks in Alabama in connection with the power-line carrier-telephone system installed for the Alabama Power Company. D. M. Cole has returned

* BELL LABORATORIES RECORD, *July*, 1926, *page* 200.

from Minneapolis where he has been for several months, after turning over to the Northern States Power Company for operation the power-line telephone system installed on their lines.

P. H. PIERCE and R. A. MILLER visited the Western Electric Instrument Shop at Philadelphia on July 16th in connection with the production of the 33-A amplifier.

O. A. SHANN spent July 7th and 8th at the Gray Telephone Pay Station Company at Hartford, Connecticut, at which time tests on coin collectors were discussed.

A. F. GILSON visited Hawthorne Works the week of August 2nd in connection with the work being done on deaf equipment and on the new No. 555 receivers which are being used in the Vitaphone Equipment.

A LARGE NUMBER of emergency generator sets driven by direct-connected gas engines are in process of manufacture at Springfield, Ohio, and Buffalo, New York. V. T. Callahan recently visited the suppliers' factories to discuss some of the details of these engines.

METHODS OF TESTING step-by-step machine switching equipment occasioned a visit of J. B. Draper to the new central office soon to be placed in service at Williamsport, Pennsylvania.

A TRIAL INSTALLATION is being made of a new high-gain carrier repeater on the Denver-Sacramento Type-C carrier-telephone system. Repeaters are installed at Salt Lake City, Utah, and at Winnemucca, Nevada; and E. C. Blessing, G. W. Ames and H. E. Cassidy are spending a few weeks at these points installing and testing the new system. C. W. Green of the Laboratories and H. A. Affel, [D.& R.,A.T.& T.] have just returned from an inspection of this installation and a new carrier-current pilot-channel recently installed on the Type-C system between Denver and Sacramento.

ENGINEERING WORK on the new Cleveland toll board, which will be one of the largest toll installations in the country and will employ all of the latest developments of our toll systems, has been practically completed and manufacturing work is in active progress at Hawthorne. E. J. Johnson and R. H. Miller attended a conference with the Telephone Company's engineers at Cleveland late in July to go over the final details of the new office.

SIXTY-FIVE UNITED STATES PATENTS, covering improvements in the communication art were issued during June and July to the following members of Bell Telephone Laboratories:

A. S. Bertels
W. L. Betts
N. Blount
O. E. Buckley (6)
W. W. Carpenter
E. H. Clark (2)
A. A. Clokey
A. M. Curtis
R. C. Davis
G. D. Edwards
J. M. Eglin
G. W. Elmen (7)
H. T. Friis
J. R. Fry
R. D. Gibson
J. J. Gilbert
C. L. Goodrum (2)
A. Haddock
J. E. Harris
R. V. L. Hartley
R. A. Heising
E. E. Hinrichsen
E. M. Honan
W. G. Houskeeper (3)
J. S. Jammer*
M. J. Kelly
A. R. Kemp
B. W. Kendall
O. H. Kopp
C. E. Lane
E. R. Lundius
R. C. Mathes (2)
J. P. Maxfield
O. R. Miller
H. W. O'Neill
E. Peterson
J. C. Schelleng
E. O. Scriven
P. C. Smith
H. C. Snook
C. A. Sprague
R. L. Stokely
W. M. Stuart
G. Thompson
J. R. Townsend
E. C. Wente
J. H. White
H. Whittle
C. R. Young

* *Now of International Standard Electric.*

D. & R.

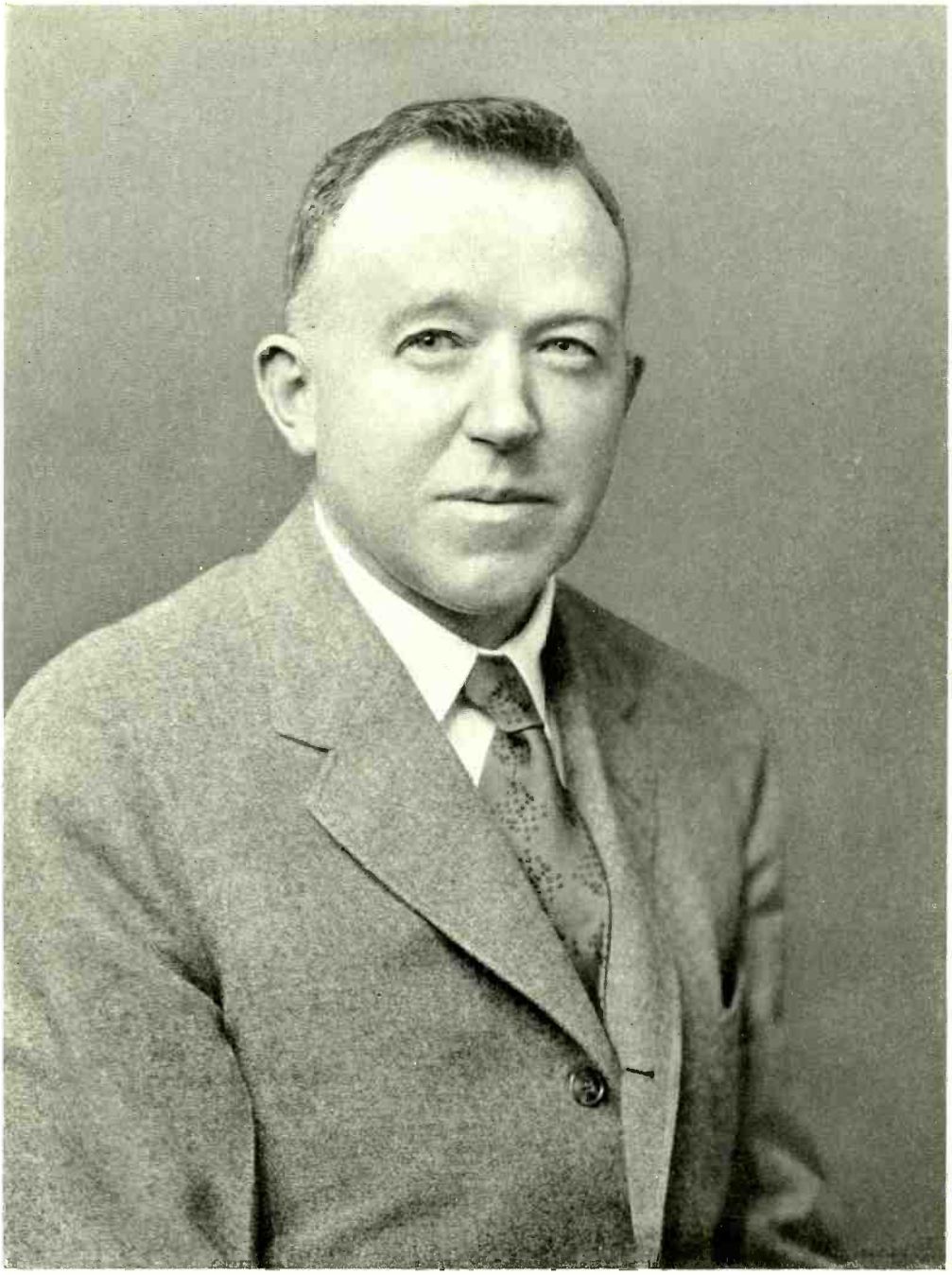
By JOHN MILLS

DEPARTMENTS evolve; new lines of function appear and are developed; and present responsibilities link with the past. To describe the Department of Development and Research of the American Telephone and Telegraph Company some statement of the past is desirable, also, because its characteristic activities preceded by years the adoption of this name. During four of those years the writer was a member of that group, entering it in 1911, while it was part of the Engineering Department of the American Telephone and Telegraph Company. The preparation of this article, therefore, bringing its memories of congenial and stimulating associates and of group achievements which made telephone history, is a bit of writing in which he takes peculiar pleasure and would have record his friendship and his pride in that past association.

At that time John J. Carty was Chief Engineer and his department, which was concerned with ensuring the technical progress of the telephone art, the establishment and maintenance of suitable standards, and the solution of peculiar problems arising in the operating field, was divided for this work according to the type of problem. One main department reported to Bancroft Gherardi as Engineer of Plant and another to K. W. Waterson as Engineer of Traffic. Subdivisions of plant engineering included: Outside Plant under F. L. Rhodes; Inside Plant under L. F. Morehouse; and Transmission and Protection problems under F. B. Jewett. It was the last group that the writer joined and the problem to which he was assigned was known as "repeater on loaded lines," one of the then basic problems of long-distance communication and as such underlying the 1914-1915 extension of telephone service from New York to San Francisco.

Some two years earlier Mr. Carty and Mr. Gherardi had been on the Pacific coast where they made a two months' study of the telephone situation. Mr. Carty had been impressed, and perhaps even oppressed, by the telephonic isolation of the Pacific coast and the lack of direct communication with his own office. A short conversation ensued, of question by Mr. Carty and answer by Mr. Gherardi. "Can we talk from New York to San Francisco?" "Yes." "Do you know how?" "No." "Can we find out?" "Yes." Shortly afterward work on the project started. It was a fundamental research with a definite goal.

It did not proceed very rapidly at first because it was not the only development and research project in which the department was concerned. Loading of phantom circuits was only just being completed and the problem of multiplex cable connections from Boston to Washington was absorbing considerable attention. The Trans-



Edwin Henry Colpitts

Assistant Vice-President American Telephone and Telegraph Company

mission and Protection Department by which most of the fundamental work needed to be done, or coordinated, consisted of only eight or ten men who were already well loaded with other development projects and with current engineering activities. During the next year some fundamental studies of a theoretical character were made by G. A. Campbell who reported individually to the Chief Engineer; investigations of repeater operations and improvements in electro-mechanical repeaters were carried out in the Western Electric Company by H. E. Shreeve; and R. S. Hoyt, first as a member of that company, and later as a member of the Transmission and Protection Department, made some illuminating measurements of the impedance of loaded lines. In the meantime both the Engineering Department of the American Telephone and Telegraph Company and the laboratory group of the Western Electric added to their personnel. The research group was formed at West Street under E. H. Colpitts; H. D. Arnold was employed; and studies in electronics and gaseous conduction were initiated. Early in 1911 sufficient additional personnel had been acquired. The work was then started with a very definite understanding as to its goal and to divisions of responsibility.

There were problems to be met in the field and entirely new physical principles to be developed in laboratories. The corresponding groups cooperated closely; and much of the plant of the Long Lines Department of the American Telephone and Telegraph Company became their laboratory for measurements and for trial of devices. The route was laid out; standards of line construction determined; problems of insulation solved; the necessity for a new type of loading coil appreciated; and additional problems therefore referred to the Laboratory for development. As the work progressed, and successful conclusion of the development studies appeared more certain, traffic studies and problems of operation and maintenance received more attention and were studied by the Engineering Department of the American Telephone and Telegraph Company. In the summer of 1914 Mr. Vail spoke the first words transmitted by telephone between New York and San Francisco.

Other projects of developments were proceeding at the same time, but the one just described illustrates the then organization of the engineering work of the American Telephone and Telegraph Company. The recognition of an economic and physical need in the field; origination and coordination of developments to meet this need; economic and engineering selection from the material means developed; the standardization of these means; and problems of operation and engineering in their application to particular cases—all were handled by the same general organization.

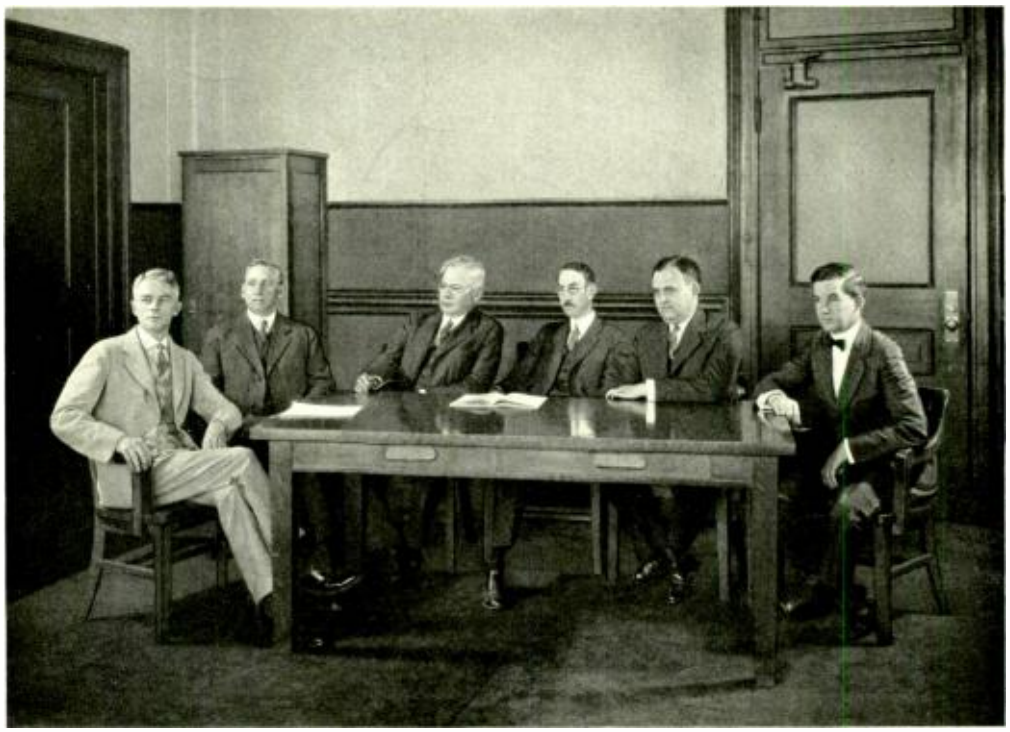
The next step in functional organization came in the division of the much augmented department into two groups, namely, those concerned with problems of operation and engineering, and those concerned with problems of development and research. The first-named problems became the particular care of Mr. B. Gherardi, then appointed Vice-President of the American Telephone and Telegraph Company; and the research problems continued to be the care of Vice-President J. J. Carty.

With the further growth and intensification of research and development activities F. B. Jewett was appointed Vice-President of the American Telephone and Telegraph Company to coordinate from that position, and as President of our Bell Telephone Laboratories, all the development and research work of the System.

Reporting to Dr. Jewett, in the organization of the American Telephone and Telegraph Company, is Dr. E. H. Colpitts, Assistant Vice-President of that company. His connection with the communication art has been rich in experience and fruitful in contributions. In matters relating to transmission, as distinct from switching, he has been intimately and constructively concerned with practically every line of development since his entry into the Bell System in 1899. Loading was then just in prospect; he worked on its problems, including its extension to the loading of phantom circuits and duplex cable. Inductive interference between power and telephone circuits was another problem of those early days. Four years, from 1907-1911, in charge of the Physical Laboratory at West Street gave him a wide familiarity with apparatus which supplemented the field and laboratory experience he had had in Boston from 1899 to 1907.

In 1911 the present Research Department of the Laboratories was formed and placed under his direc-

Standing: I. W. Green, R. D. Parker, H. M. Bascom, B. C. Bellows, W. G. Blauvelt.
Seated: R. W. Morris, L. F. Morehouse, G. K. Thompson



R. B. Hill, L. B. Fish, R. F. Hosford, R. A. Haislip, H. D. Bender, C. S. Gordon

tion. Its first problem was the development of telephone repeaters which was quickly followed by carrier-current and radio systems. To these projects Mr. Colpitts' contributions were not only those of direction but included important inventions—and individual experimentation not only in the laboratory but far afield, as the writer can testify from nights when they worked together at Long Lines boards at Omaha and Denver and other places. Similar memories of Mr. Colpitts in early morning hours of experimentation might be given by many others—H. D. Arnold, H. E. Shreeve, B. W. Kendall, R. V. L. Hartley, C. R. Englund, and R. S. Hoyt, to mention only a few.

As fundamental preparation for his contributions in communication, Mr. Colpitts had trained at Mount Allison University in New Brunswick, taken graduate work at Harvard in mathematics, physics, and engineering, and had two years of research experience in its physical laboratories. From 1917 to 1924 he was Assistant Chief Engineer in the Engineering Department of the Western Electric Company in charge of its research groups. During 1924 he was appointed to his present position of Assistant Vice-President of the American Telephone and Telegraph Company.

Associated with Mr. Colpitts for the supervision, along functional lines, of the Department of Development and Research are three department heads and three staff engineers.

Of these Lyman F. Morehouse, Equipment and Development Engineer, is responsible for work on inside plant equipment. Mr. Morehouse entered the Bell System in 1906, com-

ing from the University of Michigan where he had been a professor of electrical engineering. His first posi-

F. L. Rhodes

tion was with the Western Electric and during part of that connection he was in Europe as its Transmission Engineer. After two years he was transferred to the American Telephone and Telegraph Company as Equipment Engineer. His responsibilities since then have been along the lines of inside plant equipment, and have widened and grown with the development of this field of activity, in which he has made individual contributions. One of his particular interests has been machine switching.

In his department, which has a personnel of about one hundred and thirty-five, H. M. Bascom is responsible for local telephone systems; W. G. Blauvelt for local switching systems; R. C. Bellows for toll switching system studies; and R. W. Morris for toll line equipment. R. D. Parker is concerned with telegraph systems; I. W. Green with subscriber equipment; and G. K. Thompson, a specialist in transmission and sub-station equipment, is at present engaged on special assignments where his knowledge of equipment and his long experience in the art are of great value.

Outside plant problems of a development character are handled under F. L. Rhodes, Outside Plant Development Engineer, by a department of about thirty-five people. Mr. Rhodes entered the Bell System in 1892 immediately after his graduation from Massachusetts Institute of Technology. He became concerned with the development and standardization of materials and methods for outside plant, and practically from the beginning of his connection with the System he has had responsible charge of

H. S. Warren

this work. For years he has represented the System in national organizations concerned with codes and standards for outside wire construction and his individual contributions have been of great importance. Under his general supervision problems of timber and preservatives and general materials are cared for by R. F. Hosford; cables and apparatus by R. A. Haislip; pole line hardware and subway materials constitute problems for L. B. Fish; wire, conductors, and insulators for C. S. Gordon; questions of the standardization of tools are handled by H. D. Bender; and R. B. Hill makes economic studies of a development character.

Transmission problems are under O. B. Blackwell, Transmission Development Engineer. Before Mr. Blackwell came with the Bell System he was a student at Massachusetts Institute of Technology where F. B. Jewett was then teaching. The two were associated from the beginning of their Bell System work and Mr. Blackwell shortly became the transmission expert of Dr. Jewett's

H. S. Sheppard

G. A. Campbell

"Transmission and Protection Department." His individual contributions to the theory of transmission, which were many in those early days, have been formative, as any reader of K. S. Johnson's book on telephone transmission will know, for Mr. Johnson received his early training in that department under Mr. Blackwell.

Responsible for the problems of transmission, in which over one hundred and sixty people are engaged, are a group of men who came to the department about fifteen years ago. With all of them the writer once had, as a member of the group, the pleasure of cooperating. Their individual contributions are well known to the readers of technical literature and cover problems of telephone repeaters, low-frequency telegraph, transmission measuring and the like under

A. B. Clark; carrier and radio work under Lloyd Espenschied; quality, sub-station sets, problems of local transmission and loading under W. H. Martin; and inductive interference and cross induction under L. P. Ferris, J. R. Carson of this group is concerned with theoretical investigations in the general field of transmission and has made notable contributions of a mathematical-physical character, particularly in the study of transients and in inventions like that of carrier-suppression systems.

In the days of the Boston laboratory, which has been referred to above, records of experiments and theories were kept in loose-leaf files instead of in laboratory books assigned to individual experimenters. When the writer entered the American Telephone and Telegraph Company and was assigned to the problem of repeaters on loaded lines, his first task was to become familiar with the prior art by searching some forty or fifty volumes of these files, then known from their binding as the "black files." Two names which frequently appeared, as reporting developments of scientific interest and economic importance, were those of G. A. Campbell and H. S. Warren. The respect for their creative ability and engineering contributions which that intimate study of those files developed has remained with the writer and grown with his own knowledge of the art.

Electrical interference whether of an inductive or an electrolytic character has always been a problem to the telephone engineer and in this Mr. Warren has been a specialist for

Lloyd Espenschied, A. B. Clark, J. R. Carson, L. P. Ferris, O. B. Blackwell, W. H. Martin

some years. Entering the Boston Laboratories, as a graduate from Massachusetts Institute of Technology, Mr. H. S. Warren has had a wide experience in field work and development activities particularly in problems of transmission. As a staff engineer of the Department of Development and Research he is concerned with engineering considerations and negotiations for the elimination or reduction of interference.

Mr. G. A. Campbell, a Ph.D. from Harvard, also started his work in the Boston Laboratories, where he was responsible for many early developments in loading of telephone conductors and since then for other basic studies of a broad character. His contributions, not always easily readable, being couched in highly mathematical terms, are generalized theorems of communication. His analyses of sub-station sets, of cross induction between electric circuits, of line conditions and repeater gain, of mutual and direct capacity relations in circuits, and of transmission relationships for loaded lines and filters have been of almost incalculable value to the communication art.

Assistance of a staff and service character in the Research and Development Department is assigned to H. S. Sheppard, Executive Assistant, who directs activities of more than one hundred members of the department.

Such, in brief, is an outline of the major groups of the Department of Development and Research with which the activities of our Laboratories are most closely coordinated. In their own company organization their more immediate relationships are with the Department of Operation and Engineering with which they were once associated as members of the then Engineering Department of the American Telephone and Telegraph Company.

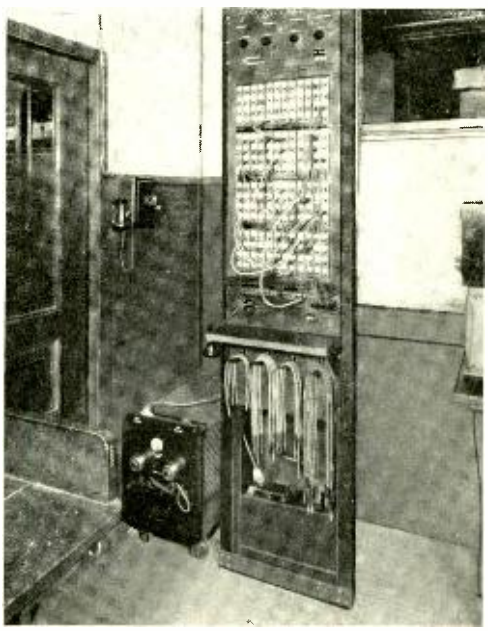
Concealing The Wires

By H. J. HEINDEL

UNTIDY appearance when wires have to be strung across a laboratory in order to make temporary connections between apparatus at various points is familiar to almost everyone. By placing in service an inter-laboratory trunking system the carrier group of the Research Department has eliminated this undesirable possibility.

The accompanying picture shows the central distributing frame located near the center of its group of laboratory rooms. To a visitor this panel conveys no idea as to its usefulness, but a little explanation indicates the time saved by such a system. He is first told that each group of four jacks (there are three groups per row) on the frame terminates in a jack box under the center of each bench in the laboratory. Each bench and corresponding group of jacks is designated by a number; so that to connect, say, bench No. 1 in room 745-B to bench No. 2 in room 745-B, the corresponding jacks on the frame are connected by means of jumper cords, the ends of which are terminated in plugs. For distributing a single source to several points means are provided by multiple jacks on the lower end of the frame. A telephone set permits testing and communicating from the frame to outside points.

After being shown how this system operates, the visitor might be told of the facilities for transmitting between these laboratories and remote points. This necessitates the use of the last two columns of jacks on the right-hand side of the central distributing frame, giving the engineers means of connecting their apparatus by direct trunks to the Systems Development Laboratory, General Development Laboratory, Radio Broadcasting



The central distributing frame

Room, Radio Development Laboratory, Control Room at WEAF, Capitol Theater, and Long Lines Department at Walker Street. The lines to Walker Street provide a means of connecting apparatus in this carrier laboratory to any part of the United States; through them currents of standard frequency have been transmitted to such remote points as San

Francisco, Montreal and Havana.

During the solar eclipse of January 24, 1925, this panel played an important role. All observation points along the path of the eclipse, at which members of the American Astronomical Society were stationed, were directly connected to recording apparatus in this laboratory. In addition to making records, timing impulses from the laboratory's standard clock were sent to WEAF and the Rocky Point Station of the Radio Corporation of America, from which points they were transmitted to observation points along the eclipse-path.

In The Month's News

R. L. JONES' title has been changed from Inspection Manager to Inspection Engineer.

A CONFERENCE on the general situation with respect to Engineering Complaints and Questions from the New England territory was held in Boston on July 22 and 23. In addition to New England Telephone and Telegraph Company engineers and Western Electric Distributing House people, R. L. Jones, G. D. Edwards, H. G. Eddy and E. J. Kelley were present from the Laboratories.

DURING July, O. S. Markuson, R. M. Moody, D. A. Quarles and H. G. Eddy were in Hawthorne in connection with regular Survey Conference work. A second general conference regarding Quality Rating, Methods and general Apparatus Inspection matters was also held in Hawthorne, and D. A. Quarles and H. F. Dodge represented the Laboratories.

L. F. PORTER has been at Kalamazoo, making field tests of the new No. 3 toll switchboard soon to be placed in service with the new step-by-step central office at that point.

H. M. STOLLER has visited the General Electric Plant at Ft. Wayne, Indiana, relative to manufacture of motors used in talking motion picture equipment. H. Pfannenstiehl was in Hawthorne for several days to assist in starting production on talking motion picture apparatus, which is being supplied by Western Electric to the Vitaphone Corporation.

"VIBRATING SYSTEMS AND SOUND" a book by I. B. Crandall, has just been published by Van Nostrand and Company. The purpose of this book is to give in modern terms a treatment of the basic theory and show how it has been applied to current problems. It is based on courses recently given by Mr. Crandall at the Laboratories and at the Massachusetts Institute of Technology. The problems chosen for discussion include a number to which the author and others in our Laboratories have made contributions in recent years, as well as other representative modern work. Several copies of the book are available in our Technical Library; copies may be bought through the Personal Purchase Department.

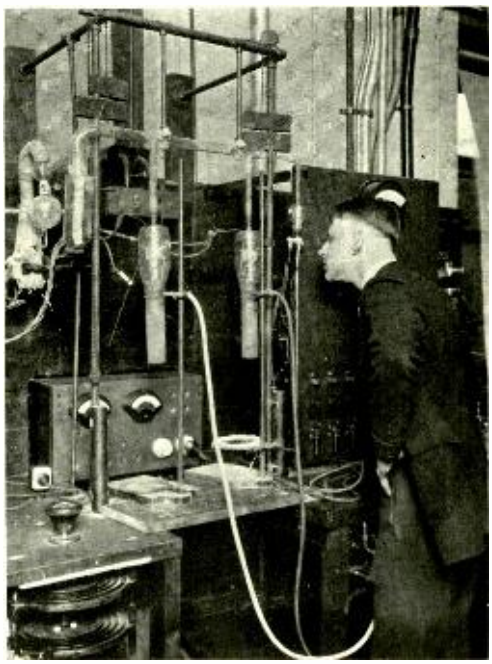
The Ionization Manometer

Developed primarily for our own use, this instrument is now marketed as a Western Electric product

A BEAUTIFULLY concise illustration of what goes on inside a vacuum tube is given by the ionization manometer. This is a device for determining what portion of the original air has been pumped out of a vacuum tube, or, as the physicist would put it, how much pressure is exerted by the air that remains.

The ionization manometer was invented by Oliver E. Buckley and first described* by him in 1916, and is really a device for counting the number of gas molecules inside a fixed space. Of course the counting is not done with a pad and pencil, nor yet with the "peg counter" familiar to telephone people. It is rather done by forcing the molecules out of the fixed space and up against a metal plate, where they control an electric current in an external circuit.

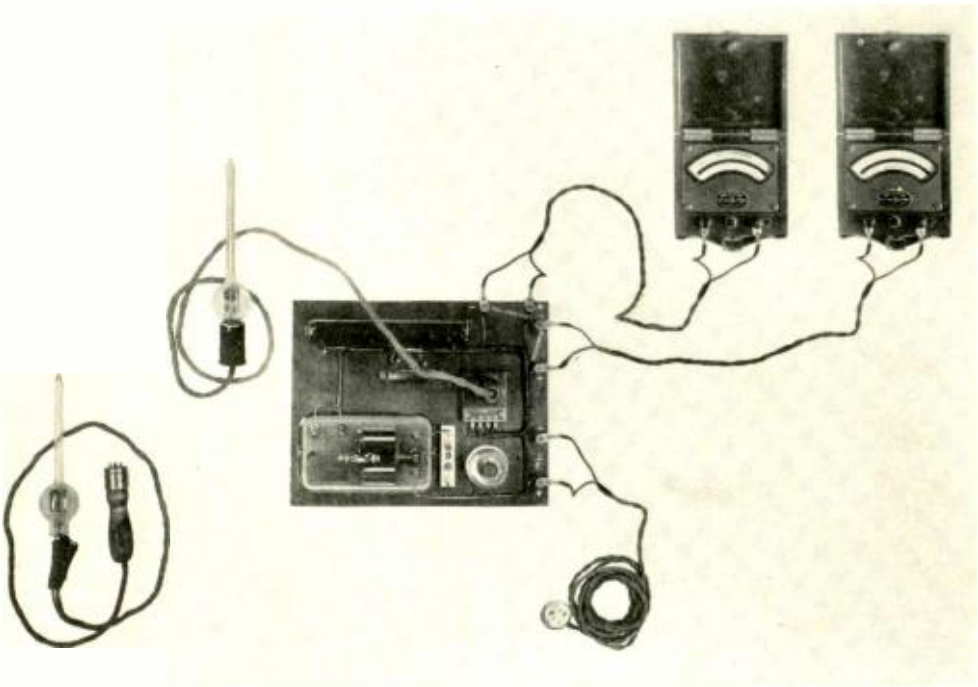
It will be recalled that each molecule of a gas consists of an equal number of positively-charged protons and negatively-charged electrons. When a molecule is hit by a free electron which is moving above a certain speed, one of the electrons is knocked loose from the molecule. This leaves in the molecule one more positive charge than there are negative charges. The molecule, now said to be *ionized*, is attracted by any negative surface. This is exactly what hapens in the ionization manometer, which in its commercial form looks very much like the familiar "E" tube. A heated filament is the source of electrons; they are given a high enough speed by applying about 110 volts positive potential to the grid. Molecules of oxygen, nitrogen, and other gases diffuse from the rest of the space under exhaustion through a tube into the space between the filament and grid. Here



Measuring the vacuum in two experimental power-tubes; the manometer is directly in front of the observer, W. H. Manthorne

* *National Academy of Sciences, Vol. 2, 1916, p. 683; also U. S. Patent 1372798.*

they are hit by the flying electrons and drift through the grid to the plate, which is kept about two volts negative so as to attract them. From the surface of the metal comes an electron to take the place of the missing one, and the molecule, its damage repaired, goes off again on its travels. The plate potential keeps forcing fresh electrons up to the surface, production of vacuum tubes at Hudson Street. Its long stem is sealed into the glass tubing system which is to be exhausted. Circuit arrangements provide for securing the filament current, and grid- and plate-voltages from a connection to a 110-volt supply of direct current. In order to keep the emission of electrons constant with varying supply



Details of the Manometer and its associated apparatus

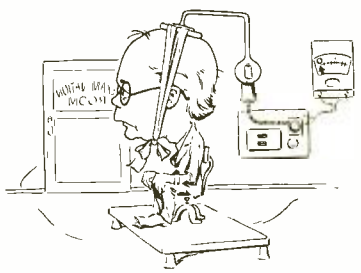
and as these are constantly being taken away, a current is set up which can be measured on a micro-ammeter. This current is proportional to the rate at which molecules are being ionized by collision—in other words, to the pressure of the gas in the tube —hence the micro-ammeter in the plate circuit can be calibrated to read pressure directly.

In our Laboratories the ionization manometer is used in vacuum research work, as well as in the commercial voltage, a relay is connected in the grid circuit. When the electron emission rises beyond a predetermined value the relay closes and short-circuits the filament; this lowers the filament temperature, and accordingly reduces the emission and the grid current to a point where the relay releases and allows the filament to heat again. The cycle is repeated about ten times a second.

The manometer tubes are made either of pyrex or lead glass, so that

they can be sealed to glass systems of either kind; and they are furnished with or without standard vacuum-tube bases. To carry the leads from a based tube to the board on which the rest of the apparatus is mounted, a four-wire extension cord with socket and plug is provided.

Extremely high vacua can be measured by the ionization method. The instrument is reliable when the amount of gas present is only one ten-billionth as much as in an equal volume of free air, and indications can be obtained for much higher vacua. One ten-billionth sounds like "next to nothing at all," but the number of molecules is far from zero; in fact, there are some three billion molecules still left in a cubic centimeter of space. Another way to think about a vacuum, and one which expresses its real importance, is in terms of the average distance which an electron can travel before colliding with a molecule of gas. In ordinary air, this distance is about one ten-thousandth of a centimeter, but when the air has been exhausted to the degree mentioned above, the "mean free path" increases to one million centimeters, or more than five miles. Of course in an ordinary vacuum tube, where the distance between the filament and plate is about an eight of an inch an electron cannot transverse its entire free path. What this means is that when the vacuum in the tube has been increased to the point where the mean free path is about five miles, the chance of an electron hitting a molecule is very much reduced compared with air at atmospheric pressure. The chance would be reduced to approximately one ten-millionth.

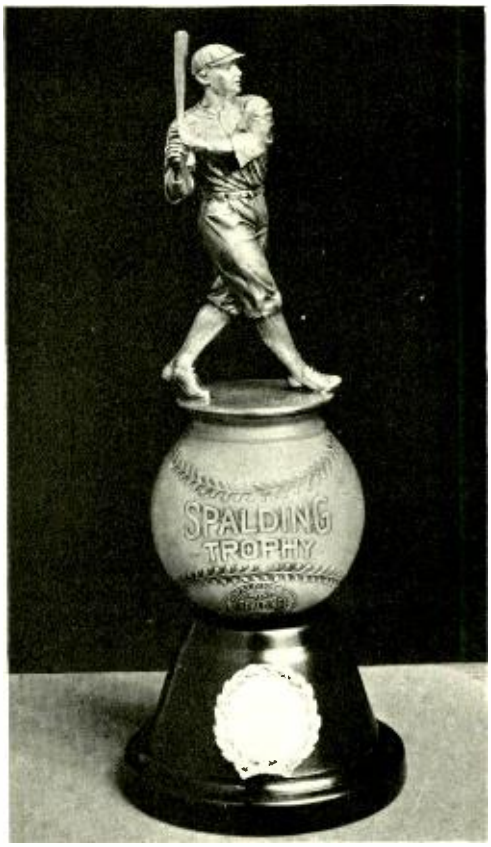


Club Notes

OUR entry into the Bell System Baseball League was an experiment which justified itself. In past years, different branches of the Western Electric Company have had baseball teams which have competed with each other, but in this league the competition has been between the various Metropolitan branches of the Bell System. This inter-company activity has been so effective in bringing about cordial relations with the baseball organizations of the New York Telephone Company and the American Telephone and Telegraph Company that plans are being made for a Bell System Athletic Association which will include all the branches of sport which the Bell Laboratories Club now promotes.

Until the formation of the League, a number of teams each year have claimed the title of "Metropolitan Champion of the Bell System" but now that the 1926 season has ended there is no doubt that the team representing the Laboratories in the Bell System League has won this title.

This was not accomplished without hard playing and good management, and not one of the games could have been considered easy. It seems that the weakest teams played hardest and best against West Street, but exceptionally good team work and the combined efforts of L. P. Bartheld as manager and Bill Trottere as captain made the Laboratories team a hard outfit to beat. The Club is proud of and grateful to the men who battled their way through the League Season, playing and defeating teams made up of the best baseball players in their respective companies.



The Interdepartmental Trophy, won by the Apparatus Development team

The final game of the season was played with the Installation Department, old enemies of West Street. The spectators who were lucky enough to see that game were thrilled from

the start to finish. A victory for West Street meant the championship. On the other hand, if 36th Street had won, a triple tie would have been created between West Street, New York Telephone Company of Long Island and Installation. It was a bitter battle until the last man was put out in the ninth inning. The Installation men played exceptionally good baseball, but with Kuhlman creating a record of 19 strikeouts, West Street was not to be denied.

On July 31, the Laboratories team was the guest of the League at an outing at Lindenhurst, Long Island. The feature of the day was a baseball game between the company-representatives and the team managers. A banquet follower, after which the trophy was presented. Each man on the team received, as a prize, an order on Alexander Taylor & Co. for merchandise; the Club received the Championship Trophy.

These men formed the team:

T. O'Neil, lf	C. W. Christ, rf
T. Ingram, 2b	H. Kuhlman, p
L. Drenkard, ss	J. M. Jorgenson, p
G. A. Brodley, 1b	L. E. Harrison, p
F. Lohmeyer, 3b	W. F. Purdy, c
W. Trottere, cf	W. Flynn, c

Substitute outfielders: J. J. Gardner, W. Bodenstat, C. Maurer, G. DeAngelis; utility, C. F. Hiscock

FINAL STANDING OF TEAMS

	Won	*Lost*	*Percent*
Bell Laboratories Club.....	6	1	858
New York Tel., Long Island.	5	2	715
Western Electric, 36th Street.	4	3	572
New York Tel., No. Man...	4	3	572
Western Electric, Hudson St..	3	4	429
New York Tel., So. Man....	3	4	429
Western Electric, Broadway..	2	5	286
American Tel. & Tel.....	1	6	143

RECORD OF LABORATORIES PITCHING STAFF

	Won	*Lost*
Kuhlman	3	1
Harrison	1	0
Jorgenson	1	0
Gardner	1	0

AFTER WINNING the interdepartmental baseball championship in 1924 and 1925, the Equipment team was obliged to bow to this team representing J. J. Lyng's Apparatus Development Department:

F. Lohmeyer, 3b	R. A. Hecht, rf
F. J. Winter, ss	C. F. Hiscock, c
C. Miller, 1b	E. A. Wieland, 2b
A. H. Volz, cf	H. W. Schaefer, c
J. F. Jessick, p (mgr.)	E. L. Manoly, rf

Utility: J. L. Sherry, J. J. Roth, F. F. Uthoff

Apparatus brought out a team this year that was unbeatable. By going through the entire season without losing a game, they won the trophy donated by A. G. Spalding & Bros. In addition each member of the team will receive an order on Alexander Taylor & Co. for merchandise.

* * *

DO YOU RIDE? Why do you? If you don't, why don't you? In an article which Dr. W. W. Townsend of Vermont has written, he gives interesting advice as to the choice of a horse and the method of instruction.

Be examined by your physician to determine if you are suffering from any physical defect which would be made worse by riding. There are a very few conditions in either men or women to which riding would be injurious. After determining that you are fit for riding, seek the advice of one who rides well as to what to do and how to do it. If you are located near a riding school and can afford instruction, by all means place yourself in the hands of the instructor, and if he is a competent and intelligent one, he will make a riding enthusiast of you. If you have not a riding school near and must "grow up to it," by all means seek the advice of some good rider. There is a camaraderie among horse lovers that is almost fraternal.

If the one who rides, whose advice you solicit, instructs you properly he will advise you to secure a "cold blooded" horse; by this is meant a horse with little thoroughbred blood, as thoroughbreds are "hot" and a beginner irritates their mouths, and their ordinary sweet temperaments become ruffled, so that they "act up," much to the discomfort of their novice riders.

Have your friend instruct you in the

proper manner to mount, and then ride at a walk, walk, walk—days and weeks if necessary—to secure balance and lightness of hand, and until your muscles get supple and your skin hardened. The faster gaits, trotting and cantering, are attractive, and one is naturally anxious to progress, but novice riding should be snail-like if an enthusiastic rider is to be developed. To the enthusiastic rider comes all the energy that he cares to assimilate from the horse, who patents not, sells not at a large profit to acquire great riches, but gives up his tonic energy for your good for the hay, oats, corn, bran, salt and love you give him.

* * *

Some time around September fifteenth the horses and Mr. Soper will be ready to help all those who are in-

terested in riding to know just how it is done. If you haven't been out with these riders before, now is a good time to avail yourself of the opportunity to have first-class instruction such as Dr. Townsend speaks of in his article. Any of those who have been riding at Van Cortlandt Park will tell you what fun it is. If you would like to join the riders get in touch with Miss M. Gilmartin as soon as possible and sign up for a period.

There are also some tickets available still for the Unity Riding Academy should you care to ride on any day other than Saturday.

THE HIKERS are planning some new and interesting hikes for the Fall season, beginning Saturday, September eleventh, with a ten-mile hike from Piermont to Alpine along the Hudson River. The cost of this trip will be approximately $1.40, including supper. On September sixteenth there will be a campfire supper on the Hudson River bank near Hazards Landing; while Sunday, September nineteenth, they plan a Scouting Trip for new trails in Jersey. The next trip out will be about six miles long, from Wakefield to Nepperhan, costing sixty cents including the cost of a supper out of doors. October third the walk covers twelve miles of good country around White Plains and Kensico Reservoir, and on October twelfth they plan to take you to Mianus River. This return hike to Connecticut has been requested by a good many who missed the last trip. Come along and join the crowd.

CLUB INTERESTS FOR WOMEN

AUTUMN'S PROGRAM for women is not yet entirely complete, but in order to give you some idea of what will be happening we might divide the activities into two groups: those continued from last year, and the new ventures. All of them are interesting, varying much in type and time to give everyone some chance to come out for a good night's fun.

One of the old sports which is always new—and especially this year, since we plan to have a representative team chosen by Miss Boynton from the different individual teams to challenge the others of the Bell System—is BASKET BALL. The regular intergroup teams will probably play on Monday nights, beginning November first. It is not too early, however, to plan to play; let's have a good crowd who will give Miss Boynton some stiff games to umpire.

SWIMMING was such a success last spring that we had to have the pool two nights. Miss Steele had ten per-cent of all the women in the company in these two classes, then had to extend the season three weeks to keep at least half of them happy. That seems to be a good record. Will this be repeated or bettered? The Carroll Club, Madison Avenue at Twenty-ninth Street, is the place during October and November. Miss Bolan is all ready to add your name to the list.

However, don't wait until October to take a swim. The Brighton Beach tickets are still available, and during September the water is warm—in fact, some people feel that it is then at its best. Besides the ocean bathing at Brighton the club tickets admit you to the pool, hand-ball courts, running track, and base ball field. Have you been down as yet? Sunday and holiday tickets are one dollar, while it only costs fifty cents on Saturdays or week days.

THE BRIDGE PLAYERS will soon find themselves in another tournament. These evenings spent in playing cards have been popular even through the summer months, keeping Miss Murtagh busy adding up scores. With the winter coming along such evenings indoors will be more popular

The SYMPHONY ORCHESTRA will again be practising, and any women who may be interested are invited to come along with their violins, 'cellos, or whatever their favorites may be, and "join the music." The practise dates will be posted later.

Of the new activities, the two which look as if they will be most popular are BOWLING and a combined class in DANCING AND GYMNASTICS. Bowling will be run on a plan similar to that of the men's club, but will probably be somewhere in New York City. The place and time have not as yet been definitely settled. The Eurythmic Dancing and Gymnastics will be very much like that taught by Bird Larson. Part of the time will be given up to exercising and indoor athletic games and the balance to Rythmic Dancing. This will not be as strenuous as Ned Wayburn's, nor yet as fairylike as that of the Noyes School; but it will be good fun, and the best part is this—plans are being made to have the Carroll Club on a night when you can take a plunge afterward, should you so desire. Then after the plunge, the cafeteria in the building will be open and supper may be enjoyed. Do these plans sound interesting to you? Then come along and join the fun.