BELL TELEPHONE QUARTERLY

VOLUME IX, 1930

INFORMATION DEPARTMENT
AMERICAN TELEPHONE AND TELEGRAPH COMPANY
195 Broadway, New York

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BELL TELEPHONE QUARTERLY

A Medium of Suggestion
and a Record of Progress

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Prosperity

Address by Walter S. Gifford, President, American Telephone and Telegraph Company, before the Chicago Association of Commerce, December 12, 1929.

RECENT events have served to focus public attention to an unusual degree upon the immediate future of business. At such times when perhaps the present is too much with us it seems to me to be helpful to take a long look backward and a long look forward. By doing so we can refresh our minds on the sources of our national wealth and the prospects for continued economic progress in spite of any temporary maladjustments which may momentarily obscure the horizon.

Our country today enjoys an average standard of living far higher than that which obtains in any other country at present, or any country at any time known to history. On what is it based? It is often ascribed to our boundless natural resources. These resources are important but in trying to fashion a true picture it is worth while to remember that all these natural resources were here before the Civil War, and at that time there was no stream of foreign observers landing on our shores to discover the secrets of our prosperity. We had, it is true, made use of the land, cut from the forests, mined coal, iron and precious metals, set up some manufactures and built up a prosperity well beyond that of the colonial period.

The possession of natural resources is not a guarantee of well-being nor prosperity. Natural resources are but tools for man to use to reach the goal of his ambitions. Other nations have had natural resources, but the power and well-being of the nations which stand out in history have rested largely upon tribute from conquered territories. One nation has grown prosperous at the expense of another. Today in this country, the civilization that we are building up is of a different sort. It is not dependent upon subjugation of other nations or tribute from them. It is being built upon sounder and more permanent foundations. Its economic objective is as broad as its political objective. Our modern conception is that well-being as well as government shall be of the people, by the people and for the people.

The democratic conception came first in politics, then in education and third in prosperity. A universal participation in government as a practical matter was an American conception. A universal participation in education was likewise first tried in the United States, and a democratic and widespread prosperity is peculiarly an American ambition and American accomplishment. The force and strength of this ideal cannot be overemphasized. A prosperity of the few at the expense of the many is subject always to the danger of attack by the many whether they be inside or outside national boundaries. And what is more serious than this, a prosperity for the few does not invite the energy, resourcefulness and ambitions of the multitude to its support and enlargement. Moreover, this conception of a prosperity for the multitude cannot be based on one man's taking riches from another. It must be and it is based upon a universal effort to create more riches. Fired with this ambition and equipped with the unlimited potentialities of universal education, the American people not only use their natural resources but infinitely multiply their uses.

We are today engaged in a conquest not of men or nations, but of nature. The opportunities for conquest are unlimited, and success is shared by all. Scientific developments, partly evolved by laborious experimentation and scientific research and partly ignited by the spark of inventive genius, are constantly increasing the use of the bounties of nature and making available new products and new services which were not even dreamed of by the generation of our parents. The resources of nature are multiplied by the laboratory of the scientist. The list of the scientific achievements of the present generation is not only impressive, it is astounding; but men of science tell us that we are on the threshold of even greater achievements, with still further possibilities. Full recognition of the potentialities of this cooperation with nature in which we are engaged is of the utmost importance, for the continued unrelenting prosecution of this kind of nature study makes for continued progress in the welfare and prosperity of our people.

But the possession of unusual natural resources and the increasing scientific knowledge of the forces of nature and of the laws governing the action of these forces do not fully account for the high standard of living enjoyed in this country. Man must not only discover natural laws, but man must adapt scientific discoveries and developments to practical uses if they are to contribute in a material way to our daily comfort and well-being. We might have all the knowledge of nature that we have but without a people of organizing ability and imagination it would not be effectively applied. Men must organize and direct the intricate economic machinery of production and distribution necessary to bring raw materials to the consumer in the form of finished products with the greatest efficiency and the least waste. Man must see to it that the growing wants of the people are satisfied as fully and as economically as possible. Now, the men who came to this country first and those who followed have been, in general, pioneers in temperament—ambitious to achieve and courageous in action. They have been imbued with the vigor and the vision of the true pioneer. They have deliberately broken away from the traditions of the Old World in order to contribute to the fashioning of a new civilization in a land of unfettered opportunity. The admixture of races has produced a population of varied instinctive abilities. A system of universal education has enhanced the native intelligence of this population; while the freedom of our institutions has contributed no small part in maintaining a sense of justice and in developing a widespread spirit of co-operation unhampered by class prejudices.

It is, in my judgment, the character of our man-power and its qualities that have rendered it possible for the United States to make effective to such an extraordinary degree the developments of science.

I should like to illustrate the type of progress made in this country by a brief reference to the telephone industry. The telephone was invented by Dr. Alexander Graham Bell only slightly more than fifty years ago. In the relatively short time which has elapsed since human speech was first transmitted electrically, the telephone business has been so organized and developed here that today practically anybody, anywhere, can talk at any time of the day or night with anybody anywhere else—not only in the United States, but in Mexico, Cuba, Canada, and most of Europe. The ability to render a service of this magnitude rests upon a nation-wide organization, employing over 450,000 American men and women, operating physical properties representing an investment of four billions of dollars which are owned by more than 500,000 stockholders. The progress of the industry has been rapid, steady, and continuous. We shall spend over $700,000,000 in 1930 for plant extensions, additions and betterments.

We are still engaged in making constant improvements in the scope, speed and accuracy of the service, in devising new methods of operation and construction which permit of greater economy; and in our industry, the ultimate limits of progress seem to be as far away as ever. Only a few days ago we inaugurated a new service—telephoning to ships at sea. Insofar as scientific knowledge is concerned, we have already conquered space and time so that it is possible technically to establish instantaneous communication between any two persons anywhere in the world, be either person or both on land, on the sea, or in the air. As a matter of fact, it is already scientifically, but not commercially, practical for each telephone user to see the person with whom he is talking. But greater scientific knowledge, as I have previously indicated, does not always make a new discovery practicable. We have spent, in the Bell System, some ten or fifteen millions of dollars a year for many years in working out the applications of Bell's fundamental discovery, improving materials, working out new circuits and making infinite changes in switchboards and other apparatus. All of this by itself would not have resulted in the almost instantaneous telephone service that we use every day. Such service is dependent upon not only technical knowledge but upon the effective co-ordination of the work of hundreds of thousands of people widely scattered but each of whom must carry on with an understanding of his or her part in the enterprise.

It is also interesting that the development of the telephone system, and this is true of many other industries, is mostly based on the new understanding of nature, and an effective organization of workers. It isn't dependent on our natural resources. A country poor in natural resources can have a telephone system almost as easily as one with prolific natural resources.

These developments in the telephone industry have been taking place in other industries. New products have been created and old products improved; new wants have been stimulated; and processes and methods have been revamped and revised so that the total physical output per worker has increased tremendously during the past fifty years. Indeed, it is hardly possible to think of an industry which has not, within the last few years, introduced new methods of organization or of manufacture which make the worker more effective in output without increasing the effort he expends.

So long as the scientists succeed in wresting more and more of the secrets of nature from her, and so long as the character and intelligence of our people remain as they are today, we are assured of continued progress to still higher levels of living standards and national prosperity.

Here we are, then, with a democratic conception of prosperity, with an eager, ambitious and inventive population, stimulated by education, with science and the ways and means of applying science constantly being better organized to increase the bounties of nature. It is the character of our people, the institutions they have created, their aims and ideals as well as their energy and inventiveness that are the wherewithals of prosperity.

The doctrine of laissez-faire which was in vogue when this country began its independent career and for many years after is still adhered to in principle by many people in business. Its essence was that the greatest good to the greatest number is attained by adding together the greatest good which each individual could achieve for himself. It was an extremely individualistic doctrine. Coincident with the organization of big business has come the belief that extreme individualism must be tempered with a regard for social consequences. In some cases big businesses have not gathered this new conception for themselves as rapidly as the public accepted it for them. But the process has gone on very rapidly. The adjustment of big business to democracy, so that it works smoothly, efficiently, and to the end of widespread prosperity, gives ample scope to the energies and abilities of our people. We could greatly increase our prosperity and stabilize it, if we made but such reasonable strides as we ought to expect in this field of human relations. It is perhaps a moral and ethical field, yet results in it are as surely translatable into economic progress as are the discoveries of pure science.

In the days of laissez-faire, if a new process threw people out of work, they were merely the victims of progress. At present this process is called technological unemployment and there is an increasing disposition on the part of the public to expect industry to make these transitions as easy on the individuals concerned as possible, as well as to improve the processes of industry as a whole—and business accepts this responsibility.

Readjustment is the price of progress. Of course, with a civilization which involves intricate machinery and interdependent relationships, the result of given tendencies is not always obvious until too late to prevent some temporary hardship on the part of small groups of our population. By and large, however, the hazards of readjustment are avoidable. Such stumbling as we may witness along the road of progress will be due not to acts of God, but to the failure of man.

It is becoming more and more generally recognized that business has a distinct responsibility in providing that the economic readjustments demanded by industrial progress are effected with the greatest possible ease. Readjustment should not be allowed to generate maladjustment. This Chicago Association of Commerce, which was organized twenty-five years ago, is a splendid example of the earnest desire and endeavor of American business men to co-operate for the advancement of the community in which they live and hence for the advancement of the nation as a whole. In recent years its interests have been many and varied, but its activities have all been forward-looking and designed to aid and direct local progress. Other groups of men in other cities, as well as groups associated in national organizations, have been working along similar lines. The results of these group efforts cannot be other than highly beneficial. With the greater understanding of the problems of readjustment that has been developed in recent years, and will increase in the years to come, there is certainly a sound basis for hope that our stumblings in the future will be more infrequent and less important. The progress of business is in the hands of you and your fellow business men. Yours is the responsibility to derive from business and industry the greatest possible beneficence.

Opportunistic speculation in the hope of quick profit, such as we have very recently witnessed, must more and more give way to systematic planning for the assurance of permanent gain. This is equally true of individuals and of business enterprises. In business organizations already the autocratic "captain of industry" has largely been superseded by a type of management which recognizes that its responsibility is three-fold—that in fact, if not in law, it is a trustee acting in the joint interests of owners, workers and customers. Recognition of this responsibility must lead to the wider practice of constructive planning based not upon a restricted view of the possibilities of the moment, but upon the vision presented by a long look ahead. If I may refer again to the telephone business, a number of years ago we inaugurated a systematic scheme for formulating fairly definite programs covering a period of five years into the future. These programs are necessarily subject to modification from time to time; but we have found that the practice of looking at least five years ahead has resulted in much more stable and economical progress than otherwise could have been possible. Other industries, I know, have also been taking similar steps to plan for the long pull; indeed, the growth in the number of large business organizations is playing a large part in making such planning feasible. "Planned progress" will not only facilitate the anticipation of coming readjustments, but will tend to minimize such temporary fluctuations in the steady rate of business expansion as may still occur.

So far as I am aware, there is no organic law which has prevented other nations from making the same rate of industrial progress as has the United States. That we have made such rapid progress and they have not is, in my judgment, due in large part to the temperament, the genius and the ideals of the people in this country. At the same time, many of our foreign friends and some of those in academic circles within our own borders are openly critical of certain elements involved in our industrial development. These criticisms usually overemphasize the materialistic aspects of our civilization and underestimate its human and idealistic values. This is sometimes called a mechanized nation, the implication being that we are becoming a people of machine-tenders—mere automatons whose individualities are submerged under the passion for standardization. Such a conception, in my opinion, is distorted in the extreme. Nowhere in the world is there a more progressive and more skilled body of workers than in this country. Nowhere in the world does the worker need to be more alert and observing. Nowhere in the world does the worker have as much opportunity for material advancement, for mental development, for recreation and bodily exercise. So far as the comforts of life are concerned, perhaps nowhere in the world is there less standardization than here. It is, of course, true that large scale industrial operations have demanded the output of large volumes of products which are uniform in character; but limitations upon styles and varieties have been no more than those dictated by common sense and total output of all products has been so large and distribution of these products so well organized that the effective range of consumers' choice remains exceedingly wide. I, for one, am certainly not prepared to concede that the urban or rural consumer in this country has, as a practical matter, a more restricted choice as to what he buys—whether it be a motor car or a pair of shoes—than the corresponding consumer in any other country. It may perhaps be that in our industrial progress we have not devoted sufficient attention to the difficult art of living as distinguished from the simpler art of making a living, but what people of any nation can as a whole give great heed to cultural development unless and until they are free from the slavery of economic want? Regardless of momentary disturbances, this freedom has been very generally acquired, and acquired once and for all, in the United States.

Under these conditions the civilization which is being developed in conjunction with our progress along the road to higher standards and greater prosperity will be one which will afford our people the fullest opportunity to become richer in cultural values as well as in material goods. Worship of the almighty dollar as an end in itself is distinctly on the decline, if it ever widely existed. Already mere money-making on the part of the individual is receiving less and less recognition as a measure of success in life. Already the approbation of business is turning more and more toward those leaders who are wise and constructive rather than ruthless and greedy opportunists who seek to build fortunes without regard to the ultimate consequences affecting the public welfare. Indeed, it is this changing tendency in sentiment which inspires me with absolute faith that our progress in the future will be even more brilliant than in the past.

Any dispassionate review of the trends of American economic life cannot fail to make clear to all who are not willfully blind that the foundations of our present day standards are sound and enduring. The profession of business is rightfully attaining a respected place among other professions contributing to a well-rounded civilization. At the same time grave responsibility rests upon you members of this Chicago Association of Commerce, for it is you and others like you throughout the country upon whom falls the duty of directing business and community affairs so that every one will be afforded the fullest opportunity of making the most out of life. Finally, let us realize at all times that unless the temper and the genius of our people are suddenly changed, unless their aspirations and perceptions are suddenly dulled, continued improvement in the standard of living and in the general welfare of this country is as inevitable as the tides of the ocean.

The sensational break in stock prices has recently engaged the attention of every one. While this break has made it clear that the future progress of the United States cannot be discounted in the market to such an extent that any one period should unduly profit, it is my judgment that for those who are willing to do their part in producing that progress there has never been a place or time which offered such assurances as the United States does at present.

With an unusual abundance of natural resources, with a genius for invention and widespread organization for exhaustive, scientific research resulting as it does in a continual conquest of nature, with a people ambitious to achieve—universally educated, free from class prejudices, and possessing unusual ability for practical organization, with a conception of government looking toward the well-being of all, with almost unbelievable developments in the way of new and more economical processes going forward in almost every industry, with science and the best methods of business organization being more generally adopted in the conduct of agriculture, with an improving recognition by management of its wider responsibilities and a growing recognition on the part of business of its possibilities for the public good—prosperity is not something to be adversely affected for an appreciable period of time by any of the maladjustments which temporarily beset the path of our orderly progress.

The facts speak for themselves and their logical results cannot and will not be altered except by a change in the character of the people of this country. We can, in my judgment, face the future with a confidence that not only will our standard of living become higher and higher so far as material needs and comforts are concerned, but that upon the foundation of this higher standard of material conditions will arise a spiritual and cultural development which will give our children and our children's children the priceless heritage of a finer civilization.

Communication Facilities in the Making

A Personal Impression

DOWN a hundred-foot strip cleared through the North Carolina woods walks a man. One would scarcely associate such a figure, square-jawed and heavy-shouldered, with so childish an occupation as the blowing of soap bubbles. Yet there he trudges, a bucket of soapsuds in his hand, intent on the business of bubble-blowing.

Through this strip of clearing runs a newly constructed telephone cable—a section of the great long distance cable that will eventually connect Washington, and through it Philadelphia, New York and the remainder of the Middle Atlantic and New England states with their sister states in the Southland. The bubble test is about to begin. Each bubble that results from it has its part in assuring the dependability of a new communication link between two important industrial sections of the nation.

As one watches this telephone man, striding along with his pail of soapsuds, and presently climbing a pole, one is watching a nation-wide telephone system in the making. For it is in a multitude of such commonplace operations as this that efficient and dependable telephone service has its genesis.

The soapsud test, which is another name for the gas-pressure test, is only one of many applied, over and over again, to every section of this particular cable, as to all others, as a means of being as certain as is humanly possible that service will be as good as it can be made, and that it will be safeguarded from interruption.

Telephone cables are made up of copper conductors—this particular cable containing 300 pairs—which are insulated from each other with spiral wrappings of paper, the entire bundle of wires being inclosed in a lead-antimony sheath. If the tiniest of holes appears in this sheath, moisture may eventually work its way into the cable, reach the paper and destroy its insulating properties, short-circuit scores of conductors and interrupt service.

As a means of testing cables for defects in the sheath and for porous joints at the splices, oil-pumped nitrogen or carbon dioxide gas is introduced into the cable under pressure, and careful gauge readings made to determine if any is escaping. If there is such an escape, the defect must be repaired. To be repaired, it must be located—hence the soapsuds. Sometimes a large leak may be detected by the characteristic hissing sound made by the gas as it rushes from the cable. When carbon dioxide is used, it can be located by running the hand along the cable sheath, as the gas is very cold. When, however, neither of these tests proves effective, the sheath must be painted with soapsuds, first at the joints and points near splices where leaks are most likely to occur, then throughout the entire length of the section to be tested. Even the most minute pinhole will be indicated by a bubble.

When millions of dollars are being spent, minutiae assume vast importance. When programs affect the social and economic welfare of wide stretches of territory, there must be no overlooking of pinholes.

A Close-up of a Construction Job

Until one has had an opportunity to obtain what might be termed a "close-up" of a construction job like the building of the cable that is being stretched southward toward Atlanta, as the writer recently did, there are a good many features of the telephone business that must, in the nature of things, remain in the realm of the abstract. An announcement, for instance, that during the past five or six years the Bell System's investment in plant and equipment has increased by about a billion and a half dollars seems little more than a matter of digits and ciphers. When, however, one has seen telephone facilities in the making, even such impersonal things as construction appropriations are translated into terms of the application of human hands and human minds to a multitude of details.

One can touch such a construction job at almost any point and find somebody grappling with a problem—it may be a group of executives deciding whether a cable shall be built through this particular territory; or an engineering staff weighing the dozens of factors involved in the selection of the specific route the line is to follow; or a foreman and his assistant in consultation over the proper means of carrying out the instructions of blue-print specifications as to the guying of a pole on some particularly troublesome corner.

Blue-prints, by the way, are not popularly supposed to be exactly surcharged with romance and drama. To the average layman, they lack warmth and color. They suggest large-scale production, slide-rule efficiency. And yet, even a blue-print thumbtacked to the wall of an engineering office is not without interest, even to one who is not thoroughly familiar with the technique of telephone construction. With the addition of certain cryptic marks in red and yellow crayon, it tells a fairly detailed story of the progress of the job, step by step, from the obtaining of the right-of-way to the completion of the last splice. And progress—even such progress as is recorded on an engineering chart—is written, first of all, in terms of human effort. There is always drama in the picture of things getting done.

Selection of Route

Every modern toll telephone cable must be provided with repeater stations at intervals of approximately fifty miles. Since it is desirable, from the standpoint of the comfort and convenience of the forces that are to operate these stations, that they be located in or near towns, rather than at isolated points, it is necessary to select a route that will, as nearly as possible, "spot" these repeater stations advantageously. Consideration must also be given to the necessity of providing the larger and more important towns and cities with long distance facilities through the cable.

Telephone cables are almost entirely immune to damage by sleet storms and similar weather disturbances, but certain conditions are accepted by telephone engineers as definite "hazards" having a bearing on the choice of a route. It is undesirable, for example, to have a cable designed for long distance transmission run close to other electric lines carrying high voltage, because of the interference of the latter, through inductance, with the delicate currents employed in carrying the telephone messages. Railways, which may in the future be electrified or which may adopt high-tension block signalling systems, are accordingly avoided.

Forest lands carrying an especially high degree of fire hazard present another danger, as do buildings too near the cable right-of-way, for the lead sheath is quite easily damaged by a blaze hot enough to melt it. Present or prospective real estate developments are avoided if possible, and unless it is necessary to enter a town to give service, a cable line usually skirts around it.

Expense and difficulty of construction and such problems as the transportation of materials also have their bearing on the choice of route. The solution of each of these separate problems is a phase of the solution of the greater problem of selecting a route that will be as nearly as possible an economical and permanent location.

The route once decided upon, it becomes necessary to obtain the right-of-way and clear it of all standing timber and brush before the actual work of cable construction can begin. In the Carolinas, many portions of the Washington-Atlanta cable run through heavily forested land and in order to afford adequate protection from fire and from falling trees it has been necessary to cut a 100-foot swath through the pine woods.

Some miles behind the gang which clears and brushes the right-of-way comes another to dig the holes and set the poles. In many sections of the country the use of the earth-boring machine has revolutionized the job of digging pole holes. Such a machine, which is in reality nothing more or less than a huge, motor-driven auger with a bore slightly greater than the diameter of the pole at the butt, can drill a hole to the required depth in a few minutes. On certain portions of the Washington-Atlanta cable, the holes were being dug by hand, this method having been adopted because of the roughness of the country and the relative cheapness of unskilled labor.

Craftsmanship in a Commonplace Job

To classify the digging of telephone pole holes as a task calling for "unskilled" labor does something less than justice to the hole diggers employed in North Carolina. There is considerable knack in efficiently manipulating the long-handled shovels and bars used in digging a five-and-one-half or six-foot hole, and with these men the operation has become almost an art. Some of the holes are "shot" with dynamite to loosen the earth but, even with the aid of explosives, the digging of an average of twelve holes a day per man calls for not a little of craftsmanship in the doing of a commonplace job.

Prosaic though the digging of a hole in the ground may seem, it presents its problems. The assistant gang foreman in charge of the crew of diggers, who is responsible for the "shooting" of the holes, must exercise good judgment, for example, in deciding at each hole to be "shot" whether to use a third of a stick of dynamite, or whether a half a stick will be required. As a simple matter of mathematics, the difference between the two is only one-sixth of a stick and it would not seem greatly important to save so small an amount on each pole. But when poles are to be set every 130 feet along a line extending across half a dozen states, small savings become momentous. Nor does the question of economy end with the savings in explosive. If too much dynamite is used, the earth will be loosened over too great an area and trouble will be experienced in tamping in the pole securely after it is set. Unless poles are properly tamped, it is sometimes necessary to go over the line after a final inspection has been made and straighten and retamp all poles that show a tendency to lean from the perpendicular.

Machines Do the Work of Many Men

The poles are set by derricks, mounted on caterpillar tractors. That is a simple sentence to write, but it tells a whole chapter in the history of telephone construction. What the invention of the power loom was to weaving, a century or more ago, the development of this simple but most efficient device has been to the telegraph, telephone and electric power and lighting industries during the past decade or more.

Before the advent of the pole derrick, poles were raised by sheer muscle-power. Gangs of ten to fifteen men were required for each job, the butt of the pole being laboriously dropped into the hole as the pole was raised with a dozen or more long pikes armed with sharpened steel points which were thrust into its sides. A long, tedious, back-straining job it was, even for a gang that had learned the trick of doing it in the least difficult way.

That an industrial revolution on a small scale has taken place in the telephone business needs no other proof than that which may be had by watching a pole-setting machine, manned by a driver and three men, picking up twenty-five-foot poles and dropping them into their holes at the average rate of something like two and a half minutes to a pole.

As a matter of fact, this application of machinery to the heavy work necessarily involved in cable construction is one of the impressive developments in the communication art during recent years. It perhaps lacks the spectacular features of such modern marvels as television and transoceanic telephony, but it has been an important factor in making telephone service more economical, more dependable and more efficient for the average telephone user, and particularly for the user of long distance service. It is obvious that modern telephone service would be impossible without the use of cables, and it is almost as obvious that cable construction would be impossible without the Bell System's huge fleet of motor trucks, tractors, motor-driven winches, pole derricks, earth-boring machines and other labor-saving devices.

From the hauling of the heavy reels to the stretching of the suspension strand and the pulling in of cable, machines are lifting burdens from the backs of men. When construction on so gigantic a scale is to be undertaken, no economy of effort must be overlooked. If service is to be provided at a minimum cost, the investment of energy, as well as of capital, must be kept at the lowest possible point.

So that, as one watches a cable construction job in progress —with caterpillar tractors making their way over stumps and rocks and across forest streams, with motors throbbing as winches pull in long stretches of heavy cable, with pole derricks doing their work so easily that it seems almost like child's play—one cannot escape the feeling that here one is watching the making of a telephone service that, at its very beginnings, is being built for economy.

Every Job a Process of Education

But machines can never entirely take the place of men. There still remain a multitude of tasks which require deft hands, long experience, keen judgment—tasks that have to be *learned*. A big construction job like that of building the Washington-Atlanta cable is something more than a job—it is a process of education. It involves an expansion of the forces normally engaged in the territory where the work is to be done. Some of this expansion may be cared for by the transfer of men from other divisions, but a considerable portion of it must come from the recruiting of new employees.

These new employees must be taught the technique of their respective jobs. Most of them are taken on as helpers and learn the tricks of the trade by experience. Whenever possible, however, a somewhat more formal process of education is provided by the organization of schools in which cable splicing and other branches of the work are taught on a regular schedule.

A rainy day, when it is impossible to undertake some branches of work, and particularly splicing, is quite likely to find an informal school in progress in the storeroom where the construction gang makes its headquarters. One group of initiates will be practicing the art—and art it is—of wiping joints with molten metal, while another will be breaking into the telephone business by making "pig-tail" wire splices. Either job is a tough one for a neophyte.

Take a "lesson" in joint-wiping, for instance. An experienced splicer, talking as he works, first demonstrates the proper technique: scoop up a ladle of melted solder from the metal pot, pour it slowly over the joint, holding a felt-padded "catch-cloth" beneath the joint and wiping the metal as it cools, then smooth off with another padded finishing cloth. That's all there is to it. But for the beginner there's far more to it than that. The melted metal is either too hot or too cold, and ten chances to one the term "catch-cloth" proves a misnomer, for a goodly portion of the smoking solder shows a perverse tendency to run up one's wrist. Never mind—try again, and do it this way this time. Over and over, on many a rainy day, the process is repeated. Some day the helper tries his hand out on the job—on a real splice, made up on a splicer's platform. Sooner or later he is no longer a helper, but a full-fledged splicer.

Or take a class in twisting wire-splices. Three hundred pairs in a full-sized toll cable, each wire to be paired with its proper mate, twisted securely and soldered, covered with a cotton sleeve, and the entire bundle of conductors boiled out with melted paraffin, wrapped in muslin—that is, roughly, the routine for which the student-splicer must prepare himself. And there's only one way to do each of these separate operations—the right way. As one watches a novice undergoing his course of training, one wonders at the endless variety of wrong ways that may be discovered in trying to do what, to the trained splicer, seems perfectly easy. Ten perfectly good fingers are suddenly and mysteriously transformed into thumbs that get in each other's way.

There was such a beginner in the storeroom at Greensboro, N. C. Rotund, normally of the most light-hearted disposition —a boy who had grown older, but not much older. Seated on an upturned keg, he was taking his turn with the rest at cranking "pig-tails." It was a muggy, sticky day and beads of perspiration stood out on the youngster's forehead as he struggled with his unfamiliar work. With a word of instruction, the splicer who was acting as teacher walked away to supervise another group of helpers.

The student straightened up with an ill-suppressed sigh.

"Well, I'll learn some day," he said, with a rueful attempt at a grin, "and in the meantime I reckon I'll just have to . . . suffer in silence!"

It is thus that telephone men are made—in the patient doing of a succession of little jobs that, once learned, go to make up the big job of providing a nation with a far-flung communication system. It is thus, in smiling "suffering in silence," that there is born the spirit of service that has become a telephone tradition.

One sees a lot of interesting pieces of mechanism in the course of a close-up inspection of such a job as this, and watches a lot of interesting processes. But, after all, machines are less interesting than men; processes are less fascinating than people. You watch these construction gangs riding out from town in the morning in their great gray trucks, watch them riding back again at night; you see them knitting their brows in the meantime over each problem as it arises, making their decisions and putting these decisions into effect; you see foremen, old hands at the game, going about their business with a word of suggestion here, a word of criticism there and not a few words of encouragement sandwiched in between; you may now and then overhear a full-throated ejaculation of disgust when something goes wrong; you will certainly hear a running fire of good-natured banter, despite the back-straining jobs that everybody expects and accepts as a part of the day's work.

Perhaps you happen on a foreman testing a suspension strand to be sure that it is being hung at the right tension to give the proper sag to the cable. It's a rather interesting operation, to the outsider: throw a handline over the strand, double it, pump it up and down until the strand is oscillating rapidly. Take out a watch and count the oscillations, timing the count for fifteen seconds. Do it again, to be sure the count is correct—maybe repeat the process again and again. Anyway, get it right. Then check the results with a table, worked out by the engineering staff, that shows the required oscillations, and therefore the required tension, for a given length of a given size of strand, at a given temperature.

Somehow this oscillation test strikes you as being a symbol. It strikes you as being something like a composite picture of the whole job—of the whole telephone service, for that matter. You cannot but be aware that, in providing the facilities for a nation-wide telephone service, even seconds assume startling importance; that machinery and manpower alike must operate at exactly the right tension. You realize, as you have perhaps never realized before, that co-ordination and co-operation must be so close that there will be no "sag" in the service when the construction job is done.

Building a telephone system is a big job. But one doesn't begin to understand how big it is until some of its abstractions are made concrete by a close-up view. Its dimensions increase when one examines its details. The importance of America's telephone facilities is magnified when one sees them in the making.

R. T. Barrett.

Operating Features of the Straightforward Trunking Method

ONE of the important factors affecting the problem of handling telephone calls in a multi-office area is the development of suitable operating methods and associated central office equipment so that a call may be completed from one central office to another central office with a minimum amount of error and with the least possible delay. Until recently the plan in most general use under manual operation has been the so-called "call circuit" trunking method.

Call Circuit Trunking

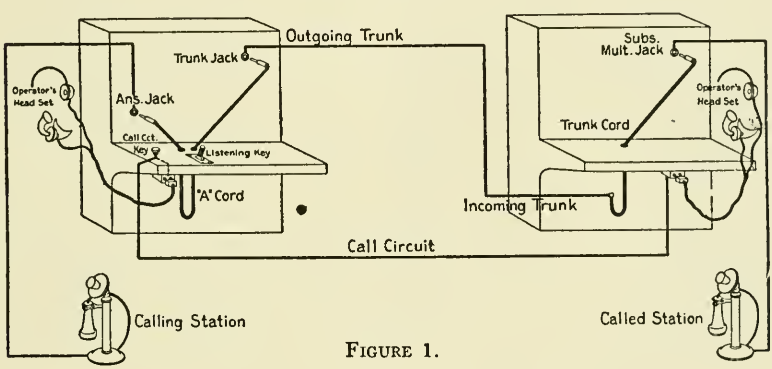


FIGURE 1.

Briefly the call circuit method, as illustrated in Figure 1, may be thus described: Having ascertained from a calling subscriber that a number is desired in another central office the "A" operator connects her telephone set to a talking circuit permanently associated with the telephone set of a "B," or trunk, operator in the particular office where the called subscriber's line terminates. This talking circuit, known as a "call circuit," is used exclusively by the "A" and "B" operators for such conversation as is required in completing calls from originating to terminating offices. The "A" operator,

Essential Steps in Completion of Connections	*Call Circuit*	*Straightforward*
1. Establishing talking circuit from " A " operator to " B " operator.	" A " operator locates and depresses call circuit key to called office connecting her telephone set to the telephone set of the " B " operator.	" A " operator selects idle trunk and plugs cord into trunk jack. " B " operator connected automatically to the selected trunk. A double spurt of tone is sent back over the trunk to indicate to the " A " operator that the " B " operator is connected. The trunk is indicated to the " B " operator by the flashing of the guard signal.
2. Passing order.	" A " operator passes order to " B " operator over call circuit.	" A " operator passes order to " B " operator over trunk in hearing of subscriber.
3. Assigning trunk over which connection is to be established.	" B " operator assigns trunk to " A " operator.	
4. Establishment of trunk connection.	" A " operator plugs cord into assigned trunk jack. " B " operator plugs trunk into multiple jack of line called.	" B " operator plugs trunk into multiple jack of line called.
5. Disconnection.	" A " operator removes cord from outgoing trunk, causing disconnect lamp to light at " B " position. " B " operator removes trunk cord from called line.	" A " operator removes cord from outgoing trunk, causing disconnect lamp to light at " B " position. " B " operator removes trunk cord from called line.

TABLE 1.

after cutting in on the call circuit, repeats the called number to the "B" operator. The "B" operator then tells the "A" operator the number of the particular trunk which she should use for completing the call, after which the "A" operator cuts out from the call circuit and connects the calling subscriber's line to the trunk assigned by the "B" operator. Meanwhile the "B" operator has connected the other end of this trunk to the line of the called party.

Call circuit operation was in successful use for many years in all multi-office cities and the service was of a high order with a relatively small number of operating errors. With this method, however, all the "A" operators in an office have access to the call circuit terminating in a "B" operator's headset with the result that, frequently a number of "A" operators endeavor to pass their orders simultaneously to one "B" operator. This is especially true during the busy hours of the day. Consequently a considerable amount of skill and experience are required on the part of both "A" and "B" operators in order to keep the call circuit method working smoothly and efficiently.

Another plan, known as the "straightforward" method, is also used for handling calls which must be trunked from one central office to another. This method, which follows in fundamental principle the well known "ring down" plan for operating trunks and toll lines, has been rapidly introduced into the multi-office cities throughout the Bell System.

Briefly, the straightforward method of trunking, as illustrated in Figure 2, contemplates the selection of an idle trunk by the originating "A" operator, a means for connecting the terminating "B" operator to the trunk selected without loss of time and without undue effort on her part, and the passing of the called number by the "A" operator over the trunk on which the call is to be completed. This passing of the number desired is heard by the calling subscriber. In Table 1 a comparison is made of the essential features of the call circuit and straightforward operating methods and possibly this brings out some of the operating details more clearly than would a lengthy description.

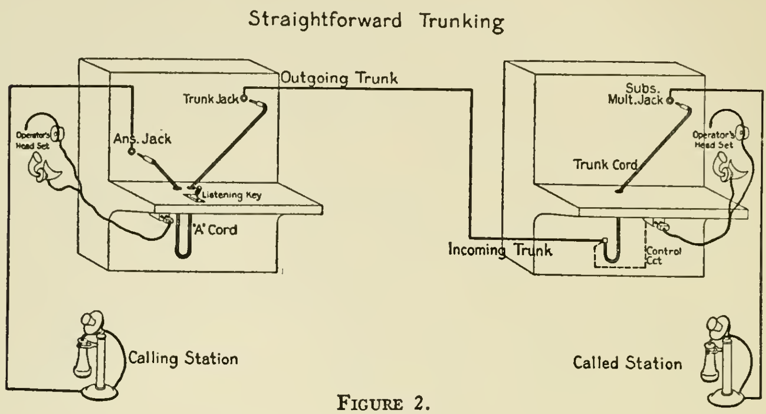


FIGURE 2.

As previously stated the number of errors resulting with call circuit operation was not large, but they are fewer with straightforward operation. This follows since the "A" and "B" operators who are completing a specific trunk call have exclusive use of the trunk at the time when the called number is passed and thus any confusion due to other operators breaking in is eliminated. Further only the called number need be passed, whereas with the call circuit method the number desired must be passed as well as the number of the trunk to be used, thus offering two chances for error. Also this method offers a check against errors in that the calling party hears the "A" operator give the number to the distant "B" operator and can immediately correct her if she repeats the number in error.

The expectations of improved service due to a reduction in the number of errors have been generally realized in the application of the straightforward method in the larger multi-office cities in the Bell System.

Another traffic advantage, due to the simplicity of the straightforward operating plan, is the lessened effort required for instructing both "A" and "B" operators. The operation of the call circuit has always been a difficult matter to teach,—many weeks of actual operation at the switchboard being necessary before operators became proficient in establishing trunk connections.

Another operating advantage is the fact that the trunks no longer need be grouped by central offices with the associated call circuit at the "B" positions. With call circuit operation this grouping had to be continually studied in order that there might be no overloading of any section of the switchboard with its consequent reaction on the service. Any marked change in the traffic trunked between offices required a rearrangement of the trunks at the "B" switchboard, which in the long run involved a considerable expense. With the straightforward method, the trunk groups may be divided within certain limitations and the individual trunks located anywhere along the trunk switchboard, which flexibility considerably lessens the cost of regrouping the trunks as changes occur in the volume of traffic handled.

An important operating change which fits in particularly well with the straightforward trunking plan is referred to as "restricted repetition," and consists in using the phrase "thank you" instead of repeating the order given by a subscriber. As previously mentioned, the straightforward trunking method permits the subscriber to hear the passing of the number to the "B" operator and affords an opportunity to correct it at that time. This makes a repetition unnecessary when the subscriber first gives the number desired to his "A" operator.

The use of "restricted repetition" effects somewhat of a reduction in the "A" operator's work time. As a result, therefore, of straightforward trunking and "restricted repetition" the working time of both the "A" and the "B" operator in handling a trunk call is decreased and this is reflected in an operating economy, tending to offset the higher equipment costs of this more accurate method of trunking.

The principal equipment difference between the "straight-forward" method and the "call circuit" method is found in the equipment at the "B" position, and at the tandem position in the case of tandem trunks. This is the equipment employed in connecting the trunk operator's telephone set to the trunk which has been selected and also that used for disconnecting the set after the desired order has been passed by the "A" operator. Several plans have been developed, each apparently having its field for a given set of conditions. The simplest method so far as equipment changes are concerned has been given the name of "jack listening" since the "B" operator plugs the trunk which has been selected by the "A" operator into a jack associated with the "B" telephone set, and disconnects after receiving the order from the "A" operator. Another method is called "key listening," where the "B" operator's telephone set is connected to the trunk as long as she depresses a listening key which is associated with that particular trunk. Another, the "automatic listening" method, employs an equipment arrangement whereby the "B" operator's telephone set is connected to the trunk automatically, that is, without requiring any action on her part. When trunks are taken up by the "A" operators at a more rapid rate than the connections can be established by the "B" operator, the waiting calls are connected to the "B" operator's set in the order of a sequence which moves from left to right over the trunks on the position. The "B" operator's telephone is disconnected either by the operation of a release key or by the plugging of the trunk cord into the multiple.

In general, the automatic listening method, while the most expensive from an equipment standpoint, is justified for machine ringing "B" positions if several positions are involved and also for tandem positions at new tandem switchboards. The key per trunk scheme, that is, the association of a listening key with each trunk, is particularly applicable to manual ringing "B" positions, to key display call indicator positions which are being temporarily operated on a straightforward basis and to tandem positions at existing tandem switchboards. The jack listening method is limited to certain small outlying offices where the number of calls handled is limited and also as an emergency safeguard where automatic listening is provided.

Figure 3 illustrates in schematic form the arrangement of the fundamental circuits at automatic listening "B" positions. The following paragraphs describe briefly the principal operating features:

1. Ten trunks splitting.

   The incoming trunks are arranged in groups of ten so that by means of splitting keys the "B" operator's set may be associated with any consecutive multiple of ten trunks. Thus she may handle 20, 30, 40, etc., trunks depending on the number of calls. This flexibility permits force adjustment in close relation to the actual traffic.

2. Release key.

   A release key permits the "B" operator to release the trunk and thus be in a position to receive a new call, while she is establishing connection on a trunk just released. This makes possible an overlap of work which tends to decrease the "B" operator's work time. In case the "B" operator fails to operate the release key the insertion of the trunk plug in the jack of the called line or in a busy-back jack will also release the "B" operator's set.

3. Pilot lamps.

   A pilot lamp associated with each ten trunk unit facilitates the location of a trunk that has been automatically connected with the "B" operator's set.

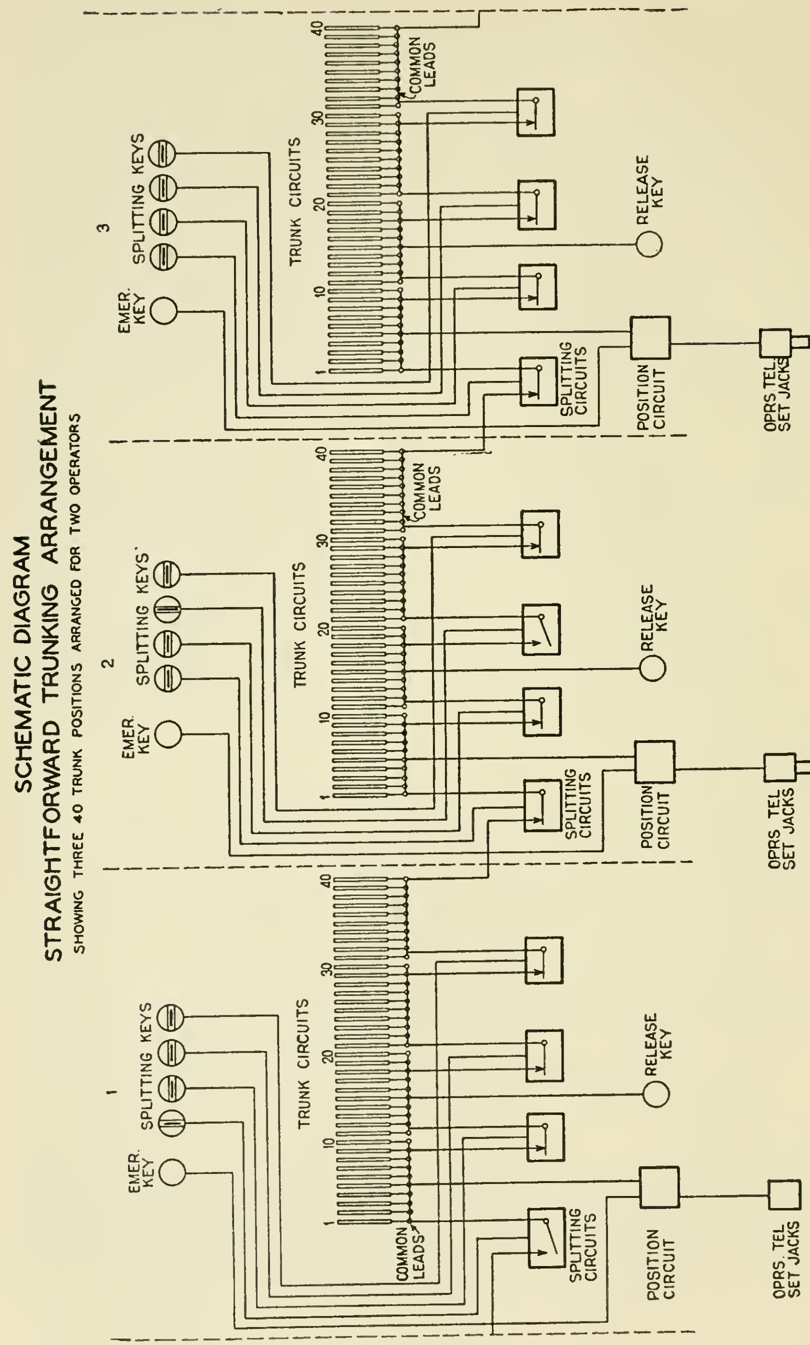

SCHEMATIC DIAGRAM
STRAIGHTFORWARD TRUNKING ARRANGEMENT
SHOWING THREE 40 TRUNK POSITIONS ARRANGED FOR TWO OPERATORS
1
2
3
EMER. KEY
SPLITTING KEYS
TRUNK CIRCUITS
COMMON LEADS
RELEASE KEY
SPLITTING CIRCUITS
POSITION CIRCUIT
OPRS. TEL SET JACKS

FIGURE 3.

4. Locking disconnect and reselection while the trunk is in the subscriber's multiple.

   If a trunk has been disconnected at the " A " end and then reselected before the " B " operator has taken down the connection, the disconnect signal remains lighted at the " B " board. If this trunk comes within the sequence of selection at the " B " positions before disconnection takes place, the signal then flashes and the " B " operator's telephone set is associated with the trunk in the usual manner.

5. Automatic peg count.

   A peg count register for each " B " position is operated by the depression of the release key or by the insertion of a plug into a jack thus automatically giving a numerical record of the calls handled.

6. All trunks busy registers.

   A register is associated with each incoming trunk group which indicates each time that all of the trunks are busy. Information obtained from these registers is used in engineering the trunk plant.

7. Emergency listening jacks.

   Listening jack circuits are provided for the rather rare cases where the automatic listening apparatus may be in trouble. The " B " operator, by plugging the trunk which has been selected into this emergency jack, connects her telephone set and is thus in a position to obtain the order.

Coming now to a consideration of some of the operating features at " A " positions where the trunking is on a straightforward basis, several methods have been developed whereby the " A " operator may quickly secure an idle trunk to the terminating office. The following table briefly outlines these methods and also gives their general field of application, the particular method for any case being selected after a careful review of all the factors.

Method of Securing Trunk	*Size of Trunk Group*
Regular trunk busy test.	Up to 20 trunks.
Regular trunk busy test supplemented by master busy on every fifth jack.	From 20 to 40 or more trunks, depending upon length of "A" switchboard.
Idle trunk and position indicating, designated "trunk indicating" for brevity.	From 30 trunks up depending upon length of "A" switchboard.

The first two operations are well known in telephone practice. The last is a development brought about by straightforward trunking and is an arrangement whereby an idle trunk at an idle "B" position is indicated by a lighted lamp associated with the outgoing trunk jack at the "A" switchboard. With this operating method the "A" operator merely has to locate the lighted lamp in the outgoing trunk multiple, plug into the associated outgoing trunk jack and immediately she is connected to the "B" operator, which is evident from the tone that she hears. The labor of testing by the "A" operator is thus reduced to a minimum and the selection of an idle "B" operator speeds up the answer slightly. There is the further traffic feature that the distribution of the calls over the group of "B" operators, resulting from the selection of an idle "B" operator, tends to make all answers approximate the average answer, eliminating the longer intervals sometimes occurring where there is no distribution of the calls.

Various ways were considered for cheapening the equipment costs of the lamp indicating arrangement which necessarily are rather high. One plan omits the lamps and lamp sockets from every other appearance in the out trunk multiple, thus splitting the trunk group into two parts so far as the lamp appearances are concerned. This reduces the number of lamps and lamp sockets by one-half and the equipment charges by an appreciable amount, although not in direct proportion. Going a step further, under certain conditions the lamps are provided only in every third appearance. It should be noted, however, that with the trunk group split into either two or three parts as just stated, there is a resulting loss in efficiency in the carrying capacity of the individual trunks. In order to reduce the number of excess trunks required by this split of the trunk group, the "A" operator tests for an idle trunk in the group not provided with lamp indicating equipment whenever all the trunks in the group having lamps are busy. Such calls, of course, entail extra operating labor but with a proper division of the group an overall economy is effected, since this extra labor is not excessive and little additional trunk equipment is required.

Where idle trunk and position indicating lamps are not available, the work of testing can be facilitated by providing preferential markings of the trunks throughout the out-trunk multiple so that each jack in a trunk group is marked as a first choice for testing for one or more "A" operators. This results in spreading the traffic more uniformly over the trunk group with the result that any "A" operator finds an idle trunk immediately on a large proportion of calls.

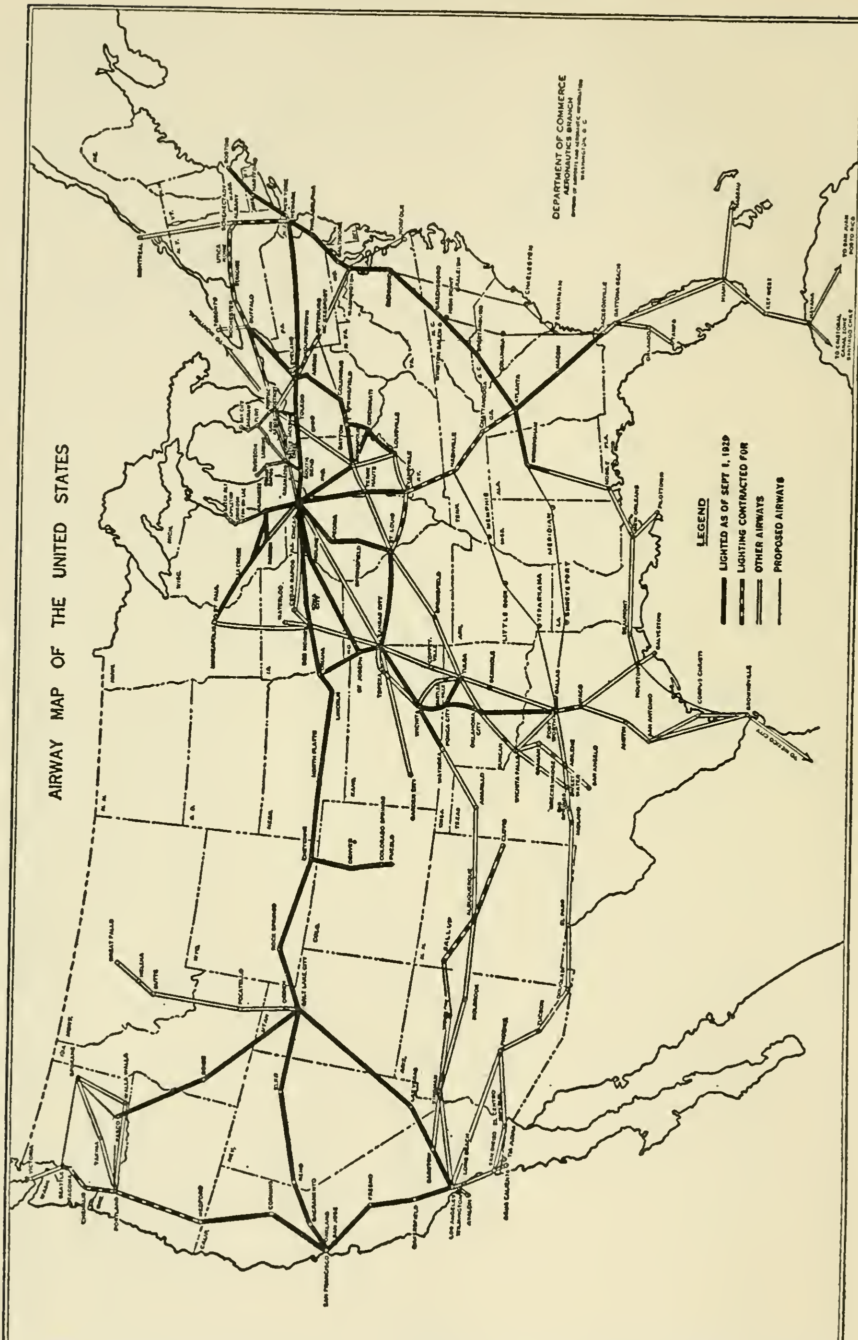
While the description so far in this article has been that of the straightforward method for completing traffic between manual offices, the same principles have been applied to the traffic outgoing from a manual to a dial office. The trunks incoming to the dial office terminate at dial system "B" positions where the trunks are associated with suitable apparatus whereby the "B" operator is connected to a trunk that has been selected by an "A" operator. The call is passed in a straightforward manner and the called number set up on a key set by the "B" operator. The connection is then established through the series of selectors to the desired subscriber's line.

In the larger cities the trunking plant represents a considerable capital investment so that it is the subject of continual study to insure the provision of an adequate plant, yet one representing the most economical plan consistent with furnishing good service. In such a trunking plan there is frequently a field for a tandem operating method. While ultimately this tandem traffic may be handled by machine switching equipment, for a number of years to come, in many cities the service can best be given through a manual tandem switchboard. The straightforward method is particularly adapted to these conditions, since the operating errors can be practically cut in half as contrasted to the call circuit method, which involves a call circuit from the "A" to the tandem operator and another from the tandem operator to the completing "B" operator.

The manual tandem boards in the larger Metropolitan areas have been converted or replaced so that they are now working on a straightforward basis. The latest type of manual straightforward tandem switchboards are equipped with automatic listening trunks, similar in operation to those already described for local trunking operation. The out trunk multiple of the completing trunks extending to the various called offices is equipped with lamps which indicate an idle trunk in each outgoing trunk group. These lamps are of particular value at tandem boards because such a high proportion of the tandem operator's work time would otherwise be devoted to testing for an idle outgoing completing trunk. Furthermore, any saving in the testing time at the tandem board is also reflected in the "A" operator's work time since she is waiting on the connection to pass the order to the "B" operator, and this in turn is reflected in the service by speeding up the connection to some extent. An interesting development growing out of the introduction of the straightforward method has been the extension of the tandem areas by routing the traffic between more distant points through tandem boards as compared with the more expensive and somewhat slower toll board operating method.

In closing this article a word as to the extent of straightforward operation may be of interest. This method is now in use at approximately 7,000 " B " positions in thirty of the larger cities. Ten former call circuit tandem switchboards with about 450 positions have been converted to straightforward operation, and eight new straightforward tandem boards have been installed with 70 positions.

F. S. James,
W. E. Farnham.


AIRWAY MAP OF THE UNITED STATES
DEPARTMENT OF COMMERCE
AERONAUTICS BRANCH
LEGEND
LIGHTED AS OF SEPT 1, 1929
LIGHTING CONTRACTED FOR
OTHER AIRWAYS
PROPOSED AIRWAYS

Communications for Aviation

Present Status of Aviation in the United States

THE past year has witnessed important developments in virtually every phase of civil aeronautics. Spectacular achievements have combined with regularly scheduled operations to popularize air transportation. It has been estimated that more than half a billion dollars is now invested in the airplane industry in the United States.

During 1928, 35 companies operated over civil airways 50 scheduled air lines and flew a total distance of 10,673,450 miles. These operators transported 49,713 passengers, 1,848,156 pounds of express, and 4,063,173 pounds of mail.

There are now 29,227 miles of established airways in the United States. More than 10,000 miles of these airways are lighted for night flying and 2,065 miles are in process of being lighted. The accompanying map shows the airways throughout the country as of September 1, 1929.

On November 1st the Department of Commerce reported that 82,816 plane-miles are flown daily on scheduled routes within the United States. In addition 8,301 plane-miles are flown daily on so-called foreign routes; that is, from points in the United States to Canada, the West Indies, Central and South America.

On September 30th the Department of Commerce reported a total of 1,460 airports and landing fields and 1,050 proposed airports. Of the established airports, 171 are lighted for night flying. The remainder are unlighted airports, intermediate landing fields, etc.

It is reported that there are now 86 air lines of which 13 carry mail, express and passengers, 9 carry mail and passengers, 14 carry passengers and express, 6 carry mail and express, 12 carry mail only, 2 carry express only, and 30 carry passengers only.

The Department of Commerce on November 1st reported 5,764 active airplane licenses and 3,095 active airplane identifications. Airplanes engaged in interstate transportation of goods or passengers must be licensed. Other airplanes may be identified, but no license or identification is required by the Federal authorities for airplanes used solely within a state. However, some states have passed laws requiring Federal licenses for intrastate traffic and it seems likely that similar laws may be adopted for other states. The figures given above are the best available for the number of airplanes in use in the United States. No figures for the airplanes engaged in the various services are available except that for the year 1928 some 28 companies out of 41 reported 268 planes engaged in air transport, presumably over scheduled routes.

Naturally, scheduled air transport operations receive the most attention. However, these scheduled operations account for only one-sixth of the total flying in the United States. Other miscellaneous air services include sight seeing, student instruction, crop dusting, aerial photography, mapping, messenger service, advertising, charter or taxicab service, etc. It is estimated that during 1928 about 60,000,000 plane-miles were flown by such miscellaneous services. There is also some private flying.

Communications

Communications are essential to the operation of air transport lines and in considering the forms of communication required they may be conveniently divided into: (*a*) ground to plane communication, and (*b*) communication between points on the ground.

Ground to Plane Communication

Of course, the only means for communication between points on the ground and planes in flight is radio and three distinct kinds of communication are required:

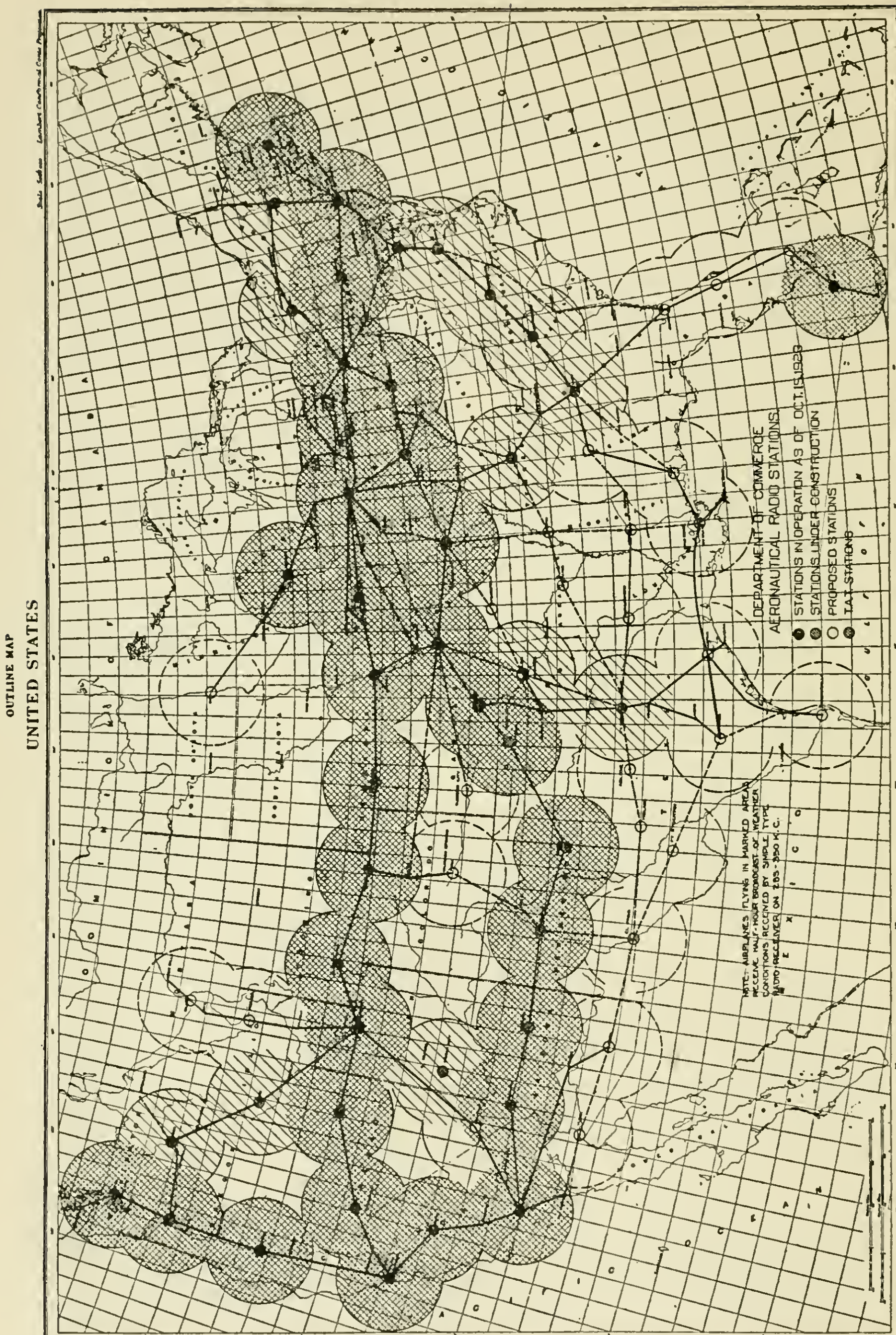
1. The radio range beacon. This is a radio transmitter located at or near important landing fields which sends out a relatively narrow beam along the airway; and the pilot in an airplane by picking up the signal on a suitable receiving set is enabled to keep on the course. Two methods of operation of the range beacon have been developed. One of these uses a visual indicator in the airplane consisting of vibrating reeds, and the other uses an aural method. The aural method is used for the range beacons now installed by the Department of Commerce and by some of the airplane operating companies.

2. Radio telephone transmitters for the purpose of transmitting weather reports and other information from the more important landing fields to airplanes in flight. This information is transmitted on wave lengths between 850 and 1,050 meters and picked up by suitable receiving sets on any airplane in the vicinity.

3. Two-way radio telephone communication between ground stations and airplanes in flight. This will be for the purpose of transmitting weather information and instructions to pilots, with the ability to get a reply from the pilot so that assurance may be had that the message has been received. This will also enable the pilot to call the ground station and ask for such information as he needs.

The radio apparatus discussed in (1) and (2) is supplied in general by the Department of Commerce as part of its function under the Air Commerce Act of 1926 in providing navigation aids. However, Transcontinental Air Transport has provided similar transmitters for its landing fields not equipped by the Department of Commerce. The receiving sets in the airplanes are owned by the airplane operating companies. The radio range beacon has been in operation on the Cleveland-New York route for more than a year. Recently it has been installed at Goshen, Sterling and Des Moines, and the Chicago and Boston beacons are now being installed.

The radio range beacon is operated in conjunction with the radio telephone stations. It is stopped every fifteen minutes and identified by station announcement followed by correct


OUTLINE MAP
UNITED STATES
DEPARTMENT OF COMMERCE
AERONAUTICAL RADIO STATIONS
STATIONS IN OPERATION AS OF OCT. 15, 1928
STATIONS UNDER CONSTRUCTION
PROPOSED STATIONS
T.A.T. STATIONS
NOTE: AIRPLANES FLYING IN MARKED AREAS RECEIVE HALF-HOUR BROADCAST OF WEATHER CONDITIONS RECEIVED BY SIMPLE TYPE RADIO-RECEIVER ON 285-350 K.C.

time and weather reports. This system has a number of advantages in that the pilot does not have to change the tuning of his receiver and is listening at all times for either radio range beacon signals or weather information. In this way it is possible to interrupt the beacon at any time and communicate emergency messages to the pilot in flight.

The accompanying map shows 25 government ground radio telephone stations for transmitting weather information to planes, in service on October 15, 1929. The map also shows 5 stations operated by Transcontinental Air Transport, 14 stations under construction and 29 proposed stations.

The two-way telephone apparatus discussed in (3) is not provided by the Department of Commerce. This two-way telephone communication will be required by the airplane operators who undertake the transport of passengers. These operators must provide every means possible to insure the safety of passengers and it is expected that they will provide their own two-way radio telephone systems.

A variation of the general plan for two-way radio telephone communication is a proposal to equip the more important landing fields with relatively low power two-way radio telephone sets, with the expectation that itinerant flyers will have their planes equipped with two-way sets so that when they are approaching a landing field they may communicate with the ground and obtain landing information and instructions. It is expected that all of these low power sets will be operated on one frequency to facilitate the establishment of such communication between any plane and any landing field.

There appears to be a field for combined radio telephone and telegraph sets where aircraft are flying long distances over water as from Florida to the West Indies, but for flying within the United States probably radio telegraphy will not be used.

Already there has been some demand for wire circuits to connect the radio telephone ground stations with nearby points for remote control operation, and some of the telephone companies are furnishing such circuits.

It does not seem likely that there will be any real demand in the near future for radio telephone communication with passengers in airplanes, in the sense of providing connection to ground stations for regular exchange and toll service. Moreover, the airplane operators appreciate that the radio facilities now contemplated cannot be used for passenger communication without jeopardizing their primary function which is the safe navigation of the airplane. It probably will be possible for passengers to write out and hand messages to the radio operator on the airplane in an emergency for transmission to a ground station where the messages may be retransmitted by either telephone or telegraph.

The Federal Radio Commission has announced that radio frequency assignments for aviation will be made only where the services so established will be available generally to all who may wish to use them. This, as well as the conflict of interest where two or more companies are operating planes over the same route, has led to the suggestion from the technical committee of air transport operators that a communication company be formed for the United States to which frequency assignments will be given and which will undertake to own and operate all the radio facilities for aviation, except those facilities furnished by the Department of Commerce. Just how this may work out is as yet uncertain.

Communication Between Points on the Ground

It has been suggested that radio telegraphy might be used for communication between landing fields. This may perhaps be an economic way to provide such communication where the volume of traffic is small, or where wires are not readily available, but with the continued growth of civil aviation it seems certain that the use of wire lines for such communication can be justified at least on the more important routes.

The Department of Commerce is using the telephone typewriter service for communicating between Newark, Chicago and 17 intermediate points as well as Maywood near Chicago; and for communicating between Reno, San Francisco, Los Angeles, San Diego and some 15 intermediate points. Private airplane transportation companies have telephone typewriter service between Los Angeles, Kingman, Winslow, Albuquerque and Clovis; between Waynoka, Wichita, Kansas City, St. Louis, Indianapolis, Columbus, Akron and Cleveland; and between Newark, Philadelphia, Baltimore, Washington, Richmond, Greensboro, Spartanburg and Atlanta. It is expected that similar service will soon be extended from Atlanta to Jacksonville and Miami.

The principal function of the telephone typewriter service is to transmit weather information between the principal airports on an airway, but it may also carry a considerable volume of routine messages in connection with the operation of the air line. In addition to this it is necessary to collect weather information from points near the airway but not on it. Ordinary telephone calls are being used to a considerable extent for this purpose. Also a number of local telephone typewriter services are being used for communication at or near an airport between the radio station, the weather bureau and, in some cases, the Post Office and operating company's offices.

Continued growth of the air transport industry will undoubtedly result in a very large increase in the wire communications required. In the past generally the air transport traffic has not been sufficient to justify private line facilities for air transportation companies, but the growth of their business, particularly in passenger carrying, probably will make such facilities necessary in the near future.

Facilities for the Public at Airports

With the advent of air passenger transport adequate pay station telephone facilities must be provided at airports, and the information available indicates that this situation is being taken care of as it develops. Also, the telegraph companies are providing public telegraph offices at some of the principal airports.

Lighter-than-air Craft

The recent trips of the *Graf Zeppelin,* have focused attention upon the possibilities of airships for the transportation of goods and passengers. It seems that the commercial use of such ships is still rather far off although a company has been formed in the United States, which, it is understood, looks toward establishing trans-pacific and later trans-atlantic air transport lines using ships of the Zeppelin type.

While airships present certain advantages especially for long flights over water, where at present airplanes cannot be safely used, it seems that they also have certain disadvantages, the more important of which are relatively high first cost in proportion to the useful load, and large ground crews and special facilities required for landing. They are also more subject to adverse winds than airplanes because of their lower speed.

One airship of 5,000,000 cubic feet capacity has been completed and another ship of the same size is nearing completion in England. The construction of two ships of 6,500,000 cubic feet capacity for the United States Navy has been started in this country. In addition, an interesting metal clad airship of 202,200 cubic feet capacity has recently been completed for the Navy. This little ship is intended to demonstrate the practicability of the metal clad construction.

The communications required for such ships it seems would be of the nature of ship-to-shore radio telegraph and radio telephone service. The radio facilities provided for aircraft would be available for airships where they are flying over established routes, as in the United States or West Indies.

R. W. Armstrong.

International Radio Technical Conference at The Hague

LAST September there was held at The Hague the first meeting of the newly organized International Technical Consulting Committee on Radio Communication, known as the CCIR. This committee corresponds in radio to the two consultative committees having to do with international wire communication, the CCI Telephone and the CCI Telegraph.

Since international conferences on electric communications are occurring rather frequently these days, it may be well, in the first place, to identify more definitely these several committees. In general, the two wire committees and the radio committee go back for their authority to two different international conventions or treaties upon the subject of electric communications:

(1) The wire convention, known as the International Telegraph Convention and Regulations. This convention is an outgrowth of wire connecting agreements between the European nations and has now come to include a number of countries outside of Europe. It is not set up to take account of the U. S. situation in electric communications, however, and for this reason the U. S. Government is not an adherent.

(2) The radio convention, recently revised at Washington and known as the International Radiotelegraph Convention of Washington, 1927. This is an outgrowth of the use of radiotelegraphy for safety of life at sea and is concerned largely with wavelength matters. The U. S. Government is an adherent.

It is the wire convention with which are affiliated the two wire consultative committees referred to above, the CCI Telephone and the CCI Telegraph. These wire committees have as their object the agreeing upon plant standards and operating practices for international communication circuits. The American Telephone and Telegraph Co. has from time to time collaborated with the CCI Telephone and has recently become a member of this committee, in view of the company's direct interest in telephone connections to other continents.

The CCI Radio, which recently met at The Hague, is organized under the Radio Convention "for the purpose of studying technical and related questions." Like the wire consulting committees, its activities are limited to the formulation of advice. The Radio Committee is concerned primarily with the problems which inhere in the fact that in radio the nations share a common transmitting medium, the outstanding technical problem being that of how to derive the maximum number of channels and minimize mutual interference. The activities of the Committee are of a two-fold interest in the United States: (1) to the Government, in respect to the regulatory application of the technical advice, and (2) to the operating agencies, in respect to the engineering of plant and the operation of radio channels.

Attending the recent Hague meeting were, therefore, both government and company representatives. The United States Government sent quite a complete delegation, headed by Gen. Saltzman, formerly Chief Signal Officer of the Army and now a member of the Federal Radio Commission. Practically all of the American communication companies interested in radio had representatives present. The Bell System was represented by Dr. W. Wilson, of the Bell Telephone Laboratories and the writer, with Mr. DeCoutouly, of the Bell Telephone Laboratories, assisting as interpreter.

Results of the Hague Conference

The outcome of the recent conference at The Hague can perhaps best be summarized by setting forth the principal subjects upon which recommendations were made, rather than the detailed recommendations themselves, as follows:

(1) Methods for comparing the frequency standards of the different nations and for measuring frequencies internationally, so that a given frequency assignment will mean the same the world over.

(2) Accuracy with which stations should be expected to hold to their assigned frequencies.

(3) Width of frequency band which is occupied by a given type of transmission, *i.e.,* telephone, telegraph, television, etc.

(4) The frequency intervals at which stations should be assigned.

It will be seen that all of this is concerned with the problem of carving up the frequency spectrum into the narrowest bands permitted by the art, for the purpose of squeezing in the maximum number of stations and of giving an indication of how many channels the world may expect to have at its disposal without undue interference.

It is of interest to note what the recommendations of this conference indicate as to the number of channels which can be simultaneously utilized in the world. With the existing engineering practice the entire known radio spectrum may be resolved into some 3,000 or 4,000 individual bands so spaced that each channel is more or less free from interference. A certain portion of the radio spectrum is only regional in its transmission effects and will permit a number of simultaneous uses to be made of the same channel at widely separated points on the earth. Other portions of the spectrum are, however, so world-wide in their effect as to greatly limit the extent to which channels can be duplicated. As compared with these present possibilities, there are already registered at the Berne Central Bureau some 9,000 frequencies for use throughout the world. It is apparent, therefore, that a large proportion of the channels which the present art can yield are already in use or bespoken.

Two definite improvements now within view may be expected to increase the effective communication capacity of the ether. One enables the wavelength of the station to be maintained closer to its assignment, thereby minimizing waste wavelength space, while the other increases the selectivity of the receiver, thereby excluding undesired signals in closely adjacent bands. The Hague Conference recognized these possibilities and recommended advanced standards based upon them. When these improvements become more or less universal, certain parts of the spectrum may be resolved into still narrower channels with a corresponding increase in the number of facilities. In general, the realization of these advances in practice will be gradual, since it is dependent on political and economic factors. There is, of course, a great difference between the nations in respect to their communication policies and their readiness to replace obsolete equipment in order to conform with higher technical standards.

The more administrative problem of dividing the frequency spectrum into wide bands for assignment to various classes of service was one of the most important ones dealt with at the Washington 1927 Conference. This question was intentionally avoided by this technical conference, as were also the related questions of rights to and responsibilities in the use of individual radio channels. These questions will need to be developed further at the next general international radio conference, due to be held at Madrid in 1932. Incidentally, there will also be before that meeting a proposal which has been advanced by the European countries, to unite the two existing conventions, the radio and the wire, into one general communications convention.

Internal Aspects of the Conference

Further points of interest concerning the complexion and the working of the conference itself are as follows:

(1) There were about 200 technical people present, representing both governments and companies, from some 40-odd countries.

(2) All findings were adopted unanimously, and the problem of voting was thereby avoided. As the committee is constituted, the voting power is exercised by the government representatives of the various countries, unless a country is represented solely by companies. There remained unsettled the question of what this voting power should be, whether each country should have a single vote or whether, as has been done in other radio conferences, the greater stake of the larger countries should be recognized by giving them a plurality of votes.

(3) Strange as it may at first seem for a communications conference, one of the most difficult problems proved to be the one of how the delegates should communicate with each other on the floor! In keeping with diplomatic custom, French was recognized as the official language of the Conference. Some of the European countries wished to confine the proceedings to French, but this would have prevented the delegates from some of the English-speaking countries, particularly those from the United States, from participating adequately in the Conference. The arrangement finally agreed upon was that a representative could speak in his own tongue, providing a translation were made immediately into French, and that a delegate could call for a translation into "one other language" of a presentation made, in

the first place, in French. The only "other language" availed of was English. In fact, it was used quite generally along with the French throughout the Conference, since about as many delegates understood English as understood French.

(4) The carrying on of the Conference was facilitated by the excellent arrangements which had been made by the Netherlands Government and by the secretarial staff of the International Bureau for the machinery of the Conference. The Conference was short, two and a half weeks, and the work was intensive. Pleasant relief was afforded by visits to radio plants and other places of interest in Holland.

Questions Remaining

At the conclusion of the Conference there were a number of questions which the Conference desired to have studied in the interim before the next meeting of the CCIR, set for Copenhagen in 1931. Each of a number of countries volunteered to take the initiative in the study of one or more of the problems and formulate proposals for the next meeting. Thus, the subject of ship-to-shore telephony, which was discussed in the Conference but which was thought to be premature for the setting up of a technical plan, was taken by Germany for further study, with the United States and a number of other nations volunteering to co-operate. The problem of co-ordinating frequency assignments in the mobile service bands was undertaken by the United States, with other nations collaborating. France undertook the study of measuring voice and noise levels in radiotelephone links between wire networks; Austria agreed to study the subject of single sideband transmission. Such allocation of work is an attempt to simplify the preparations for the next conference, but is not intended to exclude a country from submitting its own proposals where it sees fit to do so.

Lloyd Espenschied

Abstracts of Technical Papers from Bell System Sources

Further Note on the Ionization in the Upper Atmosphere,[1] by J. C. Schelleng. In this paper Mr. Schelleng records certain considerations that were omitted from a previous paper which omission resulted in some difficulty.

The Use of Continued Fractions in the Design of Electrical Networks,[2] by Thornton C. Fry. In U. S. Patent No. 1,570,215 and in several technical papers by Bartlett and Cauer it has been shown that continued fractions can often be used in designing networks with pre-assigned impedances. The chief difficulty of the method has been that it frequently required the structures to contain negative resistances, inductances or capacities and therefore the results, though correct in theory, were often worthless in practice because the networks could not be constructed.

The present paper removes this difficulty in virtually all cases where the analytic character of the desired impedance is known, that is, where it can be represented by a formula and not merely by a graph. In such cases the choice of a type of structure, as well as the assignment of values to the elements, becomes almost a matter of routine with the definite assurance in advance that no negative elements will be required.

The Mutual Impedance Between Adjacent Antennas,[3] by Carl R. Englund and Arthur B. Crawford. The simple theory for the computation of reflecting or multibranch antenna systems is sketched. If the points at which observations of elec-

[1] Proceedings of the Institute of Radio Engineers, August, 1929.
[2] Am. Math. Soc. Bull., July–August, 1929.
[3] Proceedings of the Institute of Radio Engineers, August, 1929.

trical quantities are to be made are definitely specified, a knowledge of the self and mutual impedances (properly defined) between antennas is sufficient to make the computations determinate. Of the circuit constants, the most useful and accessible is the antenna current ratio

$$K_{12} = \frac{I}{I_1} = K_0 e^{i(\phi - (2\pi d/\lambda))}$$

and in the work here reported ϕ has been measured in the range 0.33 λ to 1 λ. Experiment has shown that in this range ϕ is that theoretically calculable for a Hertzian doublet. Actually this range is equivalent to $\lambda/3$ to ∞. The discussion of experimental procedure is purposely thorough.

Telephone Communication System of the United States,[4] by Bancroft Gherardi and F. B. Jewett. This paper presents the results which have been obtained up to the present time in developing telephone communication in the United States of America, this development having been worked out in a form to meet the particular conditions which present themselves in that country. The paper first deals with a brief description of the general structure and organization of the telephone communication system giving the organization of the Bell System which handles the greater part of the telephone service of the country and the reasons for and advantages of this organization. In this connection some figures are presented with respect to the technical personnel who are continuously engaged in studies to develop the art and to provide new methods and facilities for improving the service.

Local service, that is the service within the limits of a single telephone exchange area, is next discussed. Figures are given with respect to the volumes of telephone calls handled in the Bell System, the speed with which the connections for these calls are completed and the operating force required. Ref-

[4] Presented by Dr. F. B. Jewett before the World Engineering Congress, Tokio, Japan, October, 1929, Bell System Technical Journal, January, 1930.

erence is also made to the standards of transmission given and the various problems encountered in meeting these standards. Figures are given with respect to station growth, to the increased efficiency of station apparatus and to the improvement in types of instruments. Various types of private branch exchanges provided to meet the needs of customers using a large amount of telephone service are discussed. The cable plant is considered mainly from the construction standpoint and typical illustrations are given of some of the construction practices. The various types of central office switching systems in common use are described, including magneto, common battery and dial systems, the latter including both the step-by-step and panel systems which are being provided in increasing amounts in the Bell System. The subject of buildings to house these various equipments as well as the operating forces and headquarters staffs in many cases is briefly discussed, also standardized layouts and floor plans. The problem of giving telephone service in the rural communities, which is a very important one in the telephone development in the United States, is also briefly treated.

The toll service is considered, first with respect to the shorter haul toll business and the problems involved, and then with respect to the long distance toll service. Figures are given showing the speed of service and the amount of traffic handled. For the short distance toll service, two important methods of handling the business are described, namely, manual straightforward tandem and dial tandem.

The long distance service, which has developed most rapidly in recent years, is described in some detail in the paper. Among the important features of this service is noted the recently developed method of completing toll calls with sufficient speed so that on most of the calls the calling subscriber remains at the telephone. The various types of toll circuits are described including open wire circuits operated both at voice frequencies and by carrier systems and long toll cable circuits.

The operation of these long circuits requires a large number of repeaters in tandem and the design and maintenance problems which this arrangement requires are pointed out in the paper.

Information is given with respect to international telephone connections in North America, between North America and Europe and other international connections. In covering this subject some of the important items relating to the operation of the transatlantic radio channels are given and reference made to the projected transatlantic telephone cable.

Various forms of special services closely allied with the message telephone service are described. These include telegraph service, telephone circuits provided for private use, foreign exchange service, telephone networks for program transmission to radio broadcasting stations, electrical transmission of pictures, telephony in connection with aircraft operation, ship to shore telephony, telephony to mobile stations such as railroad trains, telephone services of railroads and other public utilities, telephone public address systems and television. Reference is also made to some of the by-products of the telephone development work which include improvements in submarine cable telegraphy brought about by the discovery of the alloys known as "permalloy and perminvar," the development work in the reproduction of sound and in the talking motion pictures.

In concluding, the paper points out that careful studies of the future development of the telephone industry indicate a somewhat accelerated rate of development of the services required to meet the demands of the customers and a continuing very rapid technical development of telephone plant and systems to provide the necessary facilities.

In treating such a large subject in a paper of this kind it has been necessary to deal with technical problems in rather general terms and as an attachment to the paper references are made to numerous articles in the technical press for the more technical information.

Wire Line Systems for National Broadcasting,[5] by A. B. Clark. The interconnecting of radio broadcasting stations by special telephone lines for the simultaneous broadcasting of radio programs began on a commercial basis in 1923. Today well over 30,000 miles of program transmission circuits are in use in the United States and transcontinental broadcasts by means of such wire lines are a daily occurrence.

The paper first states the radio limitations which make wire lines necessary for broadcast coverage of large nations. A map and data are given showing the present broadcasting chains in the United States and indicating the extent of their use. An explanation is given of why program transmission circuits must have transmission characteristics materially different from message telephone circuits and a brief discussion of some of the important transmission characteristics of such circuits, including particularly "frequency range" and "volume range." The present chains in the United States which are made up almost entirely of open-wire circuits on a voice-frequency basis are briefly described. The manner in which these chains are tested and the way control is exercised are also indicated. To exercise this control requires an elaborate network of telegraph wires now aggregating over 40,000 miles and a corps of special men over 300 in number.

Structure and Nature of Troostite,[6] by Francis F. Lucas. In this paper the structure and nature of the constituent troostite (found in hardened steels) is discussed. High power metallography was first applied to this problem about six years ago and the early results were presented in an address before the Franklin Institute.

Since that time many improvements in technique have been

[5] Presented before the World Engineering Congress at Tokio, Japan, October, 1929. Proceedings of Institute of Radio Engineers, November, 1929; Bell System Technical Journal, January, 1930.

[6] Presented by the author before World Engineering Congress, Tokio, Japan, October, 1929; Bell System Technical Journal, January, 1930.

developed which have resulted in better resolution and definition. The subject has been reviewed in the past two years and with the aid of the improvements in technique, hardened steels are found to be largely mixtures of the things which metallographers call martensite and troostite.

In small specimens of 0.90 per cent carbon tool steel hardened to C-65 on the Rockwell scale, innumerable particles of troostite are found. When these particles of troostite are examined by present high power methods the structure is clearly resolved into laminated pearlite. In certain stages of development of a troostitic nodule its structure borders on the verge of present methods of resolution.

Nodular troostite develops under favorable conditions as a globular mass. At the center is a nucleus about which the growth occurred. Radial, fan-shaped grains extend outward from the nucleus and these grains show orientation phenomena when revolved about the optical axis of the microscope.

It is believed that when martensite forms, the structure develops on the old austenitic crystallographic planes. Troostite appears not to follow the old austenitic system but seems to be a reorientation of the freshly transformed alpha iron about a nucleus which usually is an inclusion, a void, a sharp corner in a grain boundary or some other detail of structure.

The structure of troostite in various stages of its formation is illustrated by means of high power photomicrographs many of which are shown at this Congress for the first time.

The following conclusions were reached:

Nodular troostite appears to be an aggregate of ferrite and carbide and in the very early stages of formation its structure is on the border of present methods of resolution. The condition of the ferrite and carbide in relation to each other is not stable—they tend to stratify forming pearlite.

Troostitic nodules grow about a nucleus which may be an inclusion, a void, a corner in a grain boundary or some other detail of structure. The nodules contain fan-shaped radial grains.

The development of troostite results in a reorientation of the ferrite—seemingly without particular reference to the old austenitic crystallographic planes. Martensite does follow the old system of austenitic planes.

The small fan-shaped grains in nodular troostite may persist as small grains or they may undergo grain growth by union. It is a matter seemingly dependent upon the thermal treatment of the specimen.

Radio Broadcasting Transmitters and Related Transmission Phenomena,[7] by Edward L. Nelson. This paper is a brief discussion of recent developments in American practice concerning radio broadcasting transmitters. Descriptive material and photographs pertaining to several new commercial transmitting equipments are included. Reference is also made to the more important aspects of the related transmission problem. On account of the scope of the subject, the treatment is necessarily superficial, but it may serve to indicate the present status of the transmitter art and its relative position with respect to the industry as a whole. A short bibliography containing some of the more important recent contributions to the subject is attached as an appendix, to which reference may be had for more detailed information.

Contemporary Advances in Physics,—XIX. Fusion of Wave and Corpuscle Theories,[8] by Karl K. Darrow. In this article certain of the simple and familiar phenomena of optics and of electronics—for instance, refraction at a boundary between two media, and diffraction by a grating—are interpreted by both of the theories, undulatory and corpuscular, which have so often been condemned as incompatible with one another; the attitude being, that the theories may be brought into con-

[7] Presented before the World Engineering Congress, Tokio, Japan, October, 1929; Proceedings of Institute of Radio Engineers, November, 1929; Bell System Technical Journal, January, 1930.

[8] Bell System Technical Journal, January, 1930.

cordance by modifying one at least in ways which, extraordinary as they seem, do not quite destroy its character.

Some Principles of Broadcast Frequency Allocation,[9] by L. E. Whittemore. This paper discusses some of the technical factors which must be considered in the allocation of frequencies to broadcasting stations in such a way as to provide the best possible coverage of a given country or continental area.

A given frequency or channel can be used for either of two kinds of service; (1) by one station, exclusively, to give high grade service to the immediate locality and opportunity for service over broad rural areas when transmission conditions are good, and (2) by two or more stations simultaneously, to give local service to a number of separate regions, each of rather restricted area. The problem, therefore, involves a determination of (1) the proper balance between the two kinds of service, rural and urban, and (2) the proper basis for the apportionment of the assignments.

Reference is made to the basis of apportionment of radio broadcasting assignments laid down in the U. S. Radio Act of 1927, and to certain suggestions which have been made for the apportionment of broadcasting frequency assignments among the countries of Europe.

A brief discussion is given of the relation between field intensity, or signal strength, and distance of transmission at broadcast frequencies. The paper also discusses briefly the effects produced in the case of (1) a single station operating exclusively on a "clear" channel, and (2) two or more stations operating simultaneously on the same channel.

It is suggested that the distribution of assignments on "clear" channels, in a given continental area be made proportional to the population of each of several large geographical units or zones and that the distribution of assignments on

[9] Proceedings, Institute of Radio Engineers, August, 1929.

"multiple assignment" channels be made to comparatively small geographical units in proportion to their areas.

An Experimental Method for the Determination of the Ballistic Demagnetization Factor,[10] by Donald Foster. A method is described for experimentally determining the ballistic demagnetization factor. By means of a double search coil of novel design the magnetization and the magnetic field intensity are determined from ballistic galvanometer deflexions. While the discussion refers mainly to circular cylinders, the scheme is adaptable to specimens of other shapes. It is particularly designed to obtain accurate measurements of field intensity in cylinders of small diameter.

Details of a special design are given.

Curves are given which illustrate the variation of the demagnetization factor with the magnetization, as well as the dependence of this relation on the material and on the dimensional ratio.

A Voltage Regulator for Gas Discharge X-Ray Tubes,[11] by F. E. Haworth. This note describes a device used in connection with a gas discharge x-ray tube, to regulate the voltage across it by automatically adjusting a mercury valve between the tube and the pumps, thus controlling the pressure of the gas. It has been used with tubes of the Hadding and Shearer types and has operated satisfactorily for more than a year. It was designed to replace the regulator described by Bozorth, which is similar in principle but has certain disadvantages, for example the moving parts have high inertia and adjustments is required when the atmospheric pressure changes.

The Significance of the Hydrogen Content of Charcoals,[12] by H. H. Lowry. Most studies of the thermal decomposition of

[10] Philosophical Magazine, September, 1929.
[11] Journal of the Optical Society of America, August, 1929.
[12] Journal of Physical Chemistry, September, 1929.

hydrocarbons are confined to an examination of the composition of the liquid and gaseous products. Among exceptions to this generalization may be mentioned the interest in coke, carbon black, and charcoal. Even in these cases the physical properties rather than the chemical composition are regarded as the factors which determine their suitability for specific uses. However, in an earlier paper it was pointed out that certain physical properties of a group of charcoals were rather simply related to the per cent hydrogen which was contained in them as determined by ultimate analysis. This group of charcoals was prepared in a gas-fired furnace from a single, especially-selected lot of anthracite coal. As stated in this earlier paper, careful consideration of the commercial records taken at the time of preparation indicated that the hydrogen content was probably determined by the maximum temperature to which the samples were heated during their preparation. The hydrogen contents ranged from 0.21 to 0.53 per cent, while the probable range of maximum temperature was 900° to 1200°. The presence of hydrogen in these charcoals was shown to be consistent with a point of view that so-called "amorphous" carbons are hydrocarbons of low hydrogen content built up of polymerized residues from the thermal decomposition of hydrocarbons of greater hydrogen content. Since the significance of the hydrogen content of charcoals has been generally overlooked, the present study was undertaken in order to evaluate the factors which may ordinarily be varied in the preparation of charcoals for various purposes. The factors which were independently varied in this study were the maximum temperature, the time of heating, the atmosphere surrounding the sample during heating and the raw material. To a limited extent the effect of previous heat treatment was also determined. A later paper will give the results of the study of the correlation of hydrogen content and some adsorptive properties of charcoals prepared under carefully controlled conditions.

Notes on the Effect of Solar Disturbances on Transatlantic Radio Transmission,[13] by Clifford N. Anderson. In 1923 when the relation between abnormal long-wave radio transmission and solar disturbances was first noted, the outstanding abnormality was the great decrease in night time signal field strength accompanying storms in the earth's magnetic field. There was a slight increase in daylight signal field but this was distinctly secondary to the effect upon night field. Previous to 1927, data on signal fields were limited to one set of measurements a week, and although daylight signal field strengths were higher during periods of increased magnetic activity, it was somewhat difficult to determine the effect of individual storms. The present notes show the effects of individual storms of 60-kc transatlantic radio transmission and also give some indication as to their effect on short-wave radio transmission.

[13] Proceedings of the Institute of Radio Engineers, September, 1929.

Notes on Recent Occurrences

FOURTH INTERNATIONAL CONGRESS OF ACCOUNTANTS ADDRESSED BY SEVERAL A. T. & T. MEN

THE Fourth International Congress of Accountants met in New York, September 9 to 14, 1929. The meeting was attended by prominent accountants of many countries. One of the United States' speakers was J. F. Behan, Assistant Comptroller of the American Telephone and Telegraph Company, whose topic was "Educational Activity in Accounting and Statistical Work." A. B. Crunden, Assistant Comptroller, and D. R. Belcher, Assistant Chief Statistician of the A. T. & T. Co., presented a paper on the straight line depreciation accounting practice of telephone companies in the United States, which was printed in the October issue of the Bell Telephone Quarterly.

The technique and advantages of budgetary practice were discussed by a number of prominent delegates, including C. A. Heiss, Comptroller of the A. T. & T. Co., who described the Bell System budget plan at some length. S. L. Andrew, Chief Statistician of the A. T. & T. Co., presented a paper pointing out the relation of statistics to accounting in modern business organizations.

An interesting feature of the Congress was an exhibit by the Long Lines Department of the A. T. & T. Co., which consisted of displays featuring out of town telephone service, telephone typewriter service and telephotographs.

PERSONNEL CONFERENCE

THE Personnel Conference at Washington, D. C., October 23 to 30 was the fifteenth meeting of the Personnel Representatives of the System since they were first brought together in New York almost exactly ten years ago.

Representatives of each of the Associated Telephone Companies, the Western Electric Company, the Bell Telephone Laboratories and several sections of the General Staff of the American Telephone and Telegraph Company brought the daily attendance up to about sixty members.

In opening the Conference E. K. Hall, Vice President of the A. T. & T. Co., briefly reviewed the several previous meetings of the group indicating some of the major developments in personnel plans and referring to some of the outstanding milestones which have marked the progressive improvement of the personnel relations in the Bell System during the past decade. Bancroft Gherardi, Vice President of the A. T. & T. Co., outlined some of the operating results and trends of the business. S. L. Andrew, Chief Statistician of the A. T. & T. Co., followed him with a paper on "The Influence of Money and Banking on Recent Economic Developments." These three talks together with comments by K. W. Waterson, Assistant Vice President of the A. T. & T. Co., on wage schedules and trends, a paper by Dr. L. D. Bristol, Health Director of the Bell System, on "Health Promotion in the Bell System," a brief description of the Nutrition Course experiment and Mr. Hall's informal talk in connection with the closing of the conference were the outstanding individual contributions to the program.

All but two of the Conference sessions were devoted to the presentation and discussion of reports prepared by Committees of Associated Company Personnel Men covering all phases of the work with which this group is primarily concerned. These reports include suggestions for the future as well as conclusions derived from the experiences of the past. In the aggregate they represent the most comprehensive summary that has ever been made of the personnel plans and activities of the System.

The subjects of the reports were as follows:

Getting Information to Employees
The Conference Process and Some of Its Possibilities

Relations of Management to Employee Representation
Management's Relations to Thrift Plans and Activities
Sources and Selection of Potential Leadership
Discovery and Development of Leadership Material
Benefit Plan Administration
Medical Department Administration and Practices

One of the Conference sessions was largely given over to a general discussion of important plans and activities which are still in process of development and have not yet been officially announced and a number of miscellaneous subjects proposed for discussion by various members of the group.

H. W. Bang, Vice President of the Illinois Bell Telephone Company, was Chairman of the Conference Committee in charge of general arrangements.

DR. JEWETT VICE CHAIRMAN OF U. S. DELEGATION TO WORLD ENGINEERING CONGRESS AT TOKYO

VICE-PRESIDENT JEWETT was named by President Hoover a member of the delegation of seventeen to represent the United States at the World Engineering Congress meeting at Tokyo in October.

Dr. Jewett, in addition to being a member of the special delegation, was Vice Chairman of the American Committee. Vice Presidents Carty and Gherardi are also members of this Committee. Dr. Jewett presented a joint paper by Mr. Gherardi and himself.

The Congress was held under the auspices of the Kogakkai —the Engineering Society of Japan—and its object was to advance and diffuse knowledge by papers and discussions on scientific and engineering subjects and to promote international cooperation in the study and application of engineering science.

The party spent two days at Honolulu en route. An extensive program of excursions and inspection tours covering Japan, Chosen and Manchuria was also arranged.

Outstanding social functions were a Tea Party given by the Mikado, a Garden Party by Prince Chichibu, Patron of the Congress, and a Banquet given by the Prime Minister.

TRANSATLANTIC TELEPHONE SERVICE EXTENDED TO ALL AUSTRIA

TRANSATLANTIC telephone service was extended to all points in Austria on November 6.

The rate for a telephone conversation between New York City and these points is $51 for the first three minutes and $17 for each additional minute. Service is available throughout the 24 hours.

Service to the city of Vienna has been available for more than a year, that city having been connected to the transatlantic circuit on November 3, 1928. Austria has a population estimated at 6,785,000, served by approximately 220,000 telephones.

Calls to Austria are routed through London, as in the case of all others to the Continent. The circuit from London to Vienna is about 900 miles long.

CONFERENCE COVERING TOLL CABLE AND ASSOCIATED DESIGN PROBLEMS

IN accordance with an announcement in a previous issue of the Headquarters Bulletin, a Conference covering Toll Cable and Associated Design Problems was held recently at 195 Broadway. Due to the large number of Associated Company people who desired to attend this conference it was necessary to divide the conference into the two successive sessions. The first of these was held in the week of November 11, 1929, the second in the week of November 18, 1929. These sessions were attended by 85 Associated Company men interested in the transmission design of the toll cable plant, and by representatives from the Bell Laboratories and the General Departments of the American Telephone and Telegraph Company. About sixty men attended each session of the conference.

At the beginning of the conference, W. H. Harrison, Plant Engineer of the A. T. & T. Co., reviewed the operating results and the trends of the toll business, giving a good idea of the growth of the toll plant and of the expected growth for the future. He called attention to the responsibility resting with those men who design this type of plant and to the importance of exercising careful judgment in the work looking towards the extension and betterment of toll service.

Papers presented at the conference covered the principal subjects involved in the engineering of toll cable plant. Important among these were:

General Toll Switching Plan and Terminal Repeater—Switching Pad Problems
Toll Cable and Loading Standardization
Toll Cable Systems
Program Transmission Systems
Short Haul Toll Problems

Other papers related to subjects closely allied with the transmission design of the toll plant, such as toll equipment matters, signaling systems, repeaters, noise and crosstalk considerations, toll transmission maintenance, and telegraph considerations.

The importance in connection with transmission design work of obtaining the views of other interested departments was generally emphasized and of much interest in this connection were papers by M. B. French, Traffic Engineer of the A. T. & T. Co., on Future Traffic Problems, by W. T. Anthony, Plant Extension Engineer of the A. T. & T. Co., on The Material Situation, and by J. N. Kirk, Outside Plant Engineer of the A. T. & T. Co., on Toll Cable Construction and Maintenance. O. B. Blackwell, Transmission Development Engineer of the A. T.

& T. Co., presented an interesting paper on development considerations. Interesting papers also were presented by Associated Company men on carrier and open wire engineering and on toll circuit layout considerations. Brief talks of especial interest were given by Vice President Gherardi and J. J. Pilliod, Engineer, Long Lines Department, A. T. & T. Co.

Among the interesting features of the conference were trips to the Kearney works of the Western Electric Company and to the Bell Telephone Laboratories, where the members of the conference saw many things of interest in connection with their work. A demonstration at 195 Broadway, of programs over 2,200 miles of the new B-22 cable program transmission system provided an added feature.

TOLL RATES CUT AGAIN JANUARY 1

A NEW schedule of toll telephone rates became effective January 1st representing an annual saving to the public of more than $5,000,000.

Approximately 45,000,000 calls a year, mostly interstate, are affected by the reductions. On most station-to-station calls during the day period to points approximately 60 to 300 miles distant there is a reduction of 10 cents. The new schedule also reduces the overtime charge on person-to-person messages of more than ten chargeable minutes on nearly all hauls. In addition there are reductions in report charges ranging from 5 cents to 40 cents and affecting the schedule at hauls generally from 100 to 2,200 miles.

This is the fourth decrease in toll and long distance rates that the American Telephone and Telegraph Company and its associated companies in the Bell System have made in less than three and a half years, according to the System's continuing policy of furnishing the best possible service at the least cost consistent with financial safety. The last previous reduction went into effect February 1, 1929, amounting to a saving to the users of telephone service of about $5,000,000 annually.

The striking increase in the use of the telephone for long distance calls that was so noticeable in 1928 has continued throughout the present year, reflecting the public's reaction to the steadily increasing speed of service and the steadily decreasing cost of the service. At the present time about 95 percent of all toll and long distance calls are handled while the calling party remains at the telephone as compared with 90 percent at the beginning of 1928 and 70 percent in 1925. New telephone installations throughout the System at the rate of 3,000 per day also indicate a constantly growing recognition of the convenience and economy of the telephone for out-of-town communication as well as for local service.

SHIP–TO–SHORE TELEPHONE SERVICE OPENED TO THE *LEVIATHAN*

ON December 8 commercial ship-to-shore telephone service connecting the telephones of the Bell System with the S. S. *Leviathan* was formally opened with an exchange of greetings between President Walter S. Gifford and others ashore, and Commodore Cunningham, in command of the *Leviathan,* 200 miles out at sea. In addition to Bell System executives and newspaper representatives, the opening ceremonies were attended by members of the Federal Radio Commission, officers of the U. S. Navy, and officials of the United States Lines, which operate the *Leviathan.*

The new service is available to the public for direct telephone connection with the S. S. *Leviathan* on all outgoing and incoming trips while the ship is within range, at charges varying from $21 to $33 for the first three minutes of service, depending upon the geographical zone in which the shore telephone is located. The charges for each additional minute vary from $7 to $11 upon a like basis.

Addressing the guests assembled at the headquarters of the American Telephone and Telegraph Company just before the exchange of greetings with Commodore Cunningham aboard the *Leviathan,* President Gifford said:

"We are meeting to inaugurate telephone service with ships at sea. This service begins today between the telephones in the United States and those on the *Leviathan.* Today we are reaching one ship. The service is new. But like all such developments in telephony, we expect that it will spread from one ship to another until within a few years what is now a novelty will be a commonplace, and people will think no more of calling a friend on any ship at sea and anywhere at sea that the ship may be than they now do of telephoning from one city to another.

"Transoceanic telephone service was only opened a little less than three years ago. All of us have been surprised at the extent to which it has been used. I think we will be equally surprised with the development of this new ship-to-shore service. The transoceanic service was opened with one long wave channel. There are now in use this long wave channel and three short wave channels. A telephone cable to supplement these channels will be operating in 1932. And early next year we shall start a radio telephone service to South America.

"In the telephone service we open today between the *Leviathan* and the Bell System, calls from telephones on land to the *Leviathan* will go through the transmitting station at Deal Beach, N. J. Calls from the *Leviathan* to telephones on land will come through the new receiving station at Forked River, N. J. On shore the receiving station and the transmitting station are separated. Not only that but they have ample room for directional antenna. On the ship, of course, both receiving and transmitting have to be done from the same point and the available space for antenna is limited. Moreover, the radio telegraph traffic on a ship like the *Leviathan* is practically continuous, and a great deal of technical work had to be done to avoid interference from this telegraph traffic as well as interference from other electrical apparatus used on the ship.

"I mention these things because I want to point out the very fundamental difference between making a demonstration and providing a service. A demonstration of the possibility of telephoning to ships at sea was made way back in the war times as a part of the preparedness investigations conducted between engineers of the Bell System and the Navy Department. But a demonstration under conditions favorably arranged and a service to work under all kinds of natural conditions without interference with the other activities aboard ship—those are two very different matters.

"The success in working out ship-to-shore service on a commercial basis is a notable addition to the long list of achievements of the telephone engineers."

TALK FROM AIRPLANE OVER NEW YORK TO *LEVIATHAN* AT SEA

ON December 22 telephone connection between an airplane in flight, 3500 feet in the air over New York Bay, and the regular commercial ship-to-shore telephone service to the S. S. *Leviathan* 700 miles out in the Atlantic Ocean, was demonstrated experimentally. Newspaper reporters, the pilot and a radio engineer made up the party in the Bell Telephone Laboratories airplane, from which conversation was transmitted to the Bell Laboratories radio station at Whippany, New Jersey, thence by wire through New York to the radio transmitting station at Deal Beach, New Jersey, and from there to the *Leviathan*. Commodore Cunningham and others aboard the ship conversed with those in the airplane for twenty minutes. Their voices came through the receiving station at Forked River, N. J., thence by wire *via* the ship-to-shore control room in New York to Whippany. From there they were transmitted by radio to the airplane in flight, where they were clearly heard.

BELL TELEPHONE QUARTERLY

A Medium of Suggestion and a Record of Progress

CONTENTS FOR APRIL 1930

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Better Speech

ONE of the most discussed subjects of the present day is our spoken language. The exciting cause of this interest is without question the universality of radio entertainment and the rapid adoption by American theaters of talking motion-pictures.

When radio was new, there was not at once the marked attitude of discrimination that exists to-day in the qualities of speech as reproduced by the loud speaker. Public attention was, at first, naturally centered on the novelty of broadcasting, and then on the unusual and varied features that were offered in broadcast programs. There was wonder and appreciation as radio stations and their advertisers sent out on many wave lengths the art of singers and orchestras, the thrill of sports contests, the inspiration of church services, the excitement of a Lindbergh homecoming, the solemnity of a President's inaugural.

When sound pictures arrived, however, they met a public that had had its sense of speech values stimulated and educated by almost continuous radio entertainment, and this entertainment had been free. The price of an admission ticket to a theater offering talking motion pictures included the right to criticize. And there was an almost immediate public verdict regarding the speech that was to be synchronized with action on the screen. This speech had to be acceptable, and almost overnight famous screen actors found themselves facing the necessity of improving their enunciation and pronunciation, of studying tone production, of learning to talk before an electrical mechanism that reproduced without extenuation every speech defect.

If America was, in a measure, speech conscious at the advent of the sound pictures, it is now emphatically more so. With more than 600 licensed broadcasting stations, a radio set for every seven families, and sound pictures affording entertainment for millions weekly, the technique of speaking, as revealed by radio announcer, political orator, occasional speaker, or screen actor, is open to an analysis that is severely critical. Listeners in millions of homes, schoolrooms, and theaters, with daily opportunity for contrasting methods as well as messages, are constantly changing their standards. Speakers have become aware that the human voice is on trial everywhere.

Speech itself has thus been advertised in an inescapable way by its newer transmission agencies, and a tremendous impetus has been given to the activities that are promoting better speech. The last convention of the National Association of Teachers of Speech gave much of its time to discussion of the new conditions, hailing such events as the annual award by the American Academy of Arts and Sciences of a medal for the radio announcer using the best diction. A profusion of newspaper and magazine articles reflects, as well as stimulates, the growing realization in all sections of the country of the importance of speech, of the commercial as well as cultural value of better speech.

To the telephone companies comprising the Bell System the speech habits of telephone users have always been a matter of specialized interest. The reason for this is the fundamental one that better speech means better telephone service. A familiar expression of this interest is the educational effort that calls attention to the value of distinct enunciation and explains how telephone facilities can best be used.

From the standpoint of the number of words which the telephone user should be able to enunciate properly in order to carry on effective conversation, the task is not a large one. Recent investigations of the words used in telephone conversations show that in 500 conversations in which about 80,000 words were noted, only 2,200, or less than 3 percent, were different words. Fifty words account for 60 percent of the total words in these conversations and 700 words account for 95 percent. Proper pronunciation, therefore, of relatively few words would go a long way towards improving the effectiveness of our speech.

It is from the standpoint of the user that telephone service is improved by better speech, and this standpoint is the one by which the telephone companies must and do measure the success of their efforts. This is because of the unique and important characteristic that differentiates telephone service from other public services, namely, that it is a personal service, placing at an individual's request a private communication channel for exclusive use between distances that may be a few feet or thousands of miles apart.

To the individual the value of this service is to a considerable extent measured by the degree of satisfaction with which he can use the facilities placed at his disposal,—by the ease with which he can understand and be understood. Anticipating his need a nationwide system is in readiness day and night, built and maintained to afford the highest practicable grade of transmission. Equipment and operating methods have been brought to such a point of efficiency that the average time for completing a long distance connection has in the last five years been reduced from 7.5 minutes to 2.4 minutes, and this despite the tremendous increase in the use of the long distance service as a business tool. Such operating features of course are in themselves contributions to the satisfaction of the user, but they are most satisfactory and beneficial when the speech transmitted is clear and intelligible as well as courteous. The important thing to note in this connection is that the telephone facilities themselves are constantly being improved so as to transmit speech more clearly and more faithfully.

Efforts to achieve this are directed at several different points in the telephone plant. Transmitters and receivers undergo continuous investigation and improvement. New types of equipment for repeater stations, through which long distance circuits pass, are constantly being sought and better forms of apparatus are being produced. The ultimate objective of such effort to improve transmission is to reproduce, at the distant end of the telephone line, the voice of the speaker with greater fidelity. Each year new methods of operating and new developments in equipment are enabling telephone engineers to approach this objective more closely.

The conclusion of this idea is readily apparent. The more naturally the speaker's voice sounds through the distant receiver, the more discernible will be any defects that may mark his speech. The potentialities of the telephone system for service will be more fully realized, therefore, when telephone users co-operate with telephone engineers by recognizing the usefulness of careful enunciation.

The ideal of a telephone service that is good from the consumers' standpoint must naturally include a definite interest in these habits of speaking, as well as in the educational activities that have as their objective the improvement of these habits. These activities include the instruction in thousands of classrooms and lecture halls, the state and national teachers' associations, such as the National Association of Teachers of Speech and the National Council of Teachers of Speech; the publication of professional periodicals like the English Journal, the Quarterly Journal of Speech, and American Speech; the public speaking classes of the Y. M. C. A. and Y. W. C. A.; the schools of elocution and dramatic expression; the special educational efforts in behalf of those having some form of speech disorder, numbering more than one million according to government estimates. Every influence that promotes better habits of speaking must be recognnized as a co-operative agency in the improvement of telephone service.

The effort to improve telephone service is reciprocal co-operation, for better service means better speech. Telephone service as understood in the Bell System is a multitude of special activities organized and co-ordinated to the end that "any one anywhere may talk to any one else anywhere else, quickly, clearly and at a reasonable cost." As research, development, engineering and their allied activities have made wider geographical areas accessible by telephone, the service has had a continuous influence on the speech of a constantly increasing number of telephone users.

For a quantitative analysis of this influence there are some interesting statistics. In the United States alone there are more than 20,000,000 interconnected telephones, and 9,000,000 more in Canada, Cuba, Mexico, South America, and Europe can be reached from any one of them. The rate of growth for several years has averaged 800,000 additional telephones every year. Every day in the United States the telephone wires carry more than 80,000,000 conversations. At each end of the telephone circuit over which each conversation is held some one is listening to human speech, and each of these conversations—except where the dial telephone is in use—is prefaced by a conversation with a telephone operator. Nearly 200,000,000 times a day, therefore, the vibrating diaphragm of a telephone receiver is reproducing some one's enunciation, inflection, tone, and mannerisms of speech.

The specific part of telephone service that is most often referred to as affecting our national habits of speech arises from the operation of telephone switchboards by young women whose methods of speaking have been corrected and improved during their preparatory training. Taught to speak clearly and pleasantly, their enunciation of numbers and central office names has led telephone users to habits of placing their calls in the same way and has served to emphasize the value of well-articulated speech. This is a matter of frequent comment by writers and speakers. Mr. Bernard Shaw is reported to have said recently, "People drop their vowels and syllables and everything else, and at the present time just make a noise. How on earth they make themselves understood to each other is difficult to know. It is pure laziness, but the language fortunately is being preserved by telephone operators and wireless announcers who have to be distinct and articulate."

Almost similar in its judgment is the remark of Dr. Frank H. Vizetelly, the editor of the New Standard Dictionary and a radio lecturer of note: "The influence of the telephone companies' system of training operators has been immeasurable, in so far as it has taught persons who use the telephone to speak carefully and enunciate clearly. There are very few of us who realize the great debt we owe to these companies for their efforts in behalf of standardized speech. To them and to the radio broadcasting companies, whose vociculturists have aided in the work, we are under an obligation that none of us can ever repay, for it is owing almost as much to their efforts as it is to the increased facilities of travel that standard English has spread."

It is always interesting to recall that the telephone itself was born in a speech laboratory. Its ancestry is the devoted interest of its inventor, Alexander Graham Bell, of his father, Alexander Melville Bell, and of his grandfather Alexander Bell, in speech and its improvement. Forty-eight books, the first published in 1845, reflect the range and thoroughness of Melville Bell's investigations. Two years after the family had removed from England to Canada, Melville Bell wrote of his son's qualifications as a teacher:

"Mr. Alexander Graham Bell having been trained for his profession from his earliest youth, and having, besides, had extensive experience,—first as my assistant, and subsequently in his own practice,—is qualified as few persons can be, for the successful treatment of cases of stammering, and other defects of speech.

"He is thoroughly acquainted with visible speech and its applications; the department of teaching the deaf to articulate having been committed from the first to his management.

"If he were not my son, I might speak more strongly, and refer to other qualifications. I content myself with testifying that he has given the most gratifying satisfaction in every engagement. I have perfect confidence in staking my professional reputation on the results of his teaching."

It was with this knowledge of speech that Bell, in 1872, opened in Boston his school of vocal physiology, as his announcement stated, "for the correction of stammering and other defects of utterance and for practical instruction in visible speech." The story of his studies, experiments and accomplishments is well known. With his long study of elementary electricity, reinforced by the special study of electricity he undertook at the urgent suggestion of Joseph Henry, in 1875, came his discovery of the principle of speech transmission by electricity, which led to the first telephone patent, in 1876, and has been developed so romantically into a national and international service of personal communication. This development has taken place in a speech laboratory, the organization of scientists called the Bell Telephone Laboratories, which conducts planned research to improve the telephone and related arts.

Naturally the telephone's scientists have included all knowledge of sound and audition in their field of investigation. With better telephone service always their objective, the ideals of better speech and better means for transmitting it are indissolubly linked. An important result is their co-operation with leaders in the movement to improve speech, and their discussion of fundamentals before professional associations and in the technical press. Nearly twenty years ago Dr. G. A. Campbell's profound basic treatise, "Telephone Intelligibility," appeared in the Philosophical Magazine. Dr. Harvey Fletcher's "Speech and Hearing" and Dr. I. B. Crandall's "Sound and Vibrating Systems" are recent books outstanding in the modern literature of speech science.

Another significant result of telephone research is a series of practical developments such as the artificial larynx, the audiometer, and the apparatus for bringing telephone service to the deaf, as well as the talking motion pictures that have helped to precipitate the present day discussion about the speech of individuals and the nation. That thought can now be voiced and speeded by wire and radio to distant countries, to ships at sea, and to airplanes in flight is an impressive demonstration of the part that this scientific effort has played and will continue to play in the improvement of speech.

The telephone's scientists say that their pioneering work has just begun. Prophecy must pause when remembering what has already been accomplished in fifty-four years with the principle Bell discovered. It is certain, however, that with each succeeding conquest of the limitations to a free interchange of thought by individuals, the service that transmits speech and the speech that is transmitted will act and react on each other for mutual improvement.

W. P. Banning

Transoceanic Telephone Service—General Aspects

A paper presented at the Winter Convention of the American Institute of Electrical Engineers in New York City, January 30, 1930.

COMMERCIAL telephone service between the United States and Europe was initiated January 7, 1927 over one radio circuit, using long waves (about 5,000 meters) and with the circuit terminals at New York City and London, England. Two papers[1] were presented at the Winter Convention of the Institute in February, 1928, on the subject of Transatlantic Telephony, and these outlined the situation as it stood then, after one year's experience with this new telephone service.

There has been a rapid and consistent growth in both the scope and volume of this overseas telephone service, which has clearly demonstrated that such service has a permanent and important place in international communications. It is the purpose of this paper to review briefly the changes in the character and extent of the service that have been made since the presentation of the papers referred to and to consider certain general aspects of the service as now furnished.

The initial long-wave radio circuit has now been supplemented by three radio circuits which operate at short wavelengths ranging from approximately 12 to 50 meters and which terminate at New York and London. In addition to the European service, arrangements have been made for establishing telephone service early this year between the United States and points in South America by the use of a short wave radio telephone circuit with terminals at New York and Buenos Aires. These new short-wave systems are discussed in three

[1] K. W. Waterson and O. B. Blackwell. A. I. E. E. Journal, April and May, 1928, respectively.

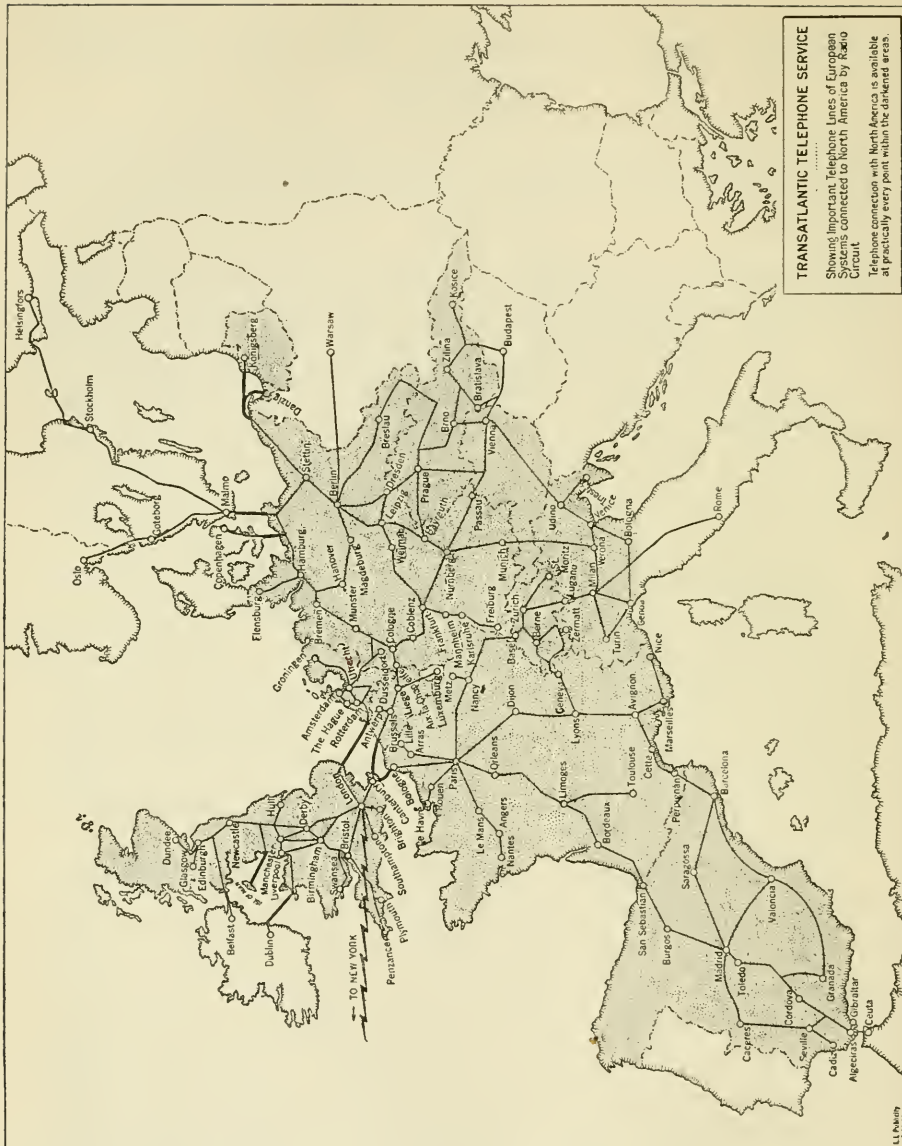

TRANSATLANTIC TELEPHONE SERVICE
Showing Important Telephone Lines of European Systems connected to North America by Radio Circuit
Telephone connection with North America is available at practically every point within the darkened areas.
TO NEW YORK
Helsingfors
Stockholm
Oslo
Goteborg
Malmo
Copenhagen
Konigsberg
Danzig
Warsaw
Stettin
Berlin
Breslau
Dresden
Leipzig
Prague
Brno
Kosice
Zilina
Bratislava
Budapest
Vienna
Passau
Munich
Nurnberg
Weimar
Magdeburg
Hanover
Hamburg
Flensburg
Bremen
Munster
Cologne
Coblenz
Frankfurt
Mannheim
Karlsruhe
Freiburg
Basel
Zurich
Berne
Lugano
Zermatt
Geneva
Milan
Verona
Venice
Udino
Bologna
Turin
Genoa
Rome
Nice
Marseilles
Avignon
Lyons
Dijon
Nancy
Metz
Luxemburg
Groningen
Amsterdam
The Hague
Rotterdam
Utrecht
Antwerp
Brussels
Lille
Arras
Dusseldorf
Paris
Rouen
Le Havre
Orleans
Le Mans
Angers
Nantes
Limoges
Bordeaux
Toulouse
Cette
Perpignan
Barcelona
San Sebastian
Burgos
Saragossa
Madrid
Valencia
Toledo
Granada
Cordova
Seville
Cadiz
Caceres
Algeciras
Gibraltar
Ceuta
London
Brighton
Southampton
Plymouth
Penzance
Bristol
Swansea
Birmingham
Derby
Hull
Manchester
Liverpool
Newcastle
Edinburgh
Glasgow
Dundee
Belfast
Dublin

FIGURE 1

papers to be presented at this meeting by Messrs. Bown, Oswald, and Cowan.

The whole of England and Scotland, Dublin and Belfast in Ireland, most of the important cities and countries in Europe, and one point in Africa, are now within reach of telephone users in the United States, Canada, Cuba, and Mexico. The number of points between which the service is available is continuously increasing, as new points and even whole new countries are added from time to time as the necessary arrangements are made. Very soon after the inauguration of the telephone service between New York and London, this service was made available to telephone users in all parts of the United States. Soon thereafter extensions were made to Canada, Cuba, and Mexico. In Europe the extensions have closely followed the development of the continental connections centering at London, which is still the European terminal of the transatlantic telephone circuits. Among the more important European extensions was the opening of service to France and Germany. The shaded areas on the map shown in Fig. 1 indicate those sections of the overseas world which could be reached by telephone from the United States, Canada, Cuba, and Mexico at the end of 1929. Twenty countries, with a population of about 400 million and with eighty-five percent of the world's telephones, were included within the area served on both sides of the Atlantic. The next major development expected will be the connection to this network of a substantial part of South America by the inauguration of telephone service over the New York-Buenos Aires circuit mentioned above.

For the year 1929, the distribution of the transatlantic calls by countries at the European end was about as follows:

England, 52 percent; France, 32 percent; Germany, 8 percent; other countries, 8 percent.

Although the daily service period was limited at the start by the restriction of the hours for telephone use of the Rugby transmitting station in England, it later became possible to extend the hours so that in the spring of 1928 the service was available about 10½ hours each business day. As the demand for the service increased and additional channels became available to increase the reliability of the service at times when atmospheric conditions were unfavorable, still further extensions were made in the hours of service. The chart in Fig. 2 shows graphically the changes in the hours of service which have been made. Since September 10, 1929, the service has

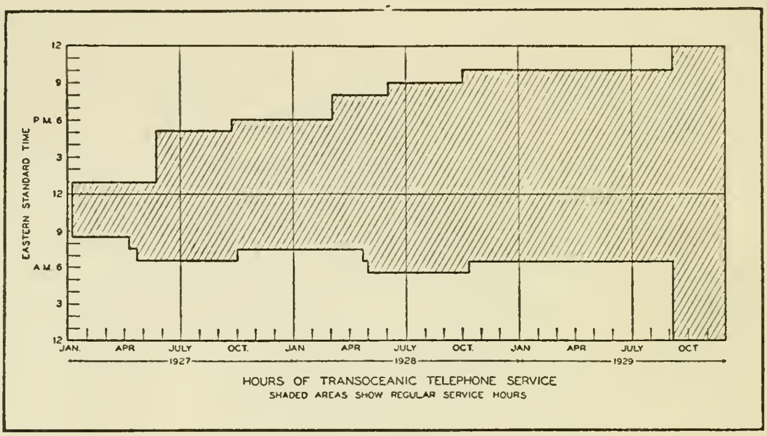


FIGURE 2

been available on a 24-hour day basis. The changes that were made in the hours of opening this service in the morning are due in part to changes in London and New York to the daylight saving plan.

The service is in greatest demand during those periods of the day in which the business hours in America and Europe overlap, although the tendency of this traffic to peak in these hours is not as great as might be expected. It is an interesting fact that even with a time difference of five or more hours, which leaves only a few overlapping business hours, the hour by hour demand for the transatlantic telephone service displays quite the same characteristics as generally comparable long distance telephone traffic in this country. Fig. 3 shows the distribution by hours of the transatlantic traffic and for purposes of comparison the distribution of other person-to-person traffic originating at New York. The remarkably close agreement may be explained in part by the fact that the usual business hours

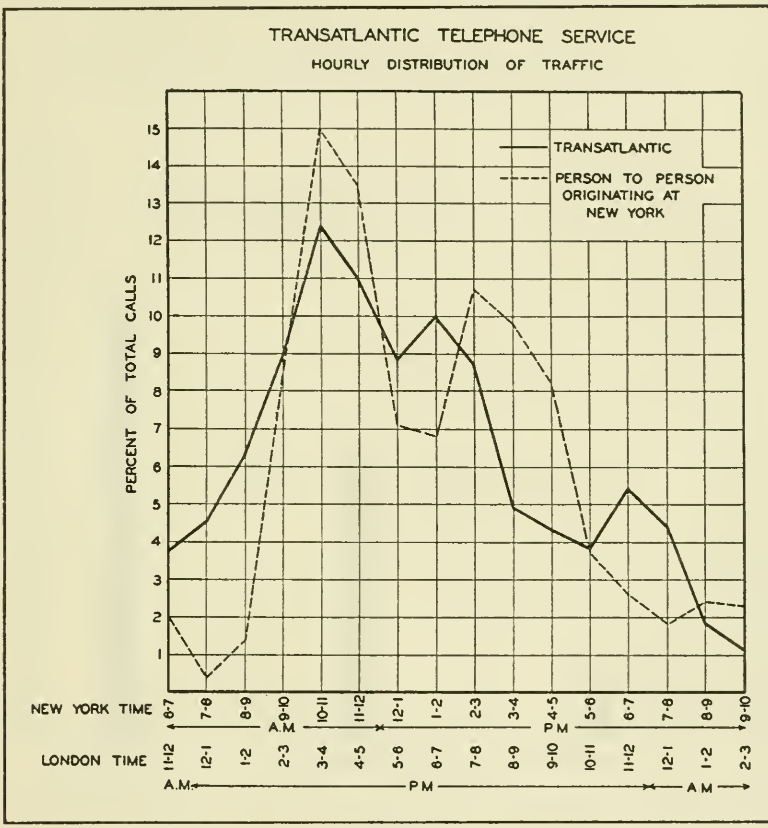


FIGURE 3

in this country correspond to the afternoon and evening in Europe, at which times there seems to be the greatest demand for transatlantic telephone facilities for conducting business and for social conversations.

The basic rate from New York to London is at present $45 for three minutes with slight additions for extensions in Europe or America. The initial rate of $75 was reduced to the present level on March 4, 1928 and this was, of course, responsible for some growth in business. The messages per day, averaged monthly, increased from 13 in February 1928 to 45 in May, only three months after the rate reduction, although part of

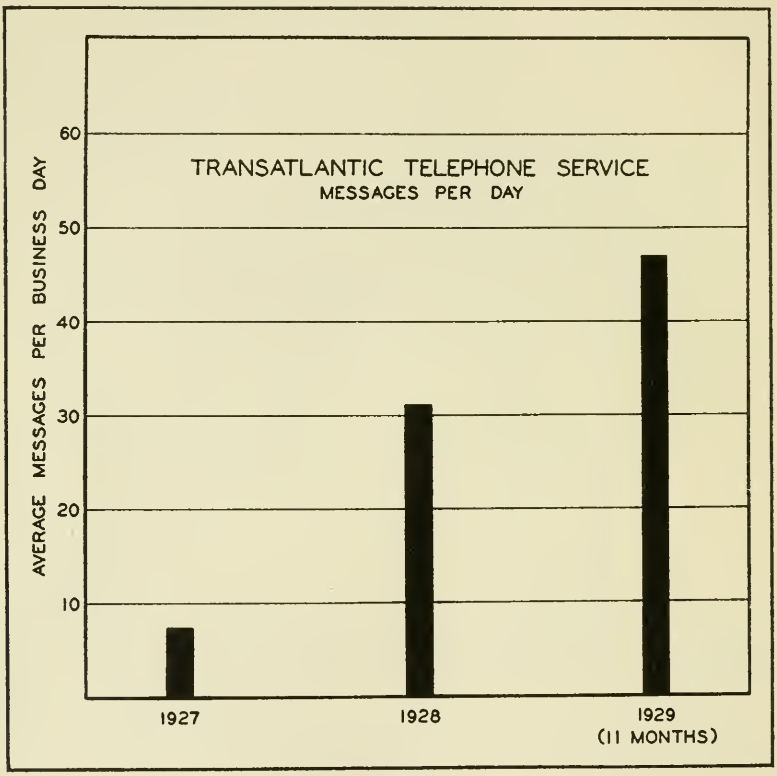


FIGURE 4

this increase was due to additional points reached by the service during this period.

The volume of business offered in the European service has grown rapidly. From a start of only a few messages each day in 1927, it has grown until during 1929 the average was close to fifty messages per business day. Fig. 4 shows this graphically. The largest number of messages handled in any one day to date was 139. Aside from the seasonal variations which usually result in a falling off of business during the summer, and the drop following the opening due to the falling off of calls placed partly out of curiosity, the trend has shown a consistent

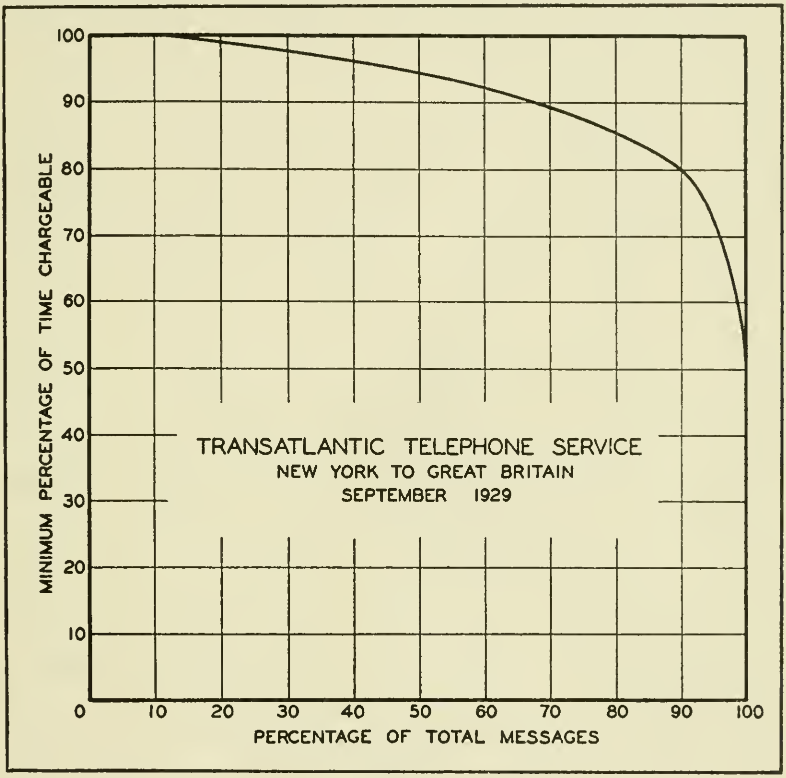


Figure 5

increase. Some of the factors contributing to this, other than the changes in rates, are the improvements in transmission and speed of completing connections, the increase in points within reach of the service, the extension of service hours, and an increasing appreciation by the public at large of the value of this service.

As to the nature of the business handled, social calls seem to make up a large percentage of the transatlantic telephone traffic. The actual percentages of the business which may be classified as social, business, or otherwise are as follows:

Social, 48 percent; Bankers and Brokers, 27 percent; Merchants, 4 percent; Miscellaneous 21 percent. It should be appreciated that there may be some inaccuracy in this classification, since it is largely based on the location of the called and calling telephones.

With connections as long as those involved in transatlantic service, and with circuits subject to the transmission variations inherent in radio, there is a likelihood that some atmospheric or other conditions will cause momentary interference to conversation. The results of transmission observations on New York-Great Britain traffic for the month of September 1929 are shown on Fig. 5. It will be noted that there were only about 5 percent of the messages on which there were sufficient adverse reactions to result in less than 75 percent of the elapsed time from beginning to end of the connection being chargeable.

As mentioned before, the scope of the transatlantic telephone service has been broadened by extensions from time to time to contiguous areas in both Europe and America. Further extensions by land lines can be expected to areas not now served, but it appears that in so far as the United States is concerned, because of the wide scope of the present land line system, the major extensions to new areas will, of necessity, be by means of new overseas services. Among these are the proposed telephone connection to South America and the ship-to-shore radio telephone service recently inaugurated. To strengthen further the ties already made, there is a comprehensive program under way which includes a transatlantic telephone cable and a second long-wave transatlantic circuit. Additional short-wave channels to Europe and South America may be added, if required by future developments of the business, and it is to be expected that telephone service to other countries will be established from time to time, as may be justified by the requirements for this form of communication.

The technical means to make this possible are now largely available, but, of course, other factors such as economic considerations must be taken into account. While continuous and consistent progress is looked for, the ideal of a world-wide telephone service operating on a comprehensive and commercial basis and with a high degree of reliability is something which must be approached gradually and with patience.

T. G. MILLER.

Telephone Man Power

EQUIPPED with more than twenty million telephones, the American public requires the daily services of more than four hundred thousand individuals to operate and maintain its telephone business.

The ordinary telephone user merely sees a telephone instrument, and (unless he "dials" his number) hears the voice of an operator. Beyond that he gives little thought to telephone plant or personnel. Yet the one telephone that he uses represents but an infinitesimal part of the four billion dollars invested in the country's telephone plant and equipment, all of which must be ready at all times for his service, since no one in the telephone business knows until a particular call is placed which two telephones are to be physically connected in completing the call. Telephone operators comprise nearly one-half of the total telephone personnel, but without the assistance of thousands of other men and women, the telephone business could not have been developed nor could it be maintained.

Much has been written about the size and intricacy of this country's telephone plant and equipment. The present article, however, deals with the man-power behind the telephone,—an army of workers which in single file would take sixteen days of eight hours steady marching to pass a given point.

The Intricacies of the Telephone Business Require Specialization

This has been rightly termed the age of specialization. Evidences of specialization are found in all activities of life, and perhaps nowhere is it more in evidence than in the telephone industry. Specialists have not only been created by the telephone business, but they have created it. In the early days of the telephone, one man was the general factotum of an exchange. He solicited new subscribers, collected rentals, repaired plant and equipment, served as relief operator, kept books and did anything else his spare time and ingenuity could care for. Such conditions could not exist today, except in the most isolated places. Special workers devote their entire time to each particular part of the telephone business.

Co-operative Effort of Employees

As specialization increases, so must co-operative effort on the part of individual workers increase. Every telephone worker lives not unto himself alone, but blends his efforts with those of many others, who may be located in the same room, across the continent, or even on another continent.

Take the case of the operator. The efficiency of her work is dependent upon the labors of thousands of others. It was necessary first to provide central office buildings, complicated switchboards; to construct and place pole and cable lines; to manufacture and install subscribers' sets and equipment; to design and install thousands of special parts; etc. It is not enough to have something that will work by itself. Bell's original crude telephone, composed of 52 parts, counting all screws, washers and nuts used in its construction, worked. But today there are more than 150,000 different parts used in the Bell System plant, and each part must function perfectly to provide the best and the cheapest service. Thousands of engineers and their assistants are employed today in the Bell System to insure this result. Whereas the operator's work depends upon all this previous work, the continuance of her job and the life of the telephone company depend also upon the concurrent activity of all of her co-workers, none of which is more requisite, for instance, than the work of those employees who maintain the mechanical and electrical efficiency of the apparatus.

Specialization and co-operative effort require proper organization of personnel. This necessity is recognized in the form of organization of the Bell System as a whole and in the organization structure of each constituent company of the System.

Organization of the Bell System

The Bell System, composed of the American Telephone and Telegraph Company and its Associated Operating Companies, comprises only twenty-five of the 8,000 telephone companies of the United States, but constitutes the largest telephone system in the world. It now employs more than 360,000 of the telephone workers of the country. In addition, there are more than 90,000 workers employed by the Western Electric Company and the Bell Telephone Laboratories, companies affiliated with the Bell System.

The American Telephone and Telegraph Company, in addition to providing and maintaining the "Long Lines" which interconnect the territories of the Associated Companies, employs more than 2,600 men and women on its general staff organization whose duty it is to prosecute the fundamental work of research and investigation necessary in the business and to render advice and assistance in general engineering, plant, traffic, operating, commercial, financial, accounting, patent, legal, administrative and all other matters involved in the efficient and economical conduct of the business.

Each Associated Operating Company, however, is highly organized to render the best possible service to the public and functions as a unit within its own territory.

These companies of highly organized workers succeeded the "general factotum" referred to above. As the early one-man exchange grew in size, an assistant was required, at first perhaps a man to attend to the clerical duties of the office. To-day, in the Bell System alone, there are more than 65,000 men and women engaged in clerical capacities. These men and women are not merely clerks; they are specialists in different phases of the business. As a group, their duties are multitudinous. Some may know little of the telephone business, others know much. Their jobs range from those handled by the youthful messenger, to those held by highly trained men and women capable of assisting in the solution of administrative problems.

Needs for Clerical Workers

The number of clerical workers in the Bell System is more than the population of Madison, the capital of Wisconsin. Some idea of the kind of duties that keep so many men and women usefully occupied may be gained by a cursory examination of a few of the clerical functions involving mass production. There are, for instance, more than 11,000,000 bills to be prepared and sent to subscribers each month. For subscribers having "message rate service," it is necessary to obtain the number of calls made from each subscriber's telephone or telephones, and to enter such calls with their related charges on these bills. More than 2,500,000 accounts require such treatment. Then the "toll" and miscellaneous charges have to be itemized, and added to the bill. Over 3,000,000 toll calls are completed each day. The tickets for these calls, which first have to be rated and then sorted by subscriber's accounts, would, if placed in one pile, tower 1,000 feet into the air. One day's business! Also, there are, on the average for each business day, more than 23,000 orders to connect, disconnect or move a subscriber's telephone. Each of such orders requires the preparation of various records in order to convey the proper information to all departments involved as expeditiously as possible. The Plant Department wants to know what changes are to be made in wire facilities, the Traffic Department needs to know what lines are to be cancelled or added on its switchboards, the Commercial Department has to make the necessary changes in its directory listings, the Accounting Department requires information for billing purposes; and so on. Again, on the average, there are nearly two million dollars expended each day by the Bell System in additions to and replacements of its plant. This expenditure involves the smallest as well as the largest units of plant. Each unit must be recorded and priced in accordance with its cost, as a basis for charges to the appropriate fixed capital accounts. Each hour of labor associated with the placement of this material must be carefully summarized and the cost included with its appropriate material costs. Other expenses not chargeable directly to any one job have to be prorated to various jobs on a fair and equitable basis.

Had it not been for the introduction of labor saving devices, such as typewriters, computing machines, addressing machines, toll billing machines, electric card punching and sorting machines, etc., the foregoing work alone could not be done without many times 65,000 people. Other clerks, to mention only a few, are busy with the preparation of the many reports of progress and results needed for supervisory control; with the preparation of reports and statements reflecting financial results; with the preparation of hundreds of reports required by municipal, state and federal bodies, etc.

Scientific Specialists

Each clerk, as mentioned before, is as a rule a specialist in his own class of work. However, more outstanding specialization—because it is of a professional nature—is to be found among employees trained as scientists, lawyers, accountants or engineers. In the latter group especially, there is, in the Bell System, a wide diversity of effort with a corresponding intensity of specialization. The Bell System, including the Western Electric Company and the Bell Laboratories, employs more than 10,000 individuals with scientific or engineering training. Substantial numbers of professionally trained men specially selected from the graduating classes of our universities and colleges are being added to this staff each year.

Telephone engineering as a science is new. It has largely been built up and fostered by the Bell System. Bell's original patent granted 54 years ago has been succeeded by over 11,000 letters patent owned, controlled by or licensed to the American Telephone and Telegraph Company. No patent granted here or abroad has been overlooked by the Bell System if it promised to add to the efficiency of the telephone art. Engineers in the Bell Laboratories have an opportunity to specialize in their chosen field of science. The physicist is allowed free play to study the laws of electricity and sound in their relation to telephony, to study the action of metals under stress, strain, climatic changes, etc. The metallurgist discovers a new alloy to increase the electrical efficiency of telephone apparatus. The electromagnetic scientist determines new values of resistance, inductance and capacity to build up a modified or new type of circuit to accomplish an additional wonder in the art of telephony. The activities of these scientists have saved millions upon millions of dollars to the Bell System in decreased capital charges and reduced operating costs.

The Wide Range of Engineering Duties

The Associated Operating Companies, relieved by the staffs of the American Telephone and Telegraph Company and Bell Telephone Laboratories of the necessity of conducting fundamental research engineering, employ engineers who specialize in work which has little if any counterpart in the industrial engineering world. Telephone engineering relating to operating methods and practices has naturally been developed by the men employed by the telephone companies during the last half century. As the business grew, it became more and more necessary to have one man or set of men assigned to a particular part of the company's engineering problem. An old definition of an engineer was given as a man who knew something about everything and everything about something. This definition is generally applicable to those engaged in telephone engineering work. For instance, some men must know everything that is to be known about toll transmission; or about outside plant construction; or about central office equipment; or about fundamental plans, etc.; in addition, they must know something about the telephone business as a whole. Each telephone company has a central engineering department which handles engineering problems of an overall character. In addition, the traffic, plant and commercial departments have their own engineering forces. Traffic engineering deals, among other things, with the problems of force requirements, operating procedure, etc. Commercial engineers deal with the growth of population with its concomitant demand for additional telephone service, determination and classification of rates to ensure the proper charges for the types of service offered to the public, proper types of equipment for varying subscribers' use, etc. Plant engineers have charge of the engineering problems involved in the construction and replacement of plant and equipment, etc.

Staff Workers

Another group of specialists are those individuals who may properly be called staff men. These are to be found in all operating departments. Their work involves the study of operating methods and procedure. Wherever one step can take the place of two, it is the duty of these men to find it and to recommend it for adoption. To be efficient they must have a comprehensive knowledge of working conditions throughout the company's territory. Routines and practices which they have developed have resulted in the saving of vast sums of money in annual operating expenses.

Plant Workers a Large Group

Another large group of Bell System workers is composed of about 80,000 plant men. These men construct the exchange and toll circuits, install subscriber's telephones, make the necessary connections in central offices, etc. They also maintain the plant in repair in order that there may be no interruption in the universal service offered by the Bell System. It is these men who exemplify the spirit of service by going out into the darkest, the stormiest and the coldest nights, when most other workers are off duty, to restore lines that have been crippled by storms or floods. They have as a slogan "The Messages Must Get Through." Plant forces require many types of specialists. One man is an expert cable splicer. Another is a wizard in locating and correcting line trouble. Another man is best fitted for the supervision of pole erection. In fact, such examples might be extended over scores of different plant occupations followed daily in the Bell System.

Specialization does not always imply limitation of activity. For instance, the expert cable splicer of today performs the work which a few years ago required the assistance of a plumber, a wire tester and a transmission tester. Again, a telephone man who enters a subscriber's house to install a telephone has a splendid opportunity to appraise the telephonic needs of the subscriber and to suggest additional facilities, such as extension telephones or wiring plans, which would make the service of greater value.

"The Voice With The Smile"

The army of telephone operators exemplified by the slogan "The Voice With The Smile," deserves more than passing mention. These women, like the plant men, have a deep sense of their responsibility. "Service First" is their ideal. The daily press often contains items about an operator who stuck to her switchboard, while other people fled, in order to call for help and to warn those threatened by an impending calamity. The operator's duties are exacting and require a high degree of tact and skill. The companies realize the character of the operator's job and provide every practicable means to promote her comfort and wellbeing. The task of operating a switchboard is also highly specialized. There is the "A" operator, who answers the subscriber's signal, the "B" operator, who completes the call in another central office, the toll operator, information operator, complaint operator, relief operator, recording operator, directory operator, etc., all under the direction of supervisors and chief operators. There are in the neighborhood of 85,000,000 telephone calls completed a day, in the United States. If one of these calls goes wrong an operator may be blamed. Who thinks to praise her for all the calls completed without trouble or delay?

Miscellaneous Classes of Telephone Workers

There is a large group of Bell System employees whose work is not so closely allied to telephone operation as is the work of those employees previously discussed. In this miscellaneous group, comprising more than 20,000 workers, are to be found doctors and nurses employed to safeguard the health of telephone men and women; chauffeurs; skilled workers in practically all the better known trades, such as carpenters, plumbers, electricians, machinists, painters, etc.; unskilled workers, such as janitors, watchmen, porters, scrubwomen, helpers, etc.; matrons, having supervision over operators' rest and locker rooms; cooks, waitresses, etc.

The Executive Forces

No organization, however well planned, could function long or efficiently without a head or executive organization. This organization in the Bell System is composed of some 175 men known as general officers and includes the presidents, vice presidents, secretaries, treasurers, general counsels, general auditors, general managers and chief engineers of the various Bell companies. These men have general supervision of the affairs of a company as a whole. They hold the reins that govern the team work of Bell employees far and wide. Present Bell System prestige has been due to the farsightedness and the splendid work of the men who are now holding, and who in the past have held, these positions. They have made it their business to see that the public was served quickly and well, that employees were treated fairly, and that holders of Bell System securities, of whom there are now about 700,000, received a proper return upon their investment.

Limitations of space forbid an adequate description of the work performed by all telephone employees. An attempt has been made merely to block out a large picture to show the general relation and interrelation of employees and their work. No telephone employee should feel, because his work has not been mentioned or not fully described, that he and his work are of less importance to the company or to the public than that of those mentioned here.

Clarence W. Foss.

Adapting Motor Vehicles to Telephone Work

TRANSPORTATION in the Bell System is handled by 18,500 owned and 4,500 rented automobile trucks and cars. While transportation, of course, is a necessary service rendered by these vehicles, there is an additional, auxiliary service demanded from them which covers an extensive field and is very important. The auxiliary use of the vehicles with power operated, labor saving devices does not interfere in any respect with the transportation function and it results in economies for the user which are often more important than the economy resulting from the transportation service. It is this additional service to which this paper refers.

Since it will not be possible to discuss in detail the many power devices which have been developed within the last few years, and the many others which are now being adapted for use with motor vehicles, only a few of the more important adaptations which have been made and used in the Bell System will be described briefly. The earlier vehicles in telephone service were purchased solely for transportation of telephone construction materials and employees. The volume of work to be done by the gangs associated with these trucks, increased rapidly. The opportunity was presented of assisting the workmen by using the truck engine power with suitable auxiliary equipment to do some of the heavier jobs. The results of these early adaptations were so good that many other developments have been completed from time to time in order to keep this branch of the work in step with the rapid growth of the telephone industry.

Much of the auxiliary equipment which will be mentioned is driven from the motor vehicle engine by means of suitable power take-offs, from the engine itself, the transmission, or the propeller shaft back of the transmission. The propeller shaft power take-off is, generally speaking, the most suitable for general use.

The general features of this unit follow transmission design although it serves an entirely different purpose. It is so arranged that power can be taken off through one or two side shafts which can be made to operate in either a forward or reverse direction. From the chain-drives out of this power take-off there can be obtained all speeds of the truck transmission. Also one of the take-off chains has reverse as well as forward speeds for the various transmission speeds. Ordinarily when the power take-off is in operation the clutch which is a part of it and which operates the propeller shaft to the rear, is disengaged. However, the design is such that when desired the truck and the power take-off can be operated simultaneously.

The design of this unit permits the chain drive to be taken from either the front or rear of the case and from either side or both sides of the propeller shaft. Of course, where the dual purpose feature is not required, the part of the case carrying the second take-off is omitted.

A power take-off opening on the side of the transmission is employed in some instances. However, it has been found generally that in driving the heavier equipment the flexibility of this power take-off is not sufficiently great. The power is taken from the lay shaft in the transmission so that the various transmission speeds are not available in the power take-off. Because of this and in order to provide some flexibility of operation, a special auxiliary transmission has been designed to fit over the power take-off opening, which gives two forward and one reverse speed. Because of the small size of the standard transmission opening, it is necessary first to bolt an adapter plate to the transmission and then bolt the take-off to the adapter plate.

As this illustrates, even the large standard transmission opening is much too small for many purposes to which it must be applied. Also, there are other difficulties in the use of power take-offs on commercial transmissions. They arise because of deviations from standard practice as regards the power take-off opening and the gear setting which co-operates with it. These non-standard power take-off openings are not any larger, only different. Such non-standard transmissions, of course, present a serious difficulty in the adapting of machinery equipment to the trucks.

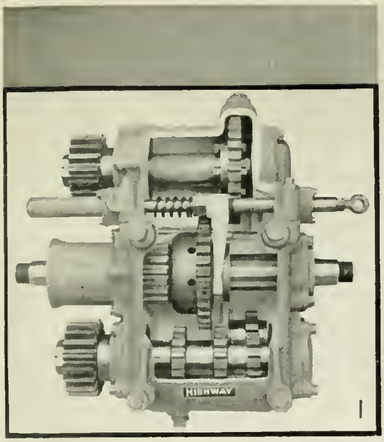
Another type of power take-off is being used at the front end of the motor vehicle engines for certain types of service. Ordinarily this take-off operates at engine speed and is controlled by a jaw clutch. However, there are some installations where it combines a friction clutch with a small transmission.

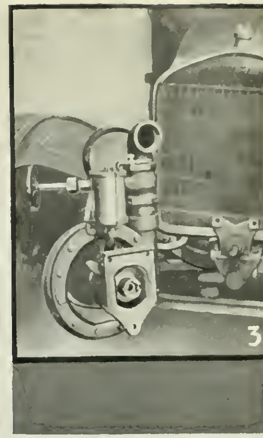
Now that we have studied the power take-offs briefly, let us next see to what this power is applied. One of the most important and broadly used power devices in the public utility field is the winch.

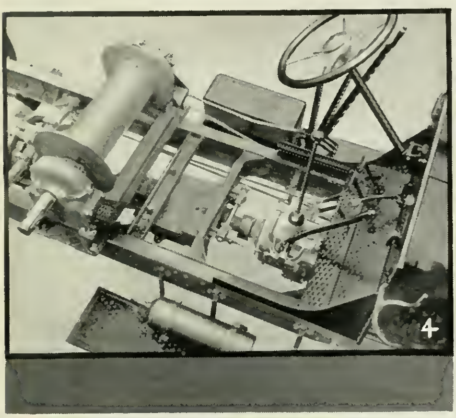
Various types of winches have been developed for the different kinds of service, i.e., oil field work, safe moving, public utility work, etc. In our studies of the truck winch problem from the telephone viewpoint, the desired goal which has been kept in mind, is to provide a unit which will make a single line pull of as much as 10,000 pounds when desired, be light in weight, easy to mount, low in cost, and which will be practically non-reversible except when driven backward by the truck engine.

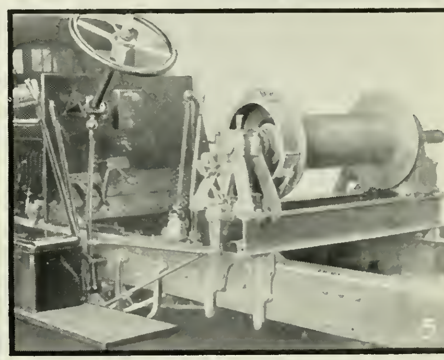
The winches which have been developed for this work are made of steel, and a unit which will accommodate 1,000 feet of 7/16-inch rope weighs about 500 pounds.

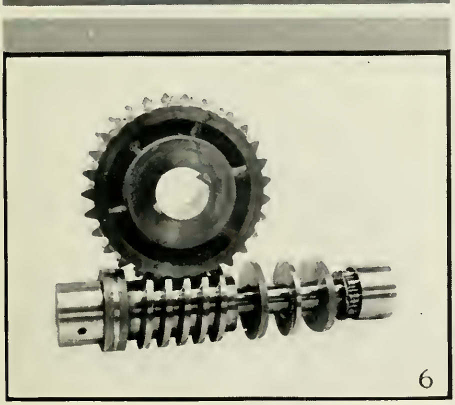
A satisfactory winch mounting is provided by castings bolted or riveted to the sides of the truck chassis frame. The winch rests on these castings and is secured to them by means of four

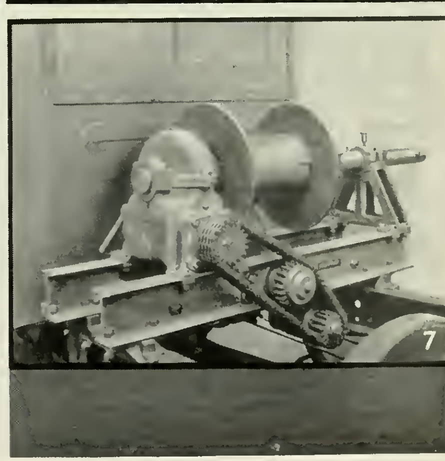






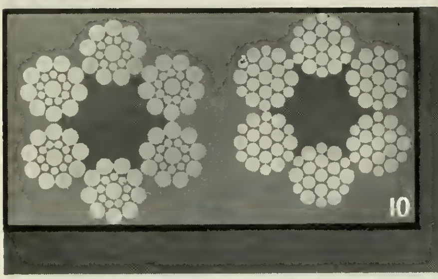
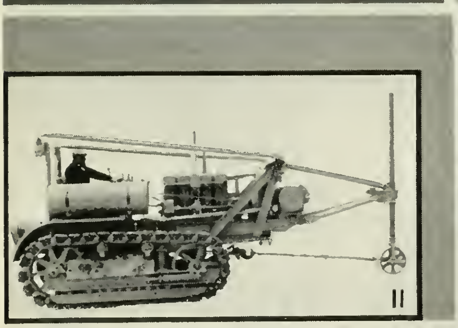
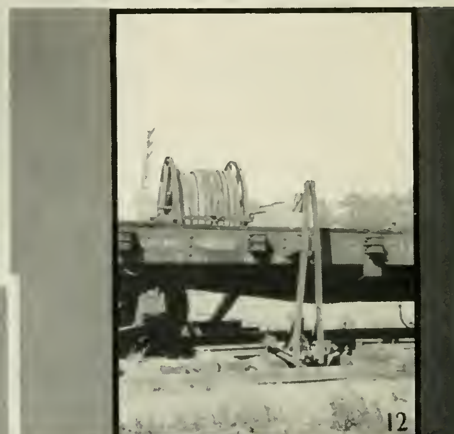






1. Propeller Shaft Power Take-Off.
2. Transmission Power Take-Off.
3. Engine Power Take-Off.
4. Winch Installed with Propeller Shaft Power Take-Off.
5. Winch Mounting.
6. Winch Worm and Wheel.
7. Light Winch Installation with Idler Brake.



8. Pulling Aerial Cable with Winch.
9. Pulling Underground Cable with Winch.
10. Seale and Warrington Lay Winch Ropes.
11. Tractor Cable Puller.
12. Car Unloader.
13. Unloading 5-Ton Reel of Cable.
14. Piking in a Pole.

heavy bolts which can readily be removed in case it is desired to detach the winch.

The worm and wheel are of such a design that within the desired operating range the winch is practically non-reversible. However, on trucks which do not have clutch brakes there is a tendency for the winch to continue to lower a heavy load slowly after the clutch is released, due to the inertia of the driving parts. Where there is a clutch brake it stops the moving parts at the time the clutch is disengaged, and there is no tendency for the load to start down once it has been stopped, until power is applied to the winch in the reverse direction.

For use with winches on trucks which do not have clutch brakes, an automatic brake has been developed. This automatic brake is incorporated in an idler sprocket arrangement which can also be used for tightening the winch chain.

Some of the earlier winches were driven by means of roller chains, but now silent chain is used because of the high chain speeds required to produce adequate rope speeds when driving through a non-reversing worm. The rope speeds required in telephone work vary from 50 to 300 feet per minute.

The steel rope which is ordinarily used on the winches varies in size from 5/16 to 7/16 inch, depending on the condition of service. The type of rope most generally used consists of six strands of 19 wires each, built around a hemp core. The breaking strength of the 5/16-inch rope ordinarily used is about 9,000 pounds and of the 7/16-inch 13,000 or 19,000 pounds, depending upon whether the material is crucible cast steel or plow steel.

It might now be of interest to see some of the services to which the winches are applied. The suspension strand which carries aerial cable is placed at tensions varying between 1,000 and 6,500 pounds. By using the winch to apply the tension to the strand, the work of placing it is done quickly and by virtue of the very accurate control of the winch, the pull can be made to exactly the desired tension.

After the aerial cable strand has been placed it is necessary to pull the cable, which varies up to 1,000 feet in length, into the rings suspended from the strand. This is ordinarily done by means of the steel winch rope. With this set-up the cable is pulled in at the rate of from 100 to 250 feet per minute, depending upon the conditions.

Where it is desired to place the telephone cable in underground ducts, it is pulled by first feeding the winch line into the duct, then attaching it to the cable end which is fed in from a reel located at the end of the duct line away from the winch. In order to prevent excessive wear in the winch line, when pulling through ducts, a type of steel rope designated as Seale Lay is used.

The outer layer of wires in the six strands of a Seale Lay rope are heavier, which results in such a rope withstanding abrasion much better than the usual Warrington type of rope in which the wires are of smaller diameter.

Some of the underground cable between cities is now being placed in duct lines which leave the highways and cross private right-of-way. For pulling in cables at such locations a special device has been developed for use with a winch on the front end of a caterpillar tractor. The wheel of this pulling outfit can be lowered into a manhole or trench and the pull made in line with the duct.

Whenever a heavy handling job arises in telephone work the first thought is to make some adaptation whereby the job can be done by means of the truck equipment. The illustration shows an example of such a case where 5-ton reels of cable must be unloaded from cars at railroad sidings, under conditions which require that all work be done from one side of the car. A framework with suitable tackle is attached to the track so that the winch line can be led under the car and up on the side opposite from the truck. The end of the winch line is attached to a yoke which holds back on the reel as it is lowered to the ground over heavy skids.

In the public utilities throught the country a very large volume of pole work is done. In the Bell System alone more than 1,000,000 telephone poles are set per year. These poles weigh from 1,000 to 3,000 pounds each and they are awkward to handle by hand methods.

With the winch and derrick combination even the largest poles can be set in their holes easily by a very small gang of men. Where it is necessary to maneuver the top of a pole through tree limbs or existing wires the operation is greatly facilitated and is much improved from a safety viewpoint, since the load can be lifted and lowered a few inches at a time by means of the truck winch. In pole handling particularly, the non-reversing feature of the winch is of prime importance. If it is desired to stop a pole at any point in the process of raising it, this can be done merely by throwing out the engine clutch. The pole then stays in a fixed position until it is either again raised or lowered by applying power from the truck engine to the winch.

The derricks are very light for their lifting capacities, being made of high strength seamless steel tubing. A derrick can be taken down from its rack on the truck and erected ready for work in a few minutes by two men.

For some classes of work it is desirable to have a pole derrick which can be raised and lowered by means of a boom line while the lifting and lowering of the pole is accomplished by the fall line from another winch drum. This has led to the development of a double drum winch, each drum of which can be operated independently. The winch, of course, is driven by a multiple power take-off.

In the winch operations, it is often necessary to wind as much as 1,000 feet or, in some cases, even 3,000 feet of rope on a winch. Unless the rope is guided on the drum, it has a tendency to pile up at one end of the drum and cause trouble in the winding operation, not to mention other difficulties which arise in unwinding the rope due to some of the outer layers having been pulled into the unevenly wound rope underneath. In order to overcome these difficulties, a winch rope winder has been designed which is driven from the drum of the winch.

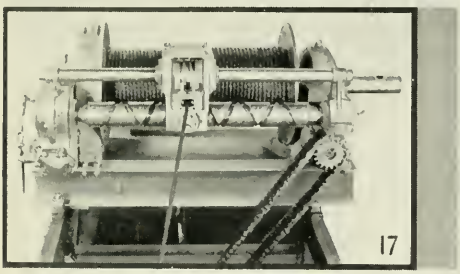
It is necessary to take the drive from the drum rather than from the winch spindle in order that when the drum clutch is released and the spindle operated independently the winder also will be released. A cam and follower move the winder carriage back and forth across the front of the drum at the proper speed to handle the size of rope being used, and the follower is so designed that it functions properly even though the rope pull is up or toward one side at a considerable angle from directly back of the winch.

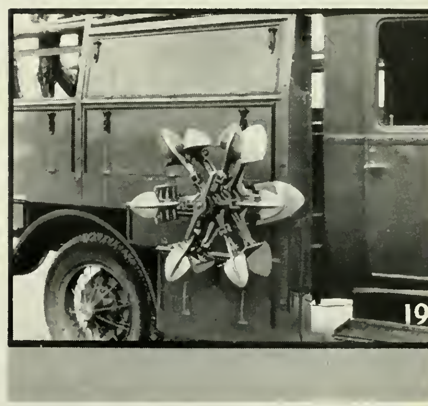
Another feature of the winch rope winder is an automatic brake which puts a slight tension in the winch line when it is being reeled on the drum without a load on the line. When there is a pull on the line this automatic brake releases itself so that there is then no wear on the winch rope due to it.

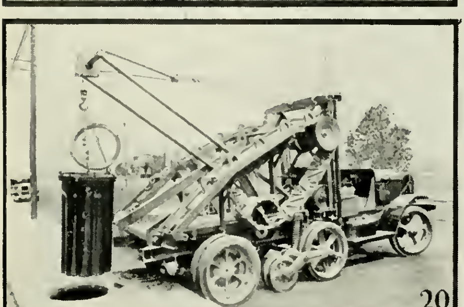
When it is necessary to take down telephone wire from the crossarms, it is desirable to roll it into coils weighing 100 to 150 pounds each in order that the junk wire can be easily handled. A collapsible power reel has been devised to do this work. The reel shaft fits over one end of the winch spindle and has a bayonet joint so that it is easily attached and removed. When the wire has been coiled on the reel and bound, a lever is turned on the end of the reel spindle, quickly collapsing the reel and releasing the coil of wire.

This collapsible reel is adequate for pulls up to about 3,000 pounds which permits its use to some extent for cable pulling and certain other classes of work, in addition to taking down wire.

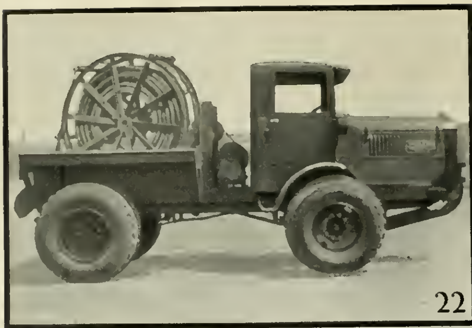
The loading of telephone poles upon trailers for delivery is another job for the power equipment. Regardless of the size of the poles, two men and the truck driver can easily and quickly load the trailer from the car or pole pile, secure the

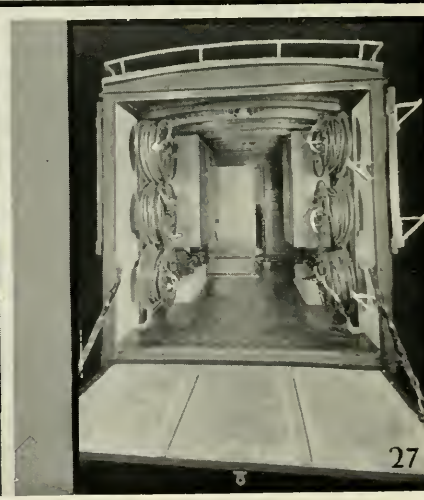






15. Erecting a Pole with Tripod Derrick.
16. Erecting a Pole with Telescoping Derrick.
17. Winch Rope Winder.
18. Collapsible Reel Operating.
19. Collapsible Reel.
20. Handling Loading Pot.
21. Loading Reel.





22. 5-Ton Reel Clamped in Truck for Delivery.
23. Self Priming Centrifugal Pump on Truck.
24. Earth Boring Machine Operating.
25. Earth Boring Machine with Auger Set at an Angle.
26. Engine Driven Generator on News Reel Truck.
27. Rear View of Body on News Reel Truck.

load on the trailer and connect the unit to the towing hook at the rear of the truck, thus completing the job in the pole yard.

Another heavy handling job in telephone work is presented by the loading coils in large iron cases, which resemble electric light transformers. Special derrick equipment has been designed for lifting these cases to any desired location on the truck platform, and, of course, they can be unloaded by reversing the operation. While the power is derived from the winch lines as in pole derrick operations, the derrick must necessarily be of a different type. It will be noted that the truck upon which this derrick is mounted carries removable tracks which permit it to operate over soft ground.

The large reels of cable used in telephone work are transported on trucks or trailers. In loading a truck, wherever practicable, the heavy reels are drawn up directly over the rear of the truck platform without the use of skids. This is accomplished by means of a sling attached to either side of the rear end of the platform, passing around the reel and hooked to the winch line.

When the reel has been pulled up into the truck body the same sling and winch line hold the reel in position during transportation. This method of securing the reel in the truck is much superior to merely chocking it front and rear because the sling not only prevents fore and aft motion of the reel but exerts a considerable force to prevent overturning which might occur in turning corners or while the truck platform might be tilted to one side.

The illustration shows a new type 100 horse power, four wheel drive truck equipped with 44 by 10 inch pneumatic tires with duals in the rear, and it is remarkable the ability it has demonstrated for negotiating hills, soft sand and mud.

Where excavation work is in progress and in manholes where cable splicing work is to be done, it is often necessary to remove large volumes of water quickly. A reliable unit for this class of work is a centrifugal pump driven from a power take-off at the front of the motor vehicle engine. Such an outfit will handle about four barrels of water per minute. This unit has the advantageous features that it is extremly portable, has a high capacity for its weight and size, and is very reliable since the power plant from which it is driven should always be in an operating condition.

This particular type of pump has an interesting priming device. There is a connection from the pump to the intake manifold of the vehicle engine, which exhausts the air from the suction hose line and pump, thus providing automatic priming for the outfit.

Preparatory to the erection of telephone poles, it is necessary to dig holes which are from 16 to 24 inches in diameter and from four to eight feet deep. Due to the small diameter as compared with the depth of these holes, it is difficult to dig them by hand even in fairly soft ground. Where hard-pan, shale, sandstone or field stones are encountered, the digging operation becomes much more difficult. Because of the large number of poles erected, this digging operation is a very important factor and in order to expedite the job and lower the cost of the construction work, earth boring machines have been developed. The one illustrated is operated from the truck engine and in a few minutes it will dig a hole which would require several man-hours to do by hand. By means of the two levers at the rear of the truck the operator can spin the auger and raise or lower it as desired in boring the hole.

The mechanism is enclosed within an oil tight case and is so designed that the rack bar has universal motion which permits the operator to set it for a hole at a considerable angle in any direction from the vertical. The boring mechanism which is mounted on the rear platform of the truck weighs about 2,000 pounds and can be removed from the truck by two men in about one-half hour, leaving the truck platform free for other service.

One of the latest adaptations of motor vehicles to special service has been the development of the Movietone outfits for making talking movie news reels. These units derive their power from generators driven by the truck engines, charging the storage batteries which are used in the operation of the equipment.

The bodies of these outfits are designed with compartments for the various units of equipment. At the rear are quick acting reels carrying insulated wire which can be paid out to any location where it is necessary to take a film at a point which cannot be reached by the truck. The entire equipment of the outfit is designed for maximum convenience and reliability in operation.

In this paper it has been sought to bring out the field of usefulness for auxiliary power equipment with the motor vehicles. The development of this field has been recent and is gaining momentum as time goes on, so that at present a great deal of new work is being done. In connection with these developments there is close co-operation with the engineers and manufacturers of motor vehicles in the designing and building of their trucks and cars so that a minimum of difficulty will be encountered by the users in adapting the power equipment to the vehicles, and so that a complete outfit when ready for the job, will represent a unity of good design from the viewpoints of cost, utility and appearance.

T. C. Smith

Office Standards and Costs as Applied to Public Utilities

A paper presented to Rochester Chapter, National Association of Cost Accountants, December 9, 1929.

In addressing a group such as this, I assume that it is wholly unnecessary to first establish the premise that in almost every line of commercial activity cost information is a valuable aid to management. That premise, I take it, is already accepted. Certainly there is today a universal realization by management of the need for cost information. Not only is there that realization, but there is a growing demand that such information be available *before* the fact rather than *after* the fact.

The function of the telephone business, and perhaps of most public utilities, that requires more clerical workers than any other function is that known in the telephone business as revenue accounting and commonly known as customers' accounting. It comprises that branch of the Accounting Department which is responsible for preparing and rendering bills to customers and maintaining their accounts. The centralization of this work exclusively in the Accounting Department as a direct responsibility of the chief accounting officer is perhaps a different allocation of the function than prevails in most public utilities.

It is my purpose to tell you this evening something of the philosophy of our approach to the problem of office standards and costs and to indicate how the consistent application of this philosophy has enabled us to realize in a large measure, a standard of performance which is most gratifying although still subject to progressive improvement. In order to crystalize the discussion, I have attempted to put into three simple words the whole basis of our philosophy. These three words are centralize, standardize and specialize.

One of the definitions of centralization is this—"to bring to a central point; bring under one system of control." Some years ago, our customers' accounting was not centralized but was decentralized in the numerous public business offices of the several companies and, while broadly speaking it was under one system of control, the difficulties of standardizing practices under the decentralized arrangement were quite serious. Furthermore, few of the offices had a sufficient volume of work to make possible the effective application of the principles of scientific management or to justify the purchase of labor-saving devices. We concluded that without centralization there could be no satisfactory progress toward standardization and specialization; and that without the application of these fundamental principles, the standard of performance, both as to quality and quantity, could not be raised to the high plane which we held as an objective. We therefore set about to centralize our customers' accounting work into units that would concentrate in one place a sufficient volume of work to keep a number of clerks continuously engaged on the same operation. The determination of the size of the units was necessarily influenced by the consideration of geographical lines, mail distances, operating organization, and other factors. By the end of 1920, centralization of our customers' accounting into relatively large units had been substantially completed. Summarizing briefly our experience in connection with centralization, it can be stated that it has enabled us to adopt to an unexpected degree many labor-saving devices, some of them of such capacity that they could not possibly be justified without centralization; that it has enabled us to more readily study and standardize practices; that it has created a more flexible organization, less susceptible to disorganization by reason of labor turnover and conditions resulting from absences. In other words, it has created a condition of mass production under which the principles of scientific management can be most effectively applied.

The next step in our philosophy is standardization. The word "standardization" sometimes has an irritating effect. It is not quite so obnoxious as the term "efficiency expert" has become in the past few years, but yet it carries a somewhat foreboding inference. In these times of mechanized activities of every kind, the use of the word "standardize" in some of its implications and, unfortunately, in some of its applications may create the fear that all of the initiative, individuality, originality and human skill is to be erased from our several jobs and that industrially, at least, we shall become mere robots. My conception of standardization, as applied to office work, falls far short of any such disagreeable outcome. In my opinion, standardization as applied to office work should have as an objective a uniform product of high quality based on proved practices. Another objective should be that of enabling the management to make comparisons. Without standardization, comparisons are most difficult and unsatisfactory if at all feasible. Analyzing the question of standardization further, I should say that the lack of it prevents effective management. It is especially advisable where the same work is being performed at different locations under different supervisory direction. The Bell System issues about 12,000,000 customers' bills each month from about 100 accounting centers scattered over the United States. In respect of that work the general staff in New York concerns itself with standardization of the fundamental practices involved in the performance of the work and the standardization of the mechanical devices and equipment. For example, after the centralization of the work had been accomplished, the next fundamental standard practice adopted was the so-called "accounting stub" plan, under which the customers' ledger or ledger cards were entirely displaced. The plan is widely used by public utilities, and I believe that it is applicable under any periodic billing where 60 percent or more of the bills are paid as rendered and where there is little need for reference to the accounts for previous months.

Following the general adoption of the accounting stub plan by the Bell System companies, the next fundamental change was the adoption of rotation billing or cycle billing. Prior to the use of this plan, all customers' bills were released on the first of each calendar month, which in view of the great volume involved created a tremendous peak load in our customers' accounting.

While the plan of rotation billing was being standardized and before half of the System had adopted it, billing machines were developed and standardized which entirely eliminated handwritten entries on our bills. In the meantime, we had standardized on a specially constructed typewriter for itemizing the charges for toll messages of which the Bell System bills nearly 85,000,000 per month. The standardization of these fundamental practices and of the equipment used necessarily carried with it standardization of a number of related practices.

Before leaving the subject of standardization, I should like to say a word about another aspect of it. Standardization does not just happen—it is not a matter of chance—it is a manufactured product—the result of thought. The staff having the responsibility for designing the standard practices should have among other qualifications that quality which someone has called "constructive imagination." I like that phrase. It expresses exactly that quality of thought which means practicality in new ideas. It means true progress. Such a quality is a great asset in almost any business capacity and especially so to one who is responsible for the development of new and better ways of doing things which constitute the daily activity of thousands of employees.

After a new practice has been conceived, the specifications must be written; but that is not all. Merely writing a standard practice does not as a rule standardize anything, especially if those to whom it is issued are free agents of an autonomous organization and not merely subordinates. If the practice you wish to standardize is to be accepted by the organization with that spirit of co-operation which is so essential for its successful application, the idea must be sold to them and not merely issued to them.

If a substantial part of the work to be done is susceptible of machine application, the most effective way to standardize the related practices and also the finished product is to standardize the mechanical equipment with which it is produced; that is, put the job in a straight-jacket and not only the job itself, but many of its associated activities, must necessarily fall into a standardized practice.

We come now to the third step in our philosophy of office standards and costs—specialization. Generally speaking, specialization is largely dependent on standardization. One of the important advantages of specialization is the relief it affords in training clerks and supervisors for the job. Another important result of specialization is the improved quality of the product. A clerk will quickly learn to do one thing and do it well, whereas if combination jobs are necessary it is generally found that some of the elements of the combination are of such a nature that they require particular qualifications which may not be required on that part of the combination job which consumes the greater part of the clerk's time. Specialization of detailed assignments also permits of specialized supervision. The practicability of assigning the work of many of the jobs on a random basis is a desirable outgrowth of specialization. The term "random assignment" as applied here refers to the plan of assigning work to the individual clerks in a specialized group on a priority sequence basis rather than to have each clerk handle a fixed assignment, such as certain alphabetical or numerical sections of the work.

A further advantage of specialization is that it simplifies the setting of wage rates. When combination jobs prevail, it is most difficult to set satisfactory rates since the component parts of the job are not easily weighted. In some cases, the work which requires the least dexterity and the smallest proportion of the clerk's time requires the highest degree of intelligence. That kind of work commands more compensation than the other, but it is on the basis of the highest qualifications required that employees expect to be paid. Specialization eliminates this difficulty and enables us to place a round peg in a round hole. Specialization in detail and in supervision does not lessen the recognition of dependence on other functions or specialized activities. Neither does it lessen responsibility to the management. If there is a proper co-ordination at each level of the organization where such co-ordination is necessary to merge the specialized activities into a well defined and smooth running production mechanism, the question of dependence and responsibility will be met.

I have not overlooked the fact that the subject includes the question of costs. In fact, what I have already said, while not addressed directly to the question of costs, underlies the whole subject of costs. Let us see how the fundamentals of centralization, standardization and specialization affect costs.

Centralization into large units makes it possible to avoid duplication of supervision, to more readily make studies for the standardization of methods, to use mechanical devices more extensively and more economically, and to set up competitive records between individuals and between offices engaged in like operations. Furthermore, without centralization as a first step standardization and specialization are very much restricted, if at all possible.

Standardization of practices makes it possible to more readily measure performance in the terms of cost. This has been well stated recently by W. H. Leffingwell, the office management specialist, who says "Measurement is the first step towards efficient management. Without it, there can be no comparison; without comparison the efficient cannot be distinguished from the inefficient." Centralization and standardization are the basic principles back of proper costs since centralization, in addition to effecting other economies, leads to standardization, and standardization leads among other things to measurement. As soon as measurements are possible and comparisons are made, whether it be of one individual with another or of one office with another, differences in production will be found which need investigation, and if investigated constructively will surely disclose a number of interesting and significant facts. Whatever is disclosed by investigation is sure to provide a basis for intelligent action, and if that spirit of progress is sustained which is so essential to success the results will be reflected inevitably in lower costs.

The desirability and necessity for measurements if effective management is to be realized is not a mere theory. Many of the instances of tangible results which have come to light would not have been definitely known without production measurements of office work.

What is the psychology back of these records? What is it that induces clerks to so conscientiously apply themselves to their work that they succeed in shattering our normal expectation of production? We are not on a piece-work basis. There is no whip-snapping and slave-driving supervision. We do not pay bonuses, although production and accuracy are factors considered in determining the amount and frequency of salary changes. I have given considerable thought to this question, and the only solution I can offer is that there is in most human beings a desire to excel their fellows; a desire to win that is stirred by competition in a contest involving skill and accuracy. In a game like this the score could not be adequately focused without measurements of performance. Without measurements of performance the rating of the various clerks is usually based on the opinion of the supervisor, and however impartial and conscientious the appraisal may be it is still an opinion. Measurement results expressed in figures and based on intelligent analysis and study of the work to be done are recognized and respected by employees as a far more accurate and impartial umpire than mere human opinion.

Specialization offers relief in training both clerks and supervisors. That, of course, directly affects costs. Certainly any scheme that will reduce the training time and bring these workers to a productive basis earlier than the commonly used combination assignment is worthy of consideration and will have a direct effect upon costs. But there are other ways in which the effect of specialization is reflected in costs. One of these is in the fixing of wage rates. It is clear that by breaking jobs down into their component parts, and by teaching only one operation or two or more similar and closely co-ordinated operations to each clerk, it is possible to appraise these several elements separately as to the degree of intelligence or dexterity each requires and to fix rates accordingly. To the extent that proper distinction may be made in the wage rates paid for different grades of work, to that extent specialization will contribute to the reduction of costs. Specialization also provides an opportunity through grading the several component parts of the entire clerical function to offer to the clerical employees the incentive of promotion with the increased compensation which usually follows each step.

Another channel through which specialization contributes to lower costs is that it unquestionably makes more simple and more accurate the determination of quantitative production standards. These standards, furthermore, are higher than they could be if job assignments were made in combination, since it is quite evident that a clerk having one specialized class of work will become more proficient in that work than would be the case if the job assignment included several kinds of work. Furthermore, the time lost in changing from one kind of work to another will be reduced in the ratio that the number of different kinds of work in each job assignment is reduced.

I have tried to show that the three important steps I have been discussing, centralization, standardization and specialization, have a vital effect on costs. Indeed, they are the foundation stones which must be laid if substantial progress is to be made, first to analyze costs and then to improve them.

Thus far I have dealt with principles and a few specific illustrations of their application to the problem of office standards and costs. These things, however sound and logical they may be, are elusive and ephemeral unless they produce results and these results are brought to a focus in a form that is tangible and readily comprehended.

We realized the importance of having an instrument of management which would bring the whole picture of results into focus and which could be used to further advance the evolution of our customers' accounting. The important instrument needed was a results report which would reflect the performance of our work in the terms of production and cost. While each of the major changes, such as that from customers' ledgers to the accounting stub plan, from first of month billing to rotation billing, and from manually prepared bills to machine prepared bills, was studied prior to its adoption and indicated either some economies or better customer service, or both, we felt that we should have production and cost data currently if we were to get an adequate measure of the results which these major changes accomplished.

When we undertook to construct the measurement report which seemed to be desirable we realized that if a beginning could be made on a report which would paint a picture in very broad strokes and even though not exact would be indicative, we could then gradually refine it as the broader picture revealed to us where such refinements were most desirable. We also had as an objective a report which could be prepared currently without the necessity of keeping continuous time records. We determined, therefore, to have a time and cost study for a representative month embracing a complete cycle of work.

When the reports of this study were received and summarized and the time factors determined for each operation for each office, we found some very wide discrepancies but we were able from this mass of cost data to set up what appeared to be reasonable performance schedules for each of the operations. A standard of production was established for each classification representing the amount of productive work that should normally be performed in one hour. This "normal" was set for each operation by determining the average performance of the offices having in the aggregate 50 per cent of the total volume and showing the best performance. There were, of course, a number of items which did not lend themselves to the establishment of production units and these we termed "Unmeasurable Work."

From the reports which are received each month, we set up a series of charts, the important ones being the number of units performed per hour and the equated cost per unit of work. We also set up certain supplemental charts. The issuance of these charts introduced the element of competition between the several companies and offices. The result was that the general production average for the entire System began to show an upward trend. There have been a number of refinements made in the report, including the establishment of new standard production units based on a subsequent study and on special consideration of individual operations, and it is interesting to note that in spite of a general tightening-up of the normal production unit the last issue of the reports showed a general average of production higher than that shown by the first reports. Furthermore, there has been a consistent trend to lower unit costs in spite of a general upward trend in the average wage payments.

In the development of our measurement report, we had a secondary objective and as our experience grew the secondary objective became almost as important as the primary objective of making comparisons and fostering competition. That secondary objective was to foster a more rapid acceptance of recommended standard practices. The measurement process had a more vital effect on standardization than we had supposed. In establishing our production standards, we necessarily took into consideration the routine methods under which that production standard could be attained. Therefore, the measurement report not only fostered competition but it also proved to be a powerful incentive for the adoption of the recommended standard routine methods that would enable the offices to reach the production standards set up on this report. Our measurement report has done more perhaps than any other one instrumentality in connection with our program to bring about the degree of standardization on customers' accounting work which has been realized by the Bell Telephone System.

Now I would not have you think that we consider this report as a substitute for management. Such reports are not in themselves an objective—they are a means to an end. Reports can never supersede management, but they can be invaluable as an aid in helping executives to do a better management job.

One of the principles of management is that responsibility and authority should be accompanied by strict accountability for results. This strict accountability cannot be intelligently enforced either individually on the clerks or collectively on the office and its management if it is based solely on human opinion. There must be some impersonal umpire in the form of records and on the basis of these, plus an intelligent appraisal of other factors, such as personality, appearance, etc., a capable and contented personnel can be achieved. Measurements of performance, especially those which are intended to measure clerical performance, cannot be precise, but so long as they are not misleading they offer a very effective means for indicating to management the weak spots where some corrective measures should be applied. To some extent, the caliber of the management may be determined on the basis of the use which is made of management reports. If an adequate report of results is constructed so that the picture presented may be correctly read and properly interpreted, and if the management uses it intelligently, the information developed will be a compass by which the supervision may steer a course toward greater efficiency in production and greater effectiveness in methods and management.

F. R. Brewster

Recent Developments in Toll Telephone Service

A paper presented at the Great Lakes District Meeting of the American Institute of Electrical Engineers in Chicago, December 2, 1929.

THE term "toll" is applied broadly to telephone service between different localities as contrasted with "local" service which is, in general, within one municipality or center

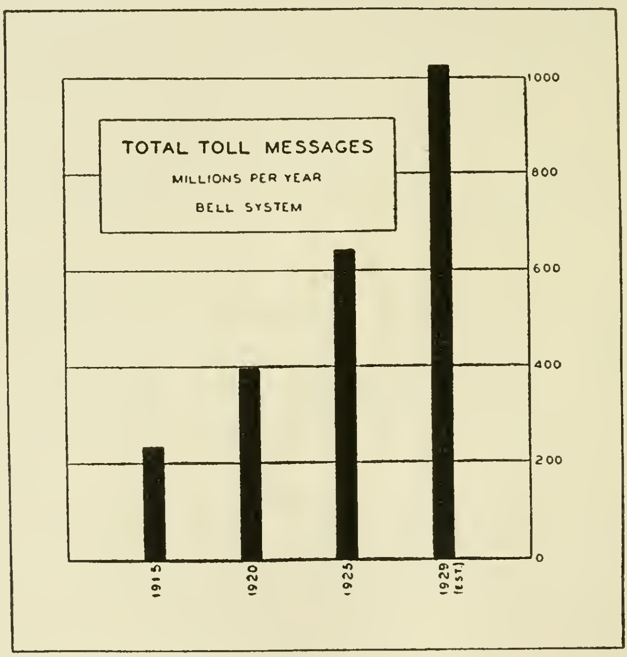


FIGURE 1

of population. From the early days of the telephone business the growth in toll service has always been rapid. This growth has, however, been particularly marked during the last few years. It is the purpose of this paper to outline briefly some of the plant design and other engineering problems associated with the present rapid growth of this service.

Magnitude of Growth

The growth of toll telephone business is illustrated by Figure 1, which shows the telephone toll messages per year in the Bell System for a number of years. This growth is perhaps more strikingly shown by Figure 2 which shows in terms of

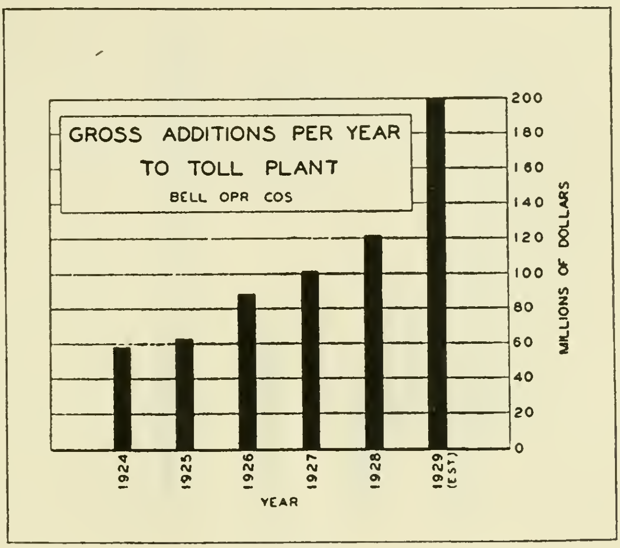


Figure 2

cost the gross additions to toll plant per year for the last few years and the estimated expenditures for 1929. It is to be noted that not only is the percent increase very rapid in comparison with that of past years, but it is expected to continue at a very rapid rate.

A remarkable feature of the increase in the toll business is the fact that the largest increases are being felt in the very long distance business, particularly on the transcontinental routes and the routes between the largest cities in the various parts of the country. Figures 3 and 4, for example, illustrate respectively the growth in toll messages over a period of years between Chicago and New York, and between Chicago and Los Angeles, which routes are typical examples of this growth. Figure 5 shows the growth in messages for the combined toll business over the transcontinental routes between Chicago and New York and Los Angeles and San Francisco over the same period. It will be noted that while the toll business in the

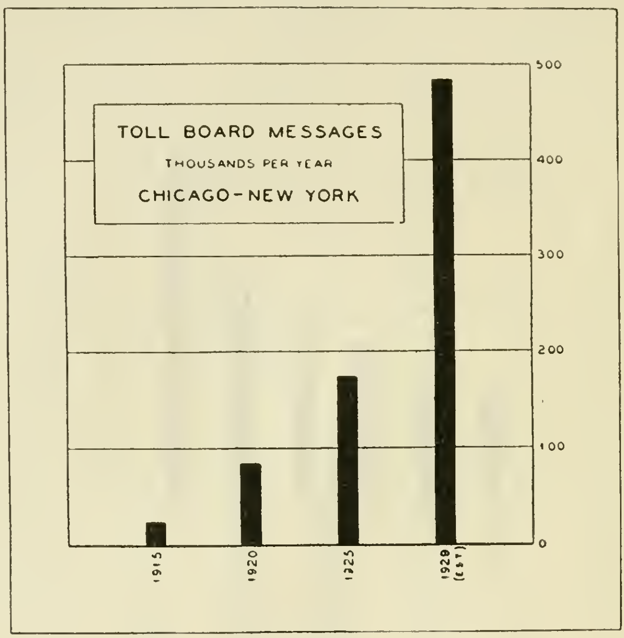


FIGURE 3

system as a whole has increased 34 percent over the last 3 years, the toll messages between Chicago and New York have increased about 115 percent, the toll messages between Chicago and Los Angeles 157 percent, and the combined transcontinental business 226 percent. These increases in toll messages have required considerable enlargement of the size of the circuit groups between distant points and have contributed largely to the major construction problems in the design and layout of the plant.

The reasons for the recent rapid growth in the toll business are many. The growth has no doubt been influenced by the good level of general business in all parts of the country. There has also been an increasing public appreciation of the extent to which telephone toll service is of value in both business and social life and of the variety of uses to which it can be put. This is evidenced by the increasing number of by-

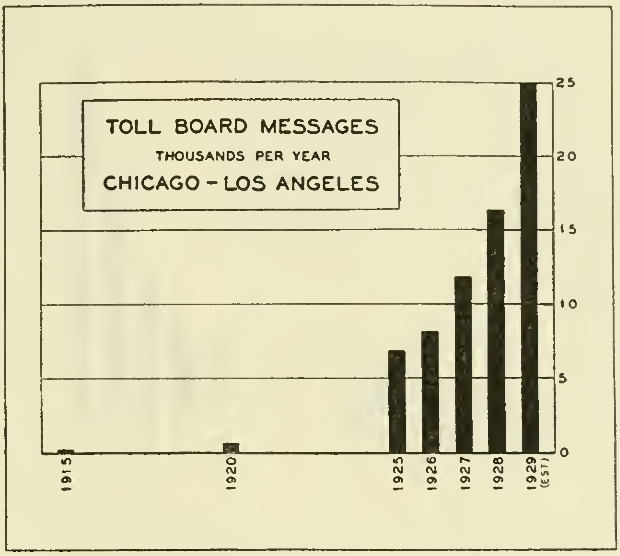


FIGURE 4

product uses and services which the toll user is constantly requiring. The continued development of economies in plant design, tending to limit increases in telephone rates to a much lower percentage than the general level of prices and which has made possible several recent rate reductions, is without doubt another important influence.

Considerable added stimulation to the growth of the toll business has undoubtedly resulted through improvements in the quality of the service given. Possibly the most important improvement in this respect is the increase in the speed of the service, that is, the decrease in the time which elapses between the placing of a call and its completion. This is shown in Figure 6. The improvement is greater for the long distance calls than for the toll service as a whole, the average speed for the toll board traffic being about 2½ minutes in 1928 as compared with almost 7 minutes in 1925.

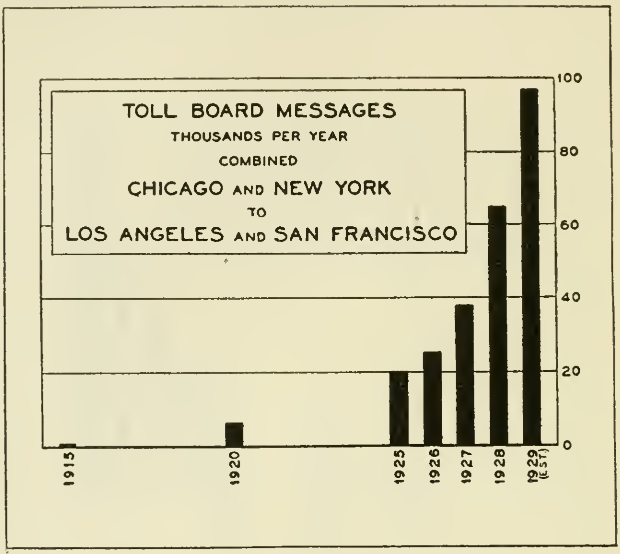


Figure 5

The increase in the speed of handling toll service has been largely brought about by the introduction of improved operating practises and facilities which have permitted the use of simplified methods of operation similar to those employed for local business. An increasing amount of the shorter haul toll business is handled directly by the local operator who first answers the subscriber's call. The speed of the large part of the longer haul business which must be handled by toll board operators has been greatly increased by arrangements whereby the toll operator first receiving the call is enabled to do both the recording work and the switching necessary to complete the call.

The result of the materially faster service has been that over 95 percent of the total toll messages are completed or reported upon while the subscriber remains at the telephone, without requiring him to hang up and be called again.

Another important improvement in the quality of service has been brought about both through large increases in the volume of sound delivered at the end of the toll circuits and

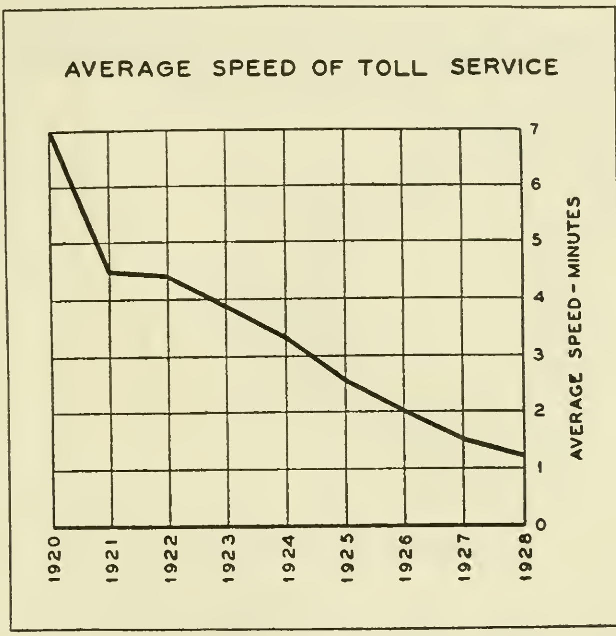


FIGURE 6

by improvements in the design of circuits, resulting in the greater distinctness and naturalness of the messages. This has included the use of methods providing for the efficient transmission of a much larger proportion of the component frequencies which make up speech. These improvements have largely reduced the percentage of messages in which the clearness of transmission is judged to be unsatisfactory, at the present time this being about 1 percent for the total toll traffic.

Other improvements in service have led to greater freedom from the possibility of interruption of the service and to its improvement in other respects. While much remains to be done in the further perfection of the toll service, it is believed that material progress has been made in fitting it to the needs of the customer and this has, no doubt, been one of the outstanding reasons for the rapid growth.

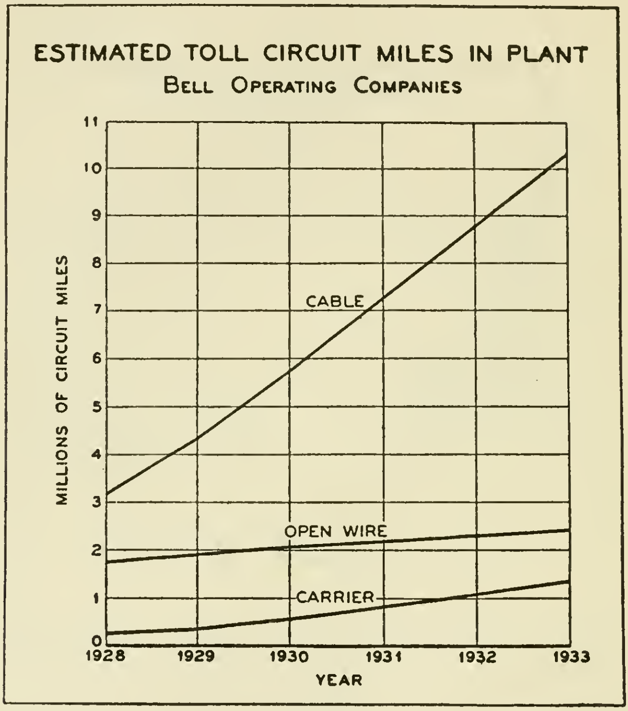


FIGURE 7

ADDITIONS TO PLANTS

The rapid growth in the toll business has required a great expansion of the toll plant and has been accompanied by material changes in the character of the plant and in the nature of the engineering problems. This expansion has been particularly marked in the case of the toll cable plant, additions to which have been experienced in practically all parts of the country. An interesting illustration of this expansion is given in Figure 7, which shows the relative proportions of the three important types of toll plants at the end of 1928 and the estimated trend for this year and the immediate years following.

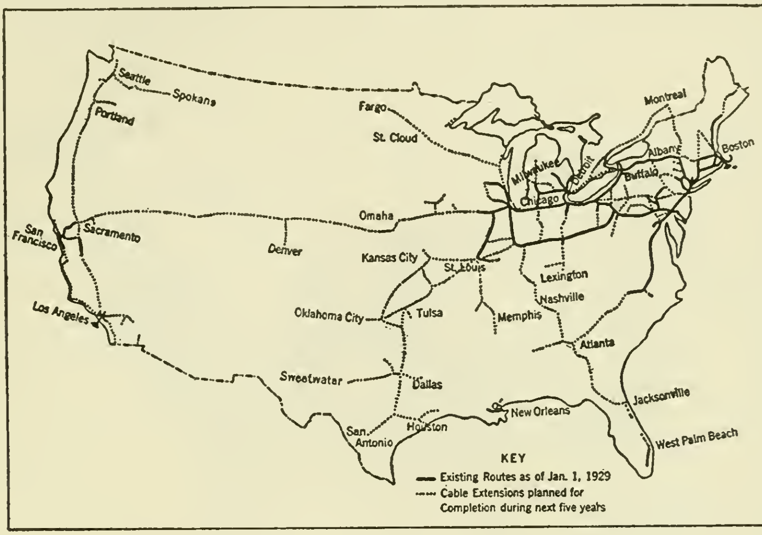


FIGURE 8. Main Toll Cable Routes of the United States

TOLL CABLES

It is interesting to note that of somewhat over six and a half million circuit miles in toll plant estimated for the end of this year, approximately four and a quarter million will be in toll cable. This percentage will be constantly increasing with the immediate following years. The extension of the toll cable program over the next five-year period contemplates cable on a large proportion of all of the major toll routes of the country. The magnitude of the proposed cable networks is shown in Figures 8 and 9. Figure 8 illustrates the main toll cable routes of the United States and Canada. Figure 9 shows the main cable routes and extensions in the northeastern area of the

United States and Canada, the development in this area being considerably more dense than in any other section of the country. It will be seen that in accordance with these proposed five-year plans toll cable will extend entirely across the continent and up and down the length of both the Atlantic and Pacific coasts, as well as practically from Canada to Mexico

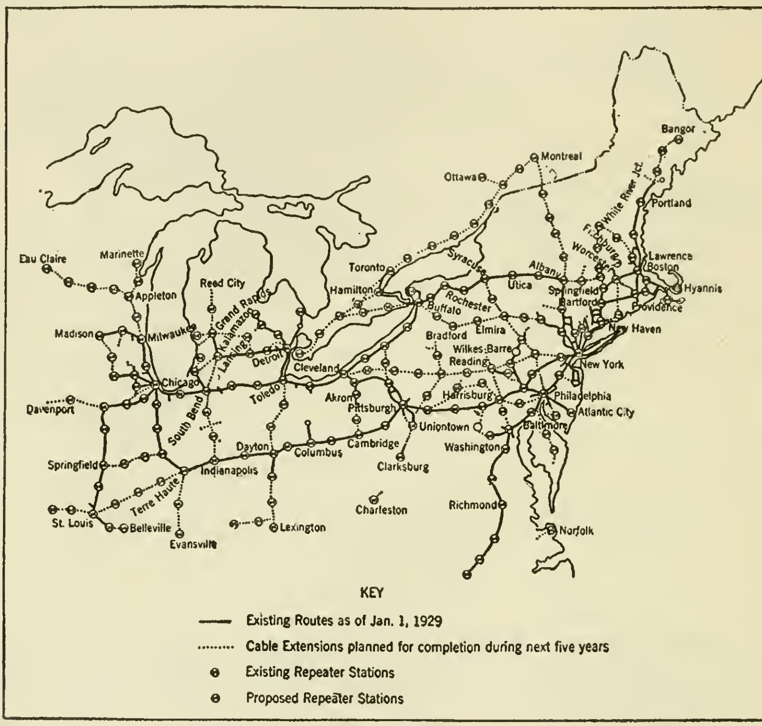


FIGURE 9. Main Toll Cable Routes in Northeastern Section of United States and Canada

in the central part of the country. With the completion of this large toll cable program, it is apparent that some of the toll messages will be routed within the five-year period through more than 4,000 miles of cable.

The toll cable which will be installed in the Bell System this year will amount to nearly 5,000 miles. This amount will be increased to between 6,000 and 7,000 miles for next year, and it is expected that the yearly additions will continue at that rate or even higher for the next few years thereafter. The estimated construction expenditures for the toll cable additions during 1929, including the supporting structures, conduit runs, and repeater and terminal equipments, will be in the order of about $100,000,000.

Types of Cable Construction

Both aerial and underground methods of toll cable construction are widely used in the Bell System, the construction at the present time being about equally divided between these two general types. The greater part of the present longer haul toll cables are of the aerial type. In the aerial construction, the cable is suspended from a steel messenger strand supported on poles, as illustrated in Figure 10. The aerial type of construction is, in general, limited to two cables per pole line and is, of course, used in the places where the growth is moderate.

The underground type of construction up to the present has consisted for the most part of cables drawn into multiple duct, usually of vitrified tile, although in certain sections of the country some use has been made of creosoted wood duct. The underground construction has naturally been employed in cities and metropolitan areas and in heavy and rapidly growing cable routes as between the cities of the Atlantic seaboard and between Chicago and New York, where the provision of facilities for placing a number of cables within a reasonable period of time is important. One of the first toll conduit and cable installations was made in 1908 between Chicago and Milwaukee.

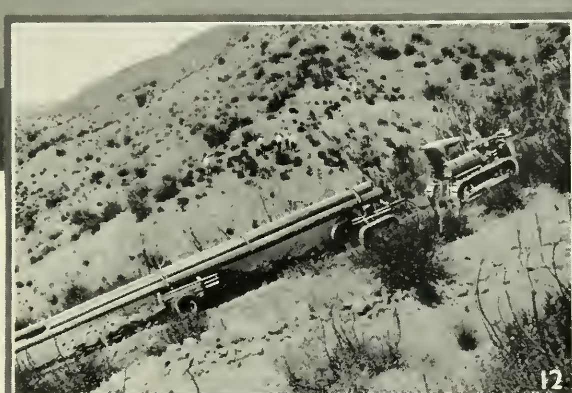
During the past year trial installations have been made of two new types of underground construction designed to meet conditions where one or two cables will handle the requirements for a considerable number of years. One of these consists of a lead sheath cable pulled into a single fiber duct. In the other, a specially protected cable is buried directly in the ground without the use of ducts. The protection, known as tape armor, is applied over a lead covered cable of conventional design, the armoring consisting of coverings of impregnated paper, jute, and steel tapes which safeguard the lead sheath from soil corrosion and mechanical damage. In both of these types of construction, manholes are built only at loading points and thus about 90 percent of the manholes employed in the more usual conduit structure are omitted.

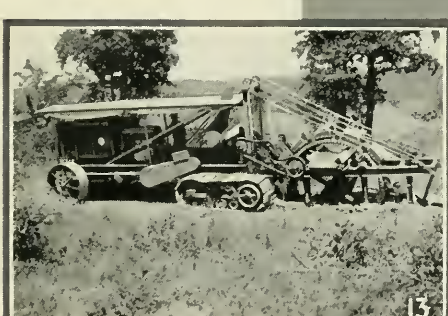
The splices at the junctions of the sections of tape armored cable between the loading points are encased in split cast iron cases filled with asphaltum compound to prevent contact with the earth. Splices at similar locations in fiber duct installations are covered by large fiber sleeves. The placing of the tape armored type of cable is illustrated in Figure 11. This type of buried construction appears to have advantages for some conditions where the rate of growth is not rapid. One interesting characteristic is reduced susceptiveness to inductive influences due to the shielding effect of the armor.

Both of these two types of construction have given satisfactory results in trial installations and it seems probable that they will find a considerable field of use in the Bell System.

Toll Cable Construction and Maintenance

The large annual additions to the toll cable plant necessitate the utmost care and precaution in planning and carrying out the construction and maintenance of this plant. The selection of the route for a toll cable is a matter of great importance, involving consideration not only of first cost and annual charges but freedom from inductive disturbances, permanency of routes, accessibility, and good co-ordination with existing telephone plant. The assurance of relative freedom from interruptions to service of the toll cable plant requires also very





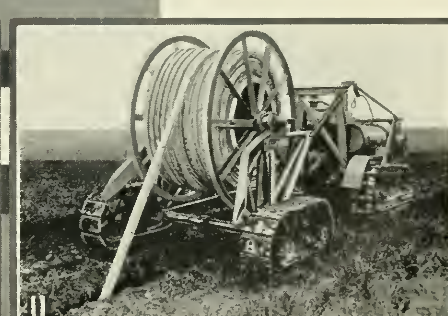
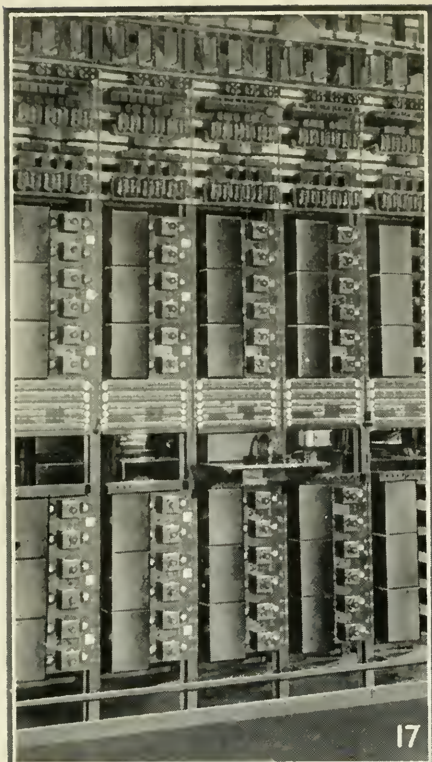


FIGURE 10. Aerial Type of Toll Cable Construction
FIGURE 11. Placing Tape Armored Type Toll Cable
FIGURE 12. Transporting Poles up Steep Grades on Tractors and Trailers over Private Right-of-Way
FIGURE 13. Heavy Duty Trenching Machine



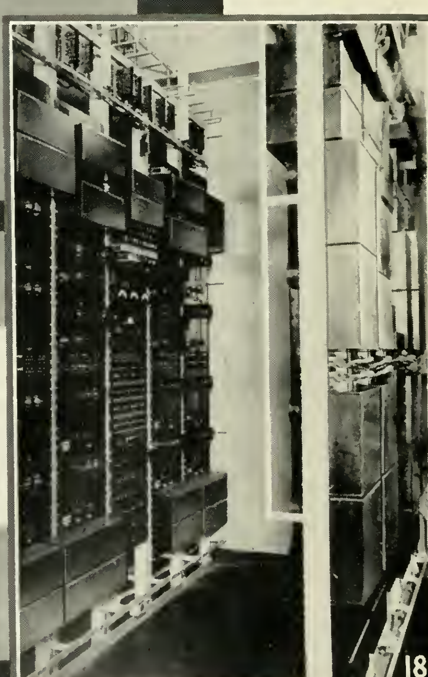


FIGURE 14. Earth Boring Machine and Derrick on Four-Wheel Drive Truck
FIGURE 17. Installation of Voice-Frequency Telephone Repeaters and Associated Apparatus
FIGURE 18. Assembly of Long Haul Carrier Telephone System Terminals
FIGURE 19. Typical Repeater Station Building

careful consideration of suitable maintenance practises. Preventive measures are continually being developed and applied to the cable plant to aid this work. Interesting in this connection is the application of continuous gas pressure and associated alarm gages for the detection of cable sheath failures.

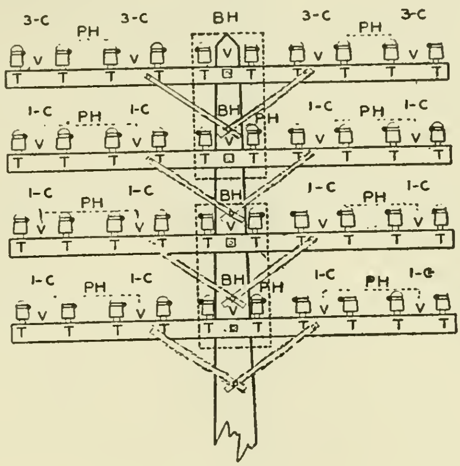
Other measures have been taken to minimize maintenance troubles on the toll cables. For example, much study has been given to the matter of securing the proper tension in the aerial cable suspension strand and a proper relation between the strand and cable tensions in order to obviate buckling of the cable due to temperature changes. Also, in placing cables in the usual multiple tile conduit before the cables enter the manholes, they are brought into a parallel formation, one above the other, by spraying the ducts at these points. By the use of this construction, the cables can be placed in the manholes free of bends.

There is also the necessity for very fast installation work in connection with the large toll projects, involving the desirability of making the fullest possible use of automotive and labor-saving equipment especially adapted for handling the pole, wire, cable, and conduit construction. This special automotive and construction apparatus includes such units as: four-wheel drive trucks, some of which are equipped with earth-boring machines; six-wheel heavy delivery trucks, several kinds of power derricks, trenching machines, back fillers, tampers, tractors, and several varieties of trailers. On private rights-of-way, as for instance over plowed fields, the ordinary wheel type trucks and trailers cannot be satisfactory used so specially equipped caterpillar tractors and trailers with caterpillar tracks are employed. Some of the more important applications of labor-saving machinery in construction work are illustrated in Figures 12, 13, and 14.

Aerial Wire and Carrier

In spite of the magnitude of the toll cable program, it is expected that it will be necessary, in order to meet the demand for additional toll circuit facilities, to string this year about 180,000 conductor miles of open-wire facilities and to install about 200,000 channel miles of carrier telephone facilities. The majority of this wire stringing will, of course, take place on existing open-wire lines not closely paralleled by toll cables. The increased use of carrier telephone facilities has materially favored the further extension of the open-wire along the long toll routes. The open-wire and carrier circuits now being designed are high grade facilities and their service characteristics and economies are such that a considerable portion of the open-wire and carrier facilities will be retained after they are paralleled by new toll cables.

Major problems presented by the open-wire and carrier construction have been those of crosstalk in the carrier circuits and noise in the very long voice-frequency circuits. In general, the magnitude of the crosstalk problems may be more fully appreciated when it is considered that carrier operation at present involves frequencies about twenty times higher than those important in causing crosstalk in voice operation and wavelengths about one-twentieth as long. Furthermore, the influence of surrounding wires, in parallel with the earth, gives rise to "second order effects" which become very marked within the carrier frequency range. Consequently, the inductive coupling per unit length between circuits is increased about in proportion to the increase in frequency, a greater number of transpositions within each wavelength is required, the carrier facilities must be balanced with respect to second order effects as well as directly to each other, and the effects of irregularities in construction must be minimized to the greatest practicable extent. It has, therefore, been necessary to give careful consideration to transposition methods and wire arrangements which would provide satisfactory crosstalk reductions and at the same time allow a maximum use of carrier facilities so that the large economies involved in superposing carrier telephone facilities on the open-wire plant may be obtained.



LEGEND

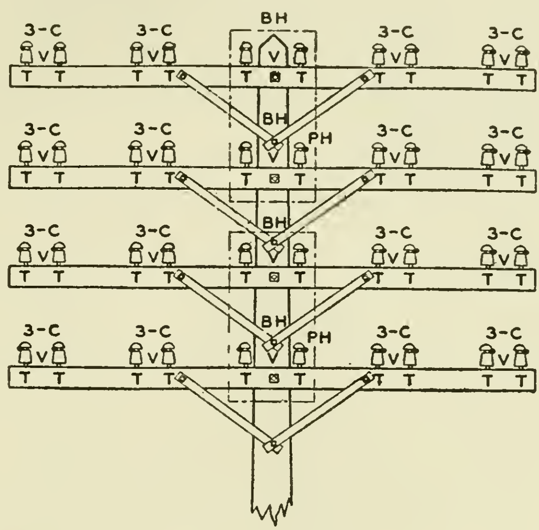
SYMBOL	FACILITY	TOTAL CIRCUITS
V	VOICE FREQUENCY-PHYSICAL	20
PH	VOICE FREQUENCY-PHANTOM	10
3-C	CARRIER SYSTEM FURNISHING 3 TELEPHONE CIRCUITS	12
1-C	CARRIER SYSTEM FURNISHING 1 TELEPHONE CIRCUIT	12
T	D-C TELEGRAPH	40
BH	CARRIER TELEGRAPH (10 CHANNEL)	40
	TOTAL TELEPHONE	54
	TOTAL TELEGRAPH	80

FIGURE 15. Pole Line Configuration. Phantomed Construction. 12-in. spacing between wires of non-pole pairs

This has resulted in trying out in the plant an entirely new form of open-wire construction. The new method involves abandoning the phantoms on the open-wire pairs on which the carrier facilities are to be superposed, reducing the spacing between the wires of these pairs to 8 in., and widening the spacing between the wires of adjacent pairs to 16 in. The pairs to be used with carrier facilities are transposed in accordance with transposition systems which are especially designed to reduce adequately the coupling between the pairs at the higher carrier frequencies. The experience obtained to date with this type of open-wire construction, while not conclusive, has indicated very favorable crosstalk results. The reduction in the spacing of the open-wire pairs has also resulted in material improvements in the noise on the voice frequency circuits. Where a large proportion of the required circuits are for long haul use, that is to say in excess of about 100 miles, the new construction methods will make it possible to obtain 70 circuits on a 40-wire pole line, 22 voice frequency and 48 carrier circuits. With this arrangement, four carrier telephone systems can be employed per crossarm. The pole pair groups are not normally used for carrier telephone purposes and may therefore remain on a phantomed basis. Figures 15 and 16 illustrate respectively the pole line configurations of the standard phantomed construction and the newer non-phantomed 8-in. spaced construction.

For routes involving a large proportion of short haul facilities, other transposition arrangements have been developed which make it possible to obtain economically 54 circuits on a 40-wire pole line. In this case the phantoms are retained and the wires are spaced on the normal 12-in. spacing owing to the fact that the carrier frequencies involved do not exceed about 10 kilocycles for the short haul facilities.

The field of use of carrier telephone facilities has been greatly increased with economies and improvements in two types of carrier telephone systems developed within the past few years. One type of system employs a frequency range of 5 to 30 kilocycles and provides three additional telephone channels normally used for long haul circuits from about 125 miles upward. Suitable intermediate repeaters are available for use with this system so as to greatly extend the range of its practical application. The longest systems of this type now in service are between Davenport, Iowa and Sacramento, California, a distance of almost 2,150 miles.



LEGEND

SYMBOL	FACILITY	TOTAL CIRCUITS	
V	VOICE FREQUENCY-PHYSICAL	20	
PH	VOICE FREQUENCY-PHANTOM	2	
3-C	CARRIER TELEPHONE	48	
T	D-C TELEGRAPH	40	
BH	CARRIER TELEGRAPH (10 CHANNELS)	40	
	TOTAL TELEPHONE		70
	TOTAL TELEGRAPH		80

FIGURE 16. Pole Line Configuration. Non-Phantomed Construction. 8-in. spacing between wires of non-pole pairs

The other system, employing a frequency range from about 4 to 10 kilocycles, provides a single additional telephone channel normally employed to provide short haul facilities, ranging from about 75 to 125 miles. No intermediate repeaters are used with this system. Under special conditions this system can be extended to operate over approximately 200 miles, by the addition of extra terminal amplifier equipment.

Other considerations in the use of long haul carrier telephone systems have been those of reducing the transmission losses at carrier frequencies and thus extending the range of the system, the lessening in the spread of the transmission loss variations under varying weather conditions, and also, the maintenance of the over-all transmission equivalents of the carrier channels within satisfactory limits.

Investigation indicated that leakage effects are the predominating causes of transmission loss variations at carrier frequencies. This led to the development of improved glass insulators which materially reduce the attenuation at carrier frequencies and substantially limit the variations in attenuation between wet and dry weather conditions. Suitable transmission regulation of the over-all circuit has been realized through the use of pilot channels, by which the levels at all points in the carrier systems are maintained within established limits. Rectification at repeaters and terminals of transmitted high-frequency control currents permits the visual indication of the relative levels on calibrated meters. As changes in line equivalents affect both the pilot frequencies and the speech channels in a related manner and are indicated on the meters, compensating gain adjustments may be made.

The increased use of carrier facilities has tended toward bringing the relative costs of different gages of open-wire circuits more closely together, chiefly because of the wider repeater spans possible with the larger gage conductors. This is especially true of the 128-mil diameter open wire circuits which are, in general, not materially different in cost from the 104-mil circuits when completely equipped for voice-frequency telephone, d-c. telegraph, and carrier telephone facilities. This has helped make economical the increased use of the larger 128-mil and 165-mil facilities throughout the open-wire plant, which is very advantageous in lessening the service interruptions due to wire breaks.

Toll Equipment Program

The rapid extension of the outside toll plant facilities has, of course, resulted in a very much increased toll equipment program. This has involved much engineering work in providing suitable switchboard and equipment arrangements, adequate building space, and improved methods of equipment assembly and office cabling. The extremely long distance circuits require numerous telephone repeaters, and the rapid expansion of the toll cable program, requiring repeater stations approximately every 50 miles, has materially increased the building and space requirements as well as the needs for additional repeaters, ringing and compositing apparatus, and adequate battery supply arrangements. As the present full size toll cables provide as many as 325 circuits, it is apparent that with many paralleling cables, building space frequently must be made available at one locality for several thousand telephone repeaters and associated apparatus. The following table, illustrating the increase in the use of telephone repeaters and carrier systems, shows the total number of telephone repeaters and carrier systems installed in the Bell System plant during 1925 and the estimated additions for the year 1930.

Estimated Additions to Bell System Plant

Year	Telephone repeaters	Carrier systems
1925	2,400	11
1930	36,000	400
Ratio	15	36

Simplified equipment arrangements have been developed which involve mounting apparatus on panels assembled on channel iron or I beam racks, thus bringing about substantial reductions in the space required as compared to the former types of mountings. The panel mounted arrangements have also considerably simplified the cabling arrangements between the various units of the toll circuit equipment required within a given office. Also, in order to simplify the layout and installation of the toll circuit equipment, arrangements have been developed whereby certain equipment is now shipped direct from the factory on completely assembled bays. Figure 17 shows a bay of voice frequency telephone repeaters arranged in accordance with the latest methods of assembly and cabling. The simplification of the equipment arrangements is further shown in Figure 18, which illustrates the complete assembly of two long haul carrier terminals with their associated testing apparatus, on standard bay arrangements.

The improved equipment arrangements have materially aided the repeater station building problem and floor plan layouts. The repeater station buildings which are being constructed throughout the country to house toll circuit equipment are, in general, fireproof buildings so designed that they may be extended vertically or laterally, depending upon the particular land conditions or other requirements involved. Figure 19 shows a typical telephone repeater station on one of the major cable routes. This building now contains about 1,000 repeaters. Telephone repeater station buildings are being constructed in several parts of the country which are designed to have an ultimate capacity of 10,000 repeaters.

Electrical Design Features

The development of very long toll telephone circuits has involved working out a succession of very interesting design features in order to obtain suitable electrical characteristics for the clear transmission of speech over these long circuits. These problems have, in general, been particularly great for very long toll cable circuits. They have been discussed in detail in a number of papers presented before the Institute. A brief review of the general nature of some of these problems and the method of solution adopted for toll cable circuits will be sufficient here.

In the early extensions of toll cables, difficulty was experienced because of the much higher losses of energy for the high-frequency components of speech than for the low-frequency components due to the large variation in attenuation of the cable for currents of different frequencies. This difficulty was met by the use of "loading," by means of which the attenuation was made much more nearly constant over the band of frequencies most important for the transmission of speech. The loading also greatly increased the efficiency of cable transmission by increasing the impedance of the circuit so that for a given power higher voltages and lower currents are used on a loaded circuit than on a circuit without loading. This made possible such cables as the early Chicago-Milwaukee cable, previously mentioned, and, by using as large gages of conductors as seemed practicable, provided satisfactory service through cables between New York and Washington and New York and Boston, distances of about 250 miles. These cables were completed in 1914.

Further extension of the range of cable transmission was limited by the difficulty of obtaining satisfactory over-all efficiency in cable on circuits of 200 or 300 miles in length. This difficulty was largely solved by the perfection of telephone repeaters, particularly those using vacuum tubes. In the design of long telephone circuits, even those in cable, it is now practicable to renew the energy of the telephone currents repeatedly without material distortion to a practically unlimited extent.

With the resulting extension of toll cable circuits to relatively great distances, as between Chicago and New York, another phenomenon became of importance. At the ends of a telephone circuit the telephone currents are in part delivered to the terminal apparatus and in part reflected back over the line due to the difference in the impedance of the line and the terminal apparatus. This effect also takes place in a minor degree at intermediate points in the line where discontinuities in electrical characteristics occur. When the time of transmission is very short, these reflected currents do not cause interference with speech unless they are relatively great in magnitude. When the time of transmission is appreciable, however, the reflected currents are heard in the telephone receivers both by the talker and by the listener as echoes. These echoes may have a serious effect in impairing the clearness of speech, the effect being progressively greater as the time lag of the echo current increases.

A first remedy for these effects was an increase in the velocity with which telephone currents were transmitted over the loaded cable circuits. This was done by a change in the design of the loading which also had other important benefits. With further increases in distance and in the efficiency of circuits, however, additional means were required to take care of these echo effects. This has been done by the development and use of means for suppressing the echoes by destroying the efficiency of the return path, that is, the transmission of speech currents in one direction over the circuit acts to prevent the transmission of echo currents in the opposite direction.

One important problem in the longer circuits has been the prevention of changes in efficiency with variations in the temperature of the circuit. The importance of this is illustrated by the fact that the energy loss in a Chicago-New York toll cable circuit may be as much as 10^9 times as great when the circuit is hot as when it is cold. The daily and even the hourly variations are sufficient to cause large variations in efficiency if not compensated. This compensation is done by the automatic change in the gain of amplifiers which is controlled by the resistance of pilot wires running through the cables and subjected to the same variations in temperature as the circuits used for message purposes.

In the longer cable circuits, the best system of loading which it has seemed practicable to employ, does not sufficiently eliminate variations in efficiency with frequency to permit the transmission of speech currents without serious distortion unless further means are provided. In such circuits, therefore, use is made of so-called "attenuation equalizers," inserted periodically along the circuit, to compensate for the variations in efficiency of the line and associated apparatus.

Another phenomenon which becomes of importance with increased length of circuit is the variation in the velocity of propagation over the circuit of different components of speech. The components of moderate frequency (about 1,000 cycles) tend to arrive at the distant end first, those of higher and lower frequencies trailing in later. This produces an additional type of distortion. Some of this distortion can be minimized by improvements in the design of the apparatus. The use of corrective networks which insert in the circuit a distortion in velocity of transmission which compensates that caused by the cable circuit characteristics is also being studied to take care of this situation.

With all of these progressive difficulties removed, it appears, looking to the future, that the limit of transmission over telephone cable circuits may be influenced by the operation of another and still more fundamental factor, namely the time required for the transmission of electric currents over these very long circuits. With the development of toll cable networks covering this country and Europe and with the completion of telephone cables across the Atlantic, total distances of transmission over toll cable circuits as great as 10,000 miles will probably be involved in the future. The types of cable circuit now used for very long distances have a velocity of propagation of about 20,000 miles a second. The time lag in a 10,000-mile cable circuit would be about half a second for transmission in each direction. A delay of this magnitude would interfere with the ordinary methods of conversation involving frequent acknowledgment, interruption, and interchange of question and answer. Looking forward to improving such conditions, research work is now under way to determine the best means of providing cable circuits of still higher velocities.

International Connections

The toll system of the United States now has connection with telephones in 21 other countries. By this means the users of this service are offered connection with 65 percent of all of the telephones in other countries of the world or 85 percent of all the telephones in the world including those in this country. Additional extensions are made from time to time. These extensions to other countries involve many unusual plant arrangements and a brief mention of these is desirable.

Due to our very close relations with Canada, the Bell System connects with Canadian telephone systems at a large number of points. All of the larger cities and a large percentage of the smaller places are available for connection. In general, however, these connections involve no unusual problems, the ordinary types of construction standard in this country being extended in Canada where closely similar standards of construction are in use. Similarly, a connection make in 1927 to Mexico City and other important cities in Mexico by the extension of open wire toll lines involves no new technical features.

The connection of this country with Cuba was accomplished in 1921 by three submarine cables, of very unusual construction. These cables, 115 miles in length, cross the Florida Straits which have a maximum depth of about 6,000 feet. Because of the great depth, the type of construction used for transoceanic telegraph cables was necessary for mechanical reasons and this made necessary a novel electrical design of the cables to provide adequate transmission efficiency. The cables have proved very satisfactory and the availability of these circuits has resulted in the gradual development of a large telephone business between points in the United States and Cuba.

In 1927 the first commercial service was opened between the United States and Europe by a circuit from New York to London. This has since been supplemented by two additional circuits and other additional circuits now under construction and planned will raise this group to six by the end of 1932. The first circuit includes for the transatlantic link a long wave radio system transmitting from points near New York and London to receiving stations in the eastern central part of Scotland and northern part of Maine, respectively. The other two circuits are short wave radio circuits, both transmitting and receiving stations being near the New York and London terminals.

These circuits, both the long wave and short wave, are of pioneer character. The effort has been to obtain as good a degree of continuity of service as transmission conditions will permit and consistent with requirements for satisfactory commercial services. In working to obtain this result one is, of course, faced with the very large variations in efficiency of transmission under various conditions and also in the magnitude of the interfering atmospherics which tend to interfere with good reception.

With the long wave transmission (5,000 meters), practically no degree of directivity of the transmitting antenna has been employed, although at the receiving antenna an improvement in the ratio of signal power to static power of about 400 to 1 is obtained by construction giving directive effects. In this connection, it might be noted that the northern location of both receiving stations is also an important factor in reducing noise. Relatively high powers are necessarily transmitted, the transmitting set power for long waves being about 200 kw. The power received by the receiving antenna is a small fraction if a micro-watt, sometimes being as small as 10^{-12} watt. It is interesting to note that this power is equivalent to that received from the North star on 10 sq. in. of the earth's surface.

With the short wave transmission using wavelengths between about 15 and 45 meters, it is possible to obtain a high degree of directivity of both transmitting and receiving antennas. The gains from the antennas used during the most important hours as compared with undirected transmission and reception represent equivalent power advantages of about 70 to 1 and 30 to 1, respectively. The transmitting powers used are somewhat lower than with the long wave, being about 15 kw. The short wave channels are, in general, less affected than the long wave by high atmospheric disturbances, but are much more affected at times of magnetic storms when large variations in the field strength of the signal at the receiving antenna often occur. Fortunately these two types of disturbances seldom appear at the same time and the two types of radio channel admirably supplement each other in the maintenance of uninterrupted service.

Work is now proceeding in the design of a transatlantic telephone cable which will provide a third type of circuit between New York and London. For this cable, transmission will probably be overland from New York to Nova Scotia, thence by submarine cable to Newfoundland, then by a second cable 1,800 miles in length from Newfoundland to the Irish Coast, and from there to London. This cable presents so great a departure from previous telephone circuits that extensive research and development are necessary to determine the most favorable methods of construction.

An additional international connection which is now being constructed is of interest, namely, a short wave radio telephone channel between New York and Buenos Aires, connecting with Montevideo.

Planning for the Future

In one or two places in this paper mention has been made of planning for the future by the intensive study of technical problems which might, if unsolved, limit future extension of the service. The scope of this paper does not permit even an outline of the numerous research projects which it is necessary to carry forward with a view to assuring continuity of uninterrupted progress in extension and improvement of toll service. This is, however, a factor of fundamental importance both in the steps which have already been taken and those which are anticipated in future years.

From the general engineering standpoint, the plans for the continued expenditure over a period of years of large amounts for permanent extension of toll plant, call for very careful attention to the fundamental planning and layout of that plant. This is particularly true in view of the large extension of toll cables and of underground toll cable conduit routes in which best engineering requires that initial construction be designed with a view to the future increase in circuit requirements for a relatively large number of years. This then is one of the important features of the engineering work of the Bell operating companies at the present time.

While fundamental plans for future development of toll plant must adequately provide for the plant extension in a given area, they must be closely co-ordinated with each other and with the plans for the country as a whole, particularly because of the importance of the large groups of long through toll circuits. As one element in facilitating this planning, there has recently been developed for the country a general basic routing plan designed to insure the highest practicable standards of service as to speed, accuracy, and transmission with maximum economical concentration of circuits on important routes. This plan will serve to limit the amount of switching required for handling toll calls between remote points.

In conclusion, I might add that those of us who are closely interested in the advancement and improvement of the toll phase of the telephone business look forward to a continued rapid development of that part of the communication art with an increasingly complex and varied engineering technique.

W. H. Harrison

Romance of the Machine

A BOOK REVIEW

MICHAEL PUPIN has again taken up the pen. Professor Pupin is best known to telephone people as the inventor of the loading coil, and to thousands of other readers as the author of one of the most interesting and inspiring of modern autobiographies, "From Immigrant to Inventor." This clear-thinking man of science has now produced a small, pocket-sized volume to which he has given the alluring title of "Romance of the Machine." Its one hundred or so of pages are packed with interest for all Americans, and particularly for those who are engaged in any branch of the development of the communication art.

The book is a vigorous defense of what certain European critics have called our American "machine civilization." To these commentators, the aim and object of American scientific endeavor has been far too generally the application of research to production—to the making of machines. They see in America a civilization already become wholly mechanistic and materialistic—a widespread deification of the machine that is nothing less than heathen idol worship.

With such a view Michael Pupin, who is almost a zealot in his Americanism, has small patience. It is not the scientist alone who speaks in these pages. It is the Serbian boy, now grown to maturity. It is the immigrant, arriving in New York at the age of seventeen, penniless and unable to speak a word of English. It is the youth toiling in factory and foundry, in laundry and in store, grimly refusing to believe that America held no opportunity for such as he. It is the night student at Columbia, the professor of electro-dynamics, the winner of the Edison Medal and of the Pulitzer Prize, the recipient of some of the highest scientific honors in the gift of America.

Such is the background against which the reader must view "Romance of the Machine," for background and book are often so merged that one becomes part of the other. As the writer reveals himself in its pages, there is in him something of the scientist—the seeker of knowledge for its own sake; something of the inventor—who talks authoritatively of machines because he has helped to make them; something of the poet and the mystic—who sees all creation as a vast machine functioning in its most minute details in accordance with the plans which brought it into being. There is in Michael Pupin, as one sees him through the words he has written, something of all this—plus a fervent patriotism that has prompted him to study America more closely and more understandingly than have most of her American-born citizens.

To the poet in Michael Pupin, as well as to the scientist in him, the universe appears as a huge "cosmic engine." To him, trains of clouds driven through the sky carrying their "life sustaining fluid to the thirsty hillsides and valleys" are so many machines propelled by the force of solar radiation. In tree and herb, in leaf and trunk and stem, drinking up life from the earth and absorbing power from the stream of solar energy, he sees the primordial machine of which "the physical activity of our 'Machine Civilization' is a tiny and crude copy, only."

If man worships the machines he himself has made, he intimates, it is because their heavenly origin has made them worthy of worship. In making machines, man has merely listened to the voice of nature. "The machine," Professor Pupin declares, "is the visible evidence of the close union between man and the spirit of the eternal truth which guides the subtle hand of nature." Almost exultantly, and certainly without apology, he concedes that, in this sense, science worships the machine. But he adds, "it is not the material machine or its material service, but the spirit behind them, which scientists and engineers worship."

Professor Pupin shows that, in the field of abstract research, America has made notable contributions to the growth of scientific knowledge, citing such outstanding examples as Joseph Henry, William Draper and Josiah Willard Gibbs. He contends that if scientific effort in the United States has been directed particularly toward applied science—toward the making of machines—it has been because the rapid growth of the country has demanded this.

The Consolidation of the Union

Treating this phase of his subject, Professor Pupin delves deep into American history and shows that the period from the close of the American Revolution to the end of the Civil War was a period during which the machine was sorely needed in the making of the American nation. He summons Washington and Lincoln, outstanding idealists of this period and of all American history, and calls upon them to testify to the value of the machine—and especially of those machines or instrumentalities which are involved in the service of providing communication—as factors in national development.

A striking phrase from the writings of Washington is from a report which accompanied the presentation of the federal constitution after its adoption by the constitutional convention. In this document Washington declares that the fundamental purpose of those who drafted the constitution was "the consolidation of the Union." This phrase Professor Pupin makes, as it were, the text of a considerable portion of his book. He shows that the "consolidation of the Union" was the purpose that lay behind Washington's lifelong interest in such instrumentalities of communication as canals, inland waterways and improved highways. He declares that one of the first of Lincoln's announced political policies called for the development of railways and canals as factors which would make for the "consolidation of the Union."

At the close of this period that lay between America's two great wars, the need of communication facilities became doubly urgent, Professor Pupin points out.

"At the end of the Civil War," says he, "the physical structure of the United States was still like a huge and perfectly formed embryo in which a nervous system had not yet reached its last stage of growth." To meet the needs of this situation, new instrumentalities of communication were created. One of the most important of these was the telephone.

Describing the first public exhibition of the telephone at the Philadelphia Centennial Exposition in 1876, Professor Pupin significantly comments: "No visitor to this exposition suspected that this tiny electrical machine, the telephone, would be some day a most powerful instrument in the consolidation of the American Union."

Of the effect of the machine in general, and of modern facilities for communication in particular, upon our national life, the author has this to say:

> "Consolidation of the Union, the dream of Washington and of Lincoln, is today a reality, much more complete and beautiful than seemed possible at the time Lincoln delivered his Gettysburg address. History does not record so great an achievement in so short a time in the life of any other nation. But no other nation had the aid of the consolidating power of the machine at the time when it sorely needed it. . . . It was providential that no other period in human history was more productive of new machines than this period. That we contributed more to this productiveness than any other nation shows only that the aid of machines meant much more to our growth than it did to the growth of any other civilized country."

"Romance of the Machine" devotes considerable space to the discussion of various forms of communication and transportation facilities which have had and are having a part in promoting the "consolidation of the Union." Professor Pupin discusses not only the telephone but the vacuum tube oscillator, the invention of which has made possible the development of radio telephony, and particularly of radio broadcasting. He also pays tribute to the automobile and to the airplane, both made possible by the development of the gas engine, as factors in drawing the widely scattered sections of the country into closer relationships.

Of the telephone and the vacuum tube he writes:

"It looks like an act of providence that the telephone was born when the consolidation of our Union needed it most; the vacuum tube oscillator arrived in time to lend its aid in the consolidation of this nation with the other nations of the world. Many an enthusiast believes that these two machines are messengers sent from heaven to aid in the guidance of this nation, and of the whole world."

An Economic Democracy

Perhaps the most interesting portion of the book, to telephone people at any rate, is that which deals with the telephone, not as an instrumentality of communication, but as an industrial development. The author points out that the American ideal of political democracy, as described in Lincoln's Gettysburg address, "was destined to give birth to a peculiarly American ideal of economic democracy which is, broadly speaking, a corollary of Lincoln's ideal of political democracy." This ideal, he continues, "demands that the wealth-producing activities of our nation should be for the benefit of all the people, and not for the benefit of single groups of people."

Tracing the history of the development of the telephone as an industry from its earliest days to the present, Professor Pupin writes:

"Our telephone industry was undoubtedly the first large American industry which blazed the way in the direction of industrial democracy. This was perfectly natural; it started as a large number of tiny local telephone corporations, most of them independent of each other, and each of them looking ahead to its own individual advancement. Such a state of things paralyzed progress in the telephone art. Mergers and consolidations were sorely needed, and dire necessity forced these tiny and numerous local corporations to merge in spite of the legislators, who dreaded the approach of a big telephone monopoly. An industrial organization extending to every part of our vast territory was the result of this merging process, resembling in a striking manner the result of the consolidation of the United States. It is obvious that in a great telephone industry, rising gradually out of the merging of numerous small corporations, the stockholders as well as the subsidiary companies were spread over the whole of the United States. A co-operation between them was badly needed. American genius for co-operative organization proved equal to the task; the final result was an industrial democracy."

The author might well have added that, just as the American political democracy had its origin in the vision of certain far-sighted men, and has grown along the lines which they planned and predicted, so this industrial democracy has grown along predetermined lines. A nation-wide telephone service and the nation-wide industrial organization to provide it are not the product of mere mergers, brought about by force of necessity. The American telephone industry of today did not simply evolve.

The telephone was less than a decade old when Theodore N. Vail wrote confidently of such a service:

"Tell our agents that we have a proposition on foot to connect the different cities for the purpose of personal communication, and in other ways to organize a grand telephonic system."

It is worthy of note that within ten years of the first public exhibition of the telephone, the working organization of the business had taken substantially the form which it has today. The original scattered licensees had combined their territories and their organizations and permanent licenses had taken the place of the earlier temporary arrangements, and there was thus created a group of telephone companies operated under patents owned and controlled by the parent company in territories clearly defined and taken together covering the entire country.

This process of growth, begun in the foresight of the founders of the telephone business, has brought into being the American telephone service of today, which, as Professor Pupin points out, is provided by an organization of four hundred and fifty thousand American men and women, operating physical properties representing an investment of four billions of dollars which are owned by more than five hundred thousand stockholders.

"Here is an industry," he declares, "which is practically owned by the people of moderate means; many of them are in the employ of the industry. . . . This industry was destined to advance along paths which lead to industrial democracy, and it has arrived there."

"Who can contemplate the great achievement of the industrial democracy inaugurated by the telephone industry," he asks in another portion of the book, "without being assured that it is a joyful message of an approaching civilization which will be more just and generous to the worker than any that the world has ever seen?"

"No other American industry is so typically American as our telephone industry. . . . We are proud of our telephone industry and of our machine civilization which this industry represents so well. Our European critics will never understand our civilization until they have mastered the present structure as well as the past history of our telephone industry."

R. T. Barrett

Notes on Recent Occurrences

OVERSEAS TELEPHONE NOW REACHES ROME, WARSAW AND HELSINGFORS

PRACTICALLY the whole of northern Italy and the city of Rome were brought within reach of North America by telephone on January 15, with the extension of transatlantic telephone service to the seven "regions" south of the Alps. On February 1, Warsaw, the capital of Poland, was also brought within the scope of the service, which was again extended on March 8 to include the city of Helsingfors, the capital of Finland.

The addition in Italy to the intercontinental network covers the Cisalpine Gaul of ancient times and Liguria. It includes Milan, Turin and Genoa, which have been connected to the transatlantic circuit for some months, and Venice, Trieste, Padua, Bologna, and many other cities famous in both ancient and modern times. The entire territory has approximately 195,000 telephones, serving a population of more than 20,000,000. Rome, with a population of 770,000, has 33,000 telephones.

Warsaw has about 50,000 telephones serving a population estimated at 1,100,000.

The extension to Helsingfors, crossing the sixtieth parallel of North latitude and reaching a new mark in eastern Europe, makes it possible to bridge, by means of an intricate linking of radio, submarine cables and land wires, a distance of more than 9,000 miles. The vast telephone system of which these are a part now stretches over forty degrees of latitude, or from semi-arctic to equatorial climates, and over 150 degrees of longitude,—nearly a half day's journey for the sun. When it is noon in San Francisco, at one end of the network, it is 9.15 at night in Helsingfors, at the other extremity.

Helsingfors has a population estimated at 230,000 with approximately 30,000 telephones or roughly thirteen instruments for every 100 inhabitants. The circuit from London, the European terminal of the transatlantic radio channels, runs through Stockholm, whence a submarine cable crosses the Baltic Sea by way of the Aland Islands to Abo in Finland. From there a land wire line carries it to Helsingfors.

The service will be available throughout the twenty-four hours, as in the case of the other European countries. The cost of a call from New York to any point in the added Italian territory, including Rome, is $51 for the first three minutes and $17 for each additional minute. The rates to Warsaw are $52.50 for the first three minutes and $17.50 per minute thereafter. To Helsingfors the rates are $53.25 for the first three minutes and $17.75 for each additional minute.

The added territory is now accessible to all telephones in the United States, Canada, Mexico and Cuba that are at present connected to the overseas radio-telephone circuits.

THE ANNUAL MEETING

AT the annual meeting of the stockholders of the American Telephone and Telegraph Company, which was held at the headquarters building, 195 Broadway, New York, on March 25, the annual report was approved and the Directors were re-elected. There were 9,003,991 shares voted.

SERVICE OPENED TO SOUTH AMERICA

TELEPHONE service between North America and South America was made available to the public on April 3d.

At eleven o'clock on the morning of that day President Walter S. Gifford of the American Telephone and Telegraph Company, in the Cabinet room of the Executive Offices, State, War and Navy Building, Washington, D. C., exchanged greetings with Col. W. F. Repp of the International Telephone and Telegraph Corporation, in Buenos Aires, Argentina. This brief conversation served as a prelude to the official opening of the service by President Hoover who, speaking from Washington, conversed successively with General Carlos Ibañez, President of Chile, at Santiago; and with Dr. Juan Campisteguy, President of Uruguay, at Montevideo. Joseph P. Cotton, Acting Secretary of State, talked from Washington with the Chilean Minister of the Interior, the Uruguayan Minister of Foreign Affairs and the American Chargé d'Affaires at Buenos Aires.

The conversations between government and telephone officials in North and South America were heard by a distinguished assembly at Washington, including diplomatic representatives of the Republics involved and officials of the American Telephone and Telegraph Company and of the International Telephone and Telegraph Corporation. The ceremonies were broadcast over a coast-to-coast radio network and were also sent out by short wave transmission for the benefit of radio listeners in foreign countries.

This new service interconnects twenty million telephones in the United States, as well as all telephones in Cuba, and all the principal points in Mexico and Canada, with the telephones in the Argentine Republic and with the cities of Santiago in Chile and Montevideo in Uruguay.

The link between the two continents is a short wave radio telephone circuit 5300 miles in length connecting the overseas radio stations of the American Telephone and Telegraph Company in the United States with the International Telephone and Telegraph Corporation's stations in the vicinity of Buenos Aires.

Booth Used in Demonstration of Two-way Television.
(See Notes on Recent Occurrences.)

Bell Telephone Quarterly

A Medium of Suggestion and a Record of Progress

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Began engineering work for The Pacific Telephone and Telegraph Company in 1902 and continued in various plant engineering capacities until 1911 when he was made General Commercial Engineer. In 1912 transferred to the American Telephone and Telegraph Company, since which time he has been engaged in various engineering capacities on the general staff.

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Brown University, Ph.B., 1917. After four years editorial and advertising experience in New York City joined Directory Group of the Commercial Engineer's staff, American Telephone and Telegraph Company, May 1924. General Commercial Supervisor's Staff, New York Telephone Company, Manhattan Area, July 1, 1930.

GEORGE K. THOMPSON

Entering the Bell System in 1882, Mr. Thompson was in charge of the section of the American Telephone and Telegraph Company's Engineering Department devoted to the development of instruments and substation equipment, and from 1919 to 1926 was in charge of a similar section in the Company's Department of Development and Research, retiring in May 1930 after 48 years of continuous service.

ROGER B. HILL

Harvard College, B.S., 1911. Engineering Department, American Telephone and Telegraph Company, 1911–1919. Department of Development and Research, 1919–1930. Since 1922 in charge of work on Development Economics, Outside Plant Division.

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Change from Manual to Dial Operation

IN December, 1921, the first dial office of the panel type designed particularly to meet the conditions of large cities was cut into service and after nine years a brief review of the use of dial telephones in the Bell System may be of interest.

For the first few years after 1921 dial service was introduced relatively slowly as it was desirable to observe its operation under all conditions and to make plans and preparations for manufacture and installation on a large scale. For the last few years the introduction has been rapid and 4,300,000 telephones have now been provided with dial service either of the panel or step type. This is 28 percent of the total stations and it is expected that the conversion to the new system in all places for which it is suitable will be completed within eight or ten years.

It has been the practice in the Bell System since its establishment more than 50 years ago to attempt to forecast the growth of the business and to design and to improve the systems, apparatus, materials and operating methods which will be necessary so that they will be available for service as required and not after the need has developed. Inasmuch as switchboards and switching systems control the service given and are the most complicated parts of the telephone plant they have naturally been the subject of particular consideration. While few people, if any, have foreseen fully the great development of the telephone, it became evident some fifteen years ago that the future public demand for service would be much greater than had been experienced up to that time, and that it would be more and more difficult and expensive to meet that demand and to continue to improve service with the manual system. In the last ten years the number of Bell telephones has increased from 8,300,000 to 15,400,000 or 85 percent. The problems of giving telephone service when there are only a few telephones in a small town are relatively simple but the value of the service is correspondingly limited. With growth the service becomes more valuable to each subscriber and the problems of interconnection compound, the difficulties increasing more rapidly than the growth in stations. In the largest metropolitan area (New York City and suburbs) there are 2,400,000 telephones served from 235 central offices and the switching system required in order that anyone may be connected promptly with anyone else is necessarily complicated. Furthermore, no place can be considered in isolation and plans must be worked out for local, toll and long distance calls to permit a nation-wide service which today is being rapidly expanded into a world system.

Careful studies were made of all known switching systems. Improvements for existing systems were worked out and development work was done on all new switching arrangements that seemed promising. To meet the complicated requirements of the largest cities and areas many new and special arrangements had to be devised. All this work took time since trials of the various features under actual operating conditions were necessary in addition to the large amount of study and design. As a result of this comprehensive investigation it was evident that the dial system would give better and more uniform service than was possible with the manual system and at less cost, the improvement being more marked in the larger cities.

It was not enough to design a system which would operate satisfactorily when fully installed, but a complete interconnecting arrangement had to be worked out so that the manual and dial systems could operate together during the transition period and without burdening the subscribers with special procedures, thus making it possible to introduce the new system with no interference to the service and without causing serious financial or employment problems. With hundreds of thousands and even millions of stations in a single metropolitan area it would be impracticable as well as prohibitive in cost to attempt a complete change from the manual to the dial basis at one time.

Experience has shown that the dial system has come fully up to expectations with regard to service. It is more accurate than manual service and when fully installed in a given place the dial service is quicker. During hours of light use such as nights, Sundays and holidays when manual boards have to be operated with a skeleton force, and therefore with a somewhat slower service, the dial service is just as rapid as during the busier hours of the day. While the dial service has to be completely installed in a given area to realize fully all of its service advantages, particularly those of speed, the methods of interconnection with existing manual offices have been so worked out that there is not only no deterioration in service during the transition period but improvement is continuous from the start of dial conversion. As was expected the dial system is also proving more adaptable to improvements and developments to keep pace with the rapidly increasing requirements of the telephone service.

There is convincing evidence that a very large proportion of the millions of present subscribers using the dial prefer that system to the manual and few express any decided preference in favor of the manual service. The dial has also realized predictions in that it has enabled improvements to be made in telephone service and the large growth to be handled at less cost than would have been possible with the manual system.

There is some impression that operators are not required with the dial system and that its use is reducing employment for women. This is probably due to the nature of the dial itself and to the original designation of the system as "automatic" although the manual system has a great deal of machinery and many automatic features. As a matter of fact a great many operators are required with the dial system to handle toll and other special calls and to assist in its general operation. As will be seen from the following figures, furthermore, the introduction of the dial is not reducing employment but it simply avoids as rapid an increase in operators as would be needed with the manual system.

When the dial system was introduced in 1920 there were 128,000 operators in the Bell System. At the present time due to the growth of the business and the requirements for operators even with the dial, 160,000 are employed although the system is now 28 percent on a dial basis. By 1940 when it is expected that the conversion to the dial system will be completed, it is estimated that 180,000 operators will be required. These figures include only the women employed in the telephone company's operating rooms. In other branches of telephone work there has been a steady increase in the number of women employed from 35,000 in 1920 to 80,000 in 1930, and it is expected that the requirements in 1940 will be about 110,000. The total number of women employed in the Bell System, therefore, has increased from 163,000 in 1920 to 240,000 at the present time with an estimated requirement of about 290,000 in 1940. In addition there were some 70,000 private branch exchange positions located on subscribers' premises in 1920 and it is expected that there will be 175,000 in 1940. While the attendants at the smaller boards frequently do other work in addition to their telephone operating these figures represent fairly the proportionate increase in employment. In any consideration of the effect of the introduction of the dial system on employment the larger amount of apparatus involved is an important factor and the number of men employed in the manufacture, installation and maintenance of that equipment shows a large increase over what would have been needed with the manual system.

In many industries the introduction of machinery has meant a large reduction in the number of people employed. Despite this it has been generally recognized that the welfare of mankind has been advanced through increased production by machine operations. Even if it were true that the dial system reduced the number of people employed, its use would probably be justified from the standpoint of improved service and the avoidance of cost increases. The telephone business is in a fortunate position from an employment viewpoint, however, and the plans have been so worked out that the change from manual to dial operation in the larger places does not result in even a temporary reduction in employment and the total number of people employed is increasing steadily in spite of the dial. There are cases in the medium sized and smaller cities where the conversion to dial is completed wholly or in large part at one time which will result in a temporary decrease in the number of operators required, but this will soon be made up by growth, and as already noted there is an increase in the number of men required when the dial system is introduced. Even in these cases, it is almost always possible through the employment of ex-operators and others desiring temporary work for a time before the cutover to avoid any reduction in the permanent force of operators.

There is another phase of the employment problem which is worth notice. In the last ten years the number of telephones has increased 85 percent while the population has increased only about 14 percent. With an increasing demand in many other industries also, for women of the type needed for telephone work, the telephone companies would have been confronted with a more and more difficult problem with the manual system to obtain the number of operators required.

The introduction of the dial system is in line with industrial and social progress. It is the general trend in both business and personal activities to expect faster methods of communication with less risk of error and the utilization of all practical mechanical devices for effecting improvements. It is the fundamental policy of the Bell System to give its customers the best possible service at all times and at the lowest cost consistent with financial safety. Without dial operation it would have been increasingly difficult to meet the needs of subscribers and to insure continued improvements in service and there would have been substantial increases in cost for a service which would have fallen farther and farther behind the possibilities of the dial system.

K. W. WATERSON.

World-Wide Telephony

IT is the aim of the Bell System to increase the possibilities of telephone connection so that ultimately any Bell System subscriber can establish communication with a telephone in any part of the civilized world. To accomplish this, additional facilities are necessary both here and in other countries, as well as suitable operating arrangements. Recent technical advances in radio telephony, particularly in short wave radio, make available means for providing these additional facilities that have not previously existed. An outline of the picture of world telephony is presented herein as it exists today with some indication of what may be expected in the future. An accompanying map shows the existing and proposed radio telephone circuits of the world.

Bell System Activities

Other than the extension of service to Cuba in April, 1921, by submarine cable, the establishment of the transatlantic radio telephone link by the American Telephone and Telegraph Company and the British General Post Office in January, 1927, was the first step in extending Bell System service beyond the North American continent. It was also the first intercontinental telephone circuit and the first long distance radio telephone circuit used for message purposes. The growth of transatlantic service from one radio circuit in 1927 to four such circuits in 1929 and from a few messages per day in 1927 to an average of some 50 messages per day in 1929 shows the importance of this step.

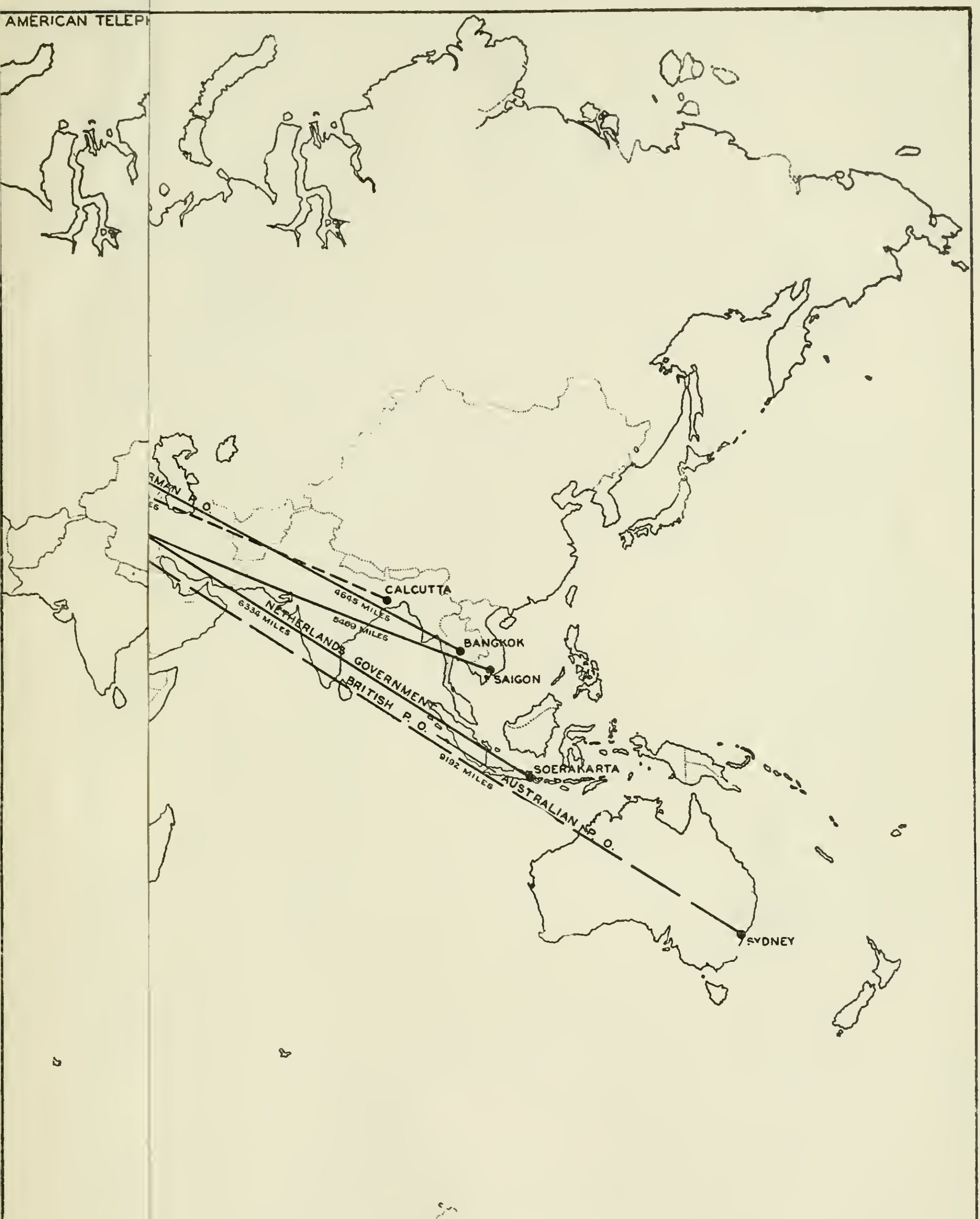
Transatlantic radio telephony has been described in numerous other articles. It is sufficient to point out here that this means is used for connecting the Bell System with the European network, the Bell System being in turn connected by wire with the telephone systems in Canada, Cuba and the principal cities of Mexico. There has recently been established a two-way short wave radio telephone circuit between New York and Buenos Aires which connects the Bell System with the telephone system of Argentina and through existing wire lines with the telephone systems of Chile and Uruguay. This means that the point has been reached where over 86 percent of the world's telephones are offered commercial interconnection in one network with a minimum of delay and with a generally satisfactory grade of service.

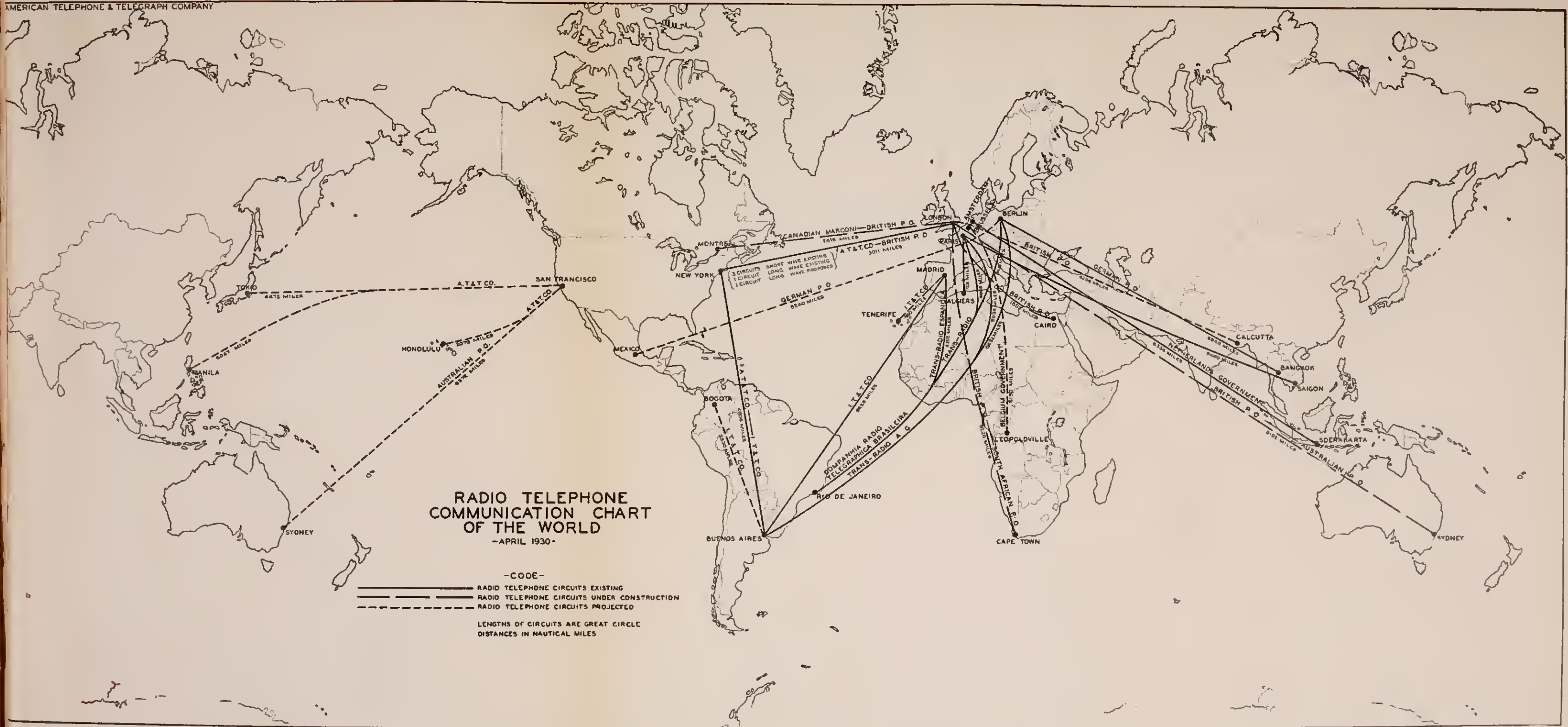
Presumably, for many years, the main group of these longer distance international circuits will be between the North American continent and Europe. The volume of traffic over the present transatlantic radio links and estimates of future growth show that ultimately more circuits will be required. There are now three short wave and one long wave two-way circuits between New York and London. Two new projects are actively under way. One, the establishment of a fifth two-way radio circuit which will be long wave, and the other a submarine telephone cable; this latter being made possible by recent developments in cable construction, including improved insulating and loading materials developed by the Bell Telephone Laboratories. These additional channels will increase both the speed and reliability of service on this important route.

There is now under way the establishment of a radio telephone station on the Pacific Coast near San Francisco, through which it is planned to extend service to the Hawaiian Islands and possibly to Australia, the Philippine Islands and the countries in the Far East.

Activities of Other Agencies

The foregoing are projects in which the Bell System is at present taking an active part or which can be said to be definitely in sight. Other nations are showing a lively interest in


AMERICAN TELEP
RMAN P. O.
CALCUTTA
4645 MILES
5469 MILES
BANGKOK
SAIGON
6334 MILES
NETHERLANDS GOVERNMENT
BRITISH P. O.
SOERAKARTA
9192 MILES
AUSTRALIAN P. O.
SYDNEY


AMERICAN TELEPHONE & TELEGRAPH COMPANY
RADIO TELEPHONE COMMUNICATION CHART OF THE WORLD
-APRIL 1930-
-CODE-
RADIO TELEPHONE CIRCUITS EXISTING
RADIO TELEPHONE CIRCUITS UNDER CONSTRUCTION
RADIO TELEPHONE CIRCUITS PROJECTED
LENGTHS OF CIRCUITS ARE GREAT CIRCLE DISTANCES IN NAUTICAL MILES
TOKIO
A.T.&T.CO.
SAN FRANCISCO
MANILA
HONOLULU
AUSTRALIAN P.O.
SYDNEY
MONTREAL
NEW YORK
CANADIAN MARCONI—BRITISH P.O.
A.T.&T.CO.—BRITISH P.O.
3 CIRCUITS SHORT WAVE EXISTING
1 CIRCUIT LONG WAVE EXISTING
1 CIRCUIT LONG WAVE PROPOSED
GERMAN P.O.
MEXICO
BOGOTA
I.T.&T.CO.
BUENOS AIRES
RIO DE JANEIRO
COMPANHIA RADIO TELEGRAPHICA BRASILEIRA
TRANS-RADIO A.G.
TRANS-RADIO ESPANOLA
TRANS-RADIO
LONDON
AMSTERDAM
BRUSSELS
PARIS
BERLIN
MADRID
TENERIFE
ALGIERS
CAIRO
BRITISH P.O.
BELGIUM GOVERNMENT
SOUTH AFRICAN P.O.
LEOPOLDVILLE
CAPE TOWN
CALCUTTA
BANGKOK
SAIGON
NETHERLANDS GOVERNMENT
SOERABAJA
SYDNEY

extending their telephone service to various parts of the world and are developing other projects which it seems pertinent to list since even though connection with the Bell System may not now be contemplated they are links in the picture of world telephony. As such they may possibly be useful in some cases for tandem operation and in others the stations may be used for the establishment of direct circuits between the United States and countries in which they are located, if there is sufficient potential traffic to warrant the project, if the apparatus is or may be made suitable from a transmission standpoint, and if satisfactory arrangements can be made with the operating agencies involved.

British Empire

Radio telephone circuits are under construction or contemplated between the following points:

London to Montreal, Canada
London to Capetown, Africa
London to Sydney, Australia
London to Cairo, Egypt
London to Calcutta, India

France

Radio telephone circuits are in operation between Paris and the following points: Buenos Aires, Rio Janeiro, Algiers and Saigon, Indo-China. In the case of the Paris-Buenos Aires circuit connection at Buenos Aires is not made to the telephone system, conversations being from a booth in the offices of the operating company. However, at Paris the circuit is connected to the European telephone network.

Spain

A radio telephone circuit has been established between Madrid and Rio Janeiro and Madrid and Buenos Aires. At

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Spain

A radio telephone circuit has been established between Madrid and Rio Janeiro and Madrid and Buenos Aires. At

Buenos Aires connection is made to the telephone system of Argentina and through that system to Chile and Uruguay. A further extension is proposed by radio telephony between Buenos Aires and Bogota, Colombia. Connections in Europe are limited to telephone subscribers in Spain. However, it is understood that connections probably will be extended to other European countries.

A radio telephone circuit is proposed between Madrid and the Canary Islands.

Germany

Telephone service is available over a radio circuit between Berlin and Rio Janeiro and between Berlin and Buenos Aires. As in the case of the Paris-Buenos Aires circuit no connection is made to the telephone system at Buenos Aires, conversations being from a booth in the offices of the operating company but at Berlin the circuit is connected to the European telephone network.

There have been reports of radio telephone experiments between Berlin and Asiatic countries. However, the only circuit reported in commercial service is between Berlin and Bangkok, Siam. Some experimental work has been done on a circuit between Berlin and Mexico City.

Belgium

A radio telephone circuit is contemplated between Brussels and the Belgian Congo.

Holland

A radio telephone circuit was recently placed in service between Amsterdam and Soerakarta, Java. This circuit now terminates in booths at both ends but work is under way to connect it to the telephone system in Holland and through it probably to the European network.

Channel Possibilities

With the exception of one long wave channel between New York and London and an additional long wave channel contemplated between these two points all other radio circuits, either existing or proposed, use or contemplate using the short wave portion of the radio spectrum. The short wave portion of the spectrum while vastly richer in channel possibilities than the long wave portion still has quite definite limitations as to the number of channels it affords. Moreover, any one of our transatlantic short wave circuits requires three frequencies for each circuit to provide continuous service over a 24 hour period. In our case we have found, for transatlantic operation, that a combination of short and long wave channels leads to far more reliable service than either portion of the radio spectrum used separately; hence our interest in the establishment of an additional long wave channel. The addition of a cable will also increase the reliability on the important New York-London route.

In international radio nations share a common transmitting medium. Recognition of this has resulted in the establishment of international means for coordinating frequency assignments through the medium of the International Radio Conferences, the most recent of which was held in Washington in 1927. Also, for the purpose of studying the many problems of international radio a committee was organized under the last radio convention called the International Technical Consulting Committee on Radio Communication, abbreviated, from the French, to C. C. I. R. The outstanding problem of this committee is to obtain world agreement on technical standards which will permit of deriving the maximum number of channels with the minimum of mutual interference.

Ship-to-Shore

Any review of world telephony should include a statement of the present status and possibilities of telephone service for ships at sea. Ships with relatively large numbers of passengers are completely isolated for days at a time except for radio communication. The Bell System has been studying the possibilities of ship-to-shore telephone service for some years and in December, 1929, commercial service was inaugurated with the steamship *Leviathan* of the United States Lines utilizing a sending and a receiving shore station established for the purpose near New York. In April of this year service was established with the steamships *Majestic* and *Olympic* of the White Star Line and was subsequently extended to the *Homeric*. It is expected that Bell System service will soon be extended to other transatlantic ships and later to coastwise vessels. Probably a shore station for ship communication will be established on the Pacific Coast at no very distant date. Experiments in ship-to-shore telephony have also been carried on in Europe, notably in England and Germany. There has recently been established commercial service between the station of the British General Post Office and several transatlantic liners.

Conclusion

Radio is proving to be an effective pioneering means for the establishment of world-wide telephone communication because it furnishes a ready method of connecting countries which are separated by natural barriers over which wires either cannot now be placed or can be placed with so great difficulty as not to be economically justified.

In some cases, such as between Europe and Africa and between the United States and South America, the barriers consist principally of large land territories which are little developed commercially. With the future industrial development of these countries and the building of railroads and highways it may reasonably be expected that telephone networks will be built up to serve at first the needs of the separate countries and later these networks will be interconnected making through wire telephone routes available.

In other cases, such as between North America and Europe and between North America and Asia, the barriers consist of broad expanses of ocean. Under these conditions wire circuits are at a large disadvantage. However, as already noted, recent developments have now made possible a telephone cable between America and Europe and plans for its construction and laying are going actively forward. It is not being placed, however, with the idea that cables of this type would be economically justified for all the traffic between this country and Europe but rather that it will increase the reliability of a service which will also depend on long wave and short wave radio circuits. For the long distances involved in connecting this country with the important countries across the Pacific the technical and economic difficulties of cable would, of course, be increased. The parts which cable and radio will ultimately play in spanning these ocean barriers will depend, of course, on the developments that it is found possible to make in both radio and cable facilities. It seems reasonable to expect, however, that radio will continue to have a very important field of usefulness under these conditions.

For mobile services, of which at present ship-to-shore communication is the outstanding example, radio is clearly the only means available.

ELAM MILLER.

Trade Mark Service in Classified Telephone Directories Contributes to Modern Merchandising

MODERN merchandising in this more complicated age of living depends largely on a comprehensive, well-planned advertising program which creates in the minds of the buying public a desire for the advertised product. Manufacturers have realized for a long time that although the brand names of their products have been well established in the minds of the readers of their advertising by these comprehensive advertising programs, their chain of marketing effort is incomplete in that it does not tell the prospective purchaser where the product can be bought.

Under these modern conditions of marketing, the prospective consumer is looking for some standard product to which his attention has been called by national advertising. He is looking not merely for a jeweler, but for a particular make of watch; not merely for a candy store, but for a special brand of chocolates; not merely for an automobile dealer, but for the agency of the particular car he wishes to buy. Of course, the advertisers of standard products cannot include the names of all their local dealers in advertisements of national circulation. The limitations of space forbid. And so, even after national advertising has successfully aroused the desire to buy, the prospective purchaser has all too often been left to wander disconsolately from store to store seeking the advertised product until he finally, in discouragement, gives it up and allows somebody to sell him "something just as good."

This constitutes a very serious hiatus in the smooth flow of distribution from producer to consumer. National advertising informs the reader of the merits of a certain product, of the advantages accruing to the owner and creates successfully, thereby, a desire to buy. But national advertising falls short of completing the sale, for it can only tell the reader what to buy, it cannot tell him where to buy it.

Realizing that the solution to this modern merchandising problem might be found in the most comprehensive buyer's guide published in this country—the Classified Telephone Directories of the Associated Bell Telephone Companies—the

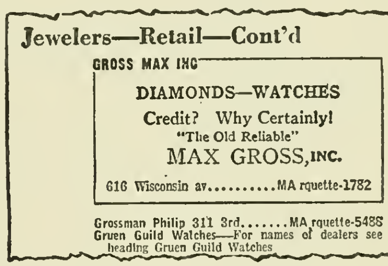

Gruen Guild Watches

You will find Gruen Guild Watches — men's wrist and pocket watches; women's gold and diamond set wristlets— at the Member Guild Jewelers listed below.

GRUEN WATCHES

"WHERE TO BUY IT"

Alsled-Kaslen Co Inc 123 Wis av.....DA ly-1544
Bloedel's Jewelry Inc 215 Wis av.MA rquette-3078
Bunde & Upmeyer Co 101 Wis av....DA ly-0760
Durner George 745 3rd.............LO cust-0148


Jewelers—Retail—Cont'd

GROSS MAX INC

DIAMONDS—WATCHES
Credit? Why Certainly!
"The Old Reliable"
MAX GROSS, INC.
616 Wisconsin av..........MA rquette-1782

Grossman Philip 311 3rd.......MA rquette-5488
Gruen Guild Watches—For names of dealers see heading Gruen Guild Watches

Trade Mark Heading Cross-referenced under a General Heading

American Telephone and Telegraph Company conducted an investigation which extended over several years. The objective of this study was to determine how to make the classified telephone directories of the greatest possible usefulness to business men and consumers alike. As a result there was developed the Trade Mark Where to Buy It Service, now available to manufacturers throughout this country and Canada. Another Bell System Service was thus added to those already in use by the public.

The Service is very simple in form, method of purchase and operation. Trade Mark Service for any one manufacturer consists of inserting the name of his product in the classified telephone directory, in towns where he has dealers, together with a list of his authorized dealers with their addresses and telephone numbers. Typical Trade Mark Headings and their associated dealer listings as they appear in the classified telephone directory will be found in the illustrations on this page and on page 201.

COUNTRY CLUB DAIRY
PASTEURIZED——WHITE LIST MILK——RAW
HIland 8000 5633 Troost Ave.

Curtain Cleaners

Curtains — Overdrapes — Blankets
COMFORTS—FANCY LINENS—SPREADS
4726-32 Forest VA lentine 7900
(2 Trunk Lines)

AMERICAN CURTAIN LAUNDRY
BEDSPREADS - DRAPES-BLANKETS - QUILTS - LINENS - RUGS
1916-20 W. 41st We Call & Deliver LO gan 4924

City Curtain Cleaners
Successors to K. C. Curtain Cleaner.
New Pinless System
2601 Indiana LInwood 3396

City Curtain Cleaners 2601 Indiana........LI nwood 3396
COUNTRY CLUB LAUNDRY
5028 Main........................VA lentine 3900

DARGILS SPECIALTY LAUNDRY
3441 Prospect Ave. :-: LInwood 6700

KATE HINKLE'S
FRENCH LAUNDRY
LACE CURTAINS - - FANCY LINENS
3121 Gillham Rd. Established 1907 WEstport 1300

Home Lace Curtain Clng Co 4728 Forest...VA lentine 7900
McMILLEN T S MRS 3118 E 15th St......BE nton 1176
Modern Lace Curtain Cleaners 609 E 15th St..GR and 2770

STAR RUG & LACE CURTAIN CLEANERS
Everything Laundered 100%
BE nton 7058 2115 Indiana Ave.

WESTPORT LAUNDRY CO
3958 Central......................WE stport 1464

Curtain Manufacturers

Brooke Curtain Corp 2609 Walnut.........HA rrison 4359
Missouri Vogue Curtains 332 W 9th.......HA rrison 6983
U S Manufacturing Co 908 Central........HA rrison 2234

Cut Stone Contractors

Beck Cut Stone Co 8427 Roanoke Bd........LO gan 3434
K C Cut Stone Co 5th & Cheyenne..........VI ctor 7189
Phenix Cut Stone Co 19th & Olive..........CL Ifton 4841
Sutermeister A Stone Co Troost & Belt Line. HA rrison 8482

Cutlery

Clark Bros Cutlery Co 312 E 11th........HA rrison 1188
HECKEL BROS 807 Main.................VI ctor 7802
Waterville Cutlery Co 312 E 11th........HA rrison 1188

Cuts

AMERICAN CUT & MATRIX CO
610 Delaware ....VI ctor 8302
BURGER-BAIRD ENGRAVING CO
7th fl Graphic Arts Bldg..........HA rrison 6130
KANSAS CITY ENGRAVING & COLORPLATE CO
8th & Walnut St......................VI ctor 4707

Cylinder Grinding

BROWN W W MACHINE WORKS
127 Sw Blvd........................GR and 0466
INTERNAL MOTOR PARTS & CYLINDER RESIZING CO
1823 Walnut ....GR and 1290
Internal Motor Parts & Cylinder Resizing Co
1823 Walnut. GR and 1290
Johnson Walter D 121 E 18th St.........HA rrison 1574
Kline Welding & Machine Works 1823 Grand. HA rrison 4397
MEIK MACHINE WORKS 1423 McGee......VI ctor 5537
TOBIAS MACHINE WKS 611 E 19th....HA rrison 6963
WHEATLEY BROS Se 25th & Broadway..HA rrison 4446

Dairies

SUMME DAIRY CO.
QUALITY AND SERVICE
WE DELIVER TO YOUR HOME
RETAIL AND WHOLESALE
LI nwood 7565

AINES FARM DAIRY
"Quality Beyond Question"
VA lentine 3880

★Aines Farm Dairy Co 3110 Gillham Rd. .VA lentine 3880
Aines Farm Dairy Co Garage 2720 Cherry....GR and 5478
Allvine Dairy Co 1709 N 7th...............FA irfax 3144
★Arctic Dairy Products Co 415 W 16th....HA rrison 5695
Bailes Farm Dairy 746 Central..............DR exel 0685
Blue Ribbon Creamery 746 Central..........DR exel 0685
Budd Park Dairy 89th & Broadway.........JA ckson 0802
Campbell Dairy Co 826 E 14th.............VI ctor 3490
Cedar Brook Dairy Farm 89th & Broadway..JA ckson 0802

CHAPMAN DAIRY
Retail: VI ctor 9620
Wholesale: VI ctor 9624

★Chapman Dairy Co
Wholesale Dept 1207 Locust..........VI ctor 9624
South Station 1310 E 63rd..........HI land 5620
Retail Dept 1207 Locust..............VI ctor 9620
East Station 5600 E 15th..........CH estnut 5620
If no answer call...................VA lentine 7134
Clover Dairy 1000 E 48th....................LO gan 6906
Co-Operative Dairy Assn 3105 Gillham Rd..VA lentine 3106

Cooks Dairy 815 W Lexington......@IN dependence 3089
Country Club Dairy Co 5633 Troost.........HI land 8000
Drink Mor Buttermilk Co 3111 E 18th.....CL Ifton 1715
Dryden Farm Dairy Holke Rd.....@IN dependence 44 N11
Elm Park Dairy Noland & Phelps Rd. @IN dependence 55 N2

ETEM DAIRY
CLEANLINESS -- RICHNESS
HI ckman 74 Hickman Mills, Mo.

Fauna-Belle Farms 2½ mi Se Leeds......LE eds 1906 N2
Forest Dairy Co 531 Forest................VI ctor 7586

FORSEN DAIRY
WE DELIVER TO YOUR HOME
BREAKFAST SERVICE
1720 QUINDARO BLVD.
Phone FA irfax 4613

Forsen Dairy 1720 Quindaro..............FA irfax 4613
Harmony Hill Dairy 8 Noland Blvd..@IN dependence 25 N6

HILLROSE FARM
WHITE LIST MILK
PAUL MATTHEY
Phone Overland 106
Call Long Distance or Dial Operator

★Home Dairy Co 3106 Gillham.........VA lentine 3106
Indep Pure Milk Co 415 S Spring...@IN dependence 3356
Jersey Meade Farm Dairy North K C.@RA ndolph 1418 N2
K C Milk Producers 4608 Troost..........WE stport 2525
Long R F 634 Arlington............@IN dependence 5400
Northeast Dairy Co 539 Troost Av...........VI ctor 7736
Primrose Farm Dairy 5106 Indep Av.........BE nton 3901
Renne Dairy Co 4510 Prospect.............WA bash 2638

SCHELLCREST FARMS
FRED P. SCHELL, Jr.
WHITE LIST MILK from Pure Bred Holstein Friesians
BABIES A SPECIALTY
Phone VI 3966 Or call LONG DISTANCE Liberty Mo., 46 F 11

Sheffield Farm Dairy 1328 Locust...........VI ctor 4697
Sni-A-Bar Dairy Farm
1418 S Pleasant. @IN dependence 3211
Summe Dairy Co 4115 E 27th.............LI nwood 7565
Superior Farm Dairy 3710 Indep Av.........CL Ifton 1292
Theroff & Doehla Creamery Co 330 N 7th....DR exel 4490
Westport Dairy 4017 Penn.............VA lentine 9206

MAPLE CREST FARM
Wood Bros.
WHITE LIST MILK
Phone Overland 80
Call for Long Distance or Dial Operator

Dairy Supplies

De Laval Sales & Service Co 1319 W 13th...HA rrison 6566

K. C. SOLDERING & RETINNING WORKS
Milk Cans, Dairy Equipment
Repaired and Retinned
GRand 1312 1907 Holmes St.

KENNEDY N A SUPPLY CO 1311 W 13th HA rrison 1070
Lowry Sales Corporation 114 Mfg Exch.....HA rrison 6177

A Classified Telephone Directory Page before the New Typography Was Adopted

"WHERE TO BUY IT" Lau—Lea 201

Laundries—Continued

Wisconsin Family Laundry 344 Madison. HA nover-1214
(See Advertisement This Page)
WONDER SERVICE LAUNDRY 873 Kinnie av. SH eridan-1520
Wood's Laundry Inc 3100 North av. KI lbourn-0480
(See Advertisement Opposite Page)

Laundry Dryers

Apartment Laundry Dryers

WISCONSIN SALES & SUPPLY CO 137 6th. MA rquette-4100

Laundry Machinery Mfrs

American Laundry Machine Co 251 26th. WE st-1741
Huebsch Mfg Co 61 Center........LO cust-5990
Prosperity Co Inc 1417 Wells.. MA rquette-6467
Troy Laundry Machinery Co Ltd 625 Cramer. LA keside-0812
Vaccione Co 56 8 Bay..........SH eridan-6153
Welded Products Mfg Co 2207 Kirkwood av. CU daby-0594

Castor Equipment

COLSON-CHICAGO CO 216 W Water.. DA ly-4222

Laundry Owners Ass'n

Members of the Laundry Owners Association own their own plants and are pledged to Service, Health and Sanitation. Affiliated with National Association.

"WHERE TO BUY IT"

American Laundry 214 Wells.... MA rquette-2071
Big 4 Laundry Corp 547 30th......WE st-2110
Buckley Laundry Co 3110 Galena.. .WE st-0634
Campbell Laundry Co 714 Michigan. MA rquette-6186
Cream City Laundry 491 Broadway. BR odwy-0330
Eva-Caroline Home Laundry 2914 Center. KI lbourn-0064
Hubinger Laundry Co 215 Garfield av LO cust-0187
Huebsch Laundry Co 866 Arlington pl. LA keside-4810
Ideal Laundry Co 1520 Wells.... MA rquette-2175
National Family Laundry Co 877 Natl av. MI tchell-5300
New Way Service Co 1627 North av. KI lborn-8000
North Av Family Laundry 346 E North av LA keside-5000
Northwestern Laundry Co 2401 North av. KI lbourn-5635
Quality Laundry Service Inc 2900 Vliet. WE st-8000
Reliance Laundry & Cleaning Co 617 Natl av. OR chard-0617
Right Laundry The 124 Howell av.. HA nover-0356
Sunshine Laundry Inc 1107 Wells. MA rquette-3333
South Side Laundry Co 873 Kinnie av. SH eridan-1520
Standard Laundry Inc 1818 Clybourn. WE st-2818
Thill's Hand Laundry 135 E Wells.. DA ly-0252
Vaughan Atlantic Laundry Co 570 E Water. DA ly-6730
Wood's Laundry Inc 3100 North av. KI lborn-0480

Laundry Supply Dealers

LELAND CHEMICAL CO INC 298 Milw. DA ly-0602
MERCHANTS CHEMICAL CO INC 420 Barclay. HA nover-5410
Phoenix Products Co 161 Chicago. BR oadway-4460
Sunshine Soda Co 218 Florida.. BR oadway-8162

Lawn Equipment Dealers

Brooks of Wis 714 Oakland av.... LA keside-3601
RYERSON DICK 2143 Pt Wash rd. ED gwood-5064

Lawn Mower Mfrs

Power Lawn Mowers

Modern Machine Works Inc 192 Milw.. DA ly-6536
(See Advertisement This Page)
RYERSON DICK 2143 Pt Wash rd. ED gwood-5064

Lawn Mower Repairers

Ryerson Dick 2143 Pt Wash rd... ED gewood-5064

Grinding Lawn Mowers

SCHWALBE BROS
Lawn Mower Grinding and Repairing
Guaranteed Work
Done at Your Home
CALL BETWEEN
6-8 A M or 4-8 P M.
874 4th.. ... CO ncord-0280

Lead

Fittings, Lead

Crown Metal Co 255 Washington.. HA nover-1294

Products, Lead

WINDSOR MFG CO 564 Clinton.. HA nover-0375

Sheet Lead

Crown Metal Co 255 Washington.. HA nover-1294

Leather Goods Dealers

BURROUGHS EDW COMPANY
Edward S. Burroughs, Mgr.
20 Years With George Burroughs & Sons
QUALITY LEATHER GOODS

Bags	Hat Boxes	Toilet Sets
Brief Cases	Men's Purses	Catalogue Cases
Trunks	Suit Cases	Portfolios
Gladstones	Ladies' Purses	Leather Specialties

Sample Room and Sales Office
3198 Plankinton Arc. Bldg.
123 Wisconsin av............... DA ly-1185

BURROUGHS GEO & SONS 459 E Water. DA ly-5614
Cures Bros 476 11th.......... MA rquette-1109
ELSNER A G & SONS
"The Leather Goods Stores"
TRUNKS—SUIT CASES
TRAVELING BAGS
—Repairing—
Two Big Stores
308 Wells .... MA rquette-3143
417-19 Juneau av........... MA rquette-1894

IRON DUKE TRAVEL THINGS CO 373 E Water. DA ly-6879
Linden Glove & Leather Clothing Co 1029 5th. LO cust-1748
Lins C J 81 E Wis av....... ... BR oadway-0365
LOOPS HARRY C 459 E Water...... DA ly-5614
Martynski Anton 491 Mitchell.... HA nover-2231
McKane-Lins Co 81 E Wis av. .. BR oadway-0365
Milwaukee Leather Products Co 130½ E Wells. BR oadway-3385
National Trunk Stores 613 Wis av... GR and-8985
(See Advertisement This Page)
Romadka's Retail 81 E Wis av.... BR oadway-0365
Seligmann S & Co 440 Milwaukee... DA ly-4058
South Side Strap Co 259 Greeley.. HA nover-4696
Yonker J B & Sons 261 W Water . GR and-8120

Wisconsin Family Laundry
Tel. HA nover 1214
The Newest Laundry in Town

Wet Wash, 20 lbs. $1.00
Week End Special, 25 lbs. $1.00

Hydro, 20 lbs. $1.30
Week End Special, 25 lbs. $1.30
Flat Pieces Ironed, Wearing Apparel Returned Damp

Rough Dry, 20 lbs. $1.60
Flat Pieces Ironed, Wearing Apparel Air Dried

344 Madison St.

Red E POWER LAWN MOWERS
FOR LAWNS EVERYWHERE

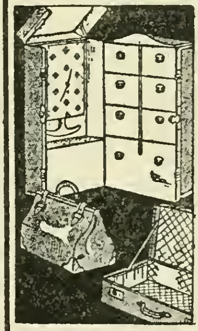
Simplicity in Construction
Easy to Operate

Lawns must not be neglected. They should be kept smooth and closely cut. The Red E Mower is just the thing for this purpose. It runs over the lawn quickly and efficiently. It does a good job, and requires little work on your part.

Guaranteed—Ask for Demonstration

Made in Milwaukee by
Modern Machine Works, Inc.
192-94 Milwaukee St.
Tel. DA ly 6536

LEATHER GOODS
We carry a complete line of:



Hand Bags
Brief Cases
Trunks
Gladstones
Hat Boxes
Men's Wallets
Suit Cases
Ladies' Purses
Catalogue Cases
Umbrellas
Leather Specialties
Fountain Pens and Novelties

"If It's Made of Leather We Can Repair It"
Repairing of Umbrellas and All Leather Goods

NATIONAL TRUNK STORES
613 WISCONSIN AVENUE
Tel. GR and 8985
98 E. WISCONSIN AVENUE
BR oadway 8630

A Classified Telephone Directory Page in the Modern Style, Showing a "Where to Buy It" Listing

The adoption of Trade Mark Service in classified telephone directories makes it possible for the manufacturer to refer to his local dealers in his national advertising—something which he could not readily do before. In his national, regional or local advertising he can incorporate a reference similar to the following:

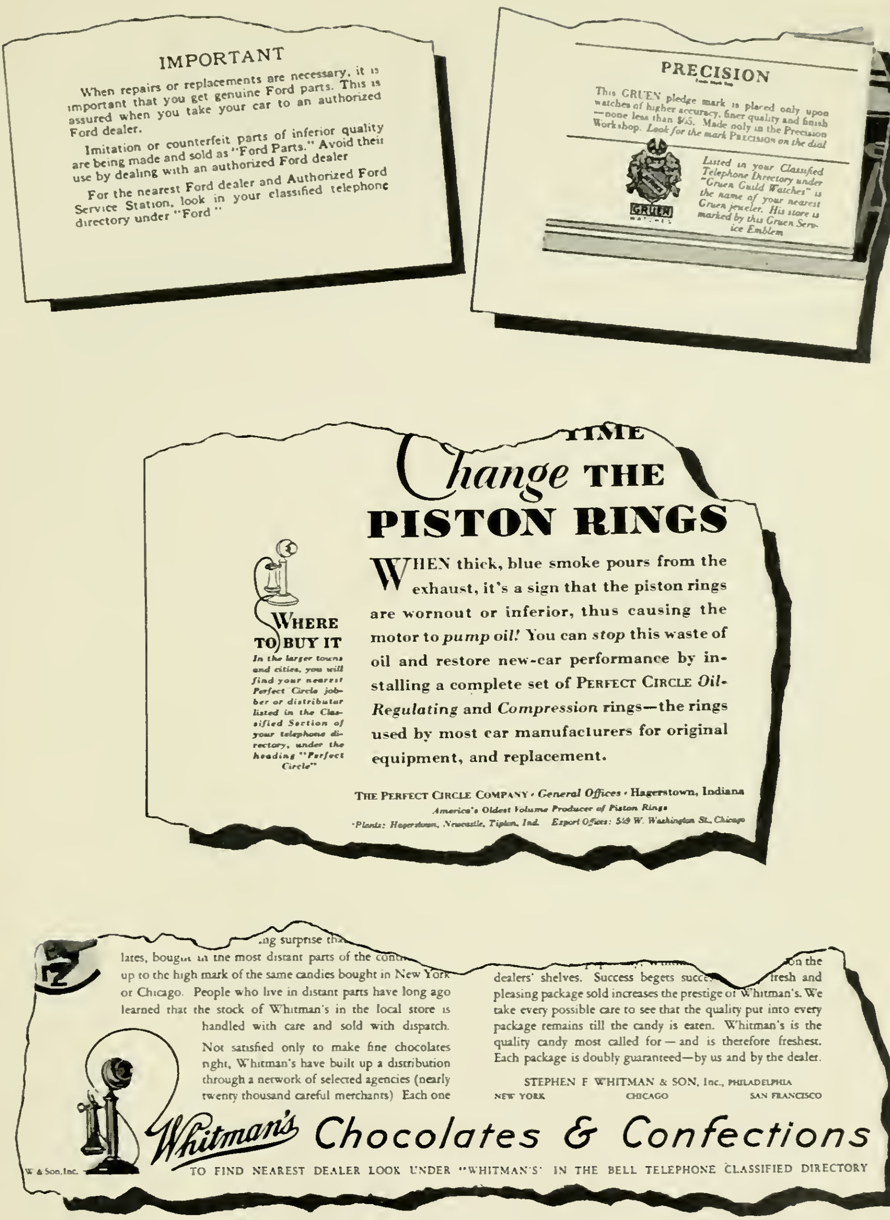
> "Your nearest dealer is listed in your local Where to Buy It Classified Telephone Directory under—(brand name)"

The illustration on the opposite page shows several such references contained in advertisements which have appeared in leading periodicals with national circulation, and a similar note printed in an automobile manufacturer's instruction book.

Trade Mark Service is now available in the telephone directories which are in use in more than 24,000 cities and towns in the United States and Canada. All or a desired part of these towns, to match the distribution of a particular product, can be covered in a single contract. The circulation of the directories is now more than 16,500,000 copies which are delivered free of charge to homes and offices with telephones.

The opportunity for the telephone companies to render this additional service to the public came with the development of the modern telephone directory which has been called the "most used and most useful of books." Through the establishment years ago of classified telephone directories, it was made easy and convenient for any prospective purchaser to find "a butcher, baker or candlestick maker" to supply his needs. Business men, too, were thus given an opportunity to let the prospective customer know they were in the business of supplying the particular kind of goods or service for which he was looking.

To make the directories of greater value to these business men and subscribers, improvements have been made in classified telephone directories during the last few years. Among these improvements have been the "conversion" of all classi-



Typical References to Trade Mark Service Contained in National Advertising and in an Automobile Instruction Book

fied directories to a new and better standard of typography, a better arrangement of the display advertising, and revision of the classifications to make for greater ease of reference and completeness of the buying service. The illustrations on pages 200 and 201 show the striking difference between the old classified telephone directory page and the new converted one. These changes were made with a view to improving the reference value of classified telephone directories as buyers' guides.

Manufacturers are using the Trade Mark Service for a variety of reasons. An automobile manufacturer, for example, who has built up an extensive, well trained and well equipped service organization, is using the Service because he realizes that, no matter how good his service stations may be, they are of little use to the automobile owner unless one can be readily found when needed.

Another manufacturer is concerned with dealers who are trading on his advertising in an undesirable way. Such a dealer puts up on the outside of his building a sign with the advertised trade name of this manufacturer's product. He then lays in a small part line stock of the product in question and a complete stock of a less known line on which his profits are greater, and which he will substitute for the advertised product whenever the buyer permits. Trade Mark Service solves this problem to a large degree since the manufacturer can arrange to list under his Trade Mark only such dealers as he approves. The Service is thus an aid to the manufacturer in directing prospective customers away from the part line and "sell-you-something-just-as-good" dealer.

Trade Mark Service also reduces to a minimum the sales which are lost when an interested prospect "postpones" a purchase because he does not know where to buy the product. Furthermore, it reduces the number of sales which are lost through the indifference of the dealer with regard to the use of signs, window displays and other means for tying up to the demand for the product that has been developed by the manufacturer's national advertising. It is also an aid in strengthening the manufacturer's dealer organization, adding new dealers and dropping the non-profitable dealers. When properly "merchandised" to the dealer the Service can be used to reduce dealer turnover. In general, dealer and consumer good-will can be improved and made more certain of retention by the use of Trade Mark Service, and above all, Trade Mark Service gives a local value to national advertising which has never before been attained. The dealer is identified by name with each of the manufacturer's national advertisements.

The solution to these problems of merchandising is an active interest of the Bell System. Several years have been spent in developing and perfecting a solution which is just beginning to bear fruit in the form of Trade Mark Merchandising Service—another contribution of the Bell System to the vast scheme of modern American intercommunication and merchandising.

HUGH W. MACNAIR.

The First Telephone Switchboard and Its Method of Operation

THE first interconnection, through a switchboard, of lines equipped with telephones, occurred at the central office of the Holmes Burglar Alarm Company, in Boston, in May, 1877. Pictures of the plug and block apparatus used at this time have been printed on many occasions, and the circumstances of its use have been referred to in several published books and articles. So far as the writers are aware, however, the complete central office and substation connections, and the method of handling a call, have never been publicly described. It is the purpose of this article to make available this information, the essentials of which were obtained many years ago from the late E. T. Holmes. Before taking up the method of operation of the switchboard, however, it will be helpful to review briefly the events leading up to its installation, as related by Mr. Holmes in his book, "A Wonderful Fifty Years."

In May, 1877, Mr. Holmes was conducting a burglar alarm business in Boston, with a central office at 342 Washington Street (Fig. 1), from which burglar alarm lines radiated to a number of banks and stores. At this central office a galvanometer was provided for each subscriber's line, so connected that if the apparatus at the subscriber's station should show a variation in resistance or an open circuit, a local contact would be closed, causing an annunciator drop to fall and a bell to ring. At each subscriber's station there was, in circuit with the vault or safe wiring, a key for transmitting signals to the central office and a bell for receiving signals from the central office. This system was only in use at night, and was disconnected during the daytime.

Mr. Holmes was keenly interested in the box telephones which were being constructed and experimented with at the shop of Charles Williams, Jr., at 109 Court Street, and persuaded Gardiner G. Hubbard to let him try them out on his burglar alarm lines. Within the next few days, five box telephones were delivered to Mr. Holmes, four of which were installed at the premises of the National Exchange Bank; the Hide and Leather Bank; the Shoe and Leather Bank; and Brewster, Bassett and Company, bankers. The fifth was installed at the Holmes central office. This telephone and the lines extending to the four banks were connected to a small telegraphic plug and block switchboard (Fig. 2), which had been made at Mr. Holmes' order. A fifth line was run from the switchboard to the shop of Charles Williams, Jr., and connected to a telephone there. After switches had been installed at the substations, for the purpose of connecting the subscribers' lines to either the substation burglar alarm circuits or box telephones, Mr. Holmes was in possession of a small experimental exchange with five subscribers, whose lines were repeatedly interconnected, and many conversations were exchanged, the burglar alarm apparatus being employed to transmit the call signals.

A public exhibition of the working of this system was given on May 17, 1877, on which occasion spectators assembled at the banking offices of Brewster, Bassett and Company talked with the Holmes central office and the Williams shop, and cornet solos, played at the Holmes office, were plainly heard at the other two points. This exhibition was noted in the Boston "Evening Transcript" of the following day, which reported that "conversation was carried on between the several points connected with perfect ease."

This experimental exchange was discontinued after being in operation about two weeks. The original switchboard was preserved by Mr. Holmes, however, and is now in the Bell System Historical Museum at 463 West Street, New York City.

Figure 1 (Above). Building at 342 Washington Street, Boston, Mass., in which the central office of the Holmes Burglar Alarm Company was located

Figure 2 (Below). The first telephone switchboard. It was designed by Mr. E. T. Holmes, and used for the first interconnection of lines equipped with telephones. The plug and block switches are shown in readiness for a call to be made.

Coming now to the method of operation of the switchboard, Figure 3 is a circuit diagram showing the substation and central office apparatus and connections for the lines of two subscribers, *B* and *D*, the apparatus being shown in readiness for a call to be made. At the central office, the subscribers' lines were permanently connected to the top plates of the plug and block switches. (As will be seen from Figure 2, there were six of these switches, five of which were in use.) The central office burglar alarm circuits were permanently connected to the lower right-hand plates of these switches. The lower left-hand plates were connected together by a common tie wire. One terminal of the central office box telephone, *T*, was connected to this common tie wire, the other terminal being connected to a two-point switch, *S*, by means of which the telephone could either be grounded or placed in circuit with a flexible cord, *C*, terminating in plug *Q*. Plugs *P-b*, *P-d*, etc., were provided for connecting the subscribers' lines to either the central office burglar alarm circuits or to the box telephone, *T*, as desired.

At each subscriber's station was a two-point switch, by means of which his line could be connected to either his substation burglar alarm circuit or to his box telephone, as desired. For telephone operation, during the daytime, the bank vault or safe at the subscriber's premises was short-circuited, this short circuit being removed at night, when the burglar alarm system was in operation.

As will be seen from Figure 3, the system operated on a normally closed circuit, from ground at the substations, through the central office galvanometers, *G-b*, *G-d*, etc., battery *B*-2 and ground. Subscriber *B*, desiring to talk with subscriber *D*, depressed key *K-B*, which momentarily opened the circuit through his central office galvanometer, *G-b*, causing its needle to deflect and close a local circuit through annunciator *A-b* and battery *B*-3, operating the annunciator shutter and closing another local circuit through vibrating bell *V* and battery *B*-3. Upon releasing key *K-B*, subscriber *B* at once moved his sub-

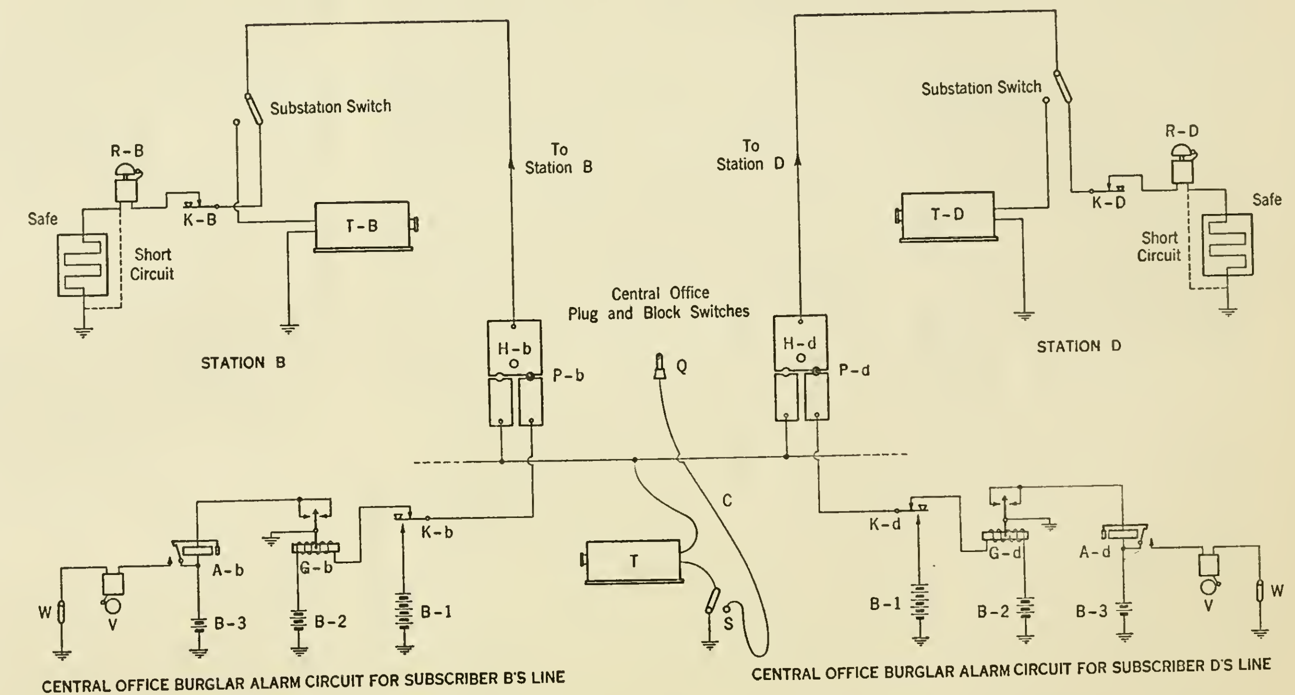


FIG. 3. - SUBSTATION AND CENTRAL OFFICE APPARATUS AND CONNECTIONS FOR TWO SUBSCRIBERS' LINES.
APPARATUS SHOWN IN READINESS TO RECEIVE A CALL

station switch from the right-hand to the left-hand contact, which disconnected his substation burglar alarm circuit from his line and connected in his box telephone, *T-B*.

The ringing of bell *V* (which was common to all of the central office annunciator circuits) and the operation of subscriber *B*'s annunciator, notified the operator that subscriber *B* desired to make a call. The operator first silenced bell *V* (and insured against its subsequent operation when one of the galvanometer circuits was again opened or unbalanced) by opening switch *W*. The operator's next act was to shift plug *P-b* from the right-hand to the left-hand hole, disconnecting subscriber *B*'s central office burglar alarm circuit and connecting the operator's telephone, *T*, in circuit with subscriber *B*'s telephone, *T-B*.

Upon learning that subscriber *B* wished to talk with subscriber *D*, the operator depressed key *K-d*, which first opened the circuit through subscriber *D*'s tap bell, *R-D*, allowing its striker to fall back, and then closed the circuit through heavy calling battery *B*-1, operating tap bell *R-D*. The operator then shifted plug *P-d* from the right-hand to the left-hand hole, disconnecting subscriber *D*'s central office burglar alarm circuit and connecting the operator's telephone, *T*, to subscriber *D*'s line.

When his bell rang, subscriber *D* moved his substation switch from the right-hand to the left-hand contact, thus disconnecting his substation burglar alarm circuit from his line and connecting in his telephone, *T-D*.

The operator, after notifying subscriber *D* that subscriber *B* wished to talk with him, removed plug *P-d* from the left-hand hole, moved switch *S* to its right-hand contact, and inserted plug *Q*, at the end of cord *C*, in hole *H-d*. This placed the telephones of subscriber *B*, the operator and subscriber *D* all in one circuit (Fig. 4). The operator could thus determine, by listening in, when the conversation was finished. When this occurred, the operator withdrew plug *Q* from hole *H-d*, re-

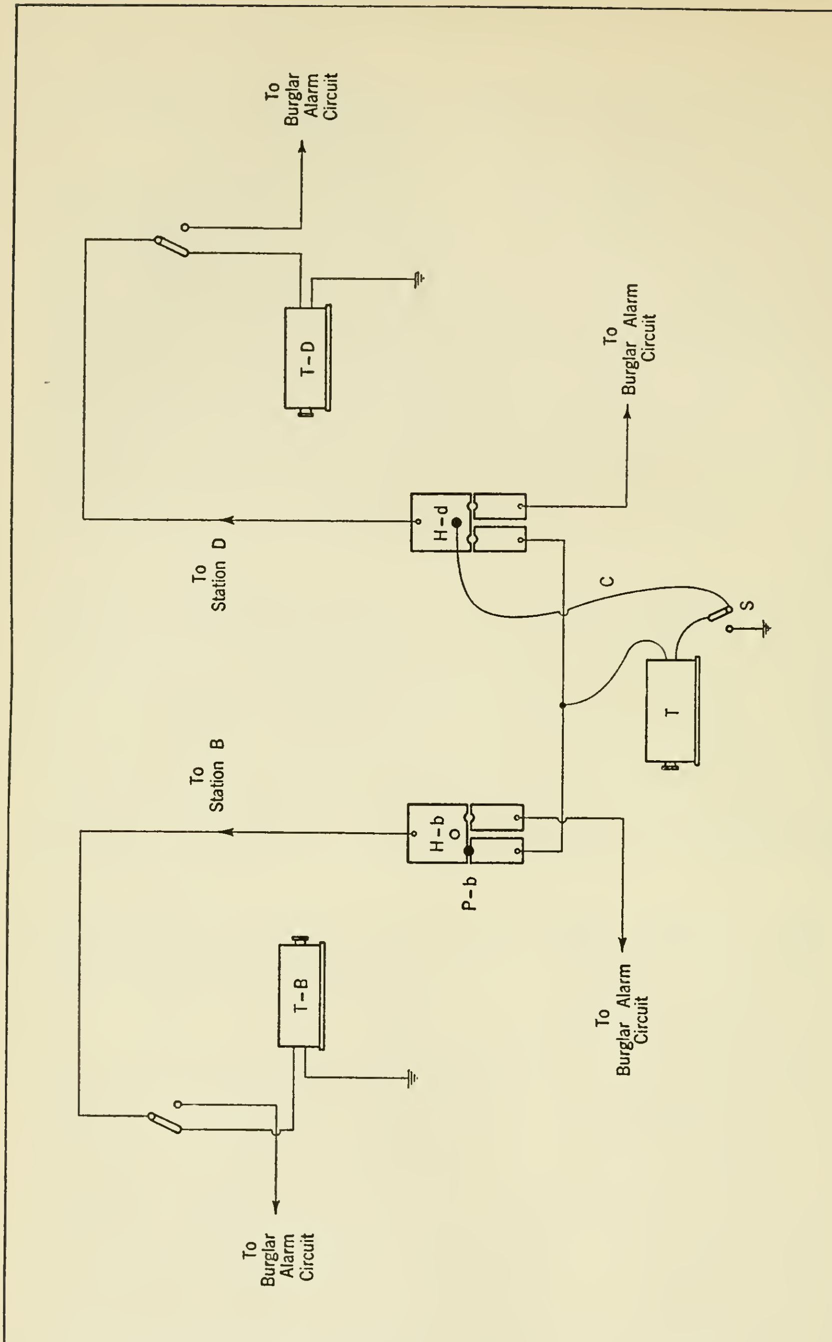


FIG. 4. - SUBSCRIBERS B AND D TALKING

placed plugs *P-b* and *P-d* in the right-hand holes of the central office plug and block switches, and moved switch *S* to its left-hand contact. When subscribers *B* and *D* had moved their substation switches to the right-hand contacts, the operator restored the shutters of annunciators *A-b* and *A-d* (the latter having fallen when its galvanometer circuit was opened), and closed switch *W*. The apparatus at the central office and substations was then in readiness for another call to be made.

G. K. Thompson,
R. B. Hill.

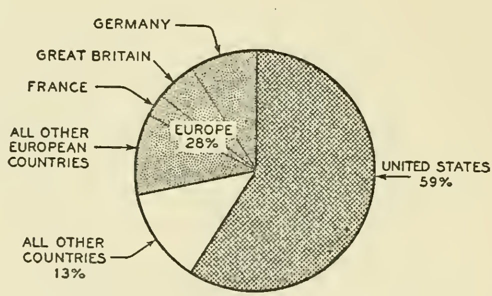
Note: The authors wish to express their indebtedness to Mr. W. L. Richards, Consulting Historian of the Bell Telephone Laboratories, for his assistance in the preparation of this article.

World's Telephone Statistics

January 1, 1929

ACCORDING to the latest annual survey of the world's telephones which was recently completed by the Chief Statistician's Division of the American Telephone and Telegraph Company, there were 32,712,284 telephones in the world on January 1, 1929. Fifty-nine percent of these, or 19,341,-295 telephones, were in the United States. Twenty-eight percent of them, or 9,236,685 telephones, were in Europe; while Asia, Africa, Oceania and the entire Western Hemisphere outside of the United States, had the remaining thirteen percent, or 4,134,304 telephones.

DISTRIBUTION OF THE WORLD'S TELEPHONES
January 1, 1929

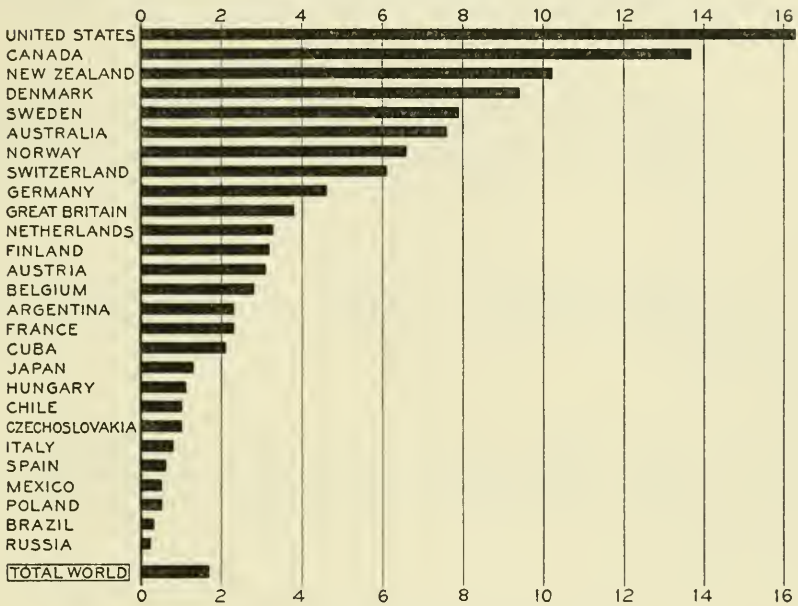


The results of the survey have been issued as a twelve page pamphlet entitled, "Telephone and Telegraph Statistics of the World, January 1, 1929," from which the accompanying tables and charts have been reproduced.

Comparative Telephone Development of Countries

During 1928 there was no change in the relative position of the principal countries as regards telephone development. The United States, with 16.3 telephones per 100 population, maintained its supremacy by a considerable margin. It is a striking fact that, despite the impetus given to telephone development in foreign countries by the re-establishment of peace-time conditions, the number of telephones per 100 population in both Europe and the world as a whole has remained practically constant as one-tenth that of the United States. Canada, with 13.7 telephones per 100 inhabitants, was the second best developed country in the world, New Zealand was

TELEPHONES PER 100 POPULATION
January 1. 1929



Telephones per 100 Population

third with 10.2, and Denmark fourth with 9.4 telephones per 100 population. It is significant in this connection that private companies operate all of the telephones in the United States, and 82 and 96 percent of the telephones in Canada and Denmark, respectively. In Europe, Germany had a development of 4.6 telephones per 100 inhabitants, less than one-third that of the United States. Great Britain had a development of 3.8, and France, 2.3 telephones per 100 people. In all three

TELEPHONE DEVELOPMENT OF THE WORLD, BY COUNTRIES

January 1, 1929

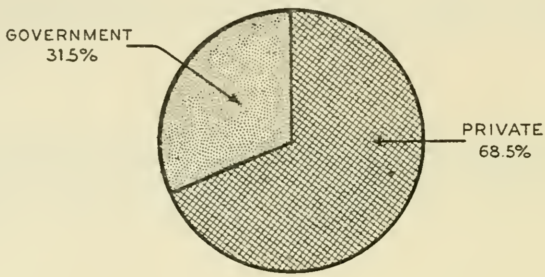
	Number of Telephones					
	Government Systems	Private Companies	Total	Per Cent of Total World	Telephones per 100 Population	Increase in Number of Telephones During 1927
NORTH AMERICA:						
United States	......	19,341,295	19,341,295	59.13%	16.3	818,528
Canada	240,408	1,094,126	1,334,534	4.08%	13.7	74,547
Central America	11,365	12,292	23,657	.07%	0.3	1,146
Mexico	1,427	76,544	77,971	.24%	0.5	13,055
West Indies						
Cuba	506	73,207	73,713	.22%	2.1	4,885
Porto Rico	820	12,156	12,976	.04%	0.9	—246
Other W. I. Places*	8,896	11,086	19,982	.06%	0.3	1,609
Other No. Am. Places*	100	10,095	10,195	.03%	2.9	1,200
Total	263,522	20,630,801	20,894,323	63.87%	12.8	914,724
EUROPE:						
Austria	209,470	......	209,470	.64%	3.1	44,239
Belgium	225,845	......	225,845	.69%	2.8	29,154
Bulgaria	17,091	......	17,091	.05%	0.3	2,733
Czechoslovakia	131,449	12,859	144,308	.44%	1.0	10,185
Denmark (March 31, 1929)	13,019	318,029	331,048	1.01%	9.4	6,816
Finland	1,000*	113,793	114,793	.35%	3.2	5,820
France	965,519	......	965,519	2.95%	2.3	82,113
Germany	2,950,430	......	2,950,430	9.02%	4.6	135,434
Great Britain and No. Ireland	1,759,686	......	1,759,686	5.38%	3.8	125,884
Greece	9,345	......	9,345	.03%	0.1	1,345
Hungary	93,159	......	93,159	.28%	1.1	5,712
Irish Free State (March 31, 1929)	26,938	......	26,938	.08%	0.9	1,621
Italy (June 30, 1929)	......	333,057	333,057	1.02%	0.8	40,190
Jugo-Slavia*	35,000	......	35,000	.11%	0.2	4,000
Latvia (March 31, 1929)	34,447	......	34,447	.11%	1.8	4,444
Netherlands	255,489	......	255,489	.78%	3.3	16,887
Norway	108,897‡	76,000	184,897	.57%	6.6	5,413
Poland	100,000*	74,410	174,410	.53%	0.5	17,000*
Portugal	6,500*	23,016	29,516	.09%	0.5	3,000*
Roumania	58,398	......	58,398	.18%	0.3	2,374
Russia§	300,000	......	300,000	.92%	0.2	40,000
Spain	......	146,333	146,333	.45%	0.6	5,119
Sweden	484,045	1,706	485,751	1.48%	7.9	18,964
Switzerland	244,248	......	244,248	.75%	6.1	20,651
Other Places in Europe*	88,330	19,177	107,507	.33%	1.2	10,000
Total	8,118,305	1,118,380	9,236,685	28.24%	1.7	639,098

South America:						
Argentina	......	239,580	239,580	.73%	2.3	7,539
Bolivia	......	2,683	2,683	.01%	0.1	71
Brazil	674	129,155	129,829	.40%	0.3	15,000*
Chile	......	42,116	42,116	.13%	1.0	3,543
Colombia	54	22,346	22,400	.07%	0.3	1,290
Ecuador	1,454	3,551	5,005	.01%	0.2	598
Paraguay	183	880	1,063	.003%	0.1	650
Peru	......	13,865	13,865	.04%	0.2	170
Uruguay	......	28,129	28,129	.09%	1.6	1,195
Venezuela	668	13,965	14,633	.04%	0.5	1,535
Other So. Am. Places	2,719	......	2,719	.01%	0.6	—19
Total	5,752	496,270	502,022	1.53%	0.6	31,572
Asia:						
British India (March 31, 1929)	19,935	33,750	53,685	.17%	0.02	1,847
China*	100,000	55,000	155,000	.47%	0.04	10,000
Japan (March 31, 1929)	811,319	......	811,319	2.48%	1.3	60,758
Other Places in Asia*	98,288	15,152	113,440	.35%	0.1	3,000
Total	1,029,542	103,902	1,133,444	3.47%	0.1	75,605
Africa:						
Egypt	43,224	......	43,224	.13%	0.2	3,122
Union of South Africa†	102,308	......	102,308	.31%	1.3	7,040
Other Places in Africa*	72,527	1,303	73,830	.23%	0.1	7,000
Total	218,059	1,303	219,362	.67%	0.2	17,162
Oceania:						
Australia‡	476,7C0	......	476,700	1.46%	7.6	34,338
Dutch East Indies	45,201	4,000	49,201	.15%	0.1	3,203
Hawaii	......	22,666	22,666	.07%	7.2	1,225
New Zealand (March 31, 1929)	152,541	......	152,541	.47%	10.2	7,989
Philippine Islands	5,528	15,888	21,416	.06%	0.2	1,542
Other Places in Oceania*	3,298	626	3,924	.01%	0.2	450
Total	683,268	43,180	726,448	2.22%	1.0	48,747
Total World	10,318,448	22,393,836	32,712,284	100.00%	1.7	1,726,908

* Partly estimated.
† March 31, 1929.
‡ June 30, 1928.
§ U.S.S.R., including Siberia and Associated Republics; partly estimated.

of these countries the telephones are operated by the Government. Argentina, with 2.3 telephones per 100 population, headed the South American countries by a wide margin, and Japan with a development of only 1.3, had more than 70 percent of all the telephones in Asia. The relative positions of the principal countries of the world in point of telephone den-

OWNERSHIP OF THE WORLD'S TELEPHONES
January 1, 1929



sity is indicated by the chart, "Telephones per 100 Population."

The increase in the number of telephones in the world during 1928 was 1,726,908. Almost one-half of these, or 818,528 telephones, were added in the United States. The increase in Europe was 639,098 telephones, of which Germany added 135,434, Great Britain 125,884 and France 82,113 stations.

Telephones in Large and Small Communities

The extent to which the smaller communities in the principal countries are provided with telephone facilities, is indicated by the table, "Telephone Development of Large and Small Communities." It will be seen that in the United States, telephone service is made available to such an extent in its less populated sections, that, with the single exception of Canada, its development of 12.6 telephones per 100 people in communities of less than 50,000 population, exceeds the *total* telephone development of all other countries. The figures for the number of

TELEPHONE DEVELOPMENT OF LARGE AND SMALL COMMUNITIES

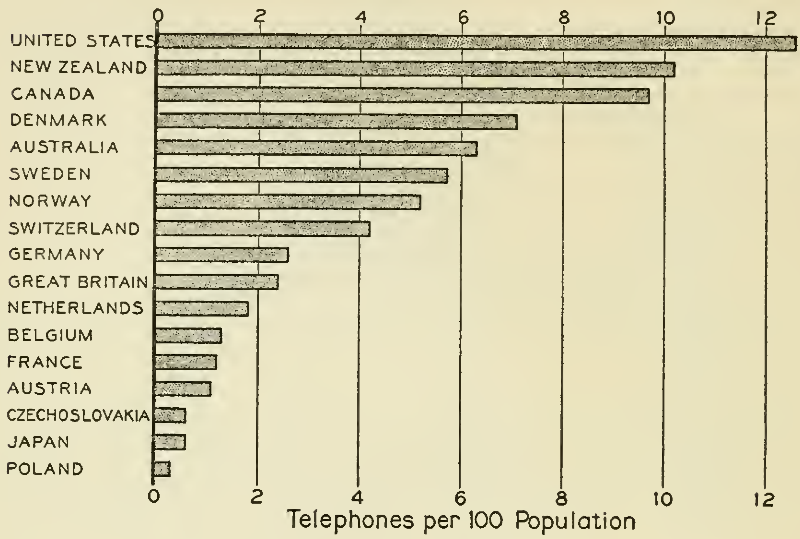
January 1, 1929

Country	Service Operated by (See note)	Number of Telephones: In Communities of 50,000 Population and Over	Number of Telephones: In Communities of less than 50,000 Population	Telephones per 100 Population: In Comunities of 50,000 Population and Over	Telephones per 100 Population: In Communities of less than 50,000 Population
Australia (June 30, 1928)*	G.	270,400	206,300	8.9	6.3
Austria	G.	158,805	50,665	6.9	1.1
Belgium	G.	162,027	63,818	5.0	1.3
Canada*	P. G.	686,000	648,534	24.2	9.7
Czechoslovakia	P. G.	58,507	85,801	4.2	0.6
Denmark	P. G.	146,311	184,737†	16.0	7.1
France	G.	566,681	398,838	6.4	1.2
Germany	G.	1,819,084	1,131,346	8.7	2.6
Great Britain and No. Ireland†	G.	1,280,871	510,423	5.3	2.4
Japan (March 31, 1929)	G.	516,188	295,131	3.6	0.6
Netherlands	G.	165,075	90,414	5.9	1.8
New Zealand (March 31, 1929)	G.	57,389	95,152	10.1	10.2
Norway	P. G.	60,713	124,184	15.0	5.2
Poland	P. G.	88,857	85,553*	2.4	0.3
Sweden	G.	192,217	293,534	20.4‡	5.7
Switzerland	G.	108,007	136,241	13.5	4.2
United States	P.	10,429,424	8,911,871	21.8	12.6

Note: P. indicates telephone service operated by private companies, G. by the Government, and P. G. by both private companies and the Government.
* Partly estimated.
† March 31, 1929.
‡ The majority of this development is due to Stockholm.

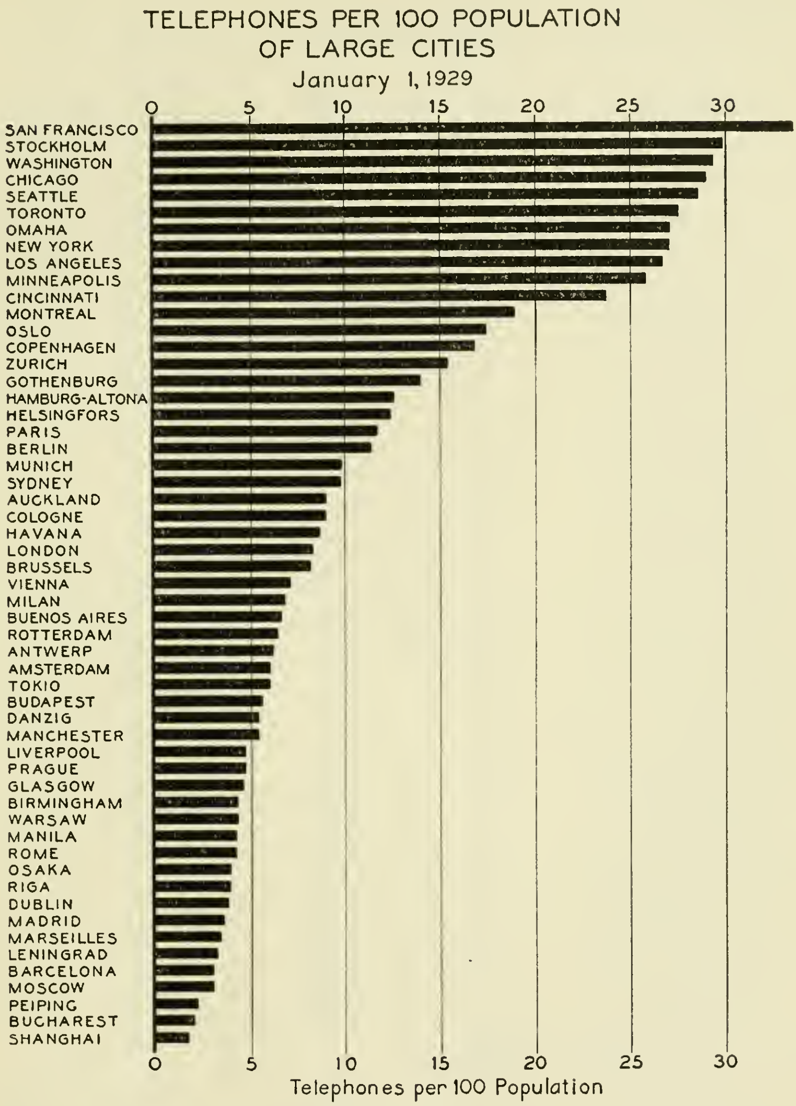
telephones per 100 inhabitants in communities of less than 50,000 population in the case of Germany (2.6), Great Britain (2.4), and France (1.2), show clearly that rural development in these large European countries is still practically insignificant when compared to similar development in the United States.

TELEPHONES PER 100 POPULATION
COMMUNITIES LESS THAN 50,000 POPULATION
January 1, 1929



Telephones in Large Cities

The table, "Telephone Development of Large Cities," further emphasizes the extent to which the telephone service in foreign countries is concentrated in the more densely populated areas. Thus, on March 31, 1929, London had 626,714 telephones, representing more than 35 percent of all the telephones in Great Britain. Paris had 341,863 telephones, also more than 35 percent of the total telephones in France. More than a fourth of all the telephones in Germany were concentrated in the four main cities of Berlin, Hamburg-Altona, Leipzig and Munich. In striking contrast to this high concentration of telephones in large cities abroad, New York City, with its 1,702,889 telephones had less than 9 percent, and Chicago



with 942,015 telephones had less than 5 percent, of the total telephones in the United States. Of the eleven large American

TELEPHONE DEVELOPMENT OF LARGE CITIES

January 1, 1929

Country and City (or Exchange Area)	Estimated Population (City or Exchange Area)	Number of Telephones	Telephones per 100 Population
ARGENTINA:			
Buenos Aires	2,056,000	135,037	6.6
AUSTRALIA:			
Adelaide	330,000	31,134	9.4
Brisbane	309,000	23,225	7.5
Melbourne	1,000,000	90,736	9.1
Sydney	1,127,000	110,847	9.8
AUSTRIA:			
Gratz	162,000	8,146	5.0
Vienna	1,977,000	140,759	7.1
BELGIUM:			
Antwerp	513,000	31,560	6.2
Brussels	927,000	76,251	8.2
Ghent	261,000	8,930	3.4
Liege	418,000	15,566	3.7
CANADA:			
Montreal	921,000	174,062	18.9
Ottawa	181,000	36,295	20.1
Toronto	678,000	186,215	27.5
CHINA:			
Canton	952,000	3,000*	0.3
Hong Kong	460,000	11,877	2.6
Peiping (Peking)	1,350,000	30,000*	2.2
Shanghai	1,615,000	28,000*	1.7
Tientsin	854,000	10,000*	1.2
CUBA:			
Havana	581,000	50,623	8.7
CZECHOSLOVAKIA:			
Prague	725,000	34,171	4.7
DANZIG, FREE CITY OF	301,000	16,356	5.4
DENMARK:			
Copenhagen	782,000	131,363	16.8
FINLAND:			
Helsingfors	227,000	28,193	12.4
FRANCE:			
Bordeaux	261,000	14,700	5.6
Lille	206,000	13,160	6.4
Lyons	583,000	23,790	4.1
Marseilles	665,000	22,801	3.4
Paris	2,930,000	341,863	11.7
GERMANY:			
Berlin	4,150,000	472,018	11.4
Breslau	574,000	40,501	7.1
Chemnitz	341,000	26,881	7.9
Cologne	721,000	64,858	9.0
Dresden	637,000	58,440	9.2
Dortmund	330,000	21,006	6.4
Düsseldorf	445,000	42,379	9.5
Essen	485,000	26,851	5.5
Frankfort-on-Main	481,000	56,298	11.7
Hamburg-Altona	1,300,000	163,276	12.6
Hannover	435,000	35,288	8.1
Leipzig	700,000	66,124	9.4
Munich	715,000	69,725	9.8
Nuremburg	480,000	34,476	7.2
Stuttgart	350,000	43,878	12.5
GREAT BRITAIN AND NORTHERN IRELAND (March 31, 1929):			
Belfast	423,000	14,329	3.4
Birmingham	1,090,000	46,855	4.3
Bradford	320,000	16,992	5.3
Bristol	400,000	16,858	4.2
Edinburgh	428,000	25,556	6.0
Glasgow	1,141,000	52,757	4.6
Hull	350,000	15,800	4.5
Leeds	492,000	19,982	4.1
Liverpool	1,138,000	53,828	4.7
London	7,570,000	626,714	8.3
Manchester	1,075,000	58,157	5.4
Newcastle	467,000	17,507	3.7
Nottingham	299,000	14,023	4.7
Portsmouth	287,000	6,499	2.3
Sheffield	500,000	17,406	3.5
Stoke-on-Trent	296,000	6,075	2.1

* Partly estimated.

TELEPHONE DEVELOPMENT OF LARGE CITIES (Concluded)

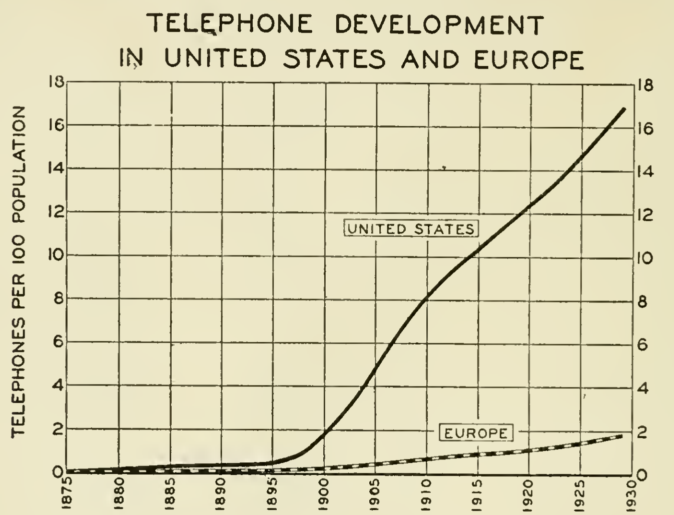
January 1, 1929

Country and City (or Exchange Area)	Estimated Population (City or Exchange Area)	Number of Telephones	Telephones per 100 Population
HUNGARY:			
Budapest	990,000	55,502	5.6
Szeged	127,000	2,420	1.9
IRISH FREE STATE (March 31, 1929):			
Dublin	394,000	14,779	3.8
ITALY:			
Genoa	542,000	18,949	3.5
Milan	831,000	56,315	6.8
Rome	771,000	32,528	4.2
Turin	502,000	22,817	4.5
JAPAN (March 31, 1929):			
Kobe	673,000	27,303	4.1
Kyoto	745,000	32,745	4.4
Nagoya	887,000	26,975	3.0
Osaka	2,370,000	93,218	3.9
Tokio	2,256,000	135,619	6.0
Yokohama	550,000	14,035	2.6
LATVIA (March 31, 1929):			
Riga	339,000	13,322	3.9
NETHERLANDS:			
Amsterdam	743,000	44,449	6.0
The Hague	457,000	35,985	7.9
Rotterdam	591,000	38,097	6.4
NEW ZEALAND (March 31, 1929):			
Auckland	210,000	18,860	9.0
NORWAY (June 30, 1928):			
Oslo	251,000	43,667	17.4
PHILIPPINE ISLANDS:			
Manila	350,000	14,747	4.2
POLAND:			
Lodz	814,000	11,018	1.4
Warsaw	1,086,000	46,623	4.3
ROUMANIA:			
Bucharest	815,000	16,355	2.0
RUSSIA (October 1, 1928):			
Leningrad	1,725,000	54,755	3.2
Moscow	2,250,000	66,542	3.0
Odessa	428,000	4,348	1.0
SPAIN:			
Barcelona	841,000	25,150	3.0
Madrid	809,000	29,362	3.6
SWEDEN:			
Gothenburg	236,000	33,089	14.0
Malmö	119,000	16,658	14.0
Stockholm	404,000	120,432	29.8
SWITZERLAND:			
Basel	144,000	18,789	13.0
Berne	111,000	15,880	14.3
Geneva	128,000	18,717	14.6
Zurich	220,000	33,965	15.4
UNITED STATES:‡			
New York	6,310,100	1,702,889	27.0
Chicago	3,250,000	942,015	29.0
Los Angeles	1,337,000	357,504	26.7
Total of the 8 cities with over 1,000,000 population	18,666,200	4,608,311	24.7
San Francisco	751,500	252,225	33.6
Cincinnati	678,100	161,019	23.7
Milwaukee	675,000	146,677	21.7
Washington	525,500	154,041	29.3
Total of the 12 cities with 500,000–1,000,000 population	7,968,300	1,698,424	21.3
Minneapolis	492,000	126,888	25.8
Portland, Ore	371,500	95,541	25.7
Omaha	232,300	62,898	27.1
Seattle	411,000	117,683	28.6
Total of the 31 cities with 200,000–500,000 population	8,999,600	1,834,164	20.4
Total of the 51 cities with over 200,000 population	35,634,100	8,140,899	22.8

* There are shown, for purposes of comparison, with cities in other countries, the total development of all cities in the United States in certain population groups and the development of certain representative cities within each of such group.

cities shown in the table, none had a development of less than 21.7 telephones per 100 population. This very high development becomes all the more significant when it is considered that, with the exception of Ottawa, Copenhagen, Oslo and Stockholm, no capital city of a foreign country had a development exceeding 15 telephones per 100 population.

Referring to the chart, "Telephones per 100 Population of Large Cities," San Francisco heads the list with a development of 33.6 telephones per 100 population. Stockholm is second with a development of 29.8 and Washington a close third with 29.3 telephones per 100 population. Of the ten cities in the chart which have a development of more than 25 telephones per 100 population, eight are located in the United States.

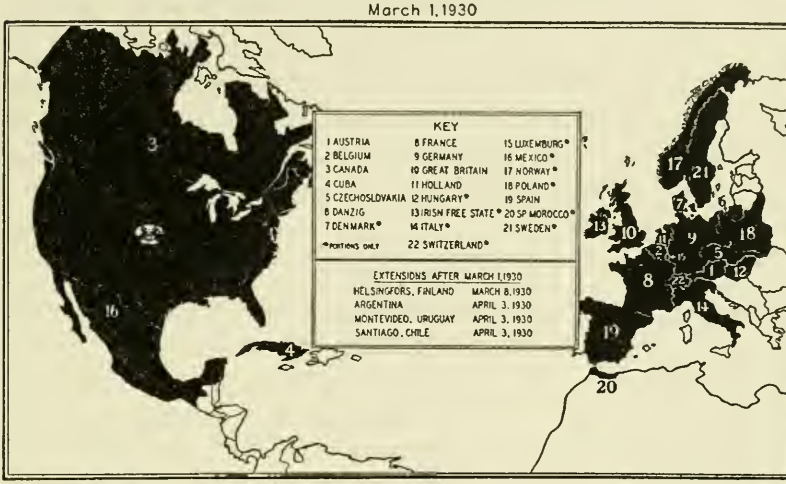


Countries Reached by Telephone from the United States

An interesting feature of the pamphlet is the chart indicating the countries which can be reached by telephone from the United States. It shows that on April 3, 1930, it was possible for a Bell System subscriber to communicate with 26 foreign countries by telephone, including the principal countries in

Europe. It is estimated that, on April 3, 1930, any Bell System subscriber was able to be connected with any one of 9,850,000 telephones outside of the United States. These telephones, together with the 4,550,000 Bell connecting tele-

COUNTRIES REACHED BY TELEPHONE FROM THE UNITED STATES
March 1, 1930



phones in the United States, comprised a total of approximately 30,150,000 telephones available to Bell System subscribers, or 86.5 percent of the estimated total of 34,840,000 telephones in the world on that date.

CLEMENT J. KOUKOL.

Notes on Recent Occurrences

TWO-WAY TELEVISION DEMONSTRATED BY BELL SYSTEM ENGINEERS

TELEVISION, as the American Telephone and Telegraph Company demonstrated on April 10th, has taken another step in its development with the production of a system of two-way television which can supplement the usual two-way telephone, permitting the parties to a conversation to see as well as to hear each other.

An experimental service between 195 Broadway and Bell Telephone Laboratories at 463 West Street, which has been in operation for some time, was disclosed and demonstrated to representatives of the press on that day. Special telephone booths were installed at these two buildings and equipped with television transmitters and receivers, designed by Bell Telephone Laboratories which have been very actively researching in television ever since their demonstration in 1927 of its scientific practicability. (*See frontis-piece.*)

This important advance in television has resulted from the efforts of the same group in Bell Telephone Laboratories as was responsible for the earlier achievements in this field. The work has continued under the direction of Dr. Herbert E. Ives, of the Laboratories' Research Department, with most important contributions by Dr. Frank Gray and by H. M. Stoller who developed synchronizing mechanisms. Amplifiers were the especial care of A. W. Horton and M. W. Baldwin.

Despite the obvious success of all their past efforts in developing television systems the engineers and scientists concerned refused to prophecy as to their next steps or the ultimate commercial importance of their experimental system.

At the demonstration on April 10th, Dr. F. B. Jewett, the President of the Laboratories, issued the following statement:

" The demonstration today by Bell Telephone Laboratories of simultaneous two-way television and speech marks a further step in the development of this interesting though as yet commercially unavailable extension of electrical communication. While the equipment has for convenience been installed only a few miles apart, and while wire circuits in ordinary underground telephone cable have been employed for the transmission channels, it might equally well have been installed hundreds or thousands of miles apart. Also it might have employed either wire or radio for the connecting channels, as was shown in the initial demonstration of television by the American Telephone & Telegraph Company in April, 1927. With suitable telephone channels of whatever sort available, the element of distance is not a controlling factor, although in this form of electrical communication as in all others greater distance ordinarily involves somewhat greater complexity and expense for channel facilities.

" At the time of the initial demonstration in 1927, of one-way television associated with two-way speech, it was stated that there was nothing inherently impossible technically in two-way television and speech. Existing knowledge at that time, particularly as regards methods of scanning, which then required intense illumination, would, however, have rendered the results rather unsatisfactory to those using the equipment. The work of Dr. Ives and his associates in Bell Telephone Laboratories during the past three years has been directed primarily toward simplification and improvement of equipment for two-way television, and particularly to improvement in the means for scanning the person whose image is to be transmitted. As the apparatus now in operation shows clearly, great progress has been made in this direction with the result that one is scarcely conscious of the scanning light or of the fact that he is doing other than looking at his distant correspondent.

" While the equipment now available for television is simpler and more efficient than that employed in the 1927 demonstrations and the results are very greatly improved, the terminal apparatus is still inherently complicated and expensive. This complication arises out of the necessity for producing, transmitting and reproducing a large number of distinct images each second if good results are to be obtained. No practical suggestions for eliminating this fundamental requirement have as yet been made and there appears to be nothing promising in our present knowledge of physical science. Correspondingly, the requirement that what is in effect a very wide band of frequencies be transmitted leaves the transmission channel problem essentially unaltered. The requirement of an extremely wide transmission band, and the further requirement that during the period of transmission the channel or channels must have a high degree of electrical stability and freedom from extraneous interference, make the channel problem both difficult and expensive. Unlike telegraph or telephone transmission, where a limited amount of channel instability or a moderate amount of electrical interference can be present without serious impairment of service, telephotography and particularly television require practically perfect interference-free channels. For these services any marked instability in the channels or any substantial electrical interference registers at once as a serious defect in the received image. It is for this reason that while radio channels, if otherwise available, can be used for the transmission of television, they are not in the present state of the art as suitable as wire channels. Wire telephone circuits, particularly if in cable, can be maintained at a high degree of constant transmission efficiency and freedom from extraneous interference. Radio channels on the other hand are subject to the well known vicissitudes of fading, static and interference, all of which result in a degraded received image.

" Although, on account of its present complexity and high cost, no substantial commercial field is yet in sight for television requiring good images, there is still a large amount of technical work which gives promise of decided improvements over the means and methods now available. Both because of this fact and because of the collateral influence which research and development work in the television field has on our general communication problems, Bell Telephone Laboratories will continue to explore the field of television."

In response to inquiries as to the future relation of television and telephony, President Walter S. Gifford of the American Telephone and Telegraph Company, on April 10th, issued the statement that:

" The demonstration today by Bell Telephone Laboratories, of simultaneous two-way television and speech, shows some of the results obtained from our continued work in the field of television. At the time of the initial demonstration of television by the American Telephone & Telegraph Company in April, 1927, it was stated that we would continue our work on television. Partial results of this work were shown in the demonstration of out-of-door television in 1928 and of color television in June, 1929.

" The equipment which has been installed for operation over telephone wires between the Laboratories building at 463 West Street and the Telephone & Telegraph Building at 195 Broadway shows what it is possible to do technically in the present state of the art in eliminating the element of distance as affecting sight and sound in the matter of telephone conversations. This can be accomplished over any distance where suitable telephone channels, either wire or radio, are available.

"Despite the fact that the research and development work of the past three years has resulted in a great improvement and simplification of the equipment required for television, it is still necessarily complicated and expensive, requiring expert attention and large units of apparatus. These facts arise out of the inherent technical requirements for satisfactory television transmission.

"While therefore substantial progress has been made on the technical side, the future commercial possibilities of television are still uncertain. In line with our long established policy of fully exploring and developing every field which gives promise of possible improvement in and extension of electrical communication, we expect to continue our work on television."

A. T. & T. CO. OFFERS STOCK AT PAR TO 500,000 STOCKHOLDERS

IN a circular letter dated April 16, 1930, the American Telephone and Telegraph Company announced the offer to stockholders of record at the close of business on May 23, 1930, of additional shares of stock at par, $100, in the proportion of one new share for each six shares then held. The subscription privilege will expire on August 1, 1930.

The purpose of the issue is to provide funds for new construction needed by the Bell System to care for additional business resulting from the constantly greater use of telephone service.

The amount of the offer is $257,000,000 based on the amount of stock outstanding at the close of business on May 23, 1930, including stock issued before the close of business on that date in the conversion of Ten-Year Convertible 4½ percent Gold Debenture Bonds of this Company, due July 1, 1939.

The number of stockholders of the Company has grown rapidly since the first of the year and on the record date for subscription rights numbered over 500,000. The half-million mark was passed on May 10. The average number of shares held by all stockholders on the record date was about 30, and the offer thus represents an average additional investment by stockholders of approximately $500.

Warrants evidencing the subscription rights were mailed to stockholders on June 9. The amount of the 1930 stock offer is the largest ever made by the American Telephone and Telegraph Company to its stockholders for subscription and the stockholders entitled to subscribe form the largest list of any corporation. The number exceeds those receiving rights to the 1928 stock offer by 70,000.

SHIP-TO-SHORE SERVICE EXTENDED TO CUBA, CANADA AND MEXICO; FOUR SHIPS NOW SERVED

SHIP-TO-SHORE telephone service, in addition to being available to the *Leviathan* of the United States Lines, was extended to the *Majestic* of the White Star Line on April 4th, to the *Olympic* of the White Star Line on April 18th and to the *Homeric* of the White Star Line on June 5th.

On April 12th the scope of the ship-to-shore service was enlarged to afford communication not only with all points in this country, but also with most of the cities of Cuba, Canada and Mexico.

TRANSATLANTIC TELEPHONE RATES SUBSTANTIALLY REDUCED

IN a general rate reduction, involving all transatlantic telephone conversations between North America and Europe, the American Telephone and Telegraph Company on May 11 lowered the rate on each call by $15 for the first three minutes and $5 for each additional minute. This date was scheduled to enable all transatlantic telephone calls on Mother's Day to be charged at the new low rates.

A marked increase in traffic followed the reduction in rates, applications being filed for 81 transatlantic calls on Mother's

Day, of which 62 were completed. This compares with 25 or 30 calls ordinarily put through on a normal Sunday.

On the basis of last year's transatlantic telephone messages, the reduction will mean a saving to the public using the service of approximately $450,000 a year. For the entire year of 1929, transatlantic telephone conversations averaged about fifty per business day.

Under the revised schedule, the basic rate for a telephone call between New York and London has been cut a third, from $45 to $30 for the first three minutes. Between New York and Paris, the rate has been lowered from $48.75 to $33.75; New York and Berlin, from $50.25 to $35.25; New York and Rome, from $51 to $36; New York and Madrid, from $51 to $36; New York and Stockholm, from $51.75 to $36.75. Rates to other points have been cut proportionately.

CONFERENCE OF GENERAL COUNSEL

A CONFERENCE of the General Counsel of the Bell System was held at Virginia Beach, Virginia, April 28th to May 2d. It was presided over by C. M. Bracelen, Vice President and General Counsel of the American Telephone and Telegraph Company.

1930 OPERATING CONFERENCE

THE Eighth Operating Conference of the Bell System was held at the Seaview Golf Club, Absecon, New Jersey, from May 7 to 14. This was attended by the Operating Vice Presidents and General Managers of the Bell Companies and representatives of the staff of the American Telephone and Telegraph Company. The Western Electric Company and the Bell Telephone Laboratories were also represented.

At the start of the conference President Walter S. Gifford and Vice President Bancroft Gherardi of the American Telephone and Telegraph Company both emphasized the keynote which was taken from the statement of policy of the Bell System in the 1927 annual report and which reads as follows: "Its duty is to provide the American public with adequate, dependable and satisfactory telephone service at a reasonable cost." Mr. Gifford congratulated the management of the companies on the good work which had been done during the difficult period of the last eighteen months and expressed his confidence that the management would continue to meet its problems and to carry out its responsibilities. Mr. Gherardi showed the part that the telephone plays in the communication system of the country and the rapid strides being made in world-wide communication service and pointed out how this increased the telephone companies' responsibilities. He outlined the progress which has been made in adequate, dependable and satisfactory telephone service and discussed the trends of revenues, expenses, investment and net earnings. He pointed out that the problem of management involves a careful balance between quality of service, wages and working conditions, appearance of plant, consideration of further rate reductions, and net return on plant.

Reviews of the important phases of the operating problem were presented by W. H. Harrison, Plant Engineer, K. S. McHugh, Commercial Engineer, M. B. French, Traffic Engineer, and R. H. Burcher, Plant Operation Engineer, all of the American Telephone and Telegraph Company. Particular emphasis was placed on the construction program and on sales work.

The activities of the Western Electric Company were outlined by E. S. Bloom, President, and by C. G. Stoll, Vice President. H. P. Charlesworth, Vice President of the Bell Telephone Laboratories, Inc., gave a very interesting picture of the activities of the Laboratories. Under the title of "The New America," S. L. Andrew, Chief Statistician of the American Telephone and Telegraph Company, presented an up-to-the-minute discussion of economic trends.

One day of the conference was devoted to group discussions in which the following subjects were covered:

Area Organizations.
Revenue Possibilities Excluding General Rate Increases.
Connecting Company Matters.
By-product or Auxiliary Services.
Multiple and Zone Registration and the Timing of Local Calls.

Other subjects discussed included wages and working conditions, college quotas and the selection and training of people.

In addition to those already mentioned the conference was addressed by Vice Presidents Cooper, Page, Hall and Carter of the American Telephone and Telegraph Company.

PRES. GIFFORD IS MADE A TRUSTEE OF THE BANK FOR SAVINGS

ON March 12, 1930, President W. S. Gifford of the American Telephone and Telegraph Company was elected a trustee of the Bank for Savings in the City of New York.

E. F. CARTER AND T. G. MILLER ARE ELECTED A. T. & T. VICE PRESIDENTS

E. F. CARTER of Cleveland has been elected a Vice President of the American Telephone and Telegraph Company, and has resigned as President of The Ohio Bell Telephone Company.

Mr. Carter will take over the duties of Vice President E. K. Hall, who, in accordance with long standing plans, is retiring from the Company on August 1 to become associated with the Amos Tuck Graduate School of Business of Dartmouth College, as lecturer on industrial relations and business management. Mr. Hall has been associated with the Bell Telephone System for over thirty years.

T. G. Miller, General Manager of the Long Lines Department, was elected a Vice President of the American Telephone and Telegraph Co. at a meeting of the board of directors on April 16. He will continue in charge of the Long Lines Department.

GENERAL COMMERCIAL CONFERENCE

A GENERAL Commercial Conference of the Bell System was held at Shawnee-on-Delaware, Pennsylvania, from May 21st to 28th, attended by the General Commercial Managers and certain staff representatives of the Associated Companies and of the American Telephone and Telegraph Company. Keith S. McHugh, Commercial Engineer of the American Telephone and Telegraph Company, opened the conference and presided throughout all of its sessions.

At the beginning of the conference, Vice President Bancroft Gherardi of the American Telephone and Telegraph Company presented a comprehensive review of the operating results and trends of the business which gave the conference members a very clear picture of the results for 1929 and the objectives for 1930.

The major part of the time of the conference was spent in the consideration of six general subjects:

Sales, Development and Customer Relations.
Business Office Operations.
Rate and Revenue Matters.
Directory Matters.
Connecting Company Matters.
Development of Commercial Supervisory Personnel.

The various subjects were introduced by American Telephone and Telegraph Company staff people and followed by papers prepared by Associated Company representatives, discussing these subjects from the standpoint of actual experience in their various territories.

Pres. Walter S. Gifford of the American Telephone and Telegraph Company gave a very interesting talk in which he mentioned the peculiar responsibility of the Commercial Department in that it must not only be technically efficient but also maintain a full and sympathetic understanding between the Telephone Company and its customers. Mr. Gifford referred also to the desirability of well coordinated and directed sales effort carried on with a proper appreciation of the customer's point of view.

Other talks of especial interest were given by Vice Presidents A. W. Page, E. F. Carter, and F. B. Jewett, of the American Telephone and Telegraph Company, by H. P. Charlesworth, Vice President of the Bell Telephone Laboratories, Inc., and by K. W. Waterson, Assistant Vice President, S. L. Andrew, Chief Statistician, L. F. Morehouse, Equipment Development Engineer, W. H. Harrison, Plant Engineer, and M. B. French, Traffic Engineer, of the American Telephone and Telegraph Company.

EMPEROR OF JAPAN CONFERS ORDER OF SACRED TREASURE ON DR. JEWETT

DR. F. B. JEWETT, Vice-President of the American Telephone and Telegraph Company and President of the Bell Telephone Laboratories, Inc., has been honored by His Majesty, the Emperor of Japan, who has conferred upon him the Order of the Third Class of the Sacred Treasure, in appreciation of his services in the development of the telegraph and telephone industry in Japan.

This is the second time that Dr. Jewett has been decorated by the Japanese Government having previously received the Order of the Rising Sun for his work in electrical communication.

Last fall, Dr. Jewett was named by President Hoover as a member of the delegation of seventeen to represent the United States at the World Engineering Congress in Tokio. In addition to being a member of the special delegation, Dr. Jewett was Vice-Chairman of the American Committee.

PRES. GIFFORD ELECTED A HARVARD OVERSEER

AT the Harvard Commencement on June 19 announcement was made that President Walter S. Gifford of the American Telephone and Telegraph Company had been elected a member of the Board of Overseers of Harvard College for a six year term.

GENERAL PLANT SUPERVISORS' CONFERENCE

THE first System conference of General Plant Supervisors was held at Shawnee-on-Delaware, Pennsylvania, from June 4th to 12th, inclusive. The conference was attended by all of the General Plant Supervisors, by certain additional representatives from the Operating Company staff and line organizations, by representatives of the Bell Telephone Laboratories, the Department of Development and Research, the Comptroller's Department and the Operation and Engineering Department of the American Telephone and Telegraph Company. Several of the nearby General Plant Managers also were present for some of the sessions.

The major part of the conference program was conducted on the committee plan basis—that is, prior to the conference a number of committees, each composed of three or four General Plant Supervisors, undertook the study of the more important phases of plant operations work with which the General Plant Supervisors are concerned and presented the conclusions of their studies at the conference. The topics handled on this basis were as follows:

1. General and Division Plant Supervisors' Staffs.
2. Administrative Reports.
3. Plant Programs.
4. Estimating Force Requirements—Design and Use of Work Schedules.
5. Forecasting and Budget Control.

6. Construction Methods and Results.
7. Installation Methods and Results.
8. Service Order Practices and Records.
9. Central Office Maintenance (Exchange and Toll).
10. Repair and Test Desk Service.
11. P.B.X. and Sub-station Maintenance.
12. Outside Plant Maintenance (Exchange and Toll).
13. Service Aspects of the Toll Maintenance Job.

Other talks and papers on matters of particular interest to the General Plant Supervisors were presented by Associate Company and American Telephone and Telegraph Company representatives, including a general review of operating results, by K. W. Waterson, Assistant Vice President, and reviews of engineering, commercial and traffic activities by H. S. Osborne, Transmission Engineer, Z. Z. Hugus, Commercial Results and Practices Engineer, and M. B. French, Traffic Engineer, all of the American Telephone and Telegraph Company. R. H. Burcher, Plant Operation Engineer, told of the important part which the plant staff organizations have played in the successful progress of plant operations work and stressed the opportunities for further effective work in the future. S. L. Andrew, Chief Statistician, gave a very interesting talk on business conditions and business statistics, with particular reference to their relationship to the telephone business. O. M. Taylor, Plant Training Engineer, spoke on the subjects of plant accidents and plant training.

Exhibit rooms were set up in which were displayed a number of the more recent developments in tools, equipment, methods and practices.

On the evening of June 4th, moving pictures were shown illustrating various construction operations, including new methods and devices for installing buried toll cable, for placing aerial cable and the use of a super-truck under unfavorable weather conditions. On the evening of June 6th, a demonstration was given showing the transmission impairment due to noise induced in the telephone circuit by exposure to power lines and to circuit unbalances introduced by various undesirable open wire, sub-station and central office conditions. On the evenings of June 9th and 10th, practical demonstrations were given of the results of using correct and incorrect mixtures of solder in wiping joints and the feasibility of dispensing with the blow torch both in wiping and unwiping operations.

During the conference, the General Plant Supervisors were asked by Chairman Hosfeld to designate those phases of their jobs which they considered the most important ones on which to focus effort during the next year or two. In their replies, the following six items were mentioned most frequently:

1. Forecasting and Budget Control (with particular reference to maintenance expense).
2. Employee Training (vote about equally divided between vocational and supervisory training).
3. Simplification and Reduction of Clerical Work Performed by the Field Forces (including more accurate reporting).
4. Improved Outside Plant Maintenance (with emphasis on preventive maintenance).
5. Improved Installation Performance (both quality and cost).
6. Improved Repair and Test Desk Service.

Throughout the conference particular emphasis was placed upon the opportunity and importance of effecting further improvements in plant costs and service, and the opinion of all present was to the effect that the conference would greatly facilitate the achievement of that result.

AN INTERCOMMUNICATING SYSTEM FOR HOMES AND OFFICES.

FIGURE 1. Push Buttons on the Instrument for Establishing Connections. (See page 270.)

Bell Telephone Quarterly

A Medium of Suggestion and a Record of Progress

CONTENTS FOR OCTOBER 1930

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International Co-operation in Telephony

UNTIL recent years international telephony has not constituted a major problem for the Bell System. The United States covers such a large continental area that the great bulk of telephone toll business of the System has been wholly within the United States. Until the placing of the Cuba cables in 1921 the only foreign connections were to Canada with whose telephone administrations, particularly the Bell Telephone Company of Canada, the working relations of the Bell System have been so close that to a large extent these connections offer no special problems.

In Europe, however, international telephony has naturally assumed a far greater importance. The division of Europe into 35 independent nations for the most part relatively small in area; the large population and the high industrial and commercial development; the existence of large centers not far apart but in separate countries and often separated by intervening countries; all these facts have naturally resulted in a great field for international telephone communications. Furthermore the fact that the telephone systems in the different countries, to a large extent, developed independently of each other, naturally led to wide differences in plant, traffic and commercial practices in the different systems.

Success in international telephone service, of course, requires the closest co-ordination of practices between the telephone administrations involved. This includes agreement upon types of service to be offered to customers, and upon methods and practices to be used by commercial and traffic forces. It includes adoption of similar standards of plant design and construction, and co-ordination of the construction and maintenance programs. In short, it is necessary to work out between the administrations involved, mutual agreement upon the details of telephone plant and methods of handling service in so far as they react on the international business.

In Europe the difficulties arising from divided control of the international business are accentuated by the number of different countries involved, the large number of different international connections and by differences in language and to some extent of commercial interest in the different countries. It is natural, therefore, that for a long time the necessity for some type of formal co-operation in telephone matters between the European countries had been recognized.

The first co-operation of this type was carried out through the medium of the International Telegraph Union. This organization was established in 1865 by a treaty between the European nations and a number of other nations of the world for the purpose of establishing a basis for international co-operation in telegraphy between nations in which the telegraph systems are owned and operated by the government. As early as 1885 some items relating to telephony were included in a revision of the service regulations for telegraphy agreed to by the members of the International Telegraph Union. With successive revisions of these regulations the telephone items gradually increased covering such fundamental matters as types of service to be offered, unit period of conversation and priority for different classes of calls.

The regulations of the International Telegraph Union, however, are in the nature of a treaty between the various nations adhering to the Union, and revisions of these regulations took place at intervals usually of between 5 and 10 years. The regulations were relatively restricted in scope. Under this arrangement there was not the continuous and informal contact desirable for the proper treatment of many questions which arose in the rapidly developing art of telephony. It therefore became increasingly clear that some more continuous and more flexible form of co-operation between the European telephone administrations was necessary.

After the close of the Great War when repeaters, long distance toll cables, carrier telephone systems and other modern developments began to be applied on a large scale to international telephony in Europe and when international trade began to resume its normal importance, there was considerable discussion of this need and various specific proposals were made. A decisive step toward crystallizing the current views into action was taken early in 1923 by a conference held in Paris between representatives of the telephone administrations of Belgium, Spain, France, Great Britain, Italy and Switzerland. This conference, organized as a preliminary committee, recommended that a permanent advisory organization be constituted. This recommendation was generally adopted by the telephone administrations of Europe and in this manner was created the present International Advisory Committee.

Method of Work of the C. C. I.

The International Advisory Committee on Long Distance Telephone Communications (known as the C. C. I. from the initials of its name in French) has, with its constituent subcommissions, since its formation, held frequent meetings and has developed a very effective form of organization and method of work.

The governing body of the Committee is the Plenary Assembly consisting of delegations from the member telephone administrations. The function of this body is to approve, reject or modify proposed recommendations which have been prepared by the working commissions and which when approved by the Plenary Assembly constitute recommendations of the C. C. I. to the member administrations. The Plenary Assembly also determines what questions shall be studied by the working commissions and passes upon all questions of organization and financing of the C. C. I. and its component parts. At the present time the Plenary Assembly meets about once a year.

The study of technical questions and the preparation of recommendations are carried out by a group of working commissions (Commissions de Rapporteurs). These commissions meet as often as need be to carry on their work, generally about twice a year. At the present time there are seven of these working commissions dealing with a wide range of plant, traffic, commercial and operation questions.

The general scope of work of each of the commissions is indicated by the following list:

CR 1. Questions concerning the protection of telephone lines against the disturbing action of power systems.
CR 2. Questions concerning the protection of telephone cables against corrosion due to electrolysis or to chemical action.
CR 3. Questions concerning transmission and maintenance.
CR 4. Questions concerning the master reference system for telephone transmission, primary reference systems and working standards.
CR 5. Questions concerning the co-ordination of wire telephony and radio telephony.
CR 6. Questions concerning traffic and operating.
CR 7. Questions concerning rates.

Another main branch of the Committee is the General Secretariat. This consists of a permanent staff located at Paris which supplements the meetings of the Plenary Assembly and the working commissions by a very extensive correspondence and makes arrangements for the various meetings. Major Georges Valensi who was formerly associated with the French telephone administration has since the organization of the C. C. I. held the position of General Secretary.

During its relatively brief existence the C. C. I. has engaged in a considerable amount of co-operative work with other organizations whose work bears upon international telephone problems. An important item of this co-operative work has been co-operation on inductive co-ordination matters with the International Railway Union, the International Union of Producers and Distributors of Electricity, the International Conference on High Voltage Electric Systems, and other organizations concerned with this problem. Since the organization of the C. C. I. similar advisory committees have been formed for telegraphy and for radio matters, and the C. C. I. has naturally co-operative relations with them on problems of mutual concern. It has also established co-operation with the International Broadcasting Union and with other international bodies.

While organized at first independently of any existing international agency, the C. C. I. became formally affiliated in 1926 with the International Telegraph Union. Under this arrangement the C. C. I. maintains an autonomous status and communicates its recommendations to the Bureau of the International Telegraph Union.

Participation of the Bell System

From the beginning of its organization the International Advisory Committee has had the hearty co-operation of the Bell System. The questions to be studied by the working commissions were transmitted to the American Telephone and Telegraph Company from time to time with the request that it send to them information regarding practices in this country which might be helpful in the consideration of these questions by the European administrations. Naturally the Company was glad to be of any service it could in response to these requests.

In 1925 the Committee took up a consideration of international agreement on units of telephone transmission and requested that representatives be sent over to explain the American practice to the European delegates. Representatives went to C. C. I. meetings in 1925 and 1926 to discuss this and associated questions. Following these discussions the C. C. I. adopted a master transmission reference system identical with the Bell System standard and recognized as standard two units of transmission loss, one the "decibel" used in this and some other countries and the other the "neper" used in some of the European countries.

With the extension of the work of the C. C. I. it became evident that many questions should be considered which, like transmission units and reference systems, have a world-wide application and are not limited to co-operation between the countries of Europe. This was accentuated by the development of intercontinental telephony by means of long radio and other circuits, inaugurated in 1927 by the establishment of commercial service between New York and London. It was evident that to an increasing extent international telephony was becoming not only a European problem, but a world problem as well, and it was decided by the C. C. I. to broaden the scope of their work and invite the telephone administrations in countries in all parts of the world who desired to co-operate in the work to join the organization. In accordance with this policy the C. C. I. sent in 1929 an invitation to the American Telephone and Telegraph Company to join the C. C. I. as representative of the Bell Telephone System. This invitation was accepted and the Bell System became formally associated with this work on June 11, 1929.

The first Plenary meeting since the adherence of the Bell System to the C. C. I. took place in Brussels June 16 to 23 of this year. It was attended by a delegation of representatives of the American Telephone and Telegraph Company headed by Vice President Gherardi and including Mr. H. E. Shreeve, Technical Representative of the Bell System in Europe; Mr. J. F. Bratney, Mr. W. H. Harrison, Mr. A. B. Clark and Mr. W. Fondiller. There were present delegations representing telephone administrations from 23 other countries, members of the Committee, and in addition a representative from Japan and representatives of various electrotechnical groups. Following the usual custom, after a general opening meeting the Committee divided into sections which studied in detail the recommendations of the various working commissions submitted for approval. After modification and informal approval of these recommendations by the sections of the Plenary Assembly a closing meeting of the Assembly as a whole was held at which formal approval was given to the recommendations of the various working commissions and of their proposed programs of work for the coming year. The entire series of meetings occupied eight days. Associated with them were some very enjoyable excursions and entertainments, including an official dinner given to the delegates by the Belgian Minister of Posts, Telegraphs and Telephones.

Naturally a good deal of the work of the C. C. I. is done throughout the year at meetings of working commissions and through informal contacts between the representatives of the various administrations. Regular participation in these various activities on behalf of the Bell System is maintained by Mr. Shreeve and his assistants from the London office of the American Telephone and Telegraph Company.

While from the nature of the situation much of the work of the C. C. I. deals with problems which primarily concern the better handling of international telephone traffic between European nations, important questions are being considered by the Committee which should in the long run help in obtaining general world-wide agreement on many matters concerning intercontinental telephone service, and in this way help in attaining the greatest development of this service. Also there is advantage in reaching world-wide agreements on many questions of standards and methods as illustrated in the question of transmission units. The advantages of Bell System co-operation in this work, however, do not end with these formal questions. The opportunity for better acquaintance between the representatives of the telephone industry in different countries is an important feature of the work of the C. C. I. and one which the American Telephone and Telegraph representatives greatly appreciate. Incidentally the work, of course, offers many opportunities for very pleasant personal contacts.

Accomplishments of the C. C. I.

As previously indicated, the work of the C. C. I. is wholly advisory, the committee having no authority to compel the adoption of its recommendations by the telephone administrations. This is probably the only way under which the Committee's work could be carried out at the present time, and it has some important advantages in assuring that its recommendations really represent a substantially unanimous consensus of the views of the different delegations and, therefore, are likely to meet the general approval of the administrations.

The recommendations of the Committee at the present time constitute several hundred printed pages. These are naturally designed particularly to apply to European practice. While any comprehensive review of this material would be out of place here, a brief statement of some outstanding points is of interest.

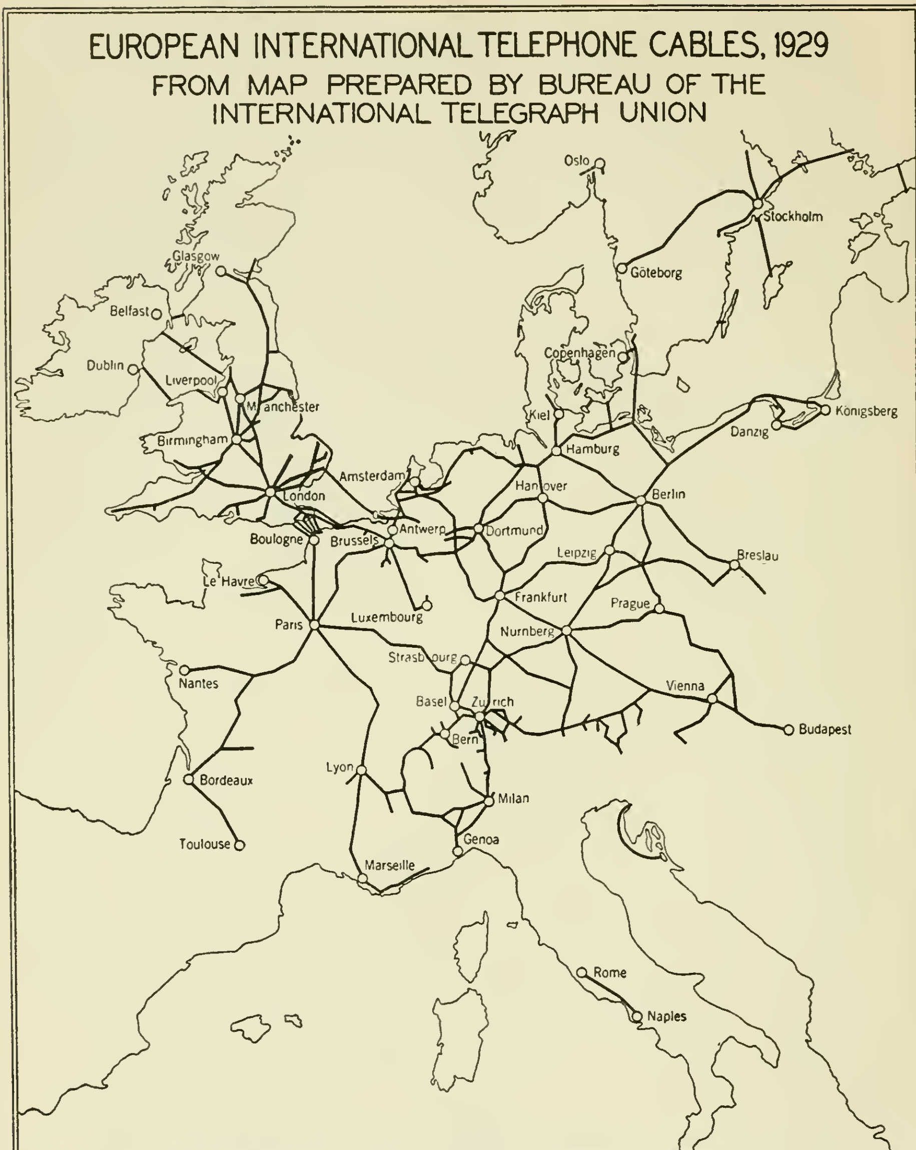
An important group of recommendations relates to general operating questions. These provide for new forms of service including a more complete person-to-person service, and short period talking service on a special contract basis, and also give details of methods of handling these services. General service regulations are liberalized to permit longer talking periods and to insure greater effort on the part of operators to complete toll calls. Provision is made for the establishment of alternate and emergency routes and for the extension of international service to new areas. Important recommendations deal with the more adequate provision of circuits to reduce delays and for the better forecasting of future circuit needs. This matter is still being actively studied.

New traffic operating practices have been provided suitable for handling the new services and the practices for present services are improved by a number of recommendations. Arrangements have been made for the collection of traffic statistics. Work is now proceeding on a manual of operating instructions for the use of operators handling international traffic.

The recommendations tend to simplify the rate structure and provide the basis of rates for new services, including program supply service. Recommendations are made regarding the division of charges between originating, terminating and intervening countries. Others deal with the sale of directories to customers and with methods of stimulating international telephone business.

A large bulk of the recommendations deals with plant matters. Much work has been done in specifying the transmission design of international circuits and of connecting lines to make them meet satisfactory standards for international service. This has resulted on the one hand in a group of outline specifications containing essential information for the design of cables, loading, repeaters and even for complete international telephone circuits, and indicating in some detail the design features to be used. Recent work in this line of the C. C. I., however, has been directed more toward a careful definition of the fundamental electrical characteristics required of each section of circuit including transmission equivalents, width of frequency band transmitted, and limits of echoes, phase distortion, crosstalk, noise and of range of transmission level. This seems to be an advantageous method of approach, particularly in view of existing differences in practice in different countries in such things as the design of cables and of loading systems, and the rivalry between different manufacturing organizations in Europe in the development of improved systems. Accompanying the recommendations just outlined are fundamental definitions of the units, terms and methods of measurement necessary for defining the electrical characteristics of the circuits.

An important part of the C. C. I.'s plant recommendations relates to the maintenance of the circuits, giving maintenance routines, methods of test and specifying even the tests on local



EUROPEAN INTERNATIONAL TELEPHONE CABLES, 1929
FROM MAP PREPARED BY BUREAU OF THE INTERNATIONAL TELEGRAPH UNION

circuits and subscribers stations. The information for the maintenance of long international circuits is now being actively expanded.

Other recommendations relate to the linking of radio and wire circuits, to the use of telephone and telegraph in the same cables, and to the requirements for special services including program circuits and picture transmission circuits.

One volume of C. C. I. recommendations contains provisions for co-ordinating international telephone circuits with power and electrified railroad circuits so as to avoid interference. These provisions have resulted from the co-operative work of the telephone representatives with representatives of international organizations of power companies and railroads. Another volume contains proposals regarding means to avoid electrolytic and chemical corrosion of cable sheaths.

Conclusion

Although the life of the International Advisory Committee has not been long, it has coincided with a period of intense international telephone development in Europe. It is estimated that by 1928 the European international telephone business had increased by more than 70 percent over that of 1925. Very rapidly the important international telephone routes in Europe have been placed in toll cable. This is indicated in the accompanying chart which shows the important telephone cables in Europe in 1929. More than half of this toll cable network has been built up since 1925.

To a large extent the successful handling of both the technical and business problems brought about by these rapid developments of international telephone business in Europe can be credited to the closer co-operation of telephone administrations resulting from the work of the C. C. I. Its activities can be expected to continue to be of increasing benefit in the development of the European telephone network. With the extension of the activities of the C. C. I. to include world-wide questions, there is every indication that with the further development of intercontinental telephony its activities will continue to broaden and grow in importance.

H. E. Shreeve
H. S. Osborne

1930 Stock Offer of the American Telephone and Telegraph Company

IN a circular letter dated April 16, 1930, the American Telephone and Telegraph Company announced an offer to stockholders of record at the close of business on May 23, 1930, of additional shares of stock at par, $100, in the proportion of one new share for each six shares then held. Rights to subscribe expired on August 1, 1930. The terms of the offer were similar to those of the offer in 1928. The issue, as usual, was not underwritten.

Debenture Bonds of 1939 Largely Converted

The terms of the offer provided a period of approximately five weeks, longer than usual, between the announcement date and the record date for subscription rights. This longer period was provided so that holders of the Ten-Year Convertible 4½% Gold Debenture Bonds (offered for subscription to the stockholders in 1929) who might desire to convert their bonds into stock in time to receive subscription rights, might have ample opportunity to act. Between the announcement date and the record date more than $132,000,000 principal amount of the convertible bonds, or sixty percent of the issue, were converted into an equal amount of stock which was entitled to subscription rights.

Purpose of the Issue

The purpose of the issue, as stated by President Gifford, was to provide funds for new construction needed by the Bell System to care for additional business resulting from the constantly greater use of telephone service.

The amount of stock offered was $257,940,700 at par, being about 39 percent more than in the 1928 issue. Stockholders receiving rights numbered 508,764. The average amount offered was approximately $500 per stockholder.

Issue Well Subscribed

The success of the offer is shown by the fact that less than one-fifth of one percent of the shares offered were not subscribed—a smaller ratio than for any similar stock issue of the Company. The local facilities provided through Bell Telephone business offices to help stockholders and the efforts made throughout the country to reach those who were thought most likely to need assistance, were doubtless responsible for reducing to a minimum the number of stockholders who, through lack of knowledge or carelessness, sacrificed their rights by allowing them to expire.

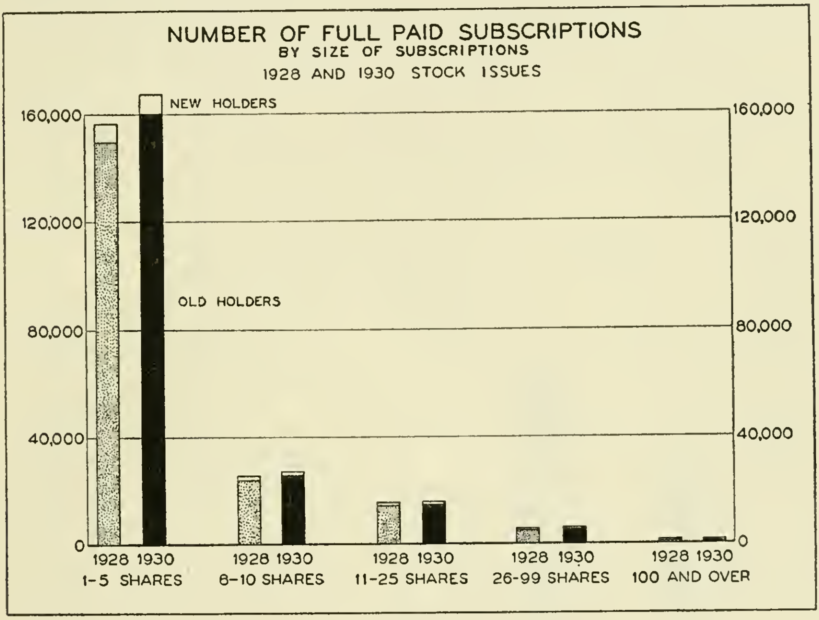


Chart I

During the period of the offer general business activity was at a low level. The securities market was in a state of unusual quietude with the general trend somewhat downward. Rights sold on the market at prices ranging principally between $21 and $17, an average higher than that of any previous issue of the Company. The subscriptions received numbered over 283,000, some 18,000 more than in the 1928 issue. There was an increase in the average number of shares per subscription from 7.0 in 1928 to 9.1 in 1930.

Subscription Statistics

At the present time the usual analysis of subscriptions has been completed only for those paid in full. Chart I on the preceding page shows these subscriptions classified as to size for the 1930 and 1928 stock issues. The lower shaded portion of the columns represents those entered by stockholders of the record date while the upper unshaded portion represents the number of new holders gained in each group. The important rôle played by small subscribers is shown by the fact that 77 percent of all full-paid subscriptions were for 5 shares or less. In addition more than three-fourths of the new stockholders gained through subscriptions fell in the 1 to 5 share group.

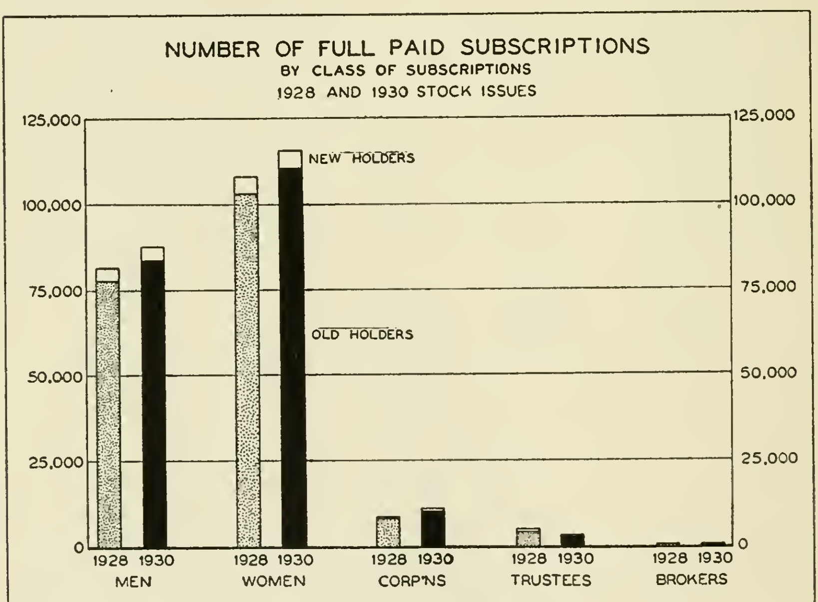


Chart II

Of a total increase of 12,000 in full-paid subscriptions over the 1928 offer, those in this group accounted for 9,500.

Chart II shows full-paid subscriptions for the 1930 and the 1928 stock issues classified according to men, women, corporations, trustees and brokers. In both offers there were more women who subscribed than men; women also formed a larger proportion of the new holders added; and men and women together accounted for 93 percent of the full-paid subscriptions.

As in previous issues the average size of full-paid subscriptions was somewhat greater than that of installment subscriptions. The following table gives comparative data for the 1930 and 1928 stock offers.

TABLE I

COMPARATIVE STATISTICS OF THE 1930 AND 1928 STOCK ISSUES
(1930 Figures Partly Estimated)

	1930 Stock Issue	1928 Stock Issue	Increase 1930 over 1928
Par value of stock offered	$257,940,700	$185,863,000	38.8%
Stockholders on record date	508,764	432,004	17.8%
Market value of a share on closing date for subscriptions	$209⅝	$176	$33⅝
Full-paid subscriptions	218,289	206,075	5.9%
Percent of total subscriptions	77.1%	77.8%	–.7%
Installment subscriptions	64,914	58,772	10.5%
Percent of total subscriptions	22.9%	22.2%	.7%
Total subscriptions	283,203	264,847	6.9%
Shares subscribed—full-paid	2,083,781	1,552,598	34.2%
Percent of total subscribed	80.9%	83.8%	–2.9%
Shares subscribed—installment	491,771	299,437	64.2%
Total shares subscribed	2,575,552	1,852,035	39.1%
Subscriptions by stockholders	270,703	250,032	8.3%
Percent of stock subscribed	96.5%	95.0%	1.5%
Subscriptions by others	12,500	14,815	–15.6%
Average shares offered per holder	5.1	4.3	.8
Average shares per subscription:			
Full-paid	9.6	7.5	2.0
Installment	7.6	5.1	2.5
Total	9.1	7.0	2.1

Local Contacts With Subscribers

Stockholders throughout the country were aided as before in the purchase and sale of rights by the Bell Telephone Securities Company which offered its facilities at about 3,000 of the business offices of the Associated Companies. That this service proved of convenience to small stockholders is shown by the fact that the average transaction was for 4.1 rights. Approximately 99,000 purchases and sales of rights were thus arranged, or one-third more than the number so handled in 1928; and, as in the case of previous offers, the larger proportion of these transactions were with the stockholders residing west of the Mississippi River, in which territory a large percentage of holders have acquired stock through the Bell Telephone Securities Company.

A study of these rights purchase and sale transactions shows that the average size of the transactions varied only slightly between large and small communities. It was found that women availed themselves of the local facilities to a greater extent than did men.

TABLE II

Rights Transactions Through Associated Companies by Size of Community

Population of Community	Number of Rights Transactions	Number of Rights Involved	Average Rights Per Transaction
Less than 5,000	3,690	15,499	4.2
5,000–99,999	27,783	118,687	4.3
100,000–999,999	34,703	142,814	4.1
1,000,000 and over	33,032	134,303	4.1
Total	99,208	411,303	4.1

There were also handled some 55,000 transactions in the purchase and sale of rights at the New York and Boston offices of the American Company, applications being made either in person or by mail. Chart III on page 256 shows the number of rights transactions, both purchase and sale, recorded by the

Bell Telephone Securities Company. In addition to arranging rights purchase and sale transactions, the Associated Companies again received subscriptions at their business offices for forwarding to the American Company and more than 52,000 subscriptions were thus handled.

The following table gives certain data concerning the number of rights purchase and sale transactions and subscriptions arranged by the Associated Companies for their patrons.

TABLE III

1930 Stock Issue Transactions Handled Locally by Associated Companies for their Patrons

Associated Companies	Purchases and Sales of Rights		Subscriptions Filed	
	Number of Transactions	In Percent of Stockholders Resident in the Territory	Number of Transactions	In Percent of Stockholders Resident in the Territory
New England Tel. & Tel. Co.	1,857	1.7%	1,718	1.5%
Southern New England Tel. Co.	771	5.1	389	2.6
New York Tel. Co.	12,616	12.9	6,743	6.9
New Jersey Bell Tel. Co.	3,352	11.4	1,660	5.6
Bell Tel. Co. of Penn.	10,745	23.4	5,164	11.2
Chesapeake and Potomac Tel. Co.	4,614	23.0	2,397	11.9
Southern Bell Tel. & Tel. Co.	3,703	20.5	1,656	9.1
Michigan Bell Tel. Co.	3,505	41.8	1,198	14.3
Indiana Bell Tel. Co.	1,084	37.3	255	8.8
Wisconsin Tel. Co.	4,108	46.0	1,693	18.9
Illinois Bell Tel. Co.	16,310	33.3	7,662	15.6
Northwestern Bell Tel. Co.	5,691	44.5	2,528	19.7
Southwestern Bell Tel. Co.	10,650	47.4	5,236	23.3
Mountain States Tel. & Tel. Co.	3,639	36.1	2,163	21.5
Pacific Tel. & Tel. Co.	16,563	41.1	12,395	30.8
Total	99,208	20.1%	52,857	10.7%

Aid Rendered Uninformed Stockholders

As in other recent subscription offers, all practicable steps were taken to reduce the number of stockholders who might allow their rights to expire. A questions and answers circular explaining as simply as possible all pertinent facts concerning the issue was mailed with the subscription warrants to all stockholders as heretofore. Then the names and addresses of stockholders who failed to utilize their 1929 subscription rights to the Convertible Bonds were prepared on cards. These were singled out as the ones most likely to need personal assistance this year. To each of these a brief letter of information was mailed from New York. The cards were then assorted geographically and sent to Associated Companies.

Representatives of the Associated Companies reached more than 82 percent of the 10,500 persons listed. Telephone conversations were had with 6,000 of them, personal interviews with 2,300 and letters sent to 1,000. Complete service was prevented by the fact that several hundred had changed their addresses without notifying the American Company.

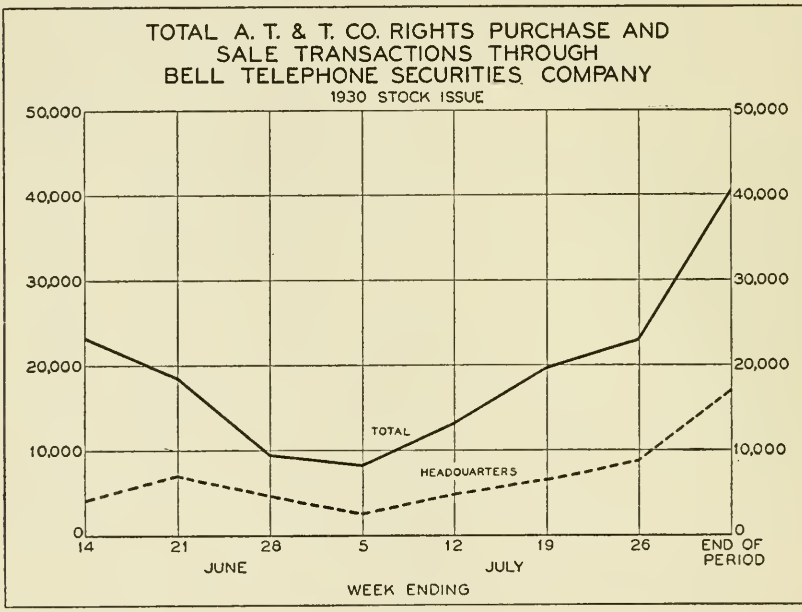


CHART III

Of the individuals reached in the field, more than one-fourth are reported as having needed help. It was discovered that some claimed not to have received their warrants, others to have lost or destroyed them. In such cases the field representatives arranged for the replacing of the missing warrants.

These contacts with the resulting human interest stories were a source of satisfaction to those associated with the work. One stockholder, a widow, who had been in ill health and was only able to be around in a wheel chair, stated when called upon that she had no money and thought her rights valueless unless used by her for subscription. Needless to say she was happy to receive some $800 from their sale.

Another widow working in a department store and supporting her mother and a young son, showed considerable amazement upon being informed that her warrants had a real cash value, as it was her belief that they were sent her in an advertising scheme.

The family of a deceased stockholder was holding the subscription warrants and two dividend checks, not knowing what to do with them. With the aid of the representative, arrangements were made for the sale of the rights, transfer of the stock and collection of the dividend checks.

A stockholder residing in a small town forwarded his warrant to the Treasurer of an Associated Company giving as his reason that he was not able to subscribe and could not sell his rights where he lived. He expressed surprise upon receiving

TABLE IV

FOLLOW-UP BY ASSOCIATED COMPANIES OF STOCKHOLDERS WHO HAD FAILED TO UTILIZE THEIR 1929 SUBSCRIPTION RIGHTS

1930 Stock Issue

Territorial Classification	Stockholders Reached		Stockholders Not Reached	Total Stockholders on List	Percent of Total Stockholders in Territory
	Needing Assistance	Not Needing Assistance			
New England Group	262	932	326	1,520	1.2%
Eastern "	711	2,201	759	3,671	1.9
Central "	524	1,424	297	2,245	2.8
Southern "	164	365	108	637	3.5
Northwestern "	101	235	65	401	3.1
Southwestern "	295	439	118	852	3.8
Mountain "	83	216	29	328	3.3
Pacific "	121	618	99	838	2.1
Total	2,261	6,430	1,801	10,492	2.1%

a check a few days later covering the sale price of his rights.

Numbers of the stockholders interviewed showed appreciation of the interest taken in rendering them help. In many instances the amount realized was of importance to them. Table IV on the preceding page gives territorial data concerning this work.

Organization Handling Stock Issue

With each successive stock issue, methods of procedure and general plans of organization have been modified and improved; and stockholders have become better acquainted with the facilities offered for service. It is believed that the 1930 offer, the largest ever made by the American Company, was handled with more dispatch than any of its predecessors.

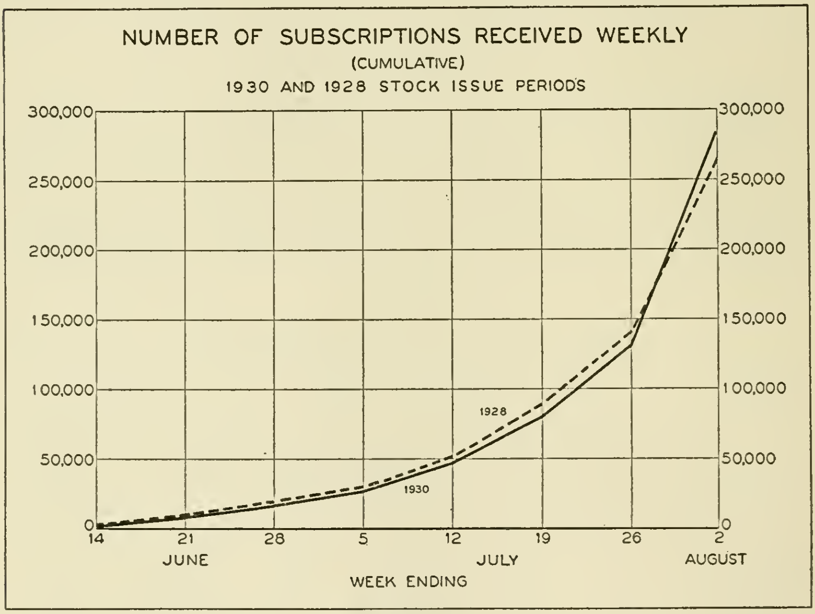


Chart IV

Some figures will give the reader an idea of the size of the latest undertaking from the standpoint of the Treasury Department. From 3,500 candidates interviewed for positions, approximately 800 temporary employees were engaged and

I. Reception Room for Persons Seeking Stock Issue Employment.

II. Part of the Organization Handling Conversions of the Debenture Bonds of 1939 Prior to the Record Date for Rights.

III. The First Step in Reviewing Subscriptions for Acceptance.

IV. Typists Recording Subscriptions on Fan-fold Forms with Others Preparing Stock Certificates.

V. Part of the Organization Preparing Stock Certificates for Mailing.

VI. A View of Part of the Bureau Handling Stock Issue Correspondence.

trained for stock issue work, and 56 van loads of furniture, equipment and supplies were provided for their use. More than 750,000 full and fractional share warrants of original issue were prepared and sent to the 500,000 stockholders; more than 600,000 pieces of subscription mail were received and dispatched in little more than three months, many of these involving incomplete subscriptions.

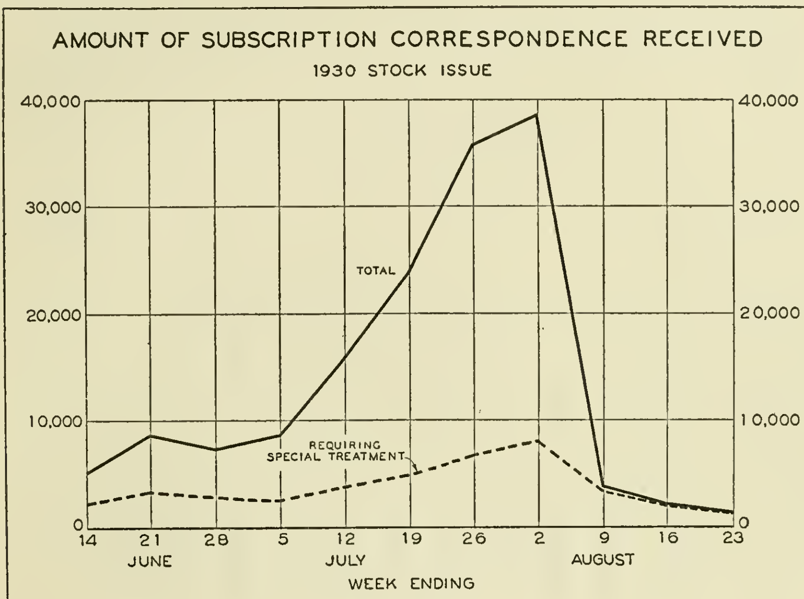


Chart V

The total number of subscriptions received weekly on a cumulative basis for both the 1930 and the 1928 stock offers is presented on Chart IV. In the last week of the subscription period more subscriptions were received than had been filed during the six weeks following the mailing of the warrants. In fact, there were 99,000 subscriptions in process of acceptance on the closing date, August 1. Chart V shows the substantial proportion of the subscription correspondence received in the later weeks of the offer. Of the mail received, 27 percent of the cases required special attention and the sending of 31,000 individually dictated letters.

One of the features of the organization was the control exercised at all times over the flow of work, regardless of volume. Supervisors knew the status of their work hourly, both in the numerous phases of accepting and registering subscriptions and in receiving and dispatching correspondence. The accompanying illustrations show various parts of the organization in the process of handling their work.

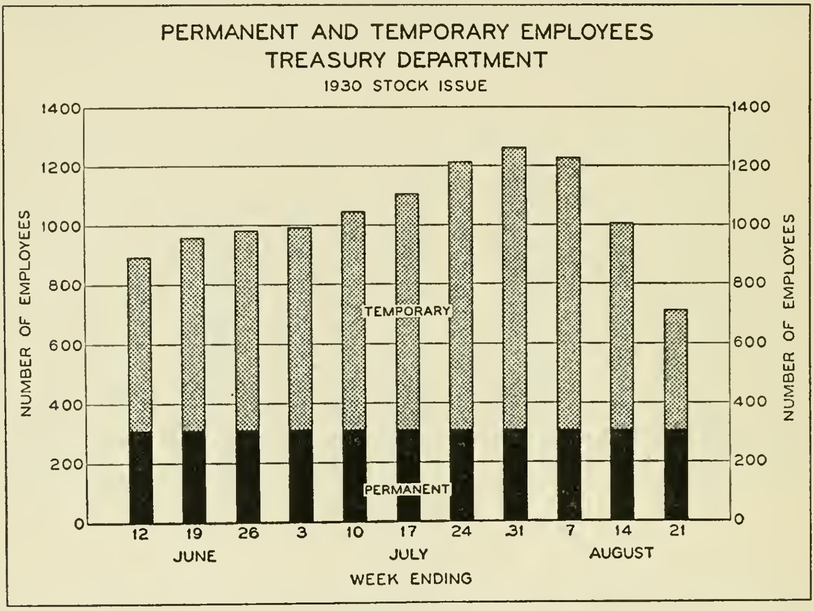


Chart VI

Special attention was directed toward securing adequate personnel. More than 350 of the men engaged were students or graduates of colleges and universities; also the Company had the good fortune to secure a number of professors and instructors, free for summer employment. To train these new employees, various courses were conducted along both general and specialized lines. In all, a total of more than 300 hours of class instruction was given which, undoubtedly, increased the productivity of the entire organization. Chart VI gives one an idea as to how the personnel of the Treasury Department was expanded and contracted to meet the requirements of the stock issue work. At the peak of the rush three-fourths of the organization were temporary employees.

Conclusion

More stockholders participated in the issue than in any previous offering by the American Telephone and Telegraph Company; the amount of the offer was larger than any heretofore made and the percentage of rights unused was the smallest.

The employees throughout the country engaged in the work showed great interest in rendering their best service and the work was done expeditiously and efficiently. Stockholders in many sections generously commended the services rendered them. The wholehearted co-operation of all made the issue a most successful one in all of its aspects.

H. Blair-Smith

Bell System Sales Activities

SALES activities have always played an important part in Bell System operations. The exception to this embraces the period during the war and immediately thereafter when the Bell Operating Companies were suffering from the diversion of men, materials and supplies for war purposes.

In the early days sales work was directed to convincing the public that the "scientific toy," as the telephone was called shortly after its invention, was a useful and reliable means of communication. At that time the telegraph was well established and well accepted by the public; for less urgent requirements the mails and the use of messengers seemed adequate. Much emphasis was placed on the written word and considerable pride was still taken in the art of penmanship. This was the situation that faced the pioneers in the telephone industry. It seemed that they alone had the vision of the ultimate place of telephone service in business and social affairs. For instance, the articles of incorporation of the American Telephone and Telegraph Company in 1885 anticipated service between the principal cities of the United States, including those on the Pacific Coast, "and with the rest of the known world, as may hereafter become necessary or desirable. . . ." The attainment of this objective included in the articles of incorporation is now near at hand. It has required continuously a combination of research and sales effort.

But it may be asked, "Why should the Bell System be active in sales at present and in the years to come, since competing telephone companies in any one community are practically a thing of the past?"

First let us consider the matter of competition. While competing telephone companies in any one community are practically non-existent, this does not mean that the telephone is in a non-competitive field. As a matter of fact, telephone service competes with all other forms of communication and is competitive in many respects with transportation. Due to this competition, it is necessary continuously to improve the service and to develop more convenient instrumentalities, and to apprise the public of these developments and how they can be made a source of additional convenience and profit. Furthermore, it is necessary to insure that each customer has the proper class of service and that the arrangements and quantity of instrumentalities on his premises are wholly adequate and suited to his particular requirements.

Until recent years telephone service generally has been viewed only in the light of a necessity. In the modern era of greater convenience and comfort both in business and in the home, the provision of telephone service is being viewed from a broader standpoint than that of necessity alone. This has led to a demand for more telephones per customer for both business and residence purposes. When this new view of furnishing telephone service is taken into consideration, it is evident that the telephone company is competing with other industries for the customer's dollar available for purchasing services or products which contribute to his convenience and comfort. While the telephone company, from the nature of its service, must be a monopoly in its field, the field itself is competitive with a number of others.

The Bell System could not have attained its present position without being progressive. The extent to which a business institution meets the public's requirements is generally held to be the degree to which it desires to serve. A desire to serve is usually manifested by the effort to sell service of high quality and this is the particular thing which the public recognizes because it is accustomed to using this measure. The sales viewpoint at all times embodies the interested and friendly attitude toward customers' desires. No company can be indifferent to public requirements if it desires the good will and confidence of the public.

An explanation of the need for sales activities by the Bell System is found in the address by President Walter S. Gifford before the Convention of the National Association of Railway and Utilities Commissioners at Dallas, Texas, and in his 1927 annual report to the stockholders of the American Telephone and Telegraph Company. At Dallas, Mr. Gifford said in part:

"the fact that the responsibility for such a large part of the entire telephone service of the country rests solely upon this company (The American Telephone and Telegraph Company) and its Associated Companies, also imposes on the management an unusual obligation to the public to see to it that the service shall at all times be adequate, dependable and satisfactory to the user."

In the 1927 annual report, Mr. Gifford reiterated this statement in the following words:

"The American Telephone and Telegraph Company accepts its responsibility for a nation-wide telephone service as a public trust. Its duty is to provide the American public with adequate, dependable and satisfactory telephone service at a reasonable cost."

Certainly if people who can afford telephone service are without it, or subscribers who have telephone service are utilizing facilities or equipment of a type which does not meet their service requirements, or which does not enable others to reach them satisfactorily, the service cannot be considered wholly adequate. Since the public does not know in many cases what constitutes adequate service, and does not know what services and facilities are available, or what the price may be, it is clearly the responsibility of the company to make these facts known to its customers.

While the telephone company is thoroughly equipped and organized to provide "dependable" service, there is no assurance that it will be furnished unless subscribers are persuaded to buy the amount and type of service which they can conveniently and profitably use. This is true because inadequate or unsuitable facility arrangements frequently interfere with dependable service, not only of the individual concerned, but also of other people who call him. To illustrate this, it is only necessary to mention conditions where subscribers have insufficient lines to handle their outgoing and incoming calls or have party lines where they need individual lines. Some business concerns are attempting to handle their traffic over terminal facilities not suited to their communication needs. There are also cases where subscribers do not answer or are slow in answering because of a lack of extension telephones. Often an effort is made to have one telephone serve the home where two or three would add materially to the convenience and dependability of the service.

Analyses of subscribers' complaints reveal that the causes of service difficulties are frequently related to the type of service, the location of the equipment, insufficient lines or stations, or other conditions of this character. Sales efforts to correct such difficulties usually remove the source of trouble and result in improved customer relations. In some exchanges a relatively high percentage of the residence telephones is served by four-party lines. Too great a percentage of four-party telephones has a detrimental effect on furnishing dependable service because of busy conditions and other types of party line interference. Here again, sales work is effective in improving the general service as well as the service of the individual.

The Bell System has its laboratories and research organizations which are continually devoting their attention to the advancement of the industry and the development of the more efficient methods of operation. These contribute materially to the improvement in quality of service and the means of producing it. Among the various things that these research organizations are doing is the development of equipment more pleasing in appearance, more convenient and more easily used. These improvements in service and instrumentalities are being brought effectively to the attention of customers through sales activities.

The products of the Bell System are services in various forms and practically all employees are engaged in rendering those services. Service embodies not only the rendering of good transmission and the speedy completion of calls, but also includes the provision of adequate and properly arranged facilities on the subscriber's premises. When telephone employees have been offered the opportunity to contribute to the general improvement of the business, they have manifested a marked willingness to assume the responsibilities for carrying on the work successfully. All employees, therefore, whether they be engaged primarily in the plant, traffic, commercial or other departments, are encouraged to engage in sales work in the interest of improving the overall service. This common objective leads to a company viewpoint rather than departmentalism and an improved morale results.

While all employees are encouraged to sell service in connection with their company duties and as they have opportunities outside of office hours, the chief responsibility for sales work rests with the commercial organization. The business office employees of the company have a direct responsibility to sell service in the interest of insuring adequate, dependable and convenient service in every case. These employees must be competent fully to analyze the subscriber's requirements and to recommend those services and facility arrangements most appropriate for the subscriber's needs. This sales viewpoint obtains not alone for new subscribers, but also in the case of present subscribers in connection with business office visits, telephone calls, or in correspondence.

In addition to the business office organizations, most commercial departments also have a number of well trained representatives who devote their entire time to sales work. These employees are actively calling on subscribers in order to obtain a better perspective of the subscriber's business or domestic requirements so that the provision of proper service and equipment arrangements may be insured. In the case of the larger business private branch exchange installations, it is frequently necessary for these employees to spend considerable time on the subscriber's premises in the analysis of the subscriber's requirements before recommendations can be made. In these cases as in all others, adequate attention is given to the requirements for both local and toll service. Experience has shown that facility arrangements as well as uses of the service can usually be recommended which result in increased convenience and greater value of the service.

Among the more usual exchange services available for business subscribers' use may be mentioned main stations, extension stations, wiring plans, private branch exchange service, order receiving equipment, code calling equipment, conference calling equipment, foreign exchange service, telephone typewriter service, off-premise private branch exchange stations, toll terminals, tie lines, private lines, etc. The more usual toll services include message toll service, short period and full talk service, reversed toll service, telephone typewriter service, Morse service, etc. Attractive service features such as the key town calling plan, the credit plan and sequence calling are also available for toll using customers. In the case of business subscribers co-operation is extended to architects and builders, preliminary to building or remodeling structures, in providing for proper conduit and other arrangements which will expedite the establishment and maintenance of service in an orderly manner.

In the residence market, especial attention has been given the last two or three years to providing proper service arrangements in the larger homes. A new dial intercommunicating system known as the 750-A private branch exchange has been developed which permits comprehensive intercommunication within the home and adequately provides for central office service. This System has many attractive service features which are discussed in another article in this issue of the Quarterly. Among the various features, separate lines may be provided for servants' use as in the case of other types of service which are offered. While this equipment only became available early in 1930, a large number of installations have already been made.

In the larger homes which do not require private branch exchange service wiring plans are being furnished which provide for holding and pick-up arrangements, for the transfer of calls and for a certain amount of intercommunication between various rooms. This arrangement is proving very popular and there is an increasing appreciation of the comfort and convenience afforded by several telephones conveniently located. Until recently the same considerations had not been given to telephone convenience and comfort as to other home conveniences. Through active sales work an attempt is being made to correct this situation, especially in view of the fact that telephones may be located in the living room, bedrooms, guest rooms, kitchen, basement, garage and servants' quarters at a surprisingly low cost. Jack and plug equipment with portable telephones in various locations adds materially to telephone comfort and convenience.

In smaller homes, as well, particular attention is given to the provision of the proper class of service, involving the installation of one or two additional telephones in convenient locations, such as the master bedroom and the kitchen.

It has also been found that a large percentage of residence subscribers are not fully conversant with the speed, quality and low cost of toll service. An effort is being made to give residence subscribers full information regarding toll service, together with telephone numbers and rates to friends, relatives or others located in out-of-town points. In building new homes or in remodeling present buildings it is desirable to arrange for conduit for telephone wiring in order to expedite the installation and maintenance of service. Bell operating companies extend full co-operation to home owners, architects and builders in providing for this desirable arrangement.

Other phases of sales work include the sale of service to non-subscribers, the sale of auxiliary and by-product services of many classifications to existing customers and the sale of directory listings, display advertising and trade mark headings in the classified directories for the convenience of the shopping public.

While the telephone industry has much in common with other businesses, there is one respect at least in which it is quite different and that is, the service of one individual cannot be isolated from that of his business associates, friends, acquaintances or any other telephone customers with whom he may have occasion to communicate. Inadequate service for one customer reacts unfavorably upon the service of others. Since the overall service is a composite of individual services, sales activities are instrumental in protecting and improving the quality of general service rendered.

The Bell System has given especial attention to sales work during the last two or three years. Customers are appreciative of this increased interest to improve their service and to make it more convenient and valuable to them both for business and social purposes. The philosophy of this sales work is that the Bell System desires to fulfill its duty to provide adequate, dependable and satisfactory service at a reasonable cost.

H. C. Lauderback

An Intercommunicating System for Homes and Offices

THE Bell System is continually working to make available new facilities and equipment to provide complete and convenient telephone service, which is well adapted to the needs of its customers. One of the newest of these arrangements, is an intercommunicating system that has been very favorably received as shown by the large number already in service and the many additional installations under consideration. It is suitable for the larger residences and apartments, for small estates and for business offices of moderate size, and is known to telephone people as the " 750-A Private Branch Exchange."

This new system offers a number of desirable features. It is simple to operate and from each telephone both outside calls and intercommunicating calls within the residence or office may be made. The instruments are of attractive design and may be obtained in various colors, if so desired.

No operator or attendant is required to answer incoming calls, since this can be done by means of push buttons at any of the telephones. Likewise, outgoing calls are established without the aid of an attendant. Intercommunicating calls are made by means of the dial. Incoming calls answered at any telephone may be transferred to any other telephone of the system.

The equipment is arranged so that both intercommunicating and outside conversations may be carried on from different telephones at the same time. Complete secrecy for both outside and intercommunicating connections is provided.

To meet varying service requirements this exchange is available in two sizes; the larger with a capacity of fifteen telephones and three outside lines and the smaller with eight telephones and two outside lines. The number of wires to each

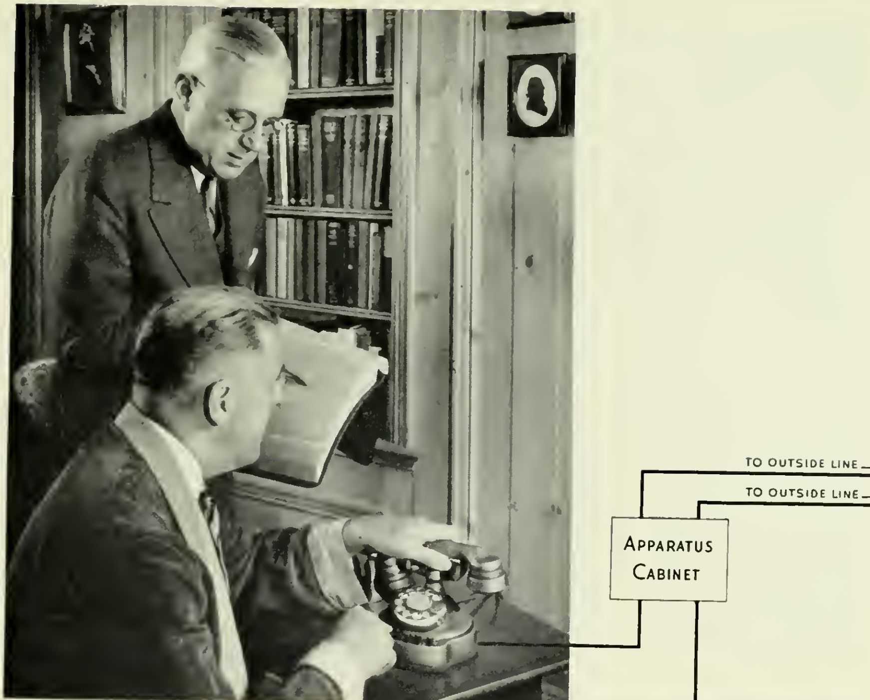


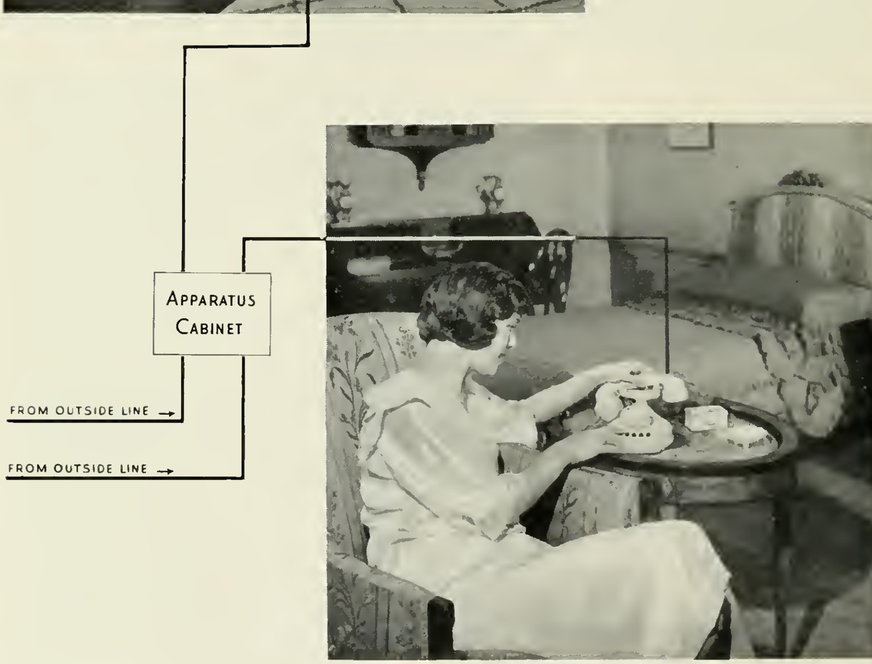
FIGURE 2 (upper). A call from the library.

FIGURE 3 (lower). A call from the kitchen.

OUTGOING CALLS.

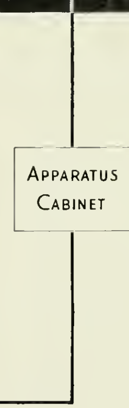
Figure 4 (upper). The maid answers in her room.

Figure 5 (lower). A call answered in privacy.



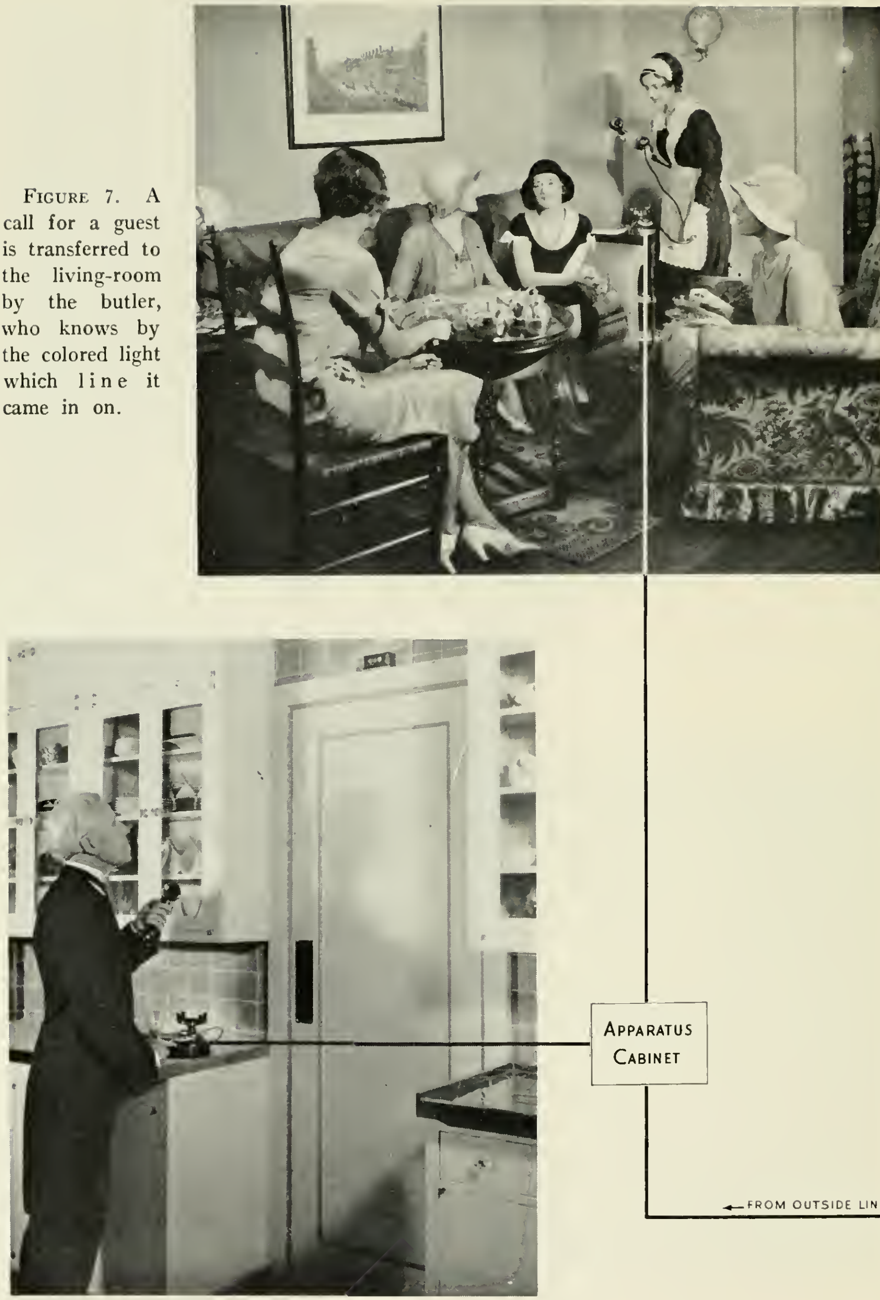
Incoming Calls.

Figure 6. The maid is asked to call the butler.



An Intercommunicating Call within the Residence.

Figure 7. A call for a guest is transferred to the living-room by the butler, who knows by the colored light which line it came in on.



A Call Received and Transferred.

telephone has been reduced to a minimum so as to simplify the installation.

Certain of the telephones, as for example those for servants in residences, can be restricted to house calls only or they can be arranged so that incoming calls can be answered and transferred but calls to the outside cannot be made. An outside line can be assigned, if desired, for the use of servants or other employees and the other outside lines reserved for family use.

A novel feature of the telephone instrument is that the push buttons for establishing the outside and intercommunicating connections are included in the instrument as shown in Figure 1. (See *frontis-piece.*) There are five of these push buttons which are distinctively colored and designated 1, 2, 3, H and L. The first three buttons connect the instrument with the outside lines, the "H" button holds the outside connection when a call is received at one telephone and transferred to another telephone, and the "L" button is depressed to make a local intercommunicating call. While ordinarily the hand set type of instrument is used, desk and wall sets with separate push buttons may also be used, if desired, at certain points.

The operation of the 750-A system may be easily understood from the accompanying pictures. Figures 2 and 3 depict the making of outside calls. The user simply depresses a button on the instrument associated with the outside line and then lifts the hand telephone in the ordinary manner. If no busy signal is received, he proceeds to make the telephone call in the usual way, either by giving the call to the telephone company operator or by dialing the number desired.

Figures 4 and 5 represent typical incoming calls. These calls are indicated by the ringing of bells associated with the outside lines. The bells are conveniently located so that they can be heard from all desired points. Incoming calls are answered by depressing push button 1, 2 or 3 associated with the outside line on which the call is being received. Each outside line has associated with it a distinctively toned bell or colored lamp signal, or both, as may be desired, for indicating the proper button to operate. In the case of the colored lamp signals, the color corresponds to the color of the button on the instrument.

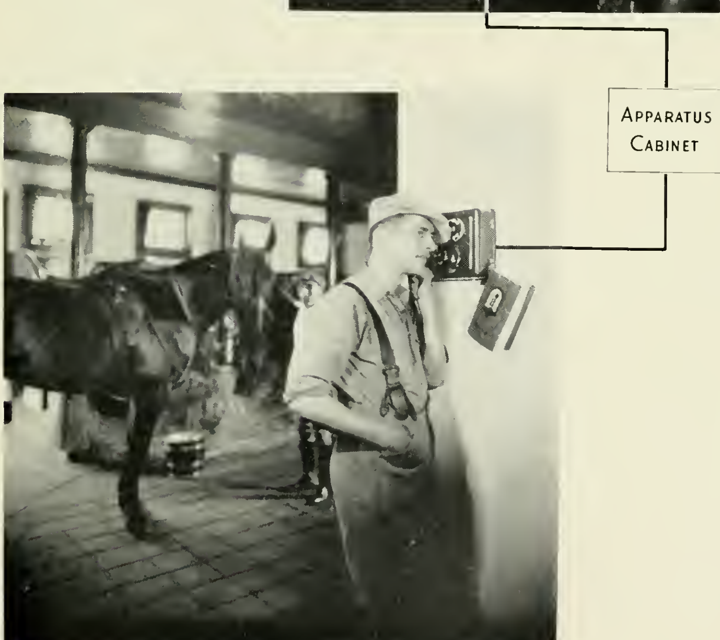
Figure 6 depicts an intercommunicating call within the residence which is established by the calling party depressing the push button "L," lifting the hand telephone and then dialing the number of the telephone desired. If the called telephone is not busy, ringing current is automatically sent over the line and rings the bell at the called telephone. The called party, in answering, depresses the "L" button on his instrument and lifts the hand telephone from the set.

Figure 7 is illustrative of a call which is answered at one telephone but transferred to another telephone. This is done by answering in the usual manner and then depressing the "H" button which operates an arrangement to hold the outside connection. The original answering party then operates his "L" button and dials the number of the telephone desired. When the called party answers and is told about the incoming call, he depresses the button of his set corresponding to the outside line over which the call is being received. This removes the holding condition from the outside line and automatically disconnects the original answering telephone.

Figure 8 illustrates the making of an intercommunicating call as already described except that it shows a call to a point outside the residence, in this case, a call from the residence to the stable.

The 750-A system is equally advantageous for the telephone service of many business concerns. Perhaps the most important feature in connection with the use of this system by business concerns requiring a small number of telephones is the fact that its operation requires no operator or attendant. Thus the subscriber is relieved of the need for providing an employee for telephone service and the problem of relief for the attendant during noon hours and at other times is avoided.

FIGURE 8. The butler calls the groom at the stable.



AN INTERCOMMUNICATING CALL TO A POINT ON THE ESTATE.

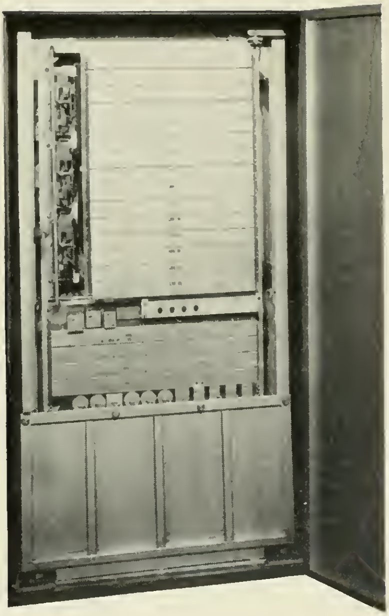


FIGURE 9 (left). This shows the compact arrangement of the apparatus required for the operation of the system.

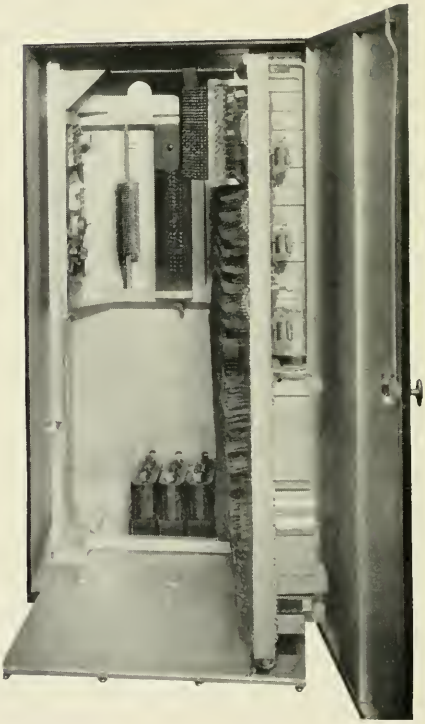


FIGURE 10 (right). This is another view of the apparatus including the power plant.

APPARATUS CABINET FOR THE NEW INTERCOMMUNICATING SYSTEM.

It has been mentioned above that the 750-A system is one that is simple to operate. However, telephone calls cannot be originated, received or switched to other points without the use of relays and other equipment. Figures 9 and 10 illustrate the very compact manner in which all of the apparatus required has been housed in a cabinet, no larger than the ordinary coat closet. The cabinet can be placed in an out of the way and inconspicuous location. The power plant used is self-contained with the switching equipment in the cabinet and is kept in operation automatically, either by current fed over wires from the central exchange or by means of equipment arranged for local charging of the batteries.

C. J. Davidson
A. Tradup

Significant Features of the Early Census Returns

THE nation's gain in population between 1920 and 1930 was the largest, numerically, ever recorded by the Federal Census. Continental United States on April 1, 1930, was found by government enumerators to have had 122,698,190 people, or 16,987,570 more than the number reported for January 1, 1920. This increase exceeds by more than a million the largest previous gain, that occurring in the period 1900–1910.

No business is more interested in the revelations of the census than is the telephone industry. Its service is so closely identified with commercial and social activities throughout the United States that any marked changes in the size, distribution, and characteristics of the nation-wide market have an important bearing on its development. Operating companies are faced with the problem of engineering their facilities to meet adequately the requirements of new subscribers, and this expansion in exchange service is definitely related to population growth. Likewise, growth in toll usage and in the demand for special contract services are closely associated with the increase in population.

Early reports of the recently completed census have furnished valuable data on population changes in the United States during the past decade. There has been considerable variation in the rate of growth between different sections of the country as well as between different types of communities; and several pronounced tendencies may be observed in the distribution of population throughout the United States. Many of the changes are fundamental in character and far reaching in effect. The time seems opportune to examine the census returns so far available and to note some of the more important features of special significance to the telephone industry.

The question naturally arises as to how the numerical difference between the 1920 and 1930 census totals attains such an unprecedented level in view of the notable decline in the birth rate since 1920 and the drastic legal restrictions placed upon foreign immigration in the early part of the past decade. The figure of nearly 17,000,000 is 2¼ million in excess of the growth realized during the previous decade, when the net immigration was 25 percent greater and the rate of natural increase some 10 percent higher. Moreover, many individuals have claimed that they were missed by the census enumerators, while some local chambers of commerce have held that the census figures for their communities were too low. This idea of an undercount, instead of adding to the apparent discrepancy between the two censuses, may actually provide an explanation. The 1920 census likewise may have been an undercount—and to a greater degree than the 1930 census. If this be true, a portion of the reported increase in population between the two dates would thus be due to the greater thoroughness of the recent census as compared with the enumeration in 1920.

A variety of factors indicate that the 1930 census may have been taken with greater efficiency than those of 1920, 1910 and 1900, all of which were apparently made on about the same basis. In 1930 the enumerators seem to have been more carefully selected and trained, and they received relatively higher compensation. Greater ease of communication resulting from better rural roads and more extensive telephone service, the policy of having local supervisors make preliminary announcements of census returns from their districts (thus permitting recounts where reasonable doubt regarding the accuracy of the figures seemed to justify them), and a better organization and supervision of the overall undertaking have all apparently played a part in making the enumeration more closely descriptive of the facts than perhaps had been possible at any previous time. In all probability the increased efficiency was most pronounced in the high density sections of large urban centers where the concentration of the poorer classes in crowded quarters would tend to make complete enumeration difficult, and in sparsely settled rural areas where scattered population might not be readily accessible and therefore might be easily missed. Although no definite correction of any excess of the reported decade increase over actual growth can be made until the detailed tables on age, sex, and nativity are available (so far only preliminary total population figures for states, counties and principal cities have been announced), it is probable that the elimination of the excess would reduce the average annual increase to about the same level as was experienced between 1910 and 1920. This would give a total increase of 13 percent for the decade, as compared with 15 percent from 1910 to 1920 and 21 percent in the previous ten years.

While this decline in rate of growth has been due partly to the diminished stream of immigrants, a more important factor has been the tendency for birth rates to fall much more rapidly than death rates. In 1910 the birth rate was about 30 per 1,000 population and the death rate was 15, while at present the birth rate is very close to 19 and the death rate about 12. Thus, in twenty years the margin which represents natural increase in population has decreased from 15 per 1,000 to 7. The reduction in the death rate has been accomplished almost entirely by reducing the infant mortality, while the rate in middle life and beyond has shown, if anything, a tendency to rise. Factors contributing to the decline in birth rates are generally higher living standards, smaller living quarters, marriages in which both husband and wife are breadwinners, the tightening of immigration restrictions against the prolific races, and finally wider knowledge and utilization of birth control information.

Urbanization of the Population

Since most of the factors tending to lower the birth rate are more prevalent in the cities than in the country, the decrease in the rate is particularly significant in view of the rapid urbanization of population that has taken place in the recent years. The spectacular increase in the number and size of urban centers is indicated by the fact that there are now 941 cities in the United States with over 10,000 population compared with 726 in 1920, and that these cities in the aggregate gained 11,600,000, or 25 percent, between 1920 and 1930, and now contain 47 percent of the total population of the country. Eighty-five of these cities gained over 100 per cent of their 1920 population, while 134 others experienced growths between 50 percent and 100 percent.

Not only have the urban centers gained enormously in population during the past decade, but the rural areas have lost heavily. Whereas in other periods the settlement of new lands resulted in rural gains outbalancing the losses in the older farming districts, since 1920 there has been no extensive frontier development to compensate for the losses elsewhere. During the past ten years the net migration from many areas has exceeded by a considerable amount the large natural increase, and consequently it appears that for the first time in our history the total rural population has actually declined.

Census returns from various districts in all parts of the United States indicate that there is a definite trend away from the smaller towns and the unincorporated areas. Of the 2,200 counties in the country which contain no community of 10,000 or more population, about 1,200 declined between 1920 and 1930. In the majority of the remaining counties the gains were comparatively slight, while in others there were indications of losses in the distinctly rural portions. These early reports tend to substantiate the Department of Agriculture estimate that the last decade has in all probability seen a loss of 4,000,000 people on the farms of the United States.

These movements of rural population may be illustrated by the group of Lake States, including Ohio, Indiana, Illinois, Michigan and Wisconsin. These states have a total of 436 counties, of which 241 lost population during the past decade. Of the losing counties, 220 were predominantly rural and in the aggregate their loss amounted to 8 percent of their 1920 population in addition to their entire natural increase. The 71 other counties with no place of 10,000 or more inhabitants gained only 5 percent since 1920; and of these, 32 were adjacent to counties distinctly urban in character.

The explanation of much of the rural decline is simple. The widespread use of motor-driven machinery and the introduction of scientific farm practices have made it possible for a smaller number of workers to produce a larger output. Increased labor efficiency in other rural industries, such as coal mining where modern drilling and loading machines have been adopted, has released many workers. Additional opportunities for untrained workers in the cities, brought about by the decrease in the foreign labor supply after the drastic restrictions on immigration went into effect and by the unusual growth in the service industries, have been instrumental in accelerating the migration from rural districts, a notable example being the movement of negroes from southern farms to industrial cities. And, finally, there has been a tendency for farmers upon retirement to move to communities with special attractions as resorts or home centers, as contrasted with the former tendency to remain on the farm.

There have been several attempts to minimize the significance of this urbanization process on the basis that it has been the smaller cities, distinctly less urban in character, which have shown the fastest rate of growth. Color is lent to this argument by the fact that some of the most spectacular gains in the country occurred in cities of between 10,000 and 25,000 population. Since 1920, that group of cities has increased in number by 133; it has gained 28 percent in population and absorbed 11 percent of the total growth of the country. A detailed examination of this group shows, however, that the fastest growing cities are mainly suburban to the largest cities in the country. Their growth, therefore, represents an overflow from the metropolitan centers and may be attributed to the attractions of the most highly urbanized districts.

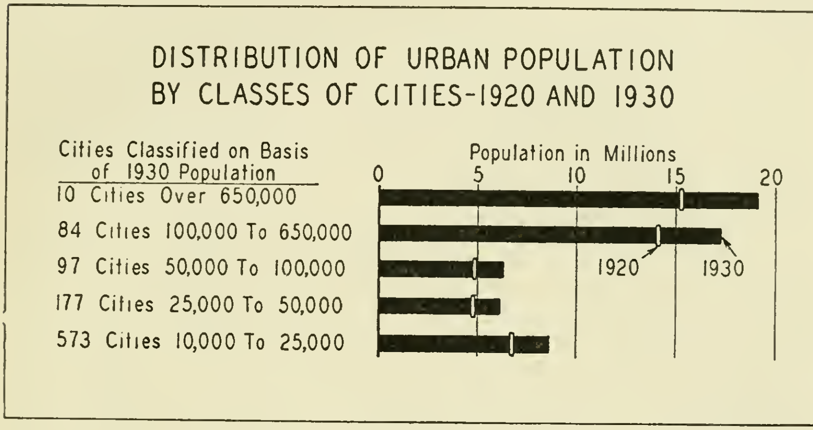


CHART 1

Since 1920, there has been a net increase of 21 in the class of cities having between 50,000 and 100,000 inhabitants and of 35 in the 25,000 to 50,000 group. These two groups each accounted for about 8 percent of the national growth and each increased about 28 percent. Cities with 100,000 or more increased in number from 68 in 1920 to 94 in 1930 and now include about 30 percent of the total population of the country. Between 1920 and 1930 these 94 cities gained about 7,000,000, representing a 24 percent rate of growth and amounting to over 41 percent of the national increase.

The total growth of the largest ten cities in the United States amounted to 3,757,000, an increase at the rate of 24.4 percent —a rate which is 50 percent higher than that for the nation as a whole. This growth occurred in spite of the fact that the increase in cities such as Philadelphia, Boston and Cleveland was limited by the presence of surrounding communities which they have not yet annexed. If the suburban territory of these ten cities were included, the proportion of the country's growth occurring in their metropolitan areas would be raised approximately from 20 percent to 40 percent. In this connection, it might be observed that numerically New York City registered the largest decennial increase ever recorded by any city in this country, while the metropolitan area, consisting of New York City and its surrounding suburban territory within 40 miles of the city hall, experienced a phenomenal population growth, exceeding by 200,000 the total increase in the State of California, a gain equivalent to one out of every seven persons added to the country's total population.

The magnitude of the urbanization movement is indicated by the growth of the entire group of cities of over 10,000 population, which absorbed 68 percent of the country's total gain; and if the suburban areas of the cities over 50,000 were included, the proportion is raised to 86 percent. These facts are significant as showing the continued growth of the large cities and as proof that much of the rapid gain in the smaller cities was due to their suburban character. One further observation seems pertinent at this point. Since the Census Bureau arbitrarily defines townships, unincorporated towns and all places of less than 2,500 inhabitants as rural, a good deal of the suburban population which is essentially urban in character will appear in official classifications as rural. This classification thus tends to mask the actual rural losses which have occurred in purely rural counties.

Growth of Special Classes of Cities

While the urban districts in general grew rapidly in population during the past decade, the different cities did not share equally in this growth. Some actually lost inhabitants while the increases in the commercial centers, with some outstanding exceptions, were quite moderate. On the other hand, certain manufacturing cities depending largely upon new and rapidly expanding industries experienced remarkable gains, and the home communities and tourist resorts made notable progress.

Some of the decade's most dramatic population shifts to cities have been caused by the desire for pleasure or for easier ways of living. The improved standard of living in the United States has resulted in an increase in the amount of travel for pleasure, in a greater proportion of young people seeking higher education, in more frequent and earlier retirement, and in the selection by the leisure and retired classes of communities whose chief feature is their attractiveness as home centers.

Widespread automobile ownership, the development of good roads, and an increase in vacationing have all contributed to the development of mountain resorts, such as Asheville and Hot Springs, seashore resorts, such as Atlantic City, and a large number of places having natural scenic beauty or special historical associations. In northern New England and New York and in the Lake States many communities which were faced with losses as their trade or lumbering declined regained their importance as a result of the exploitation of their intrinsic appeals for tourists.

The large number of young people now continuing their education beyond high school and the social and cultural advantages afforded by communities with educational and governmental institutions have caused remarkable gains in many college towns and state capitals. More than half the state capitals grew faster than the national group of cities of corresponding size, while 14 increased by over 50 percent and two more than doubled their 1920 population. It is noteworthy that Washington grew considerably in the last ten years, in spite of the release of many thousands of emergency government workers temporarily employed during the height of war activities.

The mild equable climate of Florida and California has appealed to large numbers of the retired and leisure classes whose choice of a home community is based on the play motive rather than the work motive. Consequently, such cities as Miami and Los Angeles have received heavy migrations of this element in addition to the tourist class.

Another group of cities in which there were some considerable gains includes those cities dependent mainly upon a single large industry for whose product there has been an expanding market. Cities like Detroit and South Bend, Akron and Tulsa, representing automobiles, rubber and oil, each have specific reasons for their growth and prosperity. And the newer the commodity produced, the more rapid the growth.

Generally speaking, commercial cities grew only moderately but there were a few conspicuous exceptions. Cities like Charlotte, Chattanooga, Oklahoma City, Houston and Dallas, located in areas which experienced considerable economic improvement during the past decade, profited by the increased purchasing power of their trade territories. The greater prosperity of the three southwestern cities just mentioned was due partly to the development of the oil industry and partly to the substitution of field crops for grazing.

In marked contrast to the almost universal urban growth throughout the country, there were a few cities that recorded losses of population during the last ten years due to the outward migration of workers seeking employment elsewhere. This was especially true of the textile and shoe cities of New England—Manchester, New Bedford, Fall River, Lawrence, Lowell, Brockton and Haverhill—which all suffered considerable declines due to the removal of many of their mills to other areas. Certain coastal cities which had large numbers of workers engaged in war-time activities also have lost population. This is because the 1920 census was taken before the deflation from boom conditions really became effective, and the population in these cities naturally declined after the emergency passed. This was particularly true in Hoboken and Hampton Roads, centers of shipping and shipbuilding during the war, and in Bridgeport and Wilmington, where large quantities of munitions were manufactured. Thus, people moved not only from rural to urban districts but also between cities and from one industry to another, according to the relative opportunities for employment.

However, there were some cities, starting as boom towns in certain industries, which retained their early growth and made substantial gains after the impetus of the initial stimulus subsided. During the boom period these cities, of which Wichita Falls and Shreveport are good examples, were also developing permanent commercial activities which have since enabled them to maintain their lead over longer established cities.

Geographical Distribution of Population

As might be expected from the extensive rural losses and the irregular urban gains, the population growth of the United States between 1920 and 1930 was very unevenly distributed among the several sections of the country. In general, the large and populous states recorded the most gain, while those devoted chiefly to farming showed the least. This is strikingly illustrated by the figures for the largest ten states—New York, Pennsylvania, Illinois, Ohio, Texas, California, Michigan, Massachusetts, New Jersey and Missouri. During the last ten years those states gained 11,225,000 or about two-thirds of the total population increase for the entire country, and they now contain over half the people of the nation. On the whole, the principal factors that influenced the distribution of population throughout the country were industrial expansion, the development of oil fields, and the attraction of a favorable climate, and the heaviest gains occurred where these economic considerations predominated.

It may be interesting to consider the significance of changing regional trends of population distribution by broad areas. Discarding the Mississippi as an arbitrary boundary between the East and the West, and dividing the country according to traditional lines into North, South and West, the ten years' gains were 15 percent, 13.5 percent and 33.4 percent, respectively. Thus it would appear that, in one sense, the West—the Rocky Mountain and Pacific Coast states—is still the fastest growing section. But the numerical increases tell a different story: North, 9,337,000; South, 4,668,000; West,

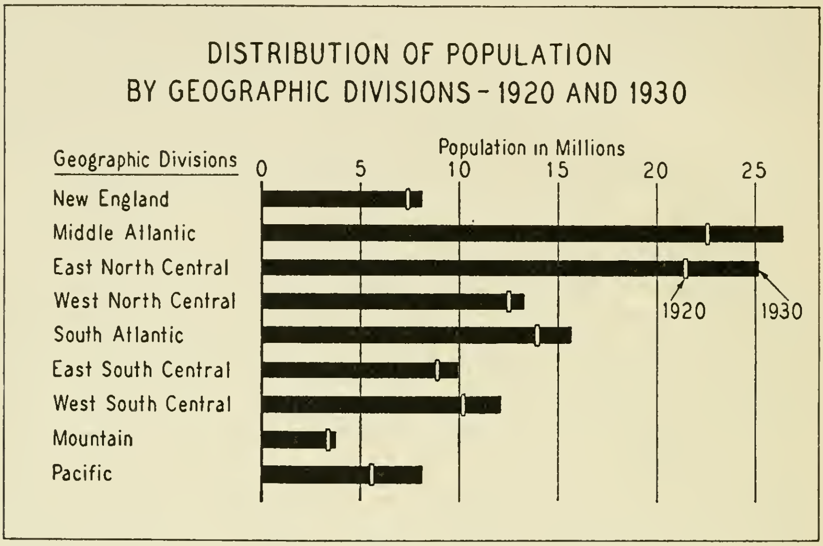


CHART 2

2,982,000. These rates of growth were far from uniform in the major geographical divisions of these three regions. In the North, the industrial belt including New York, New Jersey, Pennsylvania and the Lake States increased by nearly 7,800,000 or 17.8 percent, while New England, experiencing a severe textile depression, grew by 10.4 percent and the grain states of the West North Central division—Minnesota, Iowa, the Dakotas, Nebraska and Kansas—had the smallest rate of growth in the country, only 5.8 percent. In the South, the discovery of oil and the expansion of agricultural operations in Texas, Oklahoma and Louisiana contributed toward a population growth of 21.4 percent in this group of states, while the remainder of the region, suffering from heavy migration losses in most states, gained at a rate of only 10 percent, and this in-increase may be high because the efficiency of the 1930 census was probably especially effective in states so distinctly rural in character. In the West, the Pacific states, favored by the exploitation of California's climate and oil deposits, enjoyed a growth of 2,610,000 or 47 percent, while in contrast the Mountain states increased by only 11 percent.

Turning to population growth by individual states, some remarkable gains are found. More than one-quarter of the total increase in the United States was concentrated in two states—California, in the Far West, with an increase of 2,245,-148, and New York, in the East, with a growth of 2,234,276. Three other states—Michigan, Texas and Illinois—each account for more than 1,100,000 of the increase. Pennsylvania gained more than 900,000, and Ohio and New Jersey each gained more than 870,000. The real estate boom in Florida, capitalizing its exceptional climate, and the pronounced industrial development in North Carolina brought about impressive population gains in these two southern states. The importance of these ten states and their influence upon the distribution of population can be realized better when it is noted that this group of states, which had 47 percent of the national total in 1920, accounted for 70 percent of the past decade's increase.

In conclusion, the most significant tendencies indicated by the 1930 census are the slowing down in the national rate of growth and the tremendous shift of population from rural to urban districts. It is quite evident that the increase in the mobility of the American people has been much faster than the growth of population. Migrations, motivated by various causes and objectives, have occurred in volume and with rapidity during the past decade, and the changing trends in the regional distribution of population have much significance because they indicate a decline in the relative importance of rural industries, especially agriculture, and the increasing opportunities in the cities. The rapid growth of resorts and urban centers having special attractions to the tourist and retired classes is alone sufficient to show that there has been a general improvement in economic conditions in the United States during the last ten years with a consequent increase in purchasing power and a higher standard of living.

All these developments have a bearing upon the market for telephone service; and a consideration of these population changes is important to the telephone industry. The continued drift of population to the cities means an increasing demand for water, sewers, educational and recreational facilities, matters which bear directly upon the health and social welfare of the community. In the endeavor of public utility companies to render satisfactory service under conditions of rapid urban growth, their engineers are being faced with the serious problem of providing promptly adequate plant and distribution facilities.

Some of the conclusions based upon the preliminary reports of the 1930 census may be modified slightly as additional results are published. No doubt, too, the added data, especially that on occupations and on age, sex and nativity characteristics, will reveal other trends of significance to the telephone industry.

R. L. Tomblen

Notes on Recent Occurrences

MORE TELEPHONES IN MEXICO AND IN EUROPE CONNECTED WITH THE BELL SYSTEM

A SECOND telephone network in Mexico was brought within reach of Bell System telephones and Canadian telephones on June 12 when service was extended to the stations of the Ericsson Telephone Company in the southern republic. This system covers some 40 cities and towns in the eastern section of Mexico from the Rio Grande to the vicinity of Mexico City. This new extension brings the total of interconnected telephones in North America to over 21,000,000. The Ericsson Company has approximately 25,000 stations in Mexico City and several thousand additional throughout the rest of Mexico. To inaugurate the service, officials of the Mexican government in Mexico City talked with Mexican diplomatic representatives at Washington. Officials of a Canadian bank's branch in Mexico City conversed with the Montreal headquarters. Following these conversations Vice President T. G. Miller of the American Telephone and Telegraph Company, in New York, spoke with General Manager B. Wahlqvist of the Ericsson Telephone Company, in Mexico City.

On June 30, the transatlantic telephone service was extended to include all telephones in Sweden. Previously the overseas service to Sweden was limited to the three cities of Stockholm, Gothenburg and Malmo.

With this new "farthest north" established, the Bell System radio-telephone service connects with an area extending from within the Arctic Circle, in Europe, to nearly the fortieth parallel of south latitude in South America. The new Swedish extension will make possible a call from the United States covering an extreme distance of about 9900 miles. The cost of a three-minute conversation to any point in Sweden will be the same as for Stockholm, $36.75, with $12.25 for each additional minute.

On July 5, the transatlantic telephone service was extended to the State of Vatican City, residence of the Pope. This is a further extension of America's overseas connections in Italy, service being already available to all of Northern Italy and to the city of Rome. As in the case of other transatlantic points, the service is open to all of the United States and Cuba and to the principal cities of Canada and Mexico. The cost of a call between New York and Vatican City is $36.00 for the first three minutes and $12.00 for each additional minute.

Another Baltic state was made accessible to the United States by telephone on July 16, when Lithuania was added to the European nations connected with North America by the overseas service. The transatlantic talking zone was extended on that day to include the cities of Memel and Kovno. The cost of a three-minute call from New York to either of these cities is $35.25, with $11.75 for each additional minute. The service is available throughout the twenty-four hours. Memel is the seaport of Lithuania and Kovno its temporary capital. They have a combined population of about 250,000, with some 9,000 telephones.

A. T. & T. CO. TO ERECT SHORT WAVE STATION FOR SERVICE TO HAWAII AND ULTIMATELY TO THE FAR EAST

AS an initial step in its program of extending transoceanic telephone service into the Pacific region, the American Telephone and Telegraph Company has applied for a construction permit to erect a short wave radio-telephone station in California. This station is designed to connect the United States with various countries bordering the Pacific, and its island groups, as radio telephone stations are equipped in the distant countries. As the demand for the service develops, Bell System telephones will be connected with one after another of the Far Eastern nations through a combination of land wires and short-wave radio transmission.

As now planned, the first regular service will be provided to the island of Oahu, in the Hawaiian group. By 1932 it is expected that all subscribers of the Mutual Telephone Company of Honolulu on the island will be within voice range of United States telephones. Preliminary arrangements have been made in a series of conferences between Vice President T. G. Miller, of the American Telephone and Telegraph Company, and President J. A. Balch of the Mutual Telephone Company, who journeyed to New York City for this purpose.

Telephone administrations of other countries in the Pacific area have likewise expressed an interest in the proposed service. In time it is probable that direct telephone connections will be established with Australia, Japan and others of the more important far-eastern nations.

This telephone pioneering into the Pacific region is part of the Bell System's general program of providing telephone connection for its subscribers with all points for which the demand warrants the service.

In the original charter of the American Telephone and Telegraph Company, granted in 1885, occurs this paragraph:

"And it is further declared and certified that the general route of the lines of this association" (the American Telephone and Telegraph Company), "in addition to those hereinbefore described or designated, will connect one or more points in each and every city, town or place in said state and in each and every other of the United States and in Canada and Mexico; and each and every of said cities, towns and places is to be connected with each and every other city, town or place in said states and countries; and also by cable and other appropriate means with the rest of the known world. . . ."

At that time the longest long distance line was 240 miles, there were no telephone cables and the "other appropriate means" referred to for reaching overseas did not exist. Yet the vision accurately outlined what has happened since. At present any of the 21,000,000 Bell and Bell connected telephones in this country may be connected directly with practically all important points in Western Europe, in Argentina and Chile and the city of Montevideo, Uruguay. The radio telephone service also extends to four ocean liners—the Leviathan, Majestic, Olympic and Homeric—while at sea. The proposed radio-link to Hawaii will extend the talking range from the United States 2,100 miles westward. It will make possible a conversation between Honolulu and a point in Maine, for example, covering a distance of almost 6,000 miles.

For some time past American Telephone and Telegraph Company and Bell Laboratories' engineers have been investigating various sites on the West Coast to determine the best locations for the new radio stations. Several possibilities are under consideration and field strength tests are being conducted to select those which prove most suitable for the transmitting and receiving stations. Once the question of location is settled, the work of erecting and equipping the two stations will go forward rapidly. The construction cost, including purchase of land, manufacture of apparatus, erection of buildings and radio towers and installation of equipment, will reach a total of over $1,000,000.

At the outset the American Telephone and Telegraph Company is planning an installation which will enable the company to give service simultaneously to Hawaii and at least one of the other points in the Pacific region.

TO BUILD NEW LABORATORY IN N. J.

A NEW laboratory will shortly be erected by Bell Telephone Laboratories in Murray Hill, N. J. Property to the extent of 200 acres has been assembled in the block bounded by

Mountain Avenue, Glenside Road, Glenside Avenue, and Diamond Hill Road, in the Borough and Township of New Providence. The principal frontage is along Mountain Avenue. Adjoining the Watchung Reservation on one side, the property extends to within about half a mile of the Murray Hill railroad station on the other.

It is proposed to establish on this site a laboratory for many of the problems in communication which can best be studied in the quiet atmosphere of the suburbs. Buildings as they are gradually erected will be of moderate height, and their architecture, as well as the landscaping, will not be out of harmony with the residential character of the neighborhood. No commercial manufacturing is proposed. Final decisions have not been made as to the first groups of scientists who will work there, but it is expected that plans will progress far enough to allow ground to be broken in the autumn.

W. ALDRICH MADE A. T. & T. DIRECTOR

AT the meeting of the Directors of the American Telephone and Telegraph Company on August 20, Winthrop W. Aldrich was elected a director.

W. Cameron Forbes, who recently became ambassador to Japan, resigned as a director.

A. T. & T. CO. BUYS TELETYPE CORPORATION

THE American Telephone and Telegraph Company has purchased the Teletype Corporation by an exchange of 150,000 shares of the common stock of the two corporations, share for share. The purchase became effective October 1, 1930.

The Teletype Corporation's principal office and factory are in Chicago and it is engaged in the manufacture of printing telegraph equipment of all kinds. The Bell System for years has been the company's largest customer.

A survey of the Bell System's future needs for this type of apparatus indicates that it will continue to require a major portion of Teletype's production. Therefore, it seemed desirable to acquire Teletype in order to realize the maximum of progress and economy through the complete co-ordination of research, development and manufacture.

The Teletype Corporation will be operated as a subsidiary of the Western Electric Company.

MEDAL AND AWARD ESTABLISHED BY THE A. T. & T. CO. IN HONOR OF GENERAL JOHN J. CARTY

THE National Academy of Sciences has accepted a trust fund of $25,000 presented by the American Telephone and Telegraph Company for the establishment of a medal and award to be known as "The John J. Carty Medal and Award for the Advancement of Science." This gift has been made by the Company in recognition of "the distinguished achievements of John J. Carty as a scientist and engineer, his noteworthy contributions to the advancement of fundamental and applied science" and in appreciation of "his great service for many years in developing the art of electrical communication." It is to be "a lasting testimonial of the love and the esteem in which he is held by his many thousand associates in the Bell System."

It is planned that this medal, together with a grant of money from the accumulated interest on the fund, will be awarded not oftener than once in two years to an individual selected by the Academy "for noteworthy and distinguished accomplishment in any field of science coming within the scope of the charter of the National Academy of Sciences." The field covered in the award of this honor is very broad, inasmuch as the National Academy of Sciences, incorporated by act of Congress approved by President Lincoln in 1863, may be called upon to "investigate, examine, experiment and report upon any subject of science or art."

The medal and award may be given either for "specific accomplishment in some field of science" or "for general service in the advancement of fundamental and applied science." It is to be given without regard to race, nationality or creed.

Participating with the American Telephone and Telegraph Company in the creation of this new honor is a group of Bell System officials who have been the close associates of General Carty in the administration of the American Telephone and Telegraph Company during the last years of his active connection with it, and who are personally providing funds for the design of the medal, the permanent dies from which medals awarded by the Academy can be struck, and the cost of the first medal awarded. The design of the medal is to be the work of an eminent American medalist.

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